Prepared for:

NORTH HIGHLAND ASSOCIATES, LLC

VOLUNTARY REMEDIATION PROGRAM COMPLIANCE STATUS REPORT

MIDTOWN CLEANERS AND LAUNDRY, INC.
599 NORTH HIGHLAND AVENUE
ATLANTA, GEORGIA 30308

Prepared by:

1050 Crown Pointe Parkway, Suite 550
Atlanta, Georgia 30338
Tel: 404-315-9113

January 2013

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Ted Peyser
President

Timmerly Bullman, P.E.
Senior Environmental Engineer

January 2013

EPS

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599 NORTH HIGHLAND AVENUE
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APPENDICES

CONCISE STATEMENT OF FINDINGS

Midtown Cleaners & Laundry, Inc. (HSI #10584; property tax ID 14-0015-0003-0274) located at 599 North Highland Avenue in Atlanta, Georgia (herein referred to as the "Property) was accepted into Georgia's Voluntary Remediation Program (VRP) in a letter dated February 17, 2012. In accordance with the rules for the Georgia VRP Act, this VRP Compliance Status Report (VRP CSR) is being submitted on behalf of North Highland Associates, LLC (owner of the Property) to certify compliance of the property to applicable cleanup standards. An Environmental Covenant was filed on December 19, 2012 with the Fulton County Superior Court to ensure continued compliance with applicable cleanup standards.

A HSRA Release Notification was originally submitted on May 31, 1999 for the Property. The Property was subsequently listed on the Hazardous Site Inventory (HSI #10584) on October 15, 1999 for a release of tetrachloroethene (PCE) to soil. The Property was not listed for groundwater.

PCE and its degradation products [trichloroethene (TCE), cis-1,2-dichloroethene (DCE) and vinyl chloride] are the constituents of interest at the Property. Other chlorinated and non-chlorinated volatile organic compounds (VOCs) have been detected at the Property; however, these are attributed to petroleum releases at the adjacent Buddy's Gas Station and Convenience Store.

Corrective action was performed at the property in 2005 through 2008 using *in situ* chemical oxidation (ISCO) technology. As of January 2006, all PCE concentrations in the soil were below the Type 1 Risk Reduction Standards (RRS). In a Compliance Status Report submitted in 2006, the soils were certified to be in compliance with Type 3 RRS. In a letter (included as Appendix C) dated September 26, 2006, EPD approved of the certification stating: "This letter is to inform you that we agree that the soil at the site (Tax Parcel 14-0015-0003-0274) does not exceed Type 3 risk reduction standards (RRS) for PCE." However, it should be noted that the certification should have also included Type 1 RRS as the Type 1 and Type 3 RRS are identical. Therefore, a certification of the soil to Type 1 RRS is included in this VRP CSR. As mentioned previously, the Property was not listed on the HSI for groundwater. Per Section 12-8-107(g)(2) of the VRP Act it is not necessary to perform corrective action or to certify compliance for groundwater at this Property. Accordingly, no additional corrective action is required at the Property.

There are two potential risks due to the presence of PCE in groundwater: If a water well were to be installed at the Property, there would be a potential risk from groundwater consumption. There is also a potential risk due to PCE soil vapor intrusion if a residence were constructed at the Property. Accordingly, to assure continued compliance, North Highland Associates, LLC filed an Environmental Covenant on December 19, 2012 with the Fulton County Superior Court (Appendix G). The Environmental Covenant prohibits the use or extraction of groundwater at the Property and requires consideration and possible mitigation of soil vapor intrusion if the Property is to be developed for residential purposes in the future.

EPS

CERTIFICATION OF COMPLIANCE WITH RISK REDUCTION STANDARDS

I certify under penalty of law that this report and all attachments were prepared under my direction in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Based on my review of the findings of this report with respect to the risk reduction standards ("RRS") of the Rules for Hazardous Site Response, Rule 391-3-19-.07, I have determined that Tax Parcel No. 14-0015-0003-0274 (the "Property") is in compliance with Type RRS for soil.

In accordance with Section 12-8-107(g)(2) of the VRP Act it is not necessary to certify compliance for groundwater at this Property.

Certified by: _____

Jeff Vantosh for North Highland Associates, L.L.C.
(Property owner) of Tax Parcel ID# 14-0015-0003-0274,
2520 Peachtree Road NE, Suite 301,
Atlanta, GA 30305

Date: 1/30/2013

REGISTERED PROFESSIONAL ENGINEER CERTIFICATION

I hereby certify that I have directed and supervised the field work and preparation of this document, in accordance with State Rules and Regulations. As a registered professional geologist and/or professional engineer, I certify that I am a qualified groundwater professional, as defined by the Georgia State Board of Professional Geologists. All of the information and laboratory data in this document and in all of the attachments are true, accurate, complete, and in accordance with applicable state rules and regulations.

Timmerly Bullman, P.E., Ph.D
GA No. PE028783

1/30/13
Date

1 INTRODUCTION

1.1 Overview and Property Description

This Voluntary Remediation Program Compliance Status Report (VRP CSR) is being submitted on behalf of North Highland Associates, LLC for the Midtown Cleaners and Laundry, Inc. property (HSI #10584) located at 599 North Highland Avenue in Atlanta, Georgia (herein referred to as "Midtown Cleaners" or the "Property"). The Property is owned by North Highland Associates, LLC and is operating as Midtown Cleaners. The Property Tax ID Number is 14-0015-0003-0274 (the Fulton County tax map and warranty deed information are provided in Appendix A). North Highland Associates, LLC submitted a VRP Application in March 2011. The Georgia Environmental Protection Division (EPD) approved the application and accepted North Highland Associates, LLC as a participant in the VRP in a letter dated February 17, 2012.

The Property currently operates as Midtown Cleaners and Laundry Inc. and is situated on a single, 0.75 acre parcel located near the intersection of North Highland Avenue and North Avenue in Atlanta, Fulton County, Georgia (refer to Figure 1, Appendix B). Surrounding land elevations are depicted on a Topographic Map included as Figure 2. The cleaners and adjacent properties are illustrated on Figure 3. Adjacent properties include:

North and East: Alley owned by the City of Atlanta and then Buddy's Gas Station and Convenience Store
West: North Highland Avenue followed by Manuel's Tavern
South: Atlanta Book Exchange

1.2 Responsible Party Contact Information

North Highland Associates, LLC.
Jeff Vantosh
2520 Peachtree Road, NE
Suite 301
Atlanta, GA 30305
(404) 307-5794

1.3 Environmental History

1.3.1 Description of Source

The current building on the Property was constructed in the early 1980s and has operated as a dry cleaners from that time until the present. It is not known if the original cleaners used PCE. The dry cleaning unit used on site from 1993 - 2003 was identified as a Wasoclean DONINI D50. PCE was dispensed from 20-gallon drums stored on a steel plate adjacent to and beneath the machine. Spent PCE was distilled to a residue in a distillation tank located at the base of the machine. The machine was replaced with a non-PCE machine in 2003.

1.3.2 Constituents of Interest

PCE and its degradation products TCE, DCE and vinyl chloride are the constituents of interest at this Property. Other chlorinated and non-chlorinated VOCs have been detected; however, these are attributed to a petroleum release at the adjacent Buddy's Gas Station and Convenience Store, which is identified as a Leaking Underground Storage Tank (LUST) site by the EPD Underground Storage Tank Management Program. Thus, this VRP CSR addresses only those constituents related to Midtown Cleaners.

1.3.3 Summary of Environmental Activities

Initial subsurface investigations conducted on the Property in 1999 by AEM identified PCE in the soil and groundwater. A HSRA Release Notification was submitted on May 31, 1999 and the Property was listed on the Hazardous Site Inventory on October 15, 1999 for a release of PCE to soil. The Property was not listed for groundwater. A CSR and Corrective Action Plan (CAP) was submitted in March 2003 (EPS, 2003). Corrective action was initiated in November 2004. Corrective action included *in situ* chemical oxidation (ISCO) using potassium permanganate. Injections were made in June through December 2005. In 2006 a CSR was submitted to the EPD (EPS, 2006a). The CSR demonstrated that PCE in both the soil and groundwater at the Property had been delineated to background.

The ISCO injections in 2005 resulted in a nearly 100-fold decrease in PCE concentrations at well MW-1; however, the groundwater at the Property was not in compliance with the Type 3 RRS for PCE and TCE. Thus, a CAP Addendum (EPS, 2006a), which was subsequently modified (EPS, 2006b), was submitted in 2006 to address the groundwater at the Property. Four hydraulic fracture wells were installed in June 2007, through which potassium permanganate was injected into the subsurface in August 2007 and January 2008.

1.3.4 Media of Concern

As mentioned previously, the Property was listed on the HSI for a release of PCE to soil, but was not listed for groundwater. According to Section 12-8-107(g)(2) of the VRP Act, it is not necessary to perform corrective action or to certify compliance for groundwater at this Property.

2 ENVIRONMENTAL CONDITIONS

This section summarizes the environmental conditions at the Property. The facility has been investigated on several occasions since 1999. Appendix D contains a summary of the previous site investigations and corrective actions. Through historical spills and leaks in the dry cleaning process, PCE migrated into the subsurface soil and groundwater underneath the Property and adjacent properties. Midtown Cleaners discontinued the use of PCE in 2003. Corrective action (ISCO) at the Property resulted in the destruction of PCE in the Property soils to concentrations below the Type 1 RRS and caused over a 100-fold decrease in concentrations in the groundwater. Currently, PCE and TCE remain in groundwater under the Property, but the condition is such that a release of a reportable quantity has not occurred. Due to the volatile nature of PCE and TCE, the constituents could volatilize from the groundwater, migrate through the vadose zone, and enter the overlying buildings resulting in a potential inhalation risk or hazard. However, soil vapor intrusion modeling demonstrates that there is not an unacceptable risk due to soil vapor intrusion pathway. More information is provided in the Conceptual Site Model (CSM), which is included in the VRP Application (EPS, 2011).

2.1 Delineation

As per the HSRA requirements for the CSR, PCE in the soil was horizontally and vertically delineated to background, which is the detection limit for VOCs. Delineation of soil (see Figure 4) was demonstrated in the 2006 CSR (EPS, 2006a).

2.2 Extent of Constituents of Interest

This section provides information related to the extent of constituents of interest in soil. The only constituent of interest detected in the soil is PCE. A comparison of the PCE concentrations in soil to cleanup standards is shown below in Table 1. The cleanup criterion on this Property is the Type 1 RRS. Following the procedure defined in Section 391-3-19-.07 of the HSRA Act, the Type 1 and Type 3 RRS for PCE is based on 100 times the Type 1 HSRA groundwater concentration.

Table 1 Cleanup Criteria (mg/kg)

Constituent	Clean-up Criteria (Type 1 RRS)	Type 3 RRS	Maximum Soil Concentration Prior to Corrective Action	Maximum Soil Concentration after Corrective Action
PCE	0.5	0.5	0.67	0.0098

DL: Detection limit

Corrective action (ISCO) was implemented in 2005. On December 2, 2005 soil borings SB-1C, 2C, 3C, 4C, and 5C (Figure 5) were installed and soil samples collected with the intent of certifying the soil to RRS. All PCE concentrations were below Type 1 RRS with the exception of SB-3C (1.4 mg/kg). Subsequent permanganate injections were performed on December 19 - 21, 2005.

On January 3, 2006 soil borings SB-5, SB-6, and SB-7 (Figure 5) were installed and soil samples were again collected for certification. SB-7 was collected by the previous soil boring SB-3C, thus replacing the results from SB-3C. The highest PCE concentration was 0.009 mg/kg in SB-7 (0-4 ft-bls). All PCE concentrations are below the Type 1/3 RRS. The soils at the Property were certified to be in compliance with Type 3 RRS in the 2006 CSR; however, the certification should have stated Type 1 RRS in addition to Type 3.

3 POTENTIAL RECEPTORS AND EXPOSURE PATHWAYS

This section describes potential environmental and human exposures.

3.1.1 Environmental Receptors

The Property is located in a predominantly suburban commercial setting. Common environmental receptors in this type setting may include protected species, wetland areas, and surface water bodies.

3.1.1.1 Protected Species

Information compiled by the Georgia Natural Heritage Program (GNHP) was reviewed for Fulton County to identify sensitive wildlife receptors or protected species near the facility. The information reviewed indicated that wildlife receptors residing in the area of the facility may include small mammals such as chipmunks, squirrels, rabbits, raccoons, and opossums. Birds may include cardinals, robins, blue jays, crows, sparrows, morning doves, and other song birds. Due to the depth to groundwater (27-35 ft bls), no exposed soil, and soil meeting Type 1 RRS, exposure to wildlife receptors appears unlikely.

3.1.1.2 Wetlands and Surface Water Bodies

A review of a National Wetland Inventory (NWI) Map for Atlanta, Georgia, prepared by the U.S. Fish and Wildlife Service, indicates that the Property and adjacent properties are not located in identified wetland areas. EPS did not identify any wetland areas.

No perennial streams or other surface water bodies were identified on the facility property or on adjacent properties. The nearest creek is the Lullwater Creek; a minor tributary to the Chattahoochee River located more than 1.5 miles east of the Property. Based on the distance and surrounding topographic conditions, this creek is not suspected to be hydraulically connected to groundwater flow across the Property and is therefore not considered a likely receptor.

3.1.2 Potential Human Receptors

Human receptors at the Property include building occupants and others that may utilize the property. Potential human receptors in the area include the dry cleaner personnel and general public. Due to the retail nature of the facility, access to the Property is unrestricted.

3.1.3 Exposure Media and Pathways

3.1.3.1 Soil

Migration of or contact with impacted soil is not a concern because there is no longer impacted soil at the Property. Therefore, direct human exposure to PCE contaminated soil is an incomplete pathway.

3.1.3.2 Groundwater

Constituents released at the Property have migrated to the groundwater beneath the Property. Impacted groundwater from the Property has migrated to the east and site-related constituents have been identified in down-gradient wells. However, corrective action at the Property has significantly reduced concentrations of site-related constituents in the groundwater and a release above a reportable quantity is not present, due in large part to the lack of a drinking water well within a mile of the Property (see the following paragraph). Thus, exposure to groundwater does not need to be evaluated as the Property does not have a release of a reportable quantity.

The facility and neighboring properties are connected to the municipal water supply supplied by Fulton County. The county obtains potable water from surface reservoirs. Groundwater obtained from water wells or other sources is not utilized on the facility or adjacent properties. In order to identify nearby private or public water wells, water well surveys were performed by AEM and EPS. The AEM well survey tentatively identified five private wells within a one-mile search radius: two water wells were located at the Callenwolde Art Center (>4,500 feet southeast); two irrigation wells were located at the Jimmy Carter Presidential Center (>2,300 feet southwest) and an abandoned private well was located (1,400 feet east). According to the Release Notification prepared by AEM, "no potable wells were found within a one-mile radius of the Site." The EPS well survey identified four additional wells within a larger search radius.

3.1.3.3 Surface Water

No perennial streams or other surface water bodies were identified on the facility property or on adjacent properties. The nearest creek is the Lullwater Creek; a minor tributary to the Chattahoochee River located more than 1.5 miles east of the Property. Based on the distance and surrounding topographic conditions, this creek is not suspected to be hydraulically connected to groundwater flow across the Property and is therefore not considered a likely exposure route.

3.1.3.4 Volatilization to Indoor Air

The volatilization of PCE and its degradation products (TCE, DCE and VC) from groundwater to indoor air has been identified as a potential pathway. Both a current exposure and future exposure are considered.

Current Exposure

The impacted groundwater lies underneath the Property, Buddy's Gas Station and Buddy's Convenience Store. Thus, commercial workers at these facilities are considered potential receptors. Additionally, there is a residence located downgradient of the Property (east of the Convenience Store). Impacted groundwater is not underneath this residence. However, the residence is within 100 feet of the impacted groundwater, and the USEPA recommends evaluating structures within 100 feet of plumes.

Therefore, for the purposes of this assessment, potential exposures were evaluated for the following areas:

- Midtown Cleaners - Commercial Worker
- Buddy's Gas Station - Commercial Worker
- Buddy's Convenience Store – Commercial Worker
- Downgradient Residence - Resident

Other potential human receptors, such as a customer to Midtown and/or Buddy's and trespasser, were not evaluated explicitly. This is because exposure of these will be lower than other potential receptors (e.g., on-site commercial worker).

A model was used to determine risk-based groundwater concentrations that would be protective of human health under these scenarios. The soil vapor intrusion modeling using the Johnson-Ettinger model is discussed in Appendix E. The modeling shows that there is not an unacceptable risk due to soil vapor intrusion of PCE or TCE for any of the scenarios.

At the request of the EPD, the soil vapor intrusion modeling was conducted for constituents related to releases from the gas station. A memo summarizing this analysis that was submitted to and reviewed by the EPD is included in Appendix F.

Future Exposure

In the eventuality that the Property may be used as a residence at some point in the future, soil vapor intrusion will have to be considered in accordance with Activity and/or Use Limitation # 4 of the Environmental Covenant (see Section 5).

As mentioned previously, there is no current risk to the residence east of the convenience store due to soil vapor intrusion of PCE or TCE. At the request of the EPD, groundwater modeling to determine future groundwater concentrations near the residence was considered and a memo was submitted to and reviewed by the EPD (see Appendix F). Due to site and data limitations, the modeling effort was unsuccessful. However, actual groundwater data collected during the last ten years (both before and after ISCO injections) indicates that the plume has not migrated downgradient and is not expected to in the future.

4 COMPLIANCE WITH RISK REDUCTION STANDARDS

4.1 Soils

As of January 2006, all PCE concentrations in the soil were below the Type 1 Risk Reduction Standards (RRS). In the 2006 CSR, the soils were certified to be in compliance with Type 3 RRS. It should be noted that the certification should have also included Type 1 RRS as the Type 1 and Type 3 RRS values are the same (0.5 mg/kg). In a letter (included as Appendix C) dated September 26, 2006, the EPD approved of the certification: "This letter is to inform you that we agree that the soil at the site (Tax Parcel 14-0015-0003-0274) does not exceed Type 3 risk reduction standards (RRS) for PCE." A certification of the soil to Type 1 RRS is included in this VRP CSR. Therefore, no additional corrective action with respect to soils at the Property is needed.

4.2 Groundwater

Pursuant to O.C.G.A. 12-8-107(g)(2), neither corrective action nor certification of compliance for groundwater is required. According to Section 12-8-107(g)(2) of the VRP Act:

> "*The participant shall not be required to perform corrective action or to certify compliance for groundwater if the voluntary remediation property was listed on the inventory as a result of a release to soil exceeding a reportable quantity for soil but was not listed on the inventory as a result of a release to groundwater exceeding a reportable quantity, and if the participant further demonstrates to the director at the time of enrollment that a release exceeding a reportable quantity for groundwater does not exist at the voluntary remediation property; and the groundwater protection requirements for soils shall be based on protection of the established point of exposure for groundwater as provided under this part*."

The Property was listed on the HSI as a result of a release to soil exceeding a reportable quantity, but was not listed as a result of a release to groundwater exceeding a reportable quantity.

Although PCE and daughter compounds were present in the groundwater, the Property did not score above the Groundwater Pathway Threshold of "10" when applying the Reportable Quantities Screening Method at the time of HSI listing. These conditions are still applicable

today; thus, the Property does not currently have a release exceeding a reportable quantity[1] for groundwater. Additionally, concentrations in soil are below the Type 1 RRS and are, thus, protective of groundwater quality. Furthermore, the soil vapor modeling for the property (see Section 3.1.3.4), did not exceed established risk levels.

[1] The HSRA regulations define a reportable quantity as "the amount of any released regulated substance which causes a Site to meet the criteria for listing on the Hazardous Site Inventory."

5 ENVIRONMENTAL COVENANT

To ensure continued compliance with Type 1 RRS for soil and to ensure that there is no potential future risk due to consumption of groundwater or soil vapor intrusion, the owner of the Property filed an Environmental Covenant (Appendix G) on December 19, 2012 with the Fulton County Superior Court. The Environmental Covenant places a restriction on the use or extraction of groundwater beneath the Property for drinking water or any other non-remedial purposes. Additionally, the Covent requires that if, in the future, the Property is to be used for residential purposes, that it first must be demonstrated at that time that there is no risk due to soil vapor intrusion by one or more of the following: soil vapor intrusion modeling based on conditions at that time, soil vapor sampling, and/or soil vapor mitigation.

6 REFERENCES

Agency for Toxic Substances and Disease Register (ATSDR). Evaluating Vapor Intrusion Pathways at Hazardous Waste Sites. http://www.atsdr.cdc.gov/document/evaluating_vapor_intrusion.pdf

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EPS 2006b Corrective Action Plan Addendum No. 1. December.

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EPS 2008. Corrective Action Progress Report. April.

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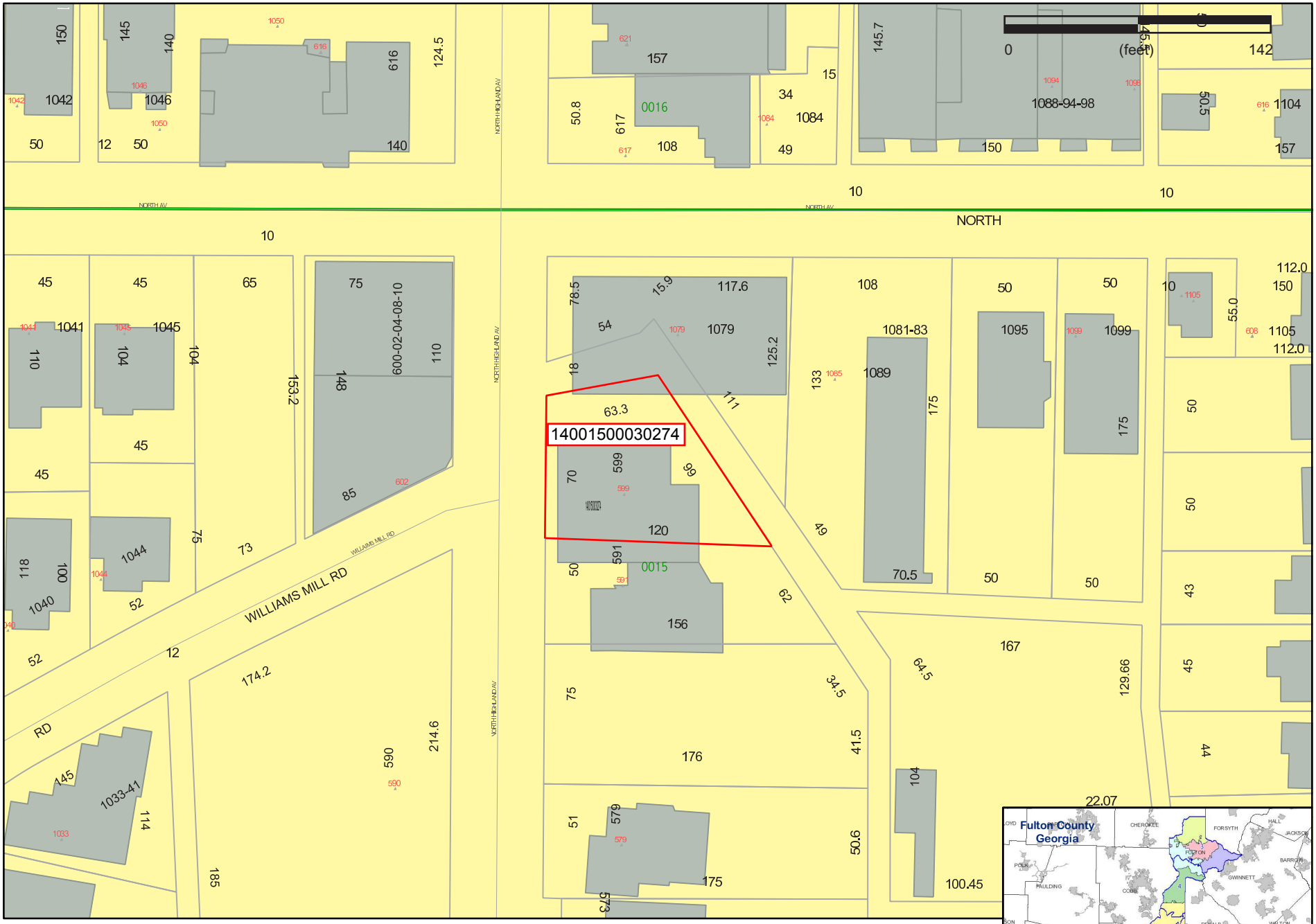
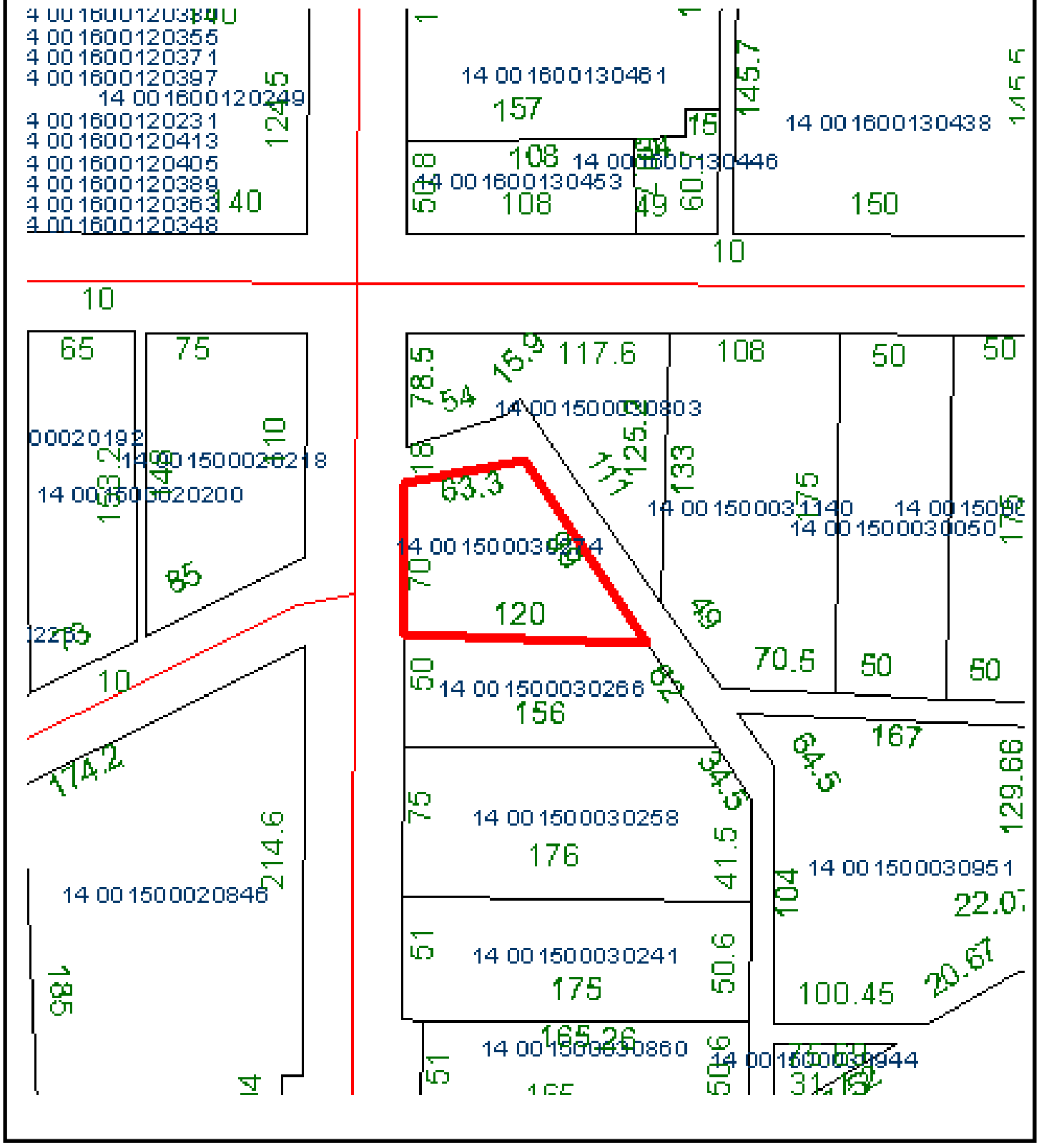
APPENDIX A

TAX MAPS AND WARRANTEE DEED



Prepared by Fulton County Department of
Environment and Community Development
Support Services Division
Geographic Information System
Date: 01.23.45



Source: www.fultonassessor.org

EPS

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Midtown Cleaners
599 N. Highland Ave
Atlanta, GA 30308

Tax Parcel Map

Fulton County, Georgia
Real Estate Transfer Tax
Paid $ 329.00
Date JAN 11 1990
By _____ Deputy Clerk

LIMITED WARRANTY DEED

STATE OF GEORGIA

FULTON COUNTY

THIS INDENTURE, effective as of the 20th day of November, in the year one thousand nine hundred eighty-nine, between

VANTOSH COMPANY, INC.,
A Georgia Corporation,

of the County of Fulton, and State of Georgia, as party or parties of the first part, hereinafter called Grantor, and

MYRA ABRAMS (7.5%), AARON I. ALEMBIK (1.6%), RITA BARON (5.0%), DAVID N. CUNNINGHAM (12.5%), HARRY HOUSEN (5.4%), CATHY SELIG (7.5%), JEFFREY P. VANTOSH (7.5%), JILL W. VANTOSH (43%), DR. STEVE WARONKER (5.0%), AND NORMAN WEITZ FAMILY TRUST (5.0%),

as party or parties of the second part, hereinafter called Grantee (the words "Grantor" and "Grantee" to include their heirs, successors and assigns where the context requires or permits).

WITNESSETH that: Grantor, for and in consideration of the sum of TEN DOLLARS ($10.00) and other good and valuable consideration in hand paid at and before the sealing and delivery of these presents, the receipt whereof is hereby acknowledged, has granted, bargained, sold, aliened, conveyed and confirmed, and by these presents does grant, bargain, sell, alien, convey and confirm unto the said Grantees, their heirs, successors and assigns,

All that tract or parcel of land lying and being in Land Lot 15, of the 14th District of Fulton County, Georgia, consisting of Tract I, Tract II and Tract III, attached hereto and made a part hereof, marked Exhibit "A."

TOGETHER with all of grantor's right, title and interest, if any, in and to any strips of land, streets and alleys abutting or adjoining said real property.

Any and all buildings and all of Grantor's right, title and interest in and to the improvements now standing upon any of the property herein described, and all of the right, title and interest of Grantor in and to all fixtures located upon or within the buildings and improvements and attached to, or installed in, or used in connection with any of the buildings and improvements, including, but not limited to, any and all partitions, dynamos, screens, awnings, motors, engines, boilers, furnaces, pipes, plumbing, elevators, cleaning and sprinkler systems, fire extinguishing equipment, water tanks, heating, ventilating, air conditioning and air cooling equipment, and gas and electric machinery, appurtenances and equipment.

All of the right, title and interest of Grantor in and to all furniture, furnishings, equipment, machinery and all other personal property now located in, upon or about the said property and the buildings and improvements located thereon.

The property herein described is the same property conveyed to Grantor by Deed of Trustee-in-Bankruptcy dated November 20, 1989, recorded in Deed Book 12993, page 151, Fulton County Records, Georgia.

GEORGIA Fulton County Clerk's Office Superior Court
Filed & Recorded JAN 11 1990 at 4:37
Janice Kirk CLERK

BOOK 13120PG213

TO HAVE AND TO HOLD the said tract or parcel of land, with all and singular the rights, members and appurtenances thereof, to the same being, belonging, or in anywise appertaining, to the only proper use, benefit and behoof of the said Grantees forever in FEE SIMPLE.

AND THE SAID Grantor will warrant and forever defend the right and title to the above described property unto the said Grantee against the claims of all persons owning, holding, or claiming by, through or under the said Party of the First Part.

IN WITNESS WHEREOF, the Grantor has signed and sealed this deed, the day and year above written through its duly authorized officer.

VANTOSH COMPANY, INC.

By _____
JEFFREY P. VANTOSH, President

(CORPORATE SEAL)

CORP. SEAL

Signed, sealed and delivered this 21st day of December, 1989, in presence of:

_____
Unofficial Witness

_____
Notary Public

Notary Public, DeKalb County, Georgia
My Commission Expires January 8, 1993.

My Commission expires: _____

(Notary Seal)

N.P. SEAL

BOOK 13120PG214

EXHIBIT "A"

TRACT I

ALL that tract or parcel of land lying and being in Land Lot 15, of the 14th District of Fulton County, Georgia, and being more particularly described as follows:

BEGINNING at a point on the east side of North Highland Avenue ninety-six and five tenths (96.5) feet south of the southeast corner of North Highland Avenue and North Avenue, said beginning point being at the south side of an eighteen (18) foot alley; running thence south along the east side of North Highland Avenue sixty-five and fifteen hundredths (65.15) feet; thence east one hundred twenty (120) feet to the southwest side of said eighteen (18) foot alley; thence northwesterly along the southwestern side of said alley ninety-nine (99) feet to a point where said alley turns; thence west along the south side of said alley sixty-three and three-tenths (63.3) feet to the point of beginning; being improved property known as 597-601 North Highland Avenue, N.E., according to the present system of numbering houses in the City of Atlanta.

TRACT II

ALL that tract or parcel of land lying and being in Land Lot 15, 14th District, Fulton County, Georgia, and being more particularly described as follows:

BEGINNING at an iron pin placed on the easterly side of North Highland Avenue two hundred seventy-seven (277) feet northerly as measured along the easterly side of North Highland Avenue from the corner formed by the intersection of the easterly side of North Highland Avenue with the northerly side of Vaud Avenue; run thence easterly along the line that forms an interior angle of 90 degrees 08 minutes with the easterly side of North Highland Avenue one hundred fifty-six (156) feet to an iron pin found on the southwesterly side of a 15-foot alley; run thence northwesterly along the southwesterly side of said 15-foot alley sixty-two (62) feet to an iron pin found; run thence westerly one hundred twenty (120) feet to an iron pin found on the easterly side of North Highland Avenue; run thence southerly along the easterly side of North Highland Avenue fifty (50) feet to the iron pin placed at the point of beginning, being improved property having a one-story frame house thereon known as 591 North Highland Avenue according to the present system of numbering houses in the City of Atlanta, Georgia, and being more particularly shown on survey prepared by Georgia Land Surveying Co., dated September 23, 1980.

JHO

EXHIBIT "A"

(Continued)

TRACT III

ALL that tract or parcel of land lying and being in Land Lot 15 of the 14th District, Fulton County, Georgia, and being more particularly described as follows:

BEGINNING at a point where the northeasterly side of a 15 foot alley intersects with the southerly side of a 10 foot alley, said 15 foot alley running parallel to the rear property line of No. 597-601 North Highland Avenue; thence following the northeasterly side of the 15 foot alley South 26 degrees 5 minutes East a distance of 64.5 feet to a point; thence following the easterly side of said alley (now a 10 foot alley) South 2 degrees 49 minutes West a distance of 104.0 feet to the north side of a 10 foot alley; thence following the northerly side of said 10 foot alley North 83 degrees 39 minutes East a distance of 100.45 feet to a point on the right-of-way of a proposed State of Georgia Road (Presidential Parkway); thence along the right-of-way of said proposed road North 69 degrees 04 minutes East a distance of 20.67 feet to a point; thence North 77 degrees 56 minutes East a distance of 22.07 feet to a point on the westerly side of a 10 foot alley; thence along the westerly side of said 10 foot alley North 0 degrees 42 minutes East a distance of 129.66 feet to a point on the south side of a 10 foot alley; thence along the southerly side of said 10 foot alley North 87 degrees 22 minutes West a distance of 167.0 feet to a point on the northeasterly side of a 15 foot alley and point of beginning.

BOOK 13120PG216

APPENDIX B

FIGURES

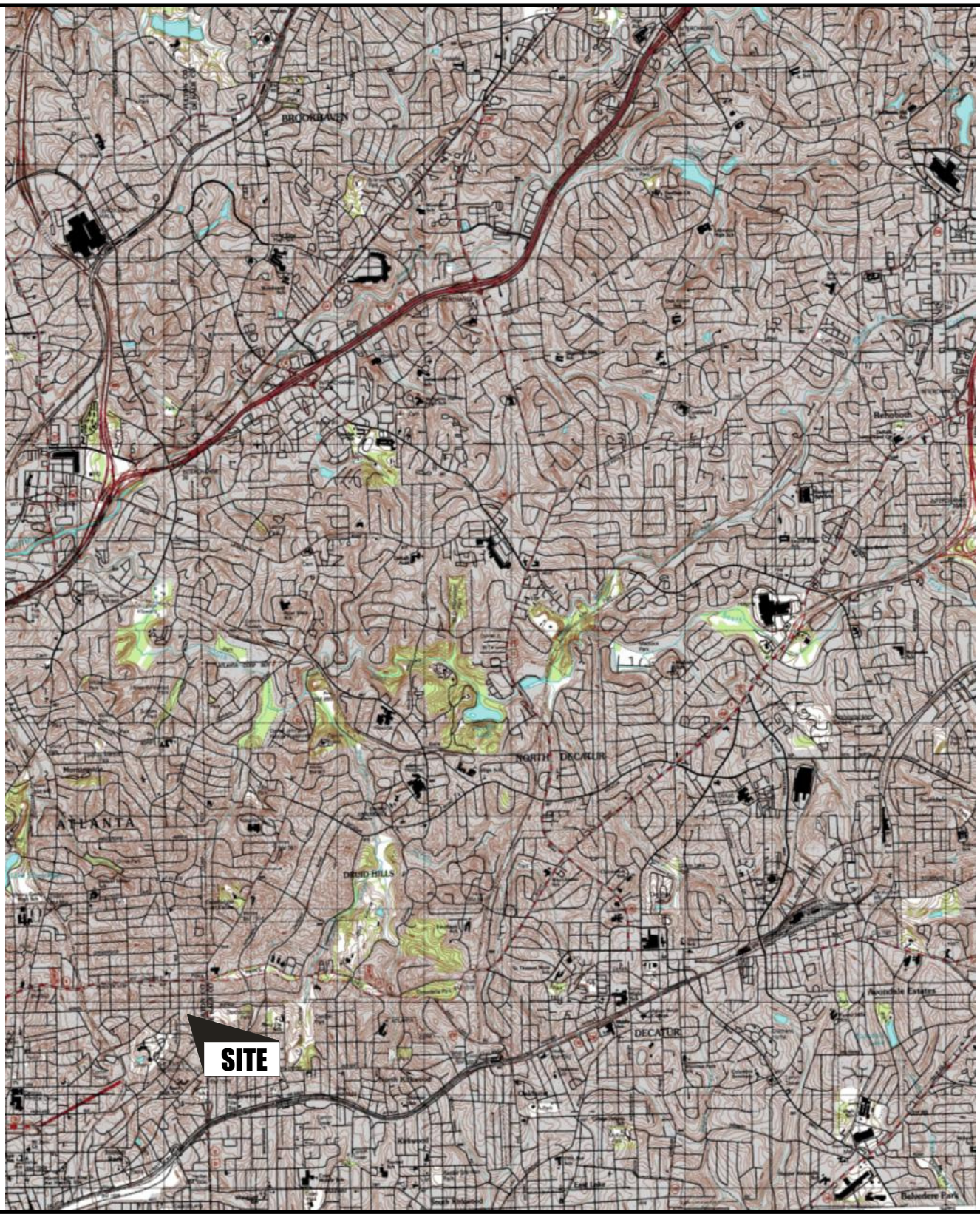
Source: Google Earth

EPS

N

Midtown Cleaners
599 N. Highland Ave
Atlanta, GA 30308

FIGURE 1
SITE LOCATION MAP



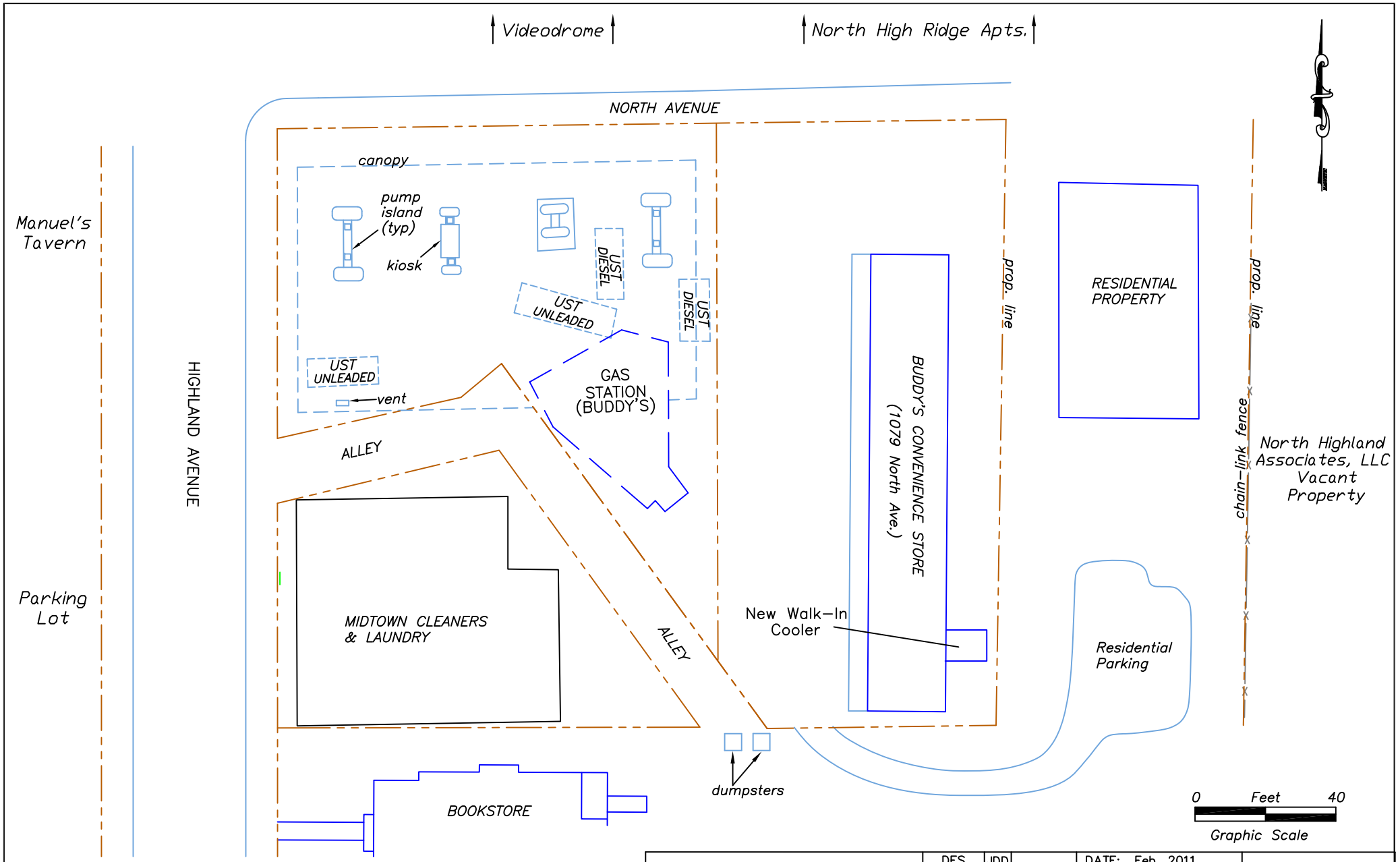
Source: USGS Quadrangle Map for Northeast Atlanta (1997) Scale: 1:24,000

EPS

N

Midtown Cleaners
599 N. Highland Ave
Atlanta, GA 30308

FIGURE 2
TOPOGRAPHIC MAP



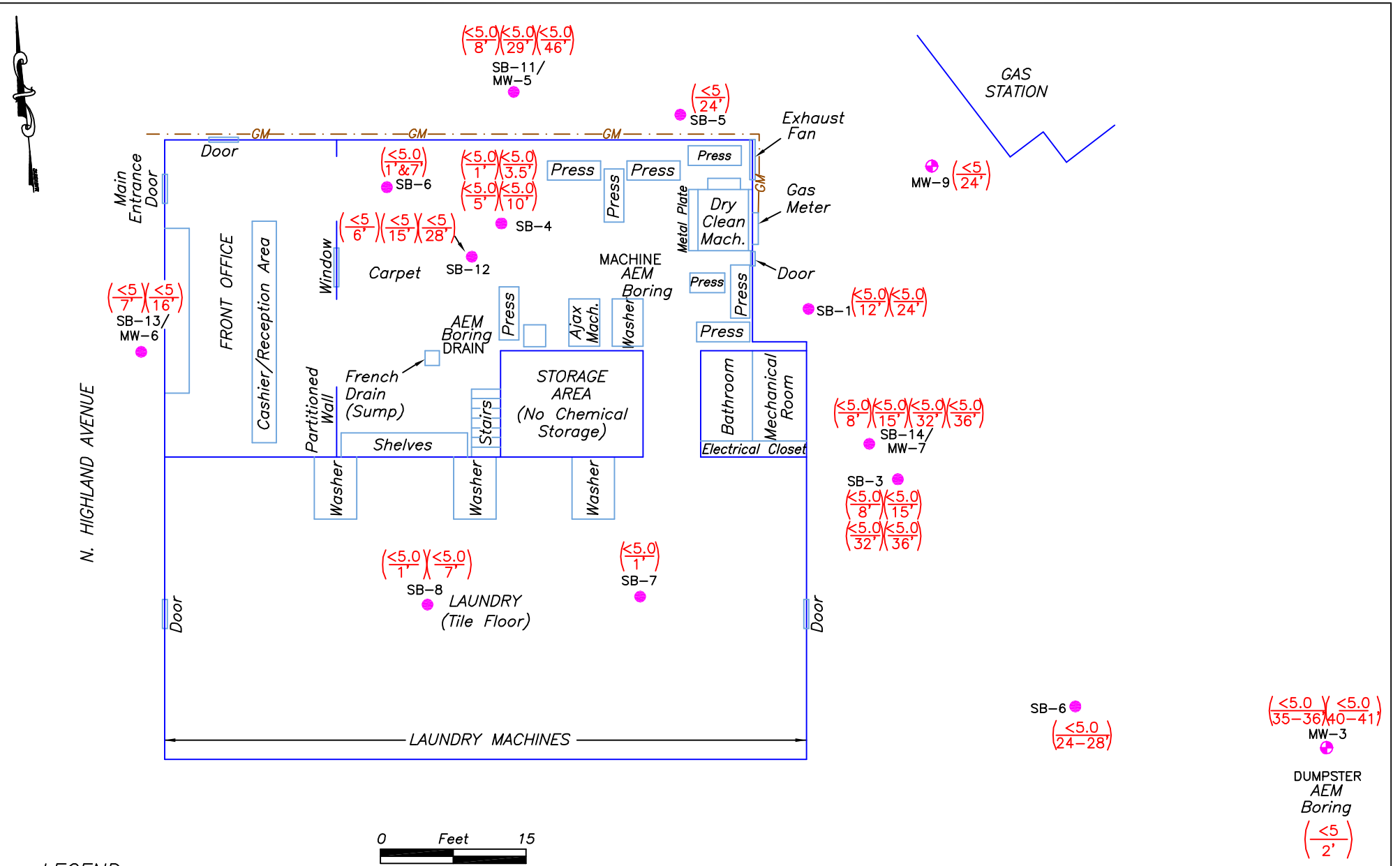
EPS
Environmental Planning Specialists, Inc.
900 Ashwood Parkway, Suite 350
Atlanta, GA 30338
Phone: (404) 315-9113
Fax: (404) 315-8509

DES	JDD		DATE: Feb. 2011
DRN	JDD		
CHK			
REV			
APP			
PRJ MGR			
OPER			

Midtown Cleaners
599 N. Highland Ave.
Atlanta, Georgia

Site Plan

FIGURE 3



LEGEND

- Existing Soil Boring Location
- Monitoring Well
- (<5.0) Below Quantitative Reporting Levels
- (<5 / 28') PCE Concentration (µg/kg) / Depth in Feet

EPS
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Phone: (404) 315-9113
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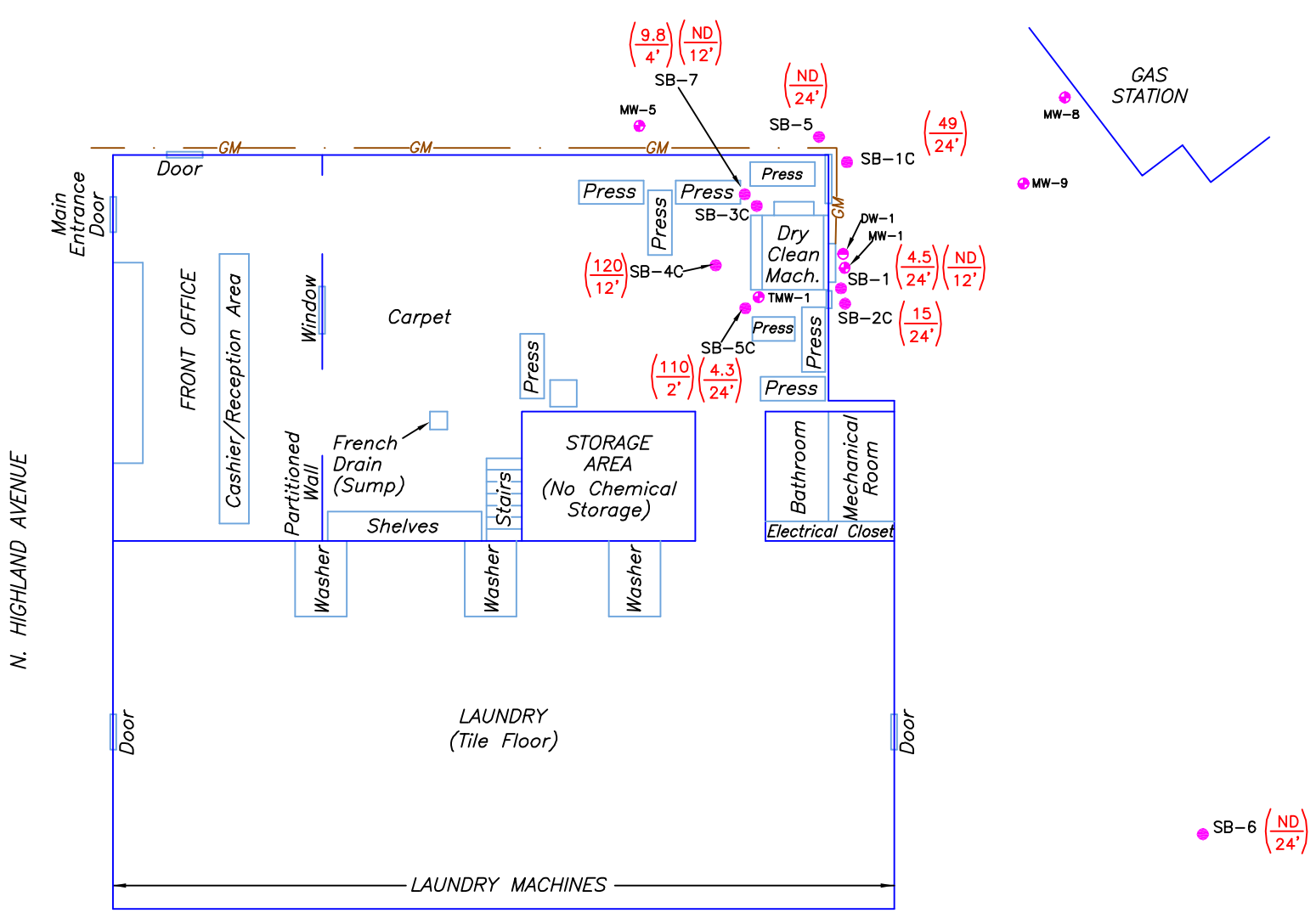
DES	JDD		DATE: Feb. 2011
DRN	JDD		
CHK			
REV			
APP			
PRJ MGR			
OPER			

Midtown Cleaners
599 N. Highland Ave.
Atlanta, Georgia

Extent of PCE
In Soil to Non-Detect (ppb)
(Taken from 2006 CSR)

FIGURE 4



LEGEND

- Existing Soil Boring Location
- Deep Well
- Monitoring Well
- GM Gas Main

0 Feet 15

Graphic Scale

EPS

Environmental Planning Specialists, Inc.
900 Ashwood Parkway, Suite 350
Atlanta, GA 30338
Phone: (404) 315-9113
Fax: (404) 315-8509

DES	JDD		DATE: Feb. 2011
DRN	JDD		
CHK			
REV			
APP			
PRJ MGR			
OPER			

Midtown Cleaners
599 N. Highland Ave.
Atlanta, Georgia

Extent of PCE (ppb) In Soil
Post Injection (2005-2006)

FIGURE 5

APPENDIX C

EPD AGREEMENT OF COMPLIANCE TO RRS

Georgia Department of Natural Resources

2 Martin Luther King, Jr. Drive. S.E., Suite 1462 East, Atlanta, Georgia 30334
Noel Holcomb, Commissioner
Environmental Protection Division
Carol A. Couch, Ph.D., Director
Hazardous Waste Management Branch
404-657-8600

September 26, 2006

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

North Highland Associates, LLC
c/o Mr. Jeff Vantosh
Vantosh Co., Inc.
1477 Spring Street
Atlanta, Georgia 30309

Re: Notice of Deficiency
Compliance Status Report
Midtown Cleaners and Laundry
Atlanta, Fulton County, Georgia
HSI Site No. 10584

Dear Mr. Vantosh:

The Environmental Protection Division (EPD) has completed its review of the May 15, 2006 letter and Compliance Status Report (CSR) submitted in response to EPD's August 11, 2005 CSR/CAP NOD letter for the Midtown Cleaners and Laundry Site. This letter is to inform you that we agree that the soil at the site (Tax Parcel 14-0015-0003-0274) does not exceed Type 3 risk reduction standards (RRS) for PCE. The following comments discuss certain aspects that require further work and/or correction before this report can be considered complete with respect to Georgia's Rules for Hazardous Site Response Chapter 391-3-19 (Rules).

CSR Deficiencies:

1. The conversion of hydraulic conductivity values from cm/s to ft/day was corrected in the May 11, 2006 letter; however, these values were not updated in the text of the CSR. The correct values listed in the May 11, 2006 letter should be used in future calculations.
2. Section 7 and 10 of the CSR appears to be incorrect, and therefore EPD is reconsidering Comment 13C of our August 11, 2005 letter. Based on information on the Fulton County Tax Assessor website (www. fultonassessor.org), properties located downgradient (east) of the Midtown Cleaners site include Tax Parcels 14001500030803 (William Corey/UST tank owner), 1400150003114 (U.S. Enterprises/Buddy's Convenience Store), 1400150003005 (Ryan Florence) and 14001500030068 (Victoria Alembik). It is very important to identify which neighboring parcels are part of the site for certifying compliance, delineation, and corrective action for groundwater at the site. The following comments should be addressed in an addendum to the CSR, or the groundwater CAP.
    a. By overlaying a site figure and a tax assessor map, it appears MW-4 is located on Victoria Alembik's property, rather than a vacant property owned by Jeff Vantosh. Please review the location of MW-4 with the Fulton County tax parcel maps and clarify which parcels are part of the Site. If property transactions have taken place, or if the information provided by the tax assessor is inaccurate, please provided documentation. Attached is the tax map overlaid on top of Figure 8 for your review.

b. The Carmichael property (Tax Parcel 14001600130438) is located side-gradient (northeast) of Midtown Cleaners and has not been sampled. Therefore, certification for the Carmichael property is not appropriate.

3. Soil data collected in 2005 and 2006 presented on Table 2 are slightly different than those shown on the laboratory data sheets. Please review the values shown on this Table.
4. Table 3 is missing the groundwater samples collected at MW-1 and TW-1 on December 2, 2005. Additionally, groundwater data for SB-1C should be included on this table.
5. The data from the MACHINE sample is missing from Figure 7.
6. SB-3C is shown on Figure 7, but should be taken off this Figure, since this sample was collected in 2005. This sample should be added to Figure 10, with a note that states that SB-7 was a confirmation sample after permanganate injection.
7. Temporary well MW-9 was installed in September 2005. Please provide a description of the purpose of this temporary well. Will this temporary well be used to collect groundwater quality samples, water levels or serve as an injection point for permanganate?
8. Horizontal delineation of PCE impacted groundwater should be conducted between MW-8 and MW-4, to determine where corrective action needs to be performed between these locations, and to allow you to certify compliance on these properties.
9. Active remediation is recommended at MW-8 and TW-1, since source/DNAPL concentrations are present at these locations.
10. Based on a detection of 6.4 ug/L at DW-1, vertical delineation has not been achieved. You may chose to monitor DW-1 quarterly for 1 year to evaluate if this concentration will attenuate over time, and what effects permanganate injections may have on groundwater quality at the site.
11. Although QA/QC samples are being collected during groundwater and soil sampling, they are not discussed in the text, nor are duplicated samples identified in Tables 2 and 3. Please add the data for duplicate samples onto the appropriate tables and include a discussion of them in the text.

EPD requests the submittal of a CAP for groundwater stating how you plan to come into compliance with RRS for groundwater. Please include a plan to collect water levels, and a full round of groundwater samples from each well on the site (BCMW-1, BCMW-2, BCMW-3, BCMW-4, BCMW-5, BCMW-6, TW-1, MW-1, DW-1, MW-2, MW-3, MW-4, MW-5, MW-6 and MW-9). Remaining deficiencies for the CSR may be addressed in a groundwater corrective action plan. Please submit a CAP by December 22, 2006. If you have any questions, please contact Katie Ross at (404) 657-8600.

Sincerely,

David Reuland
Unit Coordinator
Superfund Management Unit

cc: Ted Peyser, Environmental Planning Specialists, Inc.
Ranchhod Desai and Dennis Desai, Midtown Cleaners & Laundry, Inc.

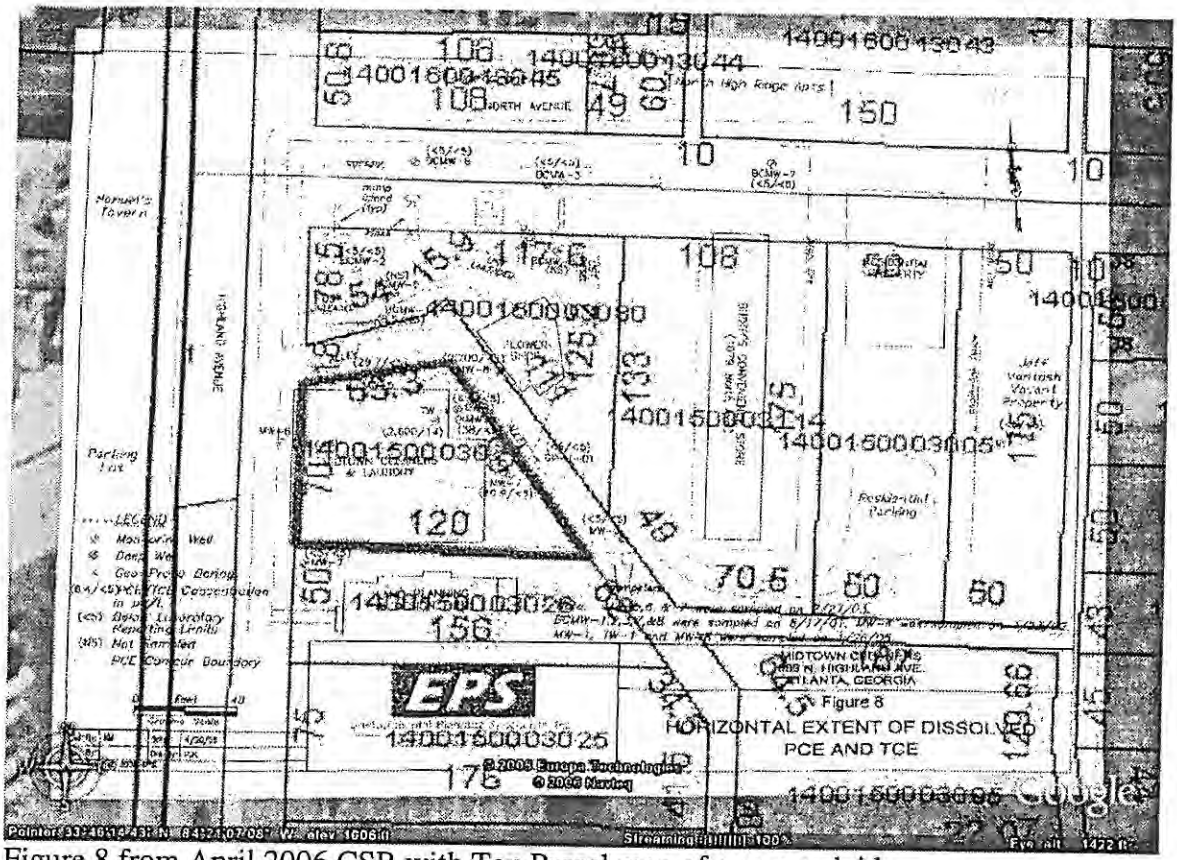


Figure 8 from April 2006 CSR with Tax Parcel map of area overlaid.

APPENDIX D

PREVIOUS SITE INVESTIGATIONS AND CORRECTIVE ACTIONS

APPENDIX D

PREVIOUS SITE INVESTIGATIONS AND CORRECTIVE ACTION

This Appendix gives a summary of investigations and corrective action activities that have occurred at the Property. The first section describes the investigations conducted prior to corrective action. The second section describes the corrective action activities and the last section summarizes the groundwater monitoring events that have taken place since corrective action was initiated.

D.1 PRE-CORRECTIVE ACTION INVESTIGATIONS

This section provides a summary of soil and groundwater investigations that have been conducted at the Property. AEM and EPS conducted investigations at the Property since 1999. Details of the sampling procedures and well installation methods used by EPS are presented in the CSR (EPS, 2006a). Figure E-1 shows the locations of where soil samples were collected and Figure E-2 shows the locations of groundwater samples. The analytical results for constituents detected in soil are shown in Table E-1. The analytical results for constituents analyzed in groundwater are shown in Tables E-2 through E-4 for chlorinated organics, non-chlorinated organics and inorganics, respectively.

D.1.1 AEM Investigations

D.1.1.1 AEM April 1999 Subsurface Investigation

In April 1999, AEM conducted a subsurface investigation at the Property. The investigation entailed the advancement of three soil borings. Boring locations included one adjacent to the dry cleaning machine, one adjacent to a floor drain, and one outside near the dumpsters.

The soil borings were advanced at the Property using a hand auger. Two soil borings completed inside the dry cleaners were designated DRAIN and MACHINE. One soil boring outside the dry cleaners near the dumpsters was designated DUMPSTER. The locations of the borings are shown on Figure E-1. The three borings were advanced to a depth of 2 feet below ground surface (ft-bls) at the MACHINE and DUMPSTER location, and 6.25 ft-bls at the DRAIN.

One soil sample from each hand auger location was selected for laboratory analysis. The selected samples were collected from the terminating depths of each boring. Soil samples were analyzed for VOCs using USEPA Method 8260B. PCE was detected in the DRAIN and

MACHINE samples at concentrations of 0.065 and 0.670 milligrams per kilogram (mg/kg) respectively. No other VOCs were detected in these samples.

Halogenated VOCs were not detected in the soil sample collected from the sample designated as DUMPSTER. Other VOCs detected included benzene (0.35 mg/kg), ethylbenzene (0.03 mg/kg), toluene (0.44 mg/kg), and total xylenes (0.13 mg/kg).

D.1.1.2 AEM May 1999 Subsurface Investigation

In May 1999, AEM installed and sampled one groundwater monitoring well, conducted a well survey, and submitted Reportable Quantities Screening Method and Release Notification Screening Forms to EPD.

Groundwater monitoring well (MW-1) was located at the exterior of the northeastern corner of the building (adjacent to the dry cleaning machine). The well boring was advanced to a depth of 35 ft-bls. The monitoring well was constructed with the screen interval at 24.5 - 34.5 ft-bls. Soils encountered during drilling included silt and sandy clays associated with the in situ weathering of the parent bedrock. One groundwater sample was collected from MW-1 and analyzed for VOCs using USEPA Method 8260B. The following VOCs were detected: PCE, 1,1,1-trichloroethane, 1,1-dichloroethene, chloroform, methylene chloride, benzene, ethylbenzene, toluene and total xylenes.

D.1.1.3 AEM Well Survey

In 1999, AEM completed a well survey within a 1-mile search radius of the Property. The well survey identified five private wells: two water wells were located at the Callanwolde Art Center (>4,500 feet southeast); two irrigation wells were located at the Jimmy Carter Presidential Center (>2,300 feet southwest) and an abandoned private well was located 1,400 feet east of the Property.

D.1.2 EPS Subsurface Investigations

EPS field investigations included a subsurface assessment inside the dry cleaners and outside the building. The assessments conducted inside the building included the advancement of borings with hand augers and direct push sampling devices. The assessments conducted outside the building involved the advancement of borings by direct push and with a hollow stem auger drill rig. Temporary and permanent monitoring wells were installed for groundwater sampling.

These investigations were performed to delineate the extent of VOC constituents in soil and groundwater and to identify pertinent geological and hydrogeological characteristics of the study area.

D.1.2.1 August 2001 Subsurface Investigation

In August, 2001, EPS sampled an existing on-Property monitoring well, MW-1, and was granted permission to access and sample five existing monitoring wells BCMW-1, BCMW-2, BCMW-3, BCMW-7, and BCMW-8, located on the adjacent Buddy's Convenience Store property. BCMW-4 could not be located to sample. BCMW-5 was excluded from sampling due to its location relative to the other monitoring wells. BCMW-6 could not be sampled due to the presence of excess LNAPL recharging into the well. These groundwater samples were collected to evaluate the horizontal extent of dissolved chlorinated VOCs north of the dry cleaning facility prior to performing any additional assessment.

PCE was detected at a concentration of 1,500 µg/l in MW-1. No degradation products of PCE were detected. PCE was detected at 8.5 µg/l in monitoring well BCMW-1. PCE and its degradation products were not detected in the other BC wells.

Elevated concentrations of petroleum hydrocarbons associated with an apparent UST release were also detected in MW-1 and the BC wells. The petroleum hydrocarbon concentrations reported for BCMW-2 and BCMW-3 are not representative due to the presence of measurable LNAPL in these two wells. The compounds detected primarily consisted of BTEX constituents, common derivatives or breakdown products, and gasoline additives. The gasoline additives include lead scavangers (1,2-dichloroethane and 1,2-dichloromethane) and MTBE.

D.1.2.2 October 2001 Subsurface Investigation

In October, 2001, EPS advanced three monitoring wells (DW-1, MW-2, and MW-3) to evaluate the horizontal and vertical extent of VOCs on the Midtown property. EPS installed MW-2 at the southwest corner of the building, MW-3 near the southeastern property boundary, and DW-1 adjacent to MW-1 as shown on Figure E-2. The new wells were sampled in November 2001 along with monitoring well MW-1 to determine the extent of dissolved chlorinated hydrocarbon VOCs. PCE was detected at 1,660 µg/l in MW-1 and 14.2 µg/l in DW-1. No other chlorinated VOCs were detected in the samples collected from these wells.

Eight soil borings were advanced by EPS in November 2001 inside the dry cleaners. One of the borings (SB-1) was advanced in close proximity to the prior AEM boring (Machine). Soil samples were collected at varying depths intervals ranging from 0.5-1, 3-3.5, or 6-7 ft bls and field screened with a Photo-Ionization Detector (PID). None of the PID readings were above background levels; therefore, shallow and deep samples were submitted from each boring for laboratory analysis. The samples were analyzed for chlorinated VOCs only.

The shallow samples were submitted to the laboratory for VOC analysis on the assumption that these samples would have the highest concentration of VOCs if permeation occurred through the concrete slab. Deeper samples were submitted for laboratory analysis in an attempt to vertically delineate potentially impacted soils.

A review of the laboratory results in Table E-1 indicates that PCE was the only VOC detected. PCE was detected in only two shallow samples: SB-3-1 (0.031 mg/kg) and SB-4-1 (0.005 mg/kg).

Five split spoon soil samples were collected during the drilling of MW-3 and DW-1. Each of the samples were analyzed for chlorinated VOC. PCE was detected in DW-1 samples at 0.012 mg/kg at 36 ft-bls, 0.01 mg/kg at 46 ft bls, and 0.018 mg/kg at 65 ft bls. No other chlorinated VOCs were detected in DW-1. No chlorinated VOCs were detected at 36 ft bls and 41 ft bls in MW-3.

D.1.2.3 January 2002 Subsurface Investigation

In January 2002, a direct push boring (GP-1) was advanced downgradient of MW-1 to delineate the horizontal extent of chlorinated VOCs. A downgradient well, MW-4, was installed on an off-Property property to delineate the extent of VOCs to background levels.

GP1-01 was advanced to a depth of 36 ft-bls, approximately 40 feet southeast and down gradient of MW-1 in an alley separating the Midtown Cleaners and Buddy's Convenience Store. PCE was not detected in this groundwater sample. Petroleum hydrocarbons similar to the compounds detected in the BC wells were detected in the sample.

MW-4 was installed on a vacant lot owned by Jeff Vantosh. The well was installed in this location after failing to obtain drilling access from Buddy's Convenience Store. No VOCs were detected in the sample collected from the well.

D.1.2.4 December 2002 and February 2003 Subsurface Investigations

In response to EPD comments, in December 2002 and February 2003, three interior soil borings (SB-1, SB-2, and SB-5) were deepened and six additional soil borings, SB-9 through SB-14 were advanced. A total of six additional samples were collected from the deepened borings. Twelve samples were collected from the new borings. All of the samples were analyzed for VOCs.

Petroleum VOCs were detected in samples collected from SB-11 and SB-14. No VOCs were detected in SB-13 located in the sidewalk adjacent to Highland Avenue. The petroleum VOCs detected included BTEX constituents, trimethylbenzenes, naphthalene, methyl-tertiary-butyl-ether (MTBE), and related BTEX derivatives. The presence of MTBE in SB-11 suggests an unleaded gasoline source. An unleaded gasoline UST is located approximately 20 feet northwest and hydraulically upgradient of SB-11. The detection of petroleum hydrocarbons in SB-14 may be attributed to the stockpiling of petroleum contaminated soils near the dumpsters and migration through the groundwater from Buddy's Convenience Store.

PCE was detected in several of the samples in concentrations ranging from 0.0053 mg/kg (SB-1-29-30) to 0.140 mg/kg (SB-9-28).

The vertical extent of PCE near the dry cleaning machine was defined to a depth of 44 ft-bls as indicated by a concentration below laboratory reporting levels in SB-9-44. VOCs other than PCE were not detected in any of the borings except SB-12. Trace levels of petroleum hydrocarbon VOCs were detected in SB-12 at depths of 6, 15, and 28 ft-bls. The compounds detected included toluene, ethylbenzene, xylenes, and trimethylbenzenes. These compounds are attributed to petroleum releases from the UST system located at the Buddy's Convenience Store. The nearest UST is located approximately 30 feet north of the building.

In December 2002, a one-inch temporary well (TW-1) was installed after advancing direct push boring SB-9 below the water table. A groundwater sample was collected from this well for VOC analysis. The results indicated the presence of 160 µg/l PCE. Low levels of VOCs attributed to the adjacent petroleum release were also detected. These compounds included benzene (5 µg/l), xylenes (5.9 µg/l), MTBE (6.6 µg/l), and 1,2-dichloroethane.

In order to complete the groundwater delineation, four additional monitoring wells were installed. Three of the wells (MW-5, MW-6, and MW-7) were constructed immediately adjacent to the building as one-inch temporary wells (Figure E-2). MW-5 was constructed in boring SB-11 located on the north side of the building. MW-6 was installed in SB-13 located on the west side of the building in the sidewalk adjacent to Highland Avenue. MW-7 was installed in SB-14 on the east side of the building. An additional permanent 2-inch monitoring well, MW-8, was installed northeast of the building in the alley.

PCE was detected in MW-5 (29.7 µg/l), MW-7 (10.9 µg/l), and MW-8 (498 µg/l). PCE was not detected in MW-6. Petroleum hydrocarbons were detected in all of the wells except MW-6. Low levels of 1,2-dichloroethane (12.5 µg/l) and chloroform (12.9 µg/l) were also detected in MW-8.

A sample was also collected from DW-1 to verify the previous PCE detection. VOCs were not detected in the sample collected.

D.1.2.5 November 2004 through July 2005 Sampling Events

Eight groundwater sampling events occurred between November 2004 and July 2005. The purpose of the events was to access the effectiveness of the remediation. The results are shown in Tables E-2 through E-4. As shown in the Table E-2, TCE was detected in the January 2005 sampling event in MW-1 and TW-1 at 6.3 µg/l and 14 µg/l, respectively. This is the first time that TCE was detected on-Property.

D.1.2.6 September 2005 Subsurface Investigation

At the request of EPD, in September 2005, soil boring SB-1 (2005) was installed adjacent to MW-1 since a soil sample was not collected from MW-1 when the well was installed by AEM in 1999. Samples were collected at 8-12 ft-bls and 24-28 ft-bls. No VOCs were detected in the soil samples.

D.2 CORRECTIVE ACTION

This section summarizes the corrective action that has been conducted to date at the Property.

D.2.1 2005 In-situ Chemical Oxidation

D.2.1.1 General Scope of Corrective Action

Corrective action began in November 2004. The soils were considered to be remediated to below Type 1/3 RRS in January 2006. The corrective action program basically consisted of monitoring/injection well installation, oxidant injection/gravity drip, and soil and groundwater sampling as described below. Corrective action at this Property was limited to PCE present in the groundwater and soil, attributable to releases from Midtown's operations, and that was present above Type 1/3 RRS.

D.2.1.2 *In Situ* Chemical Oxidation

Based on the review of the available technologies, *in situ* chemical oxidation (ISCO) was selected as the chosen technology for corrective action at this Property. Initially, the use of hydrogen peroxide (H_2O_2) was pilot tested at the Property. Based on the pilot test results, and the bench scale test, sodium and potassium permanganate (herein referred to as permanganate) were chosen as the oxidizing agents. The application of this methodology for this Property involved the injection of a concentrated oxidizer into the plume through PVC injection wells.

D.2.1.2.1 Technology Overview

Remediation of soil and groundwater contamination using ISCO involves injecting and gravity dripping oxidants directly into the source zone and downgradient plume. The oxidant chemicals react with the contaminant, producing innocuous substances such as carbon dioxide, water, and inorganic chloride. ISCO has several advantages over conventional treatment technologies such as it does not generate waste materials and is implemented over a relatively short time frame.

Permanganate is an oxidizing agent with an affinity for oxidizing organic compounds containing carbon-carbon double bonds, aldehyde groups or hydroxyl groups. As an electrophile, the permanganate ion is strongly attracted to the electrons in carbon-carbon double bonds found in chlorinated alkenes, borrowing electron density from these bonds to form a bridged, unstable oxygen compound known as a hypomanganate diester. This intermediate product further reacts by a number of mechanisms including hydroxylation, hydrolysis or cleavage. The carbon-carbon

double bond of alkenes is broken spontaneously and the unstable intermediates are converted to carbon dioxide through either hydrolysis or further oxidation by the permanganate ion. There are two forms of permanganate, $KMnO_4$ and $NaMnO_4$. The balanced oxidation-reduction reactions of $NaMnO_4$ with the various species of chlorinated ethenes can be written as follows:

Perchloroethene (PCE)

$$4NaMnO + 3C_2Cl_4 + 4H_2O \rightarrow 6CO_2 + 4MnO_2 + 4Na^+ + 12Cl^- + 8H^+$$

Trichloroethene (TCE)

$$2NaMnO + C_2HCl_3 \rightarrow 2CO_2 + 2MnO_2 + 3Cl^- + H^+ + 2Na^+$$

Dichloroethene (DCE)

$$8NaMnO_4 + 3C_2H_2Cl_2 + 2H^+ \rightarrow 6CO_2 + 8MnO_2 + 8K^+ + 6Cl^- + 2H_2O$$

Vinyl Chloride (VC)

$$10KMnO_4 + 3C_2H_3Cl \rightarrow 6CO_2 + 10MnO_2 + 10K^+ + 3Cl^- + 7OH^- + H_2O$$

The byproducts of the reactions shown above are reaction end-points. Intermediate reaction products of TCE oxidation using permanganate ion consists mainly of esters and short-chain acids. Carbon dioxide exists naturally in the subsurface from biological processes and bicarbonate partitioning in the groundwater. Manganese dioxide (MnO_2) is a natural mineral found in the soils.

Chlorine gas reacts immediately with groundwater and pore water to form hypochlorous acid (HOCl). This acid may react with methane to form trace concentrations of chloromethanes in the groundwater immediately after treatment. However, this phenomenon is typically short-lived as the subsurface conditions are converted from an anoxic state to an oxidized state.

D.2.1.2.2 Bench-Scale Test

In August and September 2002, Carus Chemical Company (CCC), LaSalle, Illinois, performed a treatability study using potassium permanganate ($KMnO_4$) to determine the groundwater oxidant demand required to reduce the chlorinated hydrocarbons detected in Midtown soils. The soil natural oxidant demand (NOD) for the low $KMnO_4$ dose ranged from an average of 3 mg/kg at 3 hours to 47 mg/kg at 48 hours. The NOD for the medium $KMnO_4$ dose ranged from an average of 38 mg/kg at 3 hours to 164 mg/kg at 48 hours. The NOD for the high $KMnO_4$ dose ranged from an average of 250 mg/kg at 3 hours to 399 mg/kg at 48 hours. Based on these values, permanganate was considered a viable option for remediation of this Property.

D.2.1.3 Corrective Action Approach

Sodium permanganate was initially injected on Property. After the evaluation of the effectiveness of the sodium permanganate, potassium permanganate was used by gravity drip for the deliver method. This decision to use potassium permanganate was based on the on cost

effectiveness in comparison to sodium permanganate. The choice to change delivery methods from injection to gravity drip was based on literature review and soil lithology.

D.2.1.4 Subsurface Injection Method

Injection of liquid permanganate into the treatment zone was performed utilizing PVC injection wells installed using direct push technology. The injection wells were constructed of 1-inch, machine slotted, 0.020-inch screen in 5 to 10-foot sections, flush threaded to Schedule 40 solid riser pipe and completed flush with surface grade. A total of 17 injection wells were installed; 7 for the remediation of soil, and 10 for the remediation of groundwater. Four injection wells were installed inside the building.

Injection was performed using an injection skid consisting of totes, 1-inch braided poly tubing, injection manifold, and a compressor (when drip was not used). Fresh water was mixed with the permanganate in the totes as required for adjusting the concentration of the permanganate prior to the injection. The specific concentration of permanganate, injection quantity, and injection rate varied based upon injection well. The typical permanganate injection concentration was 5-6%.

The remediation process was monitored as a quality control measure. Process monitoring consisted primarily of the following:

1. Confirmation of oxidant injection concentrations, volumes, and flow rates;
2. Measurement of oxidant;
3. Measurement of oxidant persistence;
4. Analysis for PCE.

Prior to determining the final level of treatment obtained, monitoring for presence of residual oxidant level will help determine if chemical reactions are completed. Due to adsorption and desorption equilibrium, contaminant concentrations may rebound.

Accordingly, after initial injections, sampling events of select groundwater monitoring wells were collected to assess the initial effectiveness of the corrective action. All wells were purged a minimum of three volumes using a dedicated bailer or submersible pump and baseline samples were obtained. Soil and groundwater samples were analyzed for VOCs by USEPA Method 8260b. General water quality parameters such as temperature, oxidation-reduction potential, pH and conductivity were measured in select wells. Note, the groundwater samples were collected only for the purpose of evaluating the effectiveness of the remediation, therefore, only the minimal required operating procedures were performed in order obtain the relative effectiveness and remain cost effective.

D.2.1.5 Summary of Injection Events

The injection events are summarized below.

Date	Activity
11/18/04	Collect groundwater samples from MW-1, MW-8, and TW-1. PCE concentrations were detected in MW-1 at 3,200 µg/L, MW-8 at 2,700 µg/L, and TW-1 at 2,200 µg/L. Install temporary borings adjacent to MW-1 and inject 165 gallons 15% H_2O_2 at 20 pounds per square inch (PSI).
12/17/04	Collect groundwater samples from MW-1, MW-8, and TW-1. PCE concentrations detected in MW-1 at 3,100 µg/L, MW-8 at 2,400 µg/L, and TW-1 at 2,400 µg/L.
1/26/05	Collect groundwater samples from MW-1, MW-8, and TW-1 to assess the effectiveness of the H_2O_2 injection. PCE concentrations were detected in MW-1 at 3,700 µg/L, MW-8 at 3,100 µg/L, and TW-1 at 2,600 µg/L.
6/15-17/05	Install injection wells IW-1 through IW-12 to treat soil and groundwater.
6/19/05	Inject 110 gallons 10% KMO_2 at 40 PSI into injection wells IW-2-6,
6/22/05	Collect groundwater samples from MW-1, DW-1, and MW-8. PCE concentrations were detected in MW-1, DW-1, and MW-8. Deliver 330 gallons 10% NaMNO4 by gravity feed into injection wells IW 1-6.
7/6/05	Sample MW-1 before delivery of $KMNO_4$. PCE concentrations detected at 2,400 µg/L. Deliver 300 gallons 5% KMO_4 into injection wells IW-5, IW-6, IW-11, and IW-12.
7/8/05	Collect a groundwater sample from MW-1 prior to KMO_4 delivery. MW-1 PCE concentration detected at 1,400 µg/L. Install boring IW-17 and deliver 75 gallons 5% KMO_4. Collect a groundwater sample from MW-1 after delivery. MW-1 PCE concentration below laboratory detection limits.
7/11/05	Collect groundwater sample from MW-1 to assess PCE rebound. PCE concentration detected at 38 µg/L.
09/30/05	Install additional borings SB-1 and MW-9, then deliver 300 gallons 5% KMO_4 into Injection wells IW-1 through IW-8
10/03/05	Deliver 125 gallons 5% KMO_4 into injection wells IW-9 through IW-12
10/20/05	Deliver 125 gallons 5% KMO_4 into injection wells IW-9 through IW-12
10/25/05	Deliver 150 gallons 5% KMO_4 into injection wells IW-1 through IW-8
10/26/05	Deliver 100 gallons 5% KMO_4 into injection wells IW-9 through IW-12
10/29/05	Deliver 200 gallons 5% KMO_4 into injection wells IW-1 through IW-8
11/13/05	Install injection wells IW-14, IW-15, IW-16. Deliver 50 gallons of 5% $KMNO_4$ into these wells.
11/22/05	Deliver 125 gallons KMO_4 into injection wells IW-14 through IW-16
11/29/05	Deliver 150 gallons KMO_4 into injection wells IW-14 through IW-16

12/02/05	Install borings SB-1C, 2C, 3C, 4C, 5C and collect soil samples for certification. Laboratory reports indicate that all PCE concentrations are below RRS with exception of SB-3C (1.4 mg/kg)
12/19/05	Deliver 200 gallons 5% KMO_4 into IW-9 – IW-12
12/20/05	Deliver 200 gallons 5% KMO_4 into IW-9 – IW-12
12/21/05	Deliver 200 gallons 5% KMO_4 into IW-9 – IW-12
01/03/06	Install borings SB-5, SB-6, and SB-7 and collect soil samples for certification. Laboratory reports indicate that all PCE concentrations are below RRS.

D.2.2 2007 – 2008 *In Situ* Chemical Oxidation

In December 2006, a Corrective Action Plan Addendum 1 (EPS, 2006) was submitted to the EPD and was modified in a letter dated May 25, 2007 (EPS, 2007). The modified CAP Addendum was approved by the EPD in a letter dated May 31, 2007. The objective of the modified CAP Addendum was to propose corrective action to bring the Property's groundwater into compliance with RRS using ISCO and monitored natural attenuation (MNA).

The following activities have taken place since the CAP Amendment:

1. Baseline Groundwater Monitoring Event – May 2007
2. Injection Well Installation – June 2007
3. Soil Oxygen Demand Sampling – June 2007
4. Well Abandonment – June 2007
5. Monitoring Well Installation – August 2007
6. Phase I Injections – August 2007
7. Interim Sampling Event 1 – November 2007
8. Phase II Injections – January 2008
9. Interim Sampling Event 2 – March 2008
10. Interim Sampling Event 3 – September 2008
11. Interim Sampling Event 4 – April 2009
12. Interim Sampling Event 5 – October 2010

This section discusses each of the items listed above in addition to results of previously performed pilot testing.

D.2.3 July 2005 Sampling

Pilot test injections were performed in July 2005 in one injection well located immediately adjacent to monitoring well MW-1. Tetrachloroethene (PCE) concentrations decreased from 1,400 µg/L to non-detect in MW-1. PCE concentrations rebounded to 320 µg/L in MW-1 in March 2007.

D.2.4 May 2007 Baseline Groundwater Monitoring Event

EPS performed the Baseline Groundwater Monitoring Event on May 22 - 24, 2007 prior to beginning Phase I of the remediation project (i.e., permanganate injections). During the event, an obstruction was encountered in MW-7 and the well could not be sampled. In addition, the EPD requested that a monitoring well (MW-10) be installed to delineate the plume in the down-gradient and easterly direction.

Due to off-Property access issues, MW-10 could not be installed prior to the Baseline Sampling Event. On August 2, 2007, MW-7R and MW-10 were installed and sampled. MW-7R was installed adjacent to MW-7 as its replacement, and MW-10 was installed east of Buddy's Convenience Store. The monitoring well installation and sampling methods are discussed further in a Corrective Action Progress Report (EPS, 2008). The locations of these wells are shown on Figure E-2.

For the purpose of this report, sample results from the August 2007 sampling of MW-7R and MW-10 are included with the discussion of the Baseline Monitoring Event.

During the Baseline Monitoring Event, ten 2-inch diameter wells, MW-1, MW-2, MW-3, MW-6, MW-7R, MW-8, MW-10, DW-1, BCMW-1, and BCMW-6, and one 1-inch diameter well, MW-5, were gauged, purged, and sampled for VOC analysis. TW-1 and MW-4 could not be found, MW-9 was dry, and BCMW-5 had petroleum light non-aqueous phase liquid through the entire wetted interval. Therefore, these well were not sampled during the Baseline Event.

D.2.5 Injection Well Construction

The CAP Addendum No. 1, dated December 2006, proposed the installation of 13 standard injection wells in the main source area and an additional three standard injection wells near MW-2. The CAP Modification dated May 25, 2007 modified the CAP Addendum No. 1 to include the installation of 4 hydraulic fracture (frac) injection wells in place of the 13 source area standard injection wells and the removal of injections in the area of MW-2.

According to FRX, Inc., the frac well installation contractor, frac wells tend to allow injection rates between 10 and 20 times faster than standard injection wells in soils similar to those in the Atlanta area. This is mainly attributed to the large area of contact between the sand frac and the formation. In a standard one-inch diameter injection well having 10 feet of screen and installed with a direct push rig, the area of contact between the sand pack and the formation is approximately 10 square feet (ft^2). A 2-inch injection well installed with an auger may have an area of contact between the sand pack and the formation of approximately 25 ft^2. In contrast, a frac well with only one sand fracture may have an area of contact between the sand and the formation of approximately 1,400 ft^2 to 2,500 ft^2. This allows direct contact with significantly more zones of higher permeability than a standard injection well would allow. Once the injectant is spread out through the aquifer, it can diffuse into lower permeable zones.

The four frac wells were installed June 6-15, 2007, using direct push technology in conjunction with sand injection equipment. Direct push rods were pushed to the desired depth using an expendable tip in each of the injection locations. The total depths of frac wells FW-1, FW-2, FW-3, and FW-4 are 35 feet below the land surface (ft bls), 37 ft bls, 33 ft bls, and 35 ft bls, respectively. Fractures were created at the bottom of each of the wells. In addition, a second fracture was created at 35 ft bls in FW-2. More information about the construction of the frac wells can be found in the Corrective Action Progress Report (EPS, 2008).

D.2.6 Well Abandonment

In June 2007, while installing the frac injection wells, EPS abandoned MW-7, which had an obstruction, and MW-9, which was originally installed as a temporary well and was shallower than the water table. All of the exterior injection wells (IW-1 through IW-8 and IW-13 through IW-16) were also abandoned. The wells were abandoned by first filling each with grout to the ground surface. The grout was allowed to settle, topped off, and finished flush with the ground surface.

D.2.7 Permanganate Soil Oxygen Demand (PSOD) Sampling

In June 2007, during direct push probing activities associated with the installation of the frac wells, two PSOD samples were collected from just below the water table, one each from borings FW-1 and FW-4. The samples were analyzed by Carus Corporation, a manufacturer of permanganate. The PSOD results ranged from 0.3 g/kg to 7.4 g/kg with an average of 3.8 g/kg. Using Property specific inputs, the Carus Corporation model predicted that 2,700 pounds of potassium permanganate would be required to treat the PCE in groundwater.

D.2.8 Phase I Potassium Permanganate Injections

On August 3, 7, and 8, 2007, EPS injected approximately 1,200 pounds of potassium permanganate into the frac wells. A 2% to 2.5% solution of permanganate was mixed in 275-gallon totes and pumped, using a diaphragm pump, through a manifold into each of the four injection wells. Flow rates and total flow for each well were measured with water meters located on each leg of the manifold.

Throughout the Phase I injections, each of the manifold legs were fully open to allow a maximum overall volume of injection. Injection wells FW-1 through FW-4 accepted flow rates of 1.3 gallons per minute (gpm), 2.7 gpm, 0.33 gpm, and 2.4 gpm, respectively. This amounts to 244 lbs, 494 lbs, 23 lbs, and 439 lbs of potassium permangate into each of the wells respectively.

D.2.9 Monitoring Well Installation

As previously discussed, on August 2, 2008, EPS installed monitoring wells MW-7R and MW-10. Well MW-7R was installed immediately adjacent to MW-7 as a replacement well for MW-7. As requested in Comment #8 in EPD's letter dated September 26, 2006, MW-10 was installed between MW-8 and MW-4. Well locations are shown on Figure E-2.

Boring MW-10 was first advanced using direct push methods and continuous soil samples were collected using a macro-core sampler. Borings MW-7R and MW-10 were then drilled using 4¼-inch outside diameter solid stem augers. Both borings were drilled to 35 ft bls

D.2.10 Phase II Potassium Permanganate Injections

On January 23, 24, 30, and 31, 2008, EPS injected approximately 500 pounds of potassium permanganate into the frac wells. A 2% solution of permanganate was mixed in 275-gallon totes and pumped using a diaphragm pump through a manifold into each of the four injection wells. Ambient air temperatures during these days were slightly above freezing. It is estimated that the water temperature was approximately 10° to 20°F lower than it was during the August 2007 injection event. The solubility of permanganate decreases as water temperature decreases. Therefore, during the cold weather injections in January, as opposed to the warm weather injections in August, a larger injection volume was required to inject the same mass of permanganate. Flow rates and total flow for each well was measured with water meters located on each leg of the manifold.

During the Phase II event, injections were first targeted to well FW-3, which received the least amount of permanganate during the Phase I injections in August 2007. Throughout the remainder of the Phase II injections, flow to wells FW-2, FW-3, and FW-4 was restricted to allow similar injection volumes to each of the four wells. Injection wells FW-1 through FW-4 had average flow rates of 0.55 gpm, 1.3 gpm, 1.2 gpm, and 1.3 gpm, respectively. For the entire Phase II injections, 70 lbs, 134 lbs, 141 lbs, and 155 lbs of potassium permangate were injected into FW-1 through FW-4, respectively.

During the March 2008 groundwater sampling event, unreacted potassium permanganate was observed in wells MW-5 and MW-8. Therefore, no additional injections were conducted.

D.3 INTERIM GROUNDWATER MONITORING EVENTS

D.3.1 November 2007 Interim Groundwater Monitoring Event

On November 28, 2007, MW-1, MW-7R, and MW-8 were sampled as part of the first Interim Groundwater Monitoring Event. Each of the wells were sampled for VOCs and inorganic compounds including arsenic, barium, cadmium, total chromium, hexavalent chromium, copper, iron, lead, selenium, and chloride. VOCs were analyzed by Method SW8260B. Inorganic compounds, not including hexavalent chromium and chloride, were analyzed by Method SW6010B. Hexavalent chromium was analyzed by Method M3500-CR D, and chloride was analyzed by Method SW9056.

D.3.2 March 2008 Interim Groundwater Monitoring Event

On March 24, 2007, MW-5, MW-7R, and MW-8 were sampled as part of the second Interim Groundwater Monitoring Event. Each of the wells were sampled for VOCs and inorganics, including arsenic, barium, cadmium, total chromium, hexavalent chromium, copper, iron, lead, selenium, and chloride.

D.3.3 September 2008 Interim Groundwater Monitoring Event

During the March 2008 sampling event, unreacted potassium permanganate was observed in wells MW-5 and MW-8. Therefore, no additional injections were conducted. EPS conducted the third post-injection sampling event on September 25 – 26, 2008. Prior to the sampling event, the GA EPD agreed that wells MW-1, MW-2, MW-3, MW-5, MW-6, MW-7R, MW-8, DW-1, and TW-1 would be sampled for volatile organic compounds and wells MW-1, MW-5, MW-7R, and MW-8 would be sampled for inorganics. During the event, MW-1, MW-7R, and TW-1 were dry and could not be sampled.

D.3.4 April 2009 Interim Groundwater Monitoring Event

Based on a request from the EPD in a letter dated December 23, 2008, an additional round of groundwater monitoring was conducted. On April 8, 2009, EPS attempted to collect groundwater samples from monitoring wells MW-1, MW-5, MW-7R, and MW-8. Wells MW-1 and MW-7R were dry. Next, EPS attempted to sample MW-6 and MW-2, but these were both dry as well. Finally, deep well DW-1 was sampled.

D.3.5 October 2010 Interim Groundwater Monitoring Event

On October 4-6, 2010, a groundwater monitoring event was conducted. Wells MW-1, MW-2, MW-3, MW-5, MW-6, MW-7R, MW-8, MW-10, DW-1, BCMW-1 and BCMW-6 were sampled and analyzed for VOCs. Samples from wells MW-1, MW-3 MW-5, MW-7R, MW-8, MW-10 and DW-1 were analyzed for inorganics.

APPENDIX D

TABLES

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Table D-1. Analytical Results for Constituents Detected in Soil (mg/kg)

Sample Number	Date	Depth	Tetrachloroethene (PCE)	Benzene	Toluene	Ethyl-benzene	Xylenes	n-propyl benzene	1,2,4 & 1,3,5-Tri-methyl benzene	Naphthalene	MTBE	2-hexanone	4-iso propyl toluene	sec-butyl benzene	n-butyl benzene	Isopropyl benzene
Type 1 RRS			0.5	0.5	100	70	1000	Not	Not	Not	Not	Not	Not	Not	Not	22
Type 3 RRS			0.5	0.5	100	70	1000	Regulated	Regulated	Regulated	Regulated	Regulated	Regulated	Regulated	Regulated	22
DRAIN	3/31/1999	6.25	0.065	<0.005	<0.005	<0.005						<0.050				
MACHINE	3/31/1999	2	**0.67**	<0.005	<0.005	<0.005						<0.050				
DUMPSTER	3/31/1999	2	<0.005	0.35	0.44	0.027	0.13					<0.050				
SB-1	11/27/2001	1	<0.005													
	11/27/2001	3.5	<0.005													
	12/10/2002	29-	0.0053	<0.003	<0.003	<0.003	<0.007	<0.0038	<0.0076	<0.0038	<0.0038	<0.0077	<0.0038	<0.0038	<0.0038	<0.003
	12/10/2002	5	<.0042	<0.004	<0.004	<0.004	<0.008	<0.0042	<0.0084	<0.0042	<0.0042	<0.0085	<0.0042	<0.0042	<0.0042	<0.004
	12/10/2002	10	<.0042	<0.004	<0.004	<0.004	<0.008	<0.0042	<0.0084	<0.0042	<0.0042	<0.0083	<0.0042	<0.0042	<0.0042	<0.004
SB-2	11/27/2001	0.5	<0.005													
	11/27/2001	3	<0.005													
	12/10/2002	8	0.13	<0.003	<0.003	<0.003	<0.007	<0.0036	<0.0072	<0.0036	<0.0036	<0.0072	<0.0036	<0.0036	<0.0036	<0.003
SB-3	11/27/2001	1	0.031													
	11/27/2001	3	<0.005													
SB-4	11/27/2001	1	0.005													
	11/27/2001	3	<0.005													
SB-5	11/27/2001	1	<0.005													
	11/27/2001	6	<0.005													
	12/10/2002	7	0.0058	<0.004	<0.004	<0.004	<0.008	<0.0041	<0.0082	<0.0041	<0.0041	<0.0082	<0.0041	<0.0041	<0.0041	<0.004
	12/10/2002	12	0.0067	<0.004	<0.004	<0.004	<0.008	<0.0042	<0.0084	<0.0042	<0.0042	<0.0084	<0.0042	<0.0042	<0.0042	<0.004
SB-6	11/27/2001	1	<0.005													
	11/27/2001	7	<0.005													
SB-7	11/28/2001	1	<0.005													
SB-8	11/28/2001	1	<0.005													
	11/28/2001	7	<0.005													
SB-9	12/10/2002	1	0.029	<0.002	<0.002	<0.002	<0.008	<0.0029	<0.0080	<0.0029	<0.0029	<0.0080	<0.0029	<0.0029	<0.0029	<0.004
	12/10/2002	8	0.037	<0.003	<0.003	<0.003	<0.008	<0.0037	<0.0080	<0.0037	<0.0037	<0.0080	<0.0037	<0.0037	<0.0037	<0.004
	12/10/2002	20	0.028	<0.003	<0.003	<0.003	<0.007	<0.0038	<0.0076	<0.0038	<0.0038	<0.0076	<0.0038	<0.0038	<0.0038	<0.003
	12/10/2002	28	0.14	<0.004	<0.004	<0.004	<0.008	<0.0042	<0.0084	<0.0042	<0.0042	<0.0084	<0.0042	<0.0042	<0.0042	<0.004
	12/10/2002	44	<0.003	<0.003	<0.003	<0.003	<0.007	<0.0036	<0.0072	<0.0036	<0.0036	<0.0072	<0.0036	<0.0036	<0.0036	<0.003
SB-10	12/10/2002	28	0.03	<0.003	<0.003	<0.003	<0.007	<0.0038	<0.0076	<0.0038	<0.0038	<0.0076	<0.0038	<0.0038	<0.0038	<0.003
SB-11	2/5/2003	8	<0.005	<0.005	0.032	0.01	0.045	<0.005	<0.005	<0.005	0.013	<0.050	<0.005	<0.005	<0.005	<0.005
	2/5/2003	29	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.014	0.096	<0.005	<0.005	<0.005	<0.005
	2/5/2003	46	<0.005	<0.005	0.072	0.032	0.196	0.008	0.114	0.01	0.054	<0.050	<0.005	<0.005	<0.005	<0.005
SB-12	2/5/2003	6	<0.005	<0.005	<0.005	0.011	0.051	<0.005	0.007	<0.005	<0.005	<0.050	<0.005	<0.005	<0.005	<0.005
	2/5/2003	15	<0.005	<0.005	0.03	0.018	0.09	<0.005	0.022	<0.005	<0.005	<0.050	<0.005	<0.005	<0.005	<0.005
	2/5/2003	28	<0.005	<0.005	0.012	<.0005	0.026	<0.005	<0.005	<0.005	<0.005	<0.050	<0.005	<0.005	<0.005	<0.005
SB-13	2/12/2003	7	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.050	<0.005	<0.005	<0.005	<0.005
	2/12/2003	16	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.050	<0.005	<0.005	<0.005	<0.005

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Table D-1. Analytical Results for Constituents Detected in Soil (mg/kg)

Sample Number	Date	Depth	Tetrachloroethene (PCE)	Benzene	Toluene	Ethyl-benzene	Xylenes	n-propyl benzene	1,2,4 & 1,3,5-Tri-methyl benzene	Naphthalene	MTBE	2-hexanone	4-iso propyl toluene	sec-butyl benzene	n-butyl benzene	Isopropyl benzene
Type 1 RRS			0.5	0.5	100	70	1000	Not	Not	Not	Not	Not	Not	Not	Not	22
Type 3 RRS			0.5	0.5	100	70	1000	Regulated	Regulated	Regulated	Regulated	Regulated	Regulated	Regulated	Regulated	22
SB-14	2/5/2003	8	<0.005	<0.005	0.015	0.007	0.034	<0.005	<0.005	<0.005	<0.005	<0.050	<0.005	<0.005	<0.005	<0.005
	2/5/2003	15	<0.005	<0.005	0.018	0.008	0.038	<0.005	<0.005	<0.005	<0.005	<0.050	<0.005	<0.005	<0.005	<0.005
	2/5/2003	32	<0.005	<0.005	0.128	0.358	1.669	0.306	6.17	2.79	<0.005	<0.005	0.1	0.053	0.846	0.099
	2/5/2003	36	<0.005	0.015	0.057	0.025	0.121	<0.005	0.029	0.026	<0.005	<0.050	<0.005	<0.005	<0.005	<0.005
SB-1 (2005)	9/30/2005	8-12	<0.005	<0.005	<0.005	<0.005	<0.010				<0.005	<0.0057				<0.005
	9/30/2005	24-28	<0.005	<0.005	<0.005	<0.005	<0.011				<0.005	<0.0061				<0.005
DW-1	10/10/2001	35-	0.012													
	10/10/2001	45-	0.01													
	10/10/2001	64-	0.018													
MW-3	10/10/2001	35-	<0.005													
	10/10/2001	40-	<0.005													
MW-9	9/30/2005	24-28	<0.004	<0.005	<0.005	<0.005	<0.011				<0.005	<0.0063				<0.004
Potassium Permanganate Injection																
SB-1C	12/2/2005	24-28	0.049	<0.005	<0.005	<0.005	<0.011				<0.005	<0.0061				<0.005
SB-2C	12/2/2005	24-28	0.015	<0.005	<0.005	<0.005	<0.010				<0.005	<0.0056				<0.005
SB-3C	12/2/2005	4	**1.40**	<0.005	<0.005	<0.005	<0.011				<0.005	<0.0064				<0.005
SB-4C	12/2/2005	12	0.120	<0.005	<0.005	<0.005	<0.011				<0.005	<0.0066				<0.005
SB-5C	12/2/2005	2-3	0.110	<0.005	<0.005	<0.005	<0.010				<0.005	<0.0057				<0.005
	12/2/2005	24-28	<0.004	<0.005	<0.005	<0.005	<0.011				<0.005	<0.0066				<0.005
Potassium Permanganate Injection																
SB-5	1/13/2006	24-28	<0.005	<0.005	<0.005	<0.005	<0.011				<0.005	<0.0065				<0.005
SB-6	1/13/2006	24-28	<0.005	<0.005	<0.005	<0.005	<0.011				0.025	0.0072				<0.005
SB-7	1/13/2006	0-4	0.0098	<0.005	<0.005	<0.005	<0.012				<0.005	<0.0071				<0.005
	1/13/2006	8-12	<0.005	<0.005	<0.005	<0.005	<0.011				<0.005	<0.0061				<0.005
Duplicate	1/13/2006	8-12	<0.005	<0.005	<0.005	<0.005	<0.013				<0.005	<0.0081				<0.005

mg/kg - milligrams per kilogram
blank cell - Constituent not analyzed
Concentrations in excess of Type1/3 RRS are shown in **bold.**
<0.005 - denotes that the sample result was below the laboratory practical quantitation limit

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Table D-2. Analytical Results for Chlorinated VOCs in Groundwater (µg/L)

Well ID	Date	Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Vinyl Chloride	1,1-Dichloroethene	1,2-Dichloroethane	1,1,1-Trichloroethane	Methylene Chloride	Chloroform
MW-1	4/23/1999	35	<5.0	<5.0	<5.0	<5.0	7.7	<5.0	6.6	5.4	13
	8/17/2001	1500	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	15
	11/27/2001	1660	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	11/18/2004	3200	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
	12/17/2004	3100	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
	1/26/2005	3700	6.3	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	8.9
	6/19/2005	**First Potassium Permanganate Injection**									
	6/22/2005	2400	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	*NA*	6.2
	7/6/2005	2400	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	*NA*	<5.0
	7/6/2005	**Second Potassium Permanganate Injection**									
	7/8/2005	1400	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	*NA*	*NA*	<5.0
	7/8/2005	**Third Potassium Permanganate Injection**									
	7/11/2005	38	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	*NA*	*NA*	*NA*
	Oct - Nov 2005	**Additional Potassium Permanganate Injections**									
	12/2/2005	12	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.6
(Duplicate)	12/2/2005	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Dec 19-21, 2005	**Additional Potassium Permanganate Injections**									
	6/13/2006	690	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	8.6
	Aug 2007	**Phase 1 Potassium Permanganate Injection**									
	5/23/2007	320	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	8
	11/28/2007	<5.0	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Jan 2008	**Phase 2 Potassium Permanganate Injection**									
	9/25/2008	Well was dry									
	4/8/2009	Well was dry									
	10/4/2010	180	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	<5.0
MW-2	11/27/2001	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	6/19/2005	**First Potassium Permanganate Injection**									
	6/22/2005	6.4	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	July - Dec 2005	**Additional Potassium Permanganate Injection**									
	12/11/2006	5.6	<5.0	<5.0	<5.0	<2.0	<5.0	*NA*	*NA*	*NA*	*NA*
	5/24/2007	<5.0	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Jan 2008	**Phase 2 Potassium Permanganate Injection**									
	9/26/2008	15	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	<5.0
	4/8/2009	Well was dry									
	10/5/2010	8.9	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	<5.0
MW-3	10/10/2001	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	11/27/2001	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	6/19/2005	**First Potassium Permanganate Injection**									
	6/22/2005	2700	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	13
	July - Dec 2005	**Additional Potassium Permanganate Injection**									
	5/10/2006	9	<5.0	<5.0	<5.0	<2.0	<5.0	6	<5.0	<5.0	34
	12/11/2006	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	*NA*	*NA*	*NA*	*NA*
	5/22/2007	<5.0	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	21
	Jan 2008	**Phase 2 Potassium Permanganate Injection**									
	9/25/2008	<5.0	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	5.9
	10/5/2010	6.2	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	<5.0

Table D-2. Analytical Results for Chlorinated VOCs in Groundwater (µg/L)

Well ID	Date	Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Vinyl Chloride	1,1-Dichloroethene	1,2-Dichloroethane	1,1,1-Trichloroethane	Methylene Chloride	Chloroform
MW-4	1/23/2002	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	*NA*
MW-5	2/27/2003	29.7	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	2005	**Potassium Permanganate Injections**									
	5/23/2007	220	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Aug 2007	**Phase 1 Potassium Permanganate Injection**									
	Jan 2008	**Phase 2 Potassium Permanganate Injection**									
	3/24/2008	77	<5.0	<5.0	<5.0	<2.0	<5.0	37	<5.0	<5.0	<5.0
	9/25/2008	68	<5.0	<5.0	<5.0	<2.0	<5.0	69	<5.0	<5.0	<5.0
	4/8/2009	43	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	<5.0
	10/5/2010	43	<5.0	<5.0	<5.0	<2.0	<5.0	140	<5.0	<5.0	6.3
MW-6	2/17/2003	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	2005	**Potassium Permanganate Injections**									
	5/24/2007	16	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	<5.0
(Duplicate)	5/24/2007	16	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Jan 2008	**Phase 2 Potassium Permanganate Injection**									
	9/26/2008	6.5	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	<5.0
	4/8/2009	Well was dry									
	10/5/2010	11	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	<5.0
MW-7	2/17/2003	10.9	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	2005	**Potassium Permanganate Injections**									
	June 2007	**Well Abandoned**									
MW-7R	8/2/2007	<5.0	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	19
	Aug 2007	**Phase 1 Potassium Permanganate Injection**									
	11/28/2007	62	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	42
	Jan 2008	**Phase 2 Potassium Permanganate Injection**									
	3/24/2008*	<7.0	<18	<24	<16	<11	<250	<250	<250	<250	<250
(Duplicate)	3/24/2008*	<7.0	<18	<24	<16	<11	<250	<250	<250	<250	<250
	9/25/2008	Well was dry									
	4/8/2009	Well was dry									
	10/5/2010	<51	<23	<35	<43	<38	<30	<16	<9.4	<36	<30
MW-8	2/17/2003	498	<5.0	<5.0	<5.0	<5.0	<5.0	12.5	<5.0	<5.0	12.9
	11/18/2004	2700	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	NA
	12/17/2004	2400	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	NA
	1/26/2005	3100	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	13
	6/19/2005	**First Potassium Permanganate Injection**									
	6/22/2005	2700	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	*NA*	*NA*
	July - Dec 2005	**Additional Potassium Permanganate Injection**									
	5/23/2007	2200	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Aug 2007	**Phase 1 Potassium Permanganate Injection**									
	11/28/2007	1500	6.3	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	<5.0
(Duplicate)	11/28/2007	2100	6	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	14
	Jan 2008	**Phase 2 Potassium Permanganate Injection**									
	3/24/2008	490	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	9.9
	9/25/2008	770	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	6.2
	4/8/2009	1800	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	6.5
	10/5/2010	890	8.6	120	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	6.2
(Duplicate)	10/5/2010	890	9	120	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	6.5
MW-10	8/2/2007	<5.0	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	<5.0

Table D-2. Analytical Results for Chlorinated VOCs in Groundwater (µg/L)

Well ID	Date	Tetrachloroethene	Trichloroethene	cis-1,2-Dichloroethene	trans-1,2-Dichloroethene	Vinyl Chloride	1,1-Dichloroethene	1,2-Dichloroethane	1,1,1-Trichloroethane	Methylene Chloride	Chloroform
	10/5/2010	<5.0	<5.0	<5.0	<5.0	<2.0	<5.0	220	<5.0	<5.0	<5.0
	10/4/2010	<5.0	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	<5.0
DW-1	11/27/2001	14.2	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	2/27/2003	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	6/19/2005	**First Potassium Permanganate Injection**									
	6/22/2005	6.4	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	*NA*	*NA*
	July - Dec 2005	**Additional Potassium Permanganate Injection**									
	5/23/2007	<5.0	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Jan 2008	**Phase 2 Potassium Permanganate Injection**									
	9/25/2008	<5.0	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	<5.0
(Duplicate)	9/25/2008	<5.0	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	<5.0
	4/8/2009	<5.0	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	<5.0
GP1-01	1/16/2002	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	14.3
BCMW-1 (NA-1)	8/17/2001	8.5	<5.0	<5.0	<5.0	<5.0	<5.0	260	<5.0	<5.0	<5.0
	2005	**Potassium Permanganate Injections**									
	5/23/2007	9.9	<5.0	26	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	<5.0
	10/5/2010	<51	<23	<35	<43	<38	<30	<16	<9.4	<36	<30
BCMW-2 (NA-2)	8/17/2001	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	44	<5.0	<5.0	<5.0
BCMW-3 (NA-3)	8/17/2001	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	3300	<5.0	<5.0	<5.0
BCMW-6	5/23/2007	<5.0	<5.0	<5.0	<5.0	<2.0	<5.0	<5.0	<5.0	<5.0	<5.0
	10/6/2010	<510	<230	<350	<430	<380	<300	<160	<94	<360	<300
BCMW-7 (MW-D)	8/17/2001	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	55	<5.0	<5.0	<5.0
BCMW-8 (MW-B)	8/17/2001	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	130	<5.0	<5.0	<5.0
TW-1	12/11/2002	160	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	11/18/2004	2200	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
	12/17/2004	2400	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
	1/26/2005	2600	14	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	9.0
	2005	**Potassium Permanganate Injections**									
	12/2/2005	2700	17	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	11
SB-1C	12/2/2005	3700	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	7.1

Notes:

* = Method detection limits are shown for PCE, TCE, cis-DCE, trans-DCE, and VC.
Laboratory reporting limits are shown for all other components.

VOCs = Voaltile Organic Compounds

µg/L - micrograms per liter

NA = Constituent not analyzed

<5.0 - denotes that the sample result was below the laboratory practical quantitation limit

EPS

Table D-3. Analytical Results for Non-Chlorinated VOCs in Groundwater (µg/L)

Well ID	Date	1,2-Dibromoethane	2-Butanone	2-Hexanone	Acetone	Benzene	Chloroethane	Cyclohexane	Toluene	Ethylbenzene	Xylenes	n-propylbenzene	1,2,4 & 1,3,5-Trimethylbenzene	Naphthalene	Methylcyclohexane	Methyl tert-Butyl Ether	4-Isopropyltoluene	sec-Butylbenzene	4-Methyl-2-Pentanone	Isopropylbenzene	Styrene	Bromobenzene	n-Butylbenzene	t-Butylbenzene
MW-1	4/23/1999	<5.0	*NA*	<5.0	*NA*	33	*NA*	*NA*	47	15	79	<5.0	<5.0	<5.0	*NA*	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	8/17/2001	*NA*	*NA*	<5.0	*NA*	36	*NA*	*NA*	75	60	256	29	146	<5.0	*NA*	38	<5.0	<5.0	<5.0	10	<5.0	<5.0	<5.0	<5.0
	11/27/2001	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
	1/26/2005	<5.0	<50	<10	<50	11	<10	<5.0	7.2	<5.0	<15	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
	12/2/2005	<5.0	<50	<10	76	<5.0	<10	<5.0	<5.0	<5.0	<15	*NA*	*NA*	*NA*	<5.0	<5.0	*NA*	*NA*	<10	<5.0	<5.0	*NA*	*NA*	*NA*
(Duplicate)	12/2/2005	<5.0	*NA*	<7.6	*NA*	<5.0	*NA*	*NA*	<5.0	<5.0	<12.6	*NA*	*NA*	*NA*	*NA*	<5.0	*NA*	*NA*	<7.6	<5.0	<5.0	*NA*	*NA*	*NA*
	6/13/2006	<5.0	<50	<10	61	<5.0	<10	<5.0	<5.0	<5.0	<15	*NA*	*NA*	*NA*	<5.0	<5.0	*NA*	*NA*	<10	<5.0	<5.0	*NA*	*NA*	*NA*
	5/23/2007	6.6	<50	<10	65	150	<10	<5.0	500	69	49	*NA*	*NA*	*NA*	14	8.6	*NA*	*NA*	<10	<5.0	<5.0	*NA*	*NA*	*NA*
	11/28/2007	<5.0	<50	<10	900	5.4	<10	<5.0	<5.0	<5.0	<15	*NA*	<5.0	<5.0	<5.0	<5.0	*NA*	*NA*	*NA*	<5.0	<5.0	*NA*	*NA*	*NA*
	9/25/2008	Well was dry																						
	10/4/2010	<5.0	<50	<10	<50	<5.0	<10	<5.0	<5.0	<5.0	<15	*NA*	*NA*	*NA*	<5.0	<5.0	*NA*	*NA*	<10	<5.0	<5.0	*NA*	*NA*	*NA*
MW-2	11/27/2001	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
	5/24/2007	<5.0	<50	<10	<50	<5.0	<10	<5.0	<5.0	<5.0	<15	*NA*	*NA*	*NA*	<5.0	<5.0	*NA*	*NA*	<10	<5.0	<5.0	*NA*	*NA*	*NA*
	9/26/2008	<5.0	<50	<10	<50	<5.0	<10	<5.0	15	<5.0	18.2	*NA*	*NA*	*NA*	<5.0	<5.0	*NA*	*NA*	<10	<5.0	<5.0	*NA*	*NA*	*NA*
	10/5/2010	<5.0	<50	<10	<50	<5.0	<10	<5.0	<5.0	<5.0	<10	*NA*	*NA*	*NA*	<5.0	<5.0	*NA*	*NA*	<10	<5.0	<5.0	*NA*	*NA*	*NA*
MW-3	11/27/2001	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
	6/22/2005	<5.0	<50	<10	<50	620	<10	96	430	110	1050	*NA*	*NA*	*NA*	76	<5.0	*NA*	*NA*	<10	15	<5.0	*NA*	*NA*	*NA*
	5/10/2006	13	<20	38	<100	1400	<10	*NA*	1200	270	2080	42	490	180	*NA*	<5.0	<5.0	<5.0	<10	29	<5.0	<5.0	<5.0	96
	5/22/2007	<5.0	<50	24	<50	860	<10	110	620	190	1710	*NA*	*NA*	*NA*	62	<5.0	*NA*	*NA*	10	25	<5.0	*NA*	*NA*	*NA*
	9/25/2008	<5.0	78	98	<50	240	<10	150	1600	450	2600	*NA*	*NA*	*NA*	75	<5.0	*NA*	*NA*	28	43	<5.0	*NA*	*NA*	*NA*
	10/5/2010	<5.0	78	91	80	200	<10	280	4000	1000	5100	*NA*	*NA*	*NA*	150	<5.0	*NA*	*NA*	32	70	<5.0	*NA*	*NA*	*NA*
MW-4	1/23/2002	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
MW-5	2/27/2003	<5.0	*NA*	<50	*NA*	825	*NA*	*NA*	1850	176	1108	22	48	18	*NA*	410	<5.0	<5.0	<5.0	7.79	<5.0	<5.0	<5.0	163
	5/23/2007	42	500	270	690	4100	*NA*	58	12000	610	7500	*NA*	*NA*	*NA*	64	1600	*NA*	*NA*	110	25	<5.0	*NA*	*NA*	*NA*
	3/24/2008	31	380	<10	3600	1700	<10	72	3700	160	610	*NA*	*NA*	*NA*	56	350	*NA*	*NA*	24	13	<5.0	*NA*	*NA*	*NA*
	9/25/2008	30	100	77	430	2000	<10	79	5200	270	3000	*NA*	*NA*	*NA*	67	930	*NA*	*NA*	28	13	<5.0	*NA*	*NA*	*NA*
	4/8/2009	14	100	110	310	3400	<10	120	4900	500	2110	*NA*	*NA*	*NA*	160	1400	*NA*	*NA*	77	23	<5.0	*NA*	*NA*	*NA*
	10/5/2010	36	410	400	1200	6400	<10	170	8200	1500	4900	*NA*	*NA*	*NA*	150	1200	*NA*	*NA*	160	55	<5.0	*NA*	*NA*	*NA*

Table D-3. Analytical Results for Non-Chlorinated VOCs in Groundwater (µg/L)

Well ID	Date	1,2-Dibromoethane	2-Butanone	2-Hexanone	Acetone	Benzene	Chloroethane	Cyclohexane	Toluene	Ethylbenzene	Xylenes	n-propylbenzene	1,2,4 & 1,3,5-Trimethylbenzene	Naphthalene	Methylcyclohexane	Methyl tert-Butyl Ether	4-Isopropyltoluene	sec-Butylbenzene	4-Methyl-2-Pentanone	Isopropylbenzene	Styrene	Bromobenzene	n-Butylbenzene	t-Butylbenzene
MW-6	2/17/2003	<5.0	*NA*	<50	*NA*	<5.0	*NA*	*NA*	<5.0	<5.0	<15	<5.0	<5.0	<5.0	*NA*	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	5/24/2007	<5.0	<50	<10	<50	<5.0	<10	<5.0	<5.0	<5.0	<15	*NA*	*NA*	*NA*	<5.0	<5.0	*NA*	*NA*	<10	<5.0	<5.0	*NA*	*NA*	*NA*
(Duplicate)	5/24/2007	<5.0	<50	<10	<50	<5.0	<10	<5.0	<5.0	<5.0	<15	*NA*	*NA*	*NA*	<5.0	<5.0	*NA*	*NA*	<10	<5.0	<5.0	*NA*	*NA*	*NA*
	9/26/2008	<5.0	<50	<10	<50	<5.0	<10	<5.0	<5.0	<5.0	<15	*NA*	*NA*	*NA*	<5.0	<5.0	*NA*	*NA*	<10	<5.0	<5.0	*NA*	*NA*	*NA*
	10/5/2010	<5.0	<50	<10	<50	<5.0	<10	<5.0	<5.0	<5.0	<10	*NA*	*NA*	*NA*	<5.0	<5.0	*NA*	*NA*	<10	<5.0	<5.0	*NA*	*NA*	*NA*
MW-7	2/17/2003	<5.0	*NA*	<5.0	*NA*	338	*NA*	*NA*	2570	619	1425	269	2098	136	*NA*	<5.0	16	33	<5.0	<5.0	<5.0	88	70	<5.0
MW-7R	8/2/2007	<5.0	93	130	150	3700	<10	280	16000	3300	10100	*NA*	*NA*	*NA*	180	<5.0	*NA*	*NA*	47	130	*NA*	*NA*	*NA*	*NA*
	11/28/2007	<5.0	200	270	<50	2800	<10	410	21000	2900	10700	*NA*	<5.0	*NA*	160	<5.0	*NA*	*NA*	<10	<5.0	<5.0	*NA*	*NA*	*NA*
	3/24/2008	<250	<2500	<500	<2500	2100	<500	1900	21000	3700	21000	*NA*	*NA*	*NA*	1300	<250	*NA*	*NA*	<500	320	<250	*NA*	*NA*	*NA*
(Duplicate)	3/24/2008	<250	<2500	<500	<2500	2400	<500	990	22000	4000	22500	*NA*	*NA*	*NA*	710	<250	*NA*	*NA*	<500	260	<250	*NA*	*NA*	*NA*
	9/25/2008	Well was dry																						
	10/5/2010	<29	<170	<61	1700 J	2100	<39	<66	14000	2500	16500	*NA*	*NA*	*NA*	<41	<37	*NA*	*NA*	<39	320 J	<10	*NA*	*NA*	*NA*
MW-8	2/17/2003	<5.0	*NA*	96	*NA*	339	*NA*	*NA*	458	128	752	47	399	<5.0	*NA*	13	<5.0	<5.0	<5.0	13	<5.0	<5.0	<5.0	<5.0
	1/26/2005	<5.0	28	<5.0	<50	990	<10	64	180	63	1250	<5.0	<5.0	<5.0	59	<5.0	<5.0	<5.0	26	18	<5.0	<5.0	<5.0	<5.0
	5/23/2007	<5.0	<50	<10	<50	510	<10	63	200	73	940	*NA*	*NA*	*NA*	66	<5.0	*NA*	*NA*	15	22	<5.0	*NA*	*NA*	*NA*
	11/28/2007	<5.0	<50	<10	<50	440	<10	90	65	28	550	*NA*	<5.0	*NA*	60	<5.0	*NA*	*NA*	<10	<5.0	<5.0	*NA*	*NA*	*NA*
(Duplicate)	11/28/2007	<5.0	<50	<10	<50	420	<10	<5.0	94	30	740	*NA*	<5.0	*NA*	49	<5.0	*NA*	*NA*	<10	28	<5.0	*NA*	*NA*	*NA*
	3/24/2008	<5.0	66	13	320	290	<10	35	<5.0	<5.0	105	*NA*	*NA*	*NA*	12	<5.0	*NA*	*NA*	21	6.1	<5.0	*NA*	*NA*	*NA*
	9/25/2008	<5.0	<50	<10	<50	190	<10	17	23	6	206	*NA*	*NA*	*NA*	9	<5.0	*NA*	*NA*	<10	6.1	<5.0	*NA*	*NA*	*NA*
	4/8/2009	<5.0	<50	<10	<50	120	<10	42	<5.0	<5.0	77	*NA*	*NA*	*NA*		<5.0	*NA*	*NA*	<10	9.6	<5.0	*NA*	*NA*	*NA*
	10/5/2010	<5.0	<50	<10	<50	56	<10	78	<5.0	<5.0	87	*NA*	*NA*	*NA*	65	<5.0	*NA*	*NA*	<10	9.2	<5.0	*NA*	*NA*	*NA*
(Duplicate)	10/5/2010	<5.0	<50	<10	<50	60	<10	72	<5.0	<5.0	89	*NA*	*NA*	*NA*	60	<5.0	*NA*	*NA*	<10	10	<5.0	*NA*	*NA*	*NA*
MW-10	8/2/2007	51	380	190	540	4300	<10	110	7200	1700	5400	*NA*	*NA*	*NA*	50	700	66	*NA*	77	*NA*	<5.0	*NA*	*NA*	*NA*
	10/5/2010	17	130	110	250	3000	<10	67	1600	640	2790	*NA*	*NA*	*NA*	30	200	*NA*	*NA*	64	28	<5.0	*NA*	*NA*	*NA*
DW-1	11/27/2001	*NA*	*NA*	<5.0	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	<5.0	<5.0
	2/27/2003	<5.0	*NA*	<5.0	*NA*	<5.0	*NA*	*NA*	<5.0	<5.0	<15.0	<5.0	<5.0	<5.0	*NA*	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	5/23/2007	<5.0	<50	<10	<50	<5.0	<10	<5.0	<5.0	<5.0	<10	*NA*	*NA*	*NA*	<5.0	<5.0	*NA*	*NA*	<10	<5.0	<5.0	*NA*	*NA*	*NA*
	9/25/2008	<5.0	<50	<10	<50	18	<10	<5.0	22	<5.0	14	*NA*	*NA*	*NA*	<5.0	7	*NA*	*NA*	<10	<5.0	<5.0	*NA*	*NA*	*NA*
(Duplicate)	9/25/2008	<5.0	<50	<10	<50	18	<10	<5.0	20	<5.0	12	*NA*	*NA*	*NA*	<5.0	8	*NA*	*NA*	<10	<5.0	<5.0	*NA*	*NA*	*NA*
	4/8/2009	<5.0	<50	<10	<50	6.0	<10	<5.0	<5.0	<5.0	<10	*NA*	*NA*	*NA*	<5.0	8	*NA*	*NA*	<10	<5.0	<5.0	*NA*	*NA*	*NA*
	10/4/2010	<5.0	<50	<10	<50	5.2	<10	<5.0	<5.0	<5.0	<10	*NA*	*NA*	*NA*	<5.0	<5.0	*NA*	*NA*	<10	<5.0	<5.0	*NA*	*NA*	*NA*

Table D-3. Analytical Results for Non-Chlorinated VOCs in Groundwater (µg/L)

Well ID	Date	1,2-Dibromoethane	2-Butanone	2-Hexanone	Acetone	Benzene	Chloroethane	Cyclohexane	Toluene	Ethylbenzene	Xylenes	n-propylbenzene	1,2,4 & 1,3,5-Trimethylbenzene	Naphthalene	Methylcyclohexane	Methyl tert-Butyl Ether	4-Isopropyltoluene	sec-Butylbenzene	4-Methyl-2-Pentanone	Isopropylbenzene	Styrene	Bromobenzene	n-Butylbenzene	t-Butylbenzene
GP1-01	1/16/2002	108	*NA*	<5.0	*NA*	9180	*NA*	*NA*	9850	619	2587	<5.0	606	145	*NA*	<5.0	<5.0	<5.0	<5.0	22	<5.0	<5.0	12	<5.0
BCMW-1 (NA-1)	8/17/2001	37	*NA*	<5.0	92	12000	*NA*	*NA*	18000	2300	9800	200	2080	660	*NA*	4300	<5.0	<5.0	92	74	27	<5.0	<5.0	<5.0
	5/23/2007	34	1300	370	2000	3400	18	220	6100	1200	3400	*NA*	*NA*	*NA*	<5.0	3800	*NA*	*NA*	150	160	<5.0	*NA*	*NA*	*NA*
	10/5/2010	<29	1800 J	<61	3900 J	27000	<39	<66	44000	6000	29000	*NA*	*NA*	*NA*	<41	11000	*NA*	*NA*	<39	390 J	120 J	*NA*	*NA*	*NA*
BCMW-2 (NA-2)	8/17/2001	<5.0	*NA*	<5.0	*NA*	2600	*NA*	*NA*	46000	4400	22200	550	4830	1000	*NA*	9100	<5.0	<5.0	89	190	78	<5.0	<5.0	<5.0
BCMW-3 (NA-3)	8/17/2001	1300	*NA*	<5.0	*NA*	27000	*NA*	*NA*	34000	4000	14400	400	3600	1000	*NA*	16000	<5.0	<5.0	140	120	70	<5.0	<5.0	<5.0
BCMW-6	5/23/2007	<5.0	4600	560	7800	38000	<10	780	61000	4900	18140	*NA*	*NA*	*NA*	770	26000	*NA*	*NA*	<10	130	<5.0	*NA*	*NA*	*NA*
	10/6/2010	<290	<1700	<610	<5000	43000	<390	<660	91000	18000	107000	*NA*	*NA*	*NA*	6100	28000	*NA*	*NA*	<390	3500 J	<100	*NA*	*NA*	*NA*
BCMW-7 (MW-D)	8/17/2001	<5.0	*NA*	<5.0	*NA*	2700	*NA*	*NA*	46	33	1020	18	240	72	*NA*	900	<5.0	<5.0	41	28	<5.0	<5.0	<5.0	<5.0
BCMW-8 (MW-B)	8/17/2001	<5.0	*NA*	<5.0	*NA*	15000	*NA*	*NA*	20000	3800	15700	480	4600	720	*NA*	1100	<5.0	<5.0	190	150	<5.0	<5.0	<5.0	<5.0
TW-1	12/11/2002	<5.0	*NA*	<5.0	*NA*	5	*NA*	*NA*	<5.0	<5.0	6	<5.0	<5.0	<5.0	*NA*	6.6	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	1/26/2005	<5.0	<50	<10	<50	<5.0	<10	<5.0	5.3	<5.0	<10	*NA*	*NA*	*NA*	<5.0	28	*NA*	*NA*	<10	<5.0	<5.0	*NA*	*NA*	*NA*
	12/2/2005	<5.0	<50	<10	<50	<5.0	<10	<5.0	<5.0	<5.0	<10	*NA*	*NA*	*NA*	<5.0	11	*NA*	*NA*	<10	<5.0	<5.0	*NA*	*NA*	*NA*
SC-1C	12/2/2005	<5.0	*NA*	<10	*NA*	16	*NA*	*NA*	14	<5.0	10	*NA*	*NA*	*NA*	*NA*	<5.0	*NA*	*NA*	<10	<5.0	<5.0	*NA*	*NA*	*NA*

Notes:
µg/L - micrograms per liter
NA = Constituent not analyzed
<5.0 - denotes that the sample result was below the laboratory practical quantitation limit

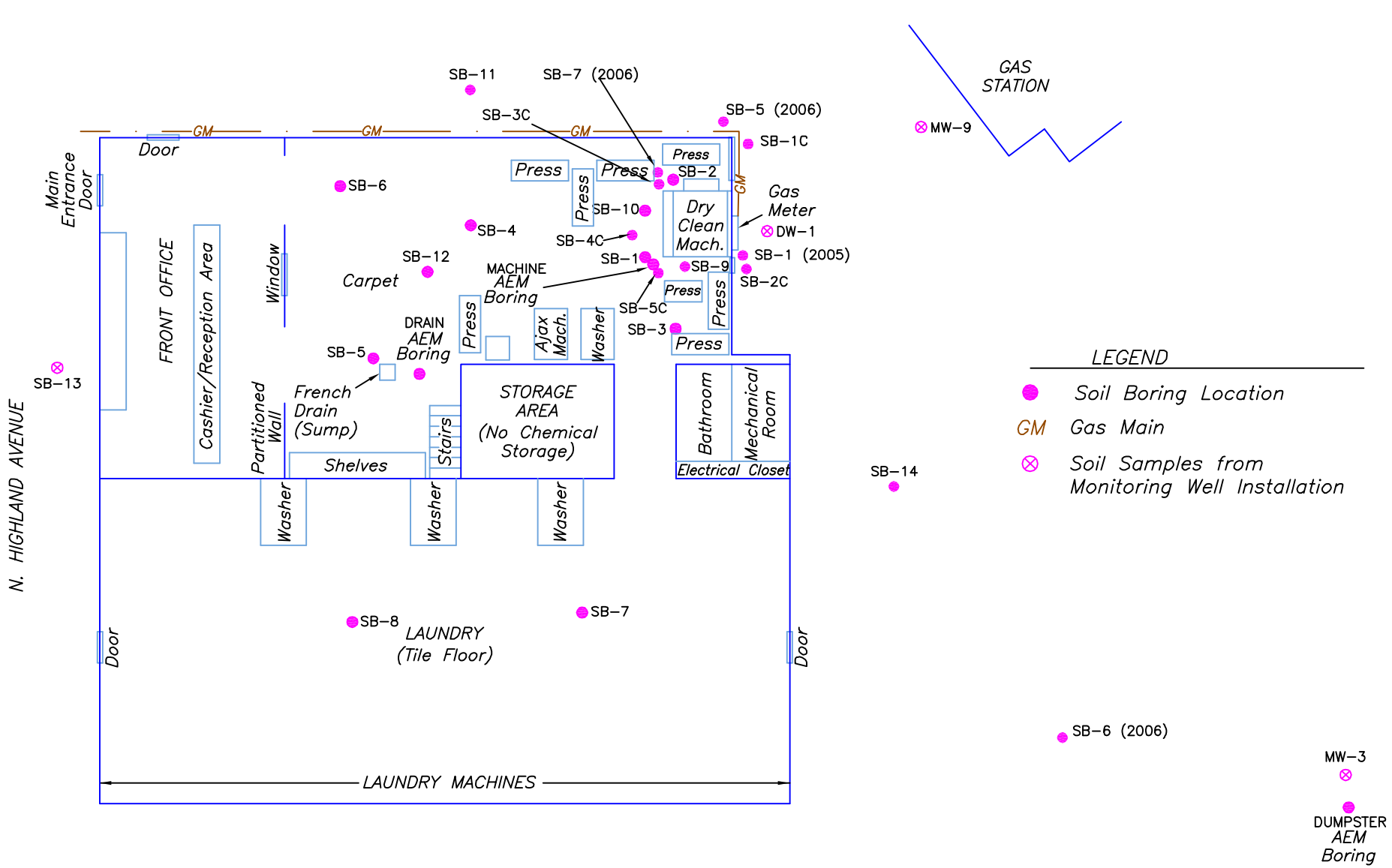
Table D-4. Analytical Results for Inorganics in Groundwater (mg/L)

Well ID	Date	Arsenic	Barium	Cadmium	Chromium (III)	Chromium (VI)	Copper	Iron	Lead	Selenium	Chloride
MW-1	11/28/2007	<0.05	0.963	<0.005	0.451	<10	0.0463	33.2	0.0386	0.0977	<50
	3/24/2008	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	9/25/2008	Well was dry									
	10/4/2010	<0.05	<0.020	<0.005	0.0356	<0.010	<0.010	<0.1	<0.010	<0.020	9.7
MW-2	11/28/2007	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3/24/2008	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW-3	11/28/2007	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3/24/2008	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	10/5/2010	<0.05	0.0234	<0.005	<0.010	<0.010	<0.010	11.9	<0.010	<0.020	22
MW-4	11/28/2007	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3/24/2008	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW-5	11/28/2007	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3/24/2008	<0.05	<0.02	<0.005	0.165	<0.250	<0.01	0.240	<0.01	<0.02	<10
	9/25/2008	<0.05	0.0931	<0.005	0.044	0.178	0.0112	10.7	<0.01	<0.02	21
	10/5/2010	<0.05	0.0599	<0.005	0.0118	<0.010	<0.010	<0.10	<0.010	<0.020	18
MW-6	11/28/2007	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3/24/2008	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MW-7R	11/28/2007	<0.05	0.0489	<0.005	<0.01	<0.01	<0.10	1.83	<0.01	<0.02	13
	3/24/2008	<0.05	0.0439	<0.005	0.028	<0.10	0.214	4.50	<0.01	<0.02	11
	9/25/2008	Well was dry									
	10/5/2010	<0.0038	0.0475	<0.0016	0.0019 J	<0.002	0.0026 J	0.197	<0.0019	0.0041 J	14
MW-8	11/28/2007	<0.05	<0.02	<0.005	<0.01	<0.01	<0.01	3.53	<0.01	<0.02	4.7
(Duplicate)	11/28/2007	<0.05	<0.02	<0.005	<0.01	<0.01	<0.01	3.23	<0.01	<0.02	4.6
	3/24/2008	<0.05	0.0539	<0.005	0.874	<0.250	0.0456	9.81	<0.01	<0.02	<10
	9/25/2008	<0.05	0.652	<0.005	0.851	<0.01	0.104	99.4	0.0475	<0.02	4.6
	10/5/2010	<0.05	0.0209	<0.005	<0.010	<0.010	<0.010	2.27	<0.010	<0.020	3.7
MW-10	11/28/2007	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3/24/2008	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	10/5/2010	<0.050	0.189	<0.005	<0.010	<0.010	<0.010	9.25	0.0101	<0.020	68
DW-1	11/28/2007	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	3/24/2008	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	10/4/2010	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

mg/l - milligrams per liter
NS = Well Not Sampled
<5.0 - denotes that the sample result was below the laboratory practical quantitation limit

APPENDIX D

FIGURES



EPS
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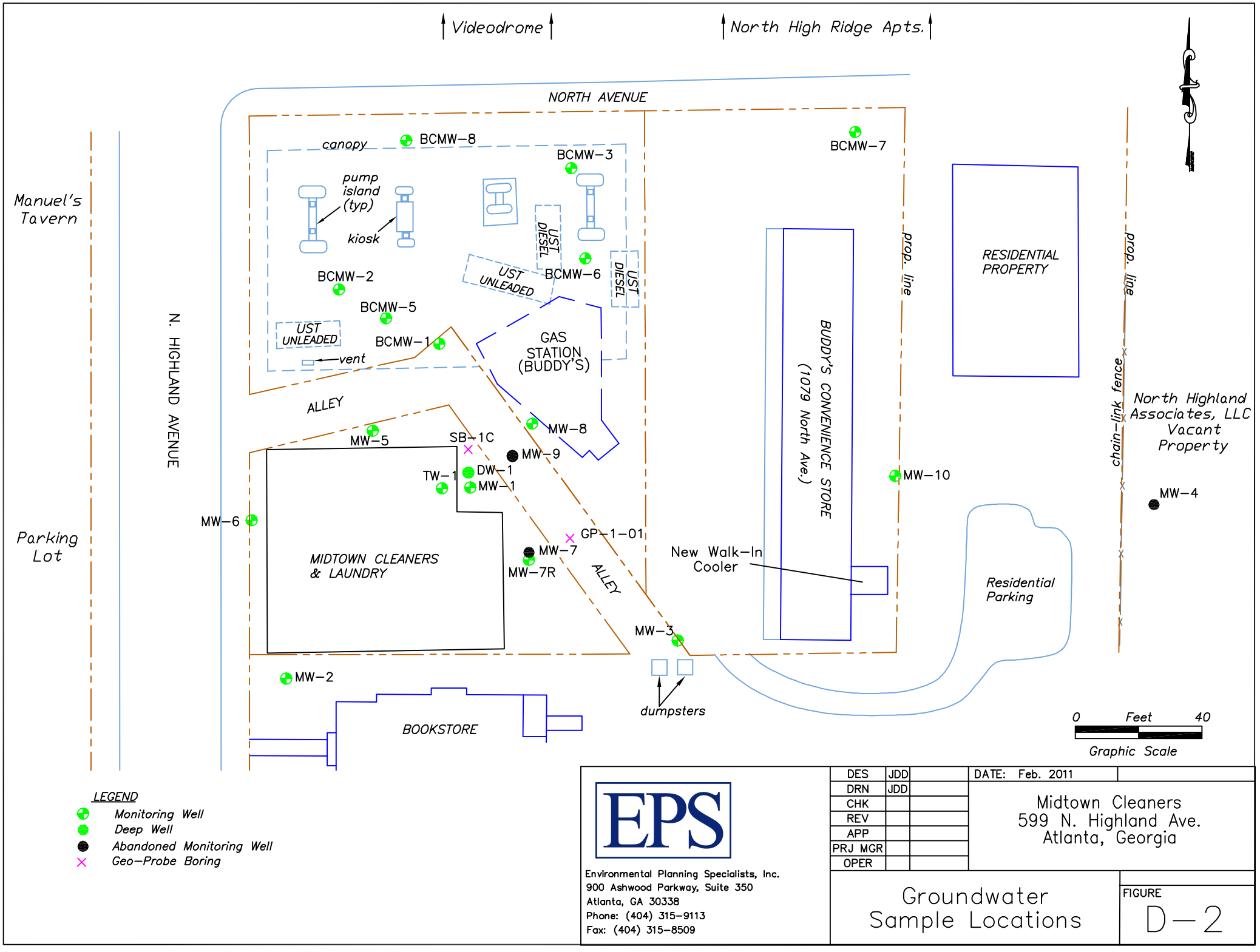
Fax: (404) 315-8509

DES	JDD		DATE: Feb. 2011
DRN	JDD		
CHK			
REV			
APP			
PRJ MGR			
OPER			

Midtown Cleaners
599 N. Highland Ave.
Atlanta, Georgia

Soil Sample Locations

FIGURE
D-1



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DES	JDD		DATE: Feb. 2011
DRN	JDD		
CHK			
REV			
APP			
PRJ MGR			
OPER			

Midtown Cleaners
599 N. Highland Ave.
Atlanta, Georgia

Groundwater Sample Locations

FIGURE
D-2

APPENDIX E

Soil Vapor Intrusion Modeling

APPENDIX E
SOIL VAPOR INTRUSION MODELING

Three constituents of interest for the Property (PCE, TCE, and DCE) were detected in groundwater at the Property in the most recent sampling event. All of these compounds are sufficiently toxic and volatile, according to Table 1 from the Subsurface Vapor Intrusion Guidance (USEPA, 2002), to warrant consideration of soil vapor intrusion. Groundwater containing PCE and TCE underlies three structures: Midtown, Buddy's Gas Station[2] and Buddy's Convenience Store. Due to the volatility of these constituents, there is a potential for these constituents to volatilize from the groundwater, migrate through the vadose zone and then enter the buildings through a process called soil vapor intrusion. Additionally, the USEPA recommends considering structures that are within 100 feet of the groundwater plume (USEPA, 2002). The residence located east of Buddy's Convenience Store is less than 100 feet from groundwater containing detectable concentrations of chlorinated VOCs. Thus, the following four scenarios were considered for soil vapor intrusion:

- Midtown Cleaners – Commercial Worker
- Buddy's Gas Station – Commercial Worker
- Buddy's Convenience Store – Commercial Worker
- Residence – Resident

These constituents were taken through a screening process to determine if modeling would be applicable. The following table compares the highest concentrations observed in the 2010 groundwater sampling to generic screening levels assuming a 10^{-5} risk (USEPA, 2002):

Table E-1. Comparison of Maximum Concentrations to Target Groundwater Concentrations (TGC)

	PCE (µg/L)	TCE (µg/L)	DCE (µg/L)
Groundwater Concentration	890	9	120
Table 2b TGC	11	5	210
Table 3b* TGC	54	5	1,000

*using attenuation factor $2x10^{-4}$ (based on loam soil with groundwater 30 feet below surface)

As the maximum PCE and TCE concentrations exceeded the screening criteria, it was determined that both constituents would be modeled. The maximum DCE concentration was less than the screening values and was, therefore, dropped from further consideration.

The USEPA Office of Emergency and Remedial Response published a series of models based on the analytical solutions of Jonson and Ettinger for estimating indoor air concentrations and associated health risks from subsurface vapor intrusion into buildings. Johnson and Ettinger (1991) developed a screening-level model that incorporates convective and diffusive

[2] In a recent (December, 2011) site visit, although it was closed, it appeared the building at Buddy's gas station is being used as an office for emissions testing.

mechanisms for vapor transport emanating from either subsurface soils or groundwater into indoor spaces located directly above the sources of contamination. The USEPA's Excel-based models use default values recommended in their Guidance (USEPA, 2002).

For this analysis, the advanced models were used to determine "acceptable" groundwater concentrations using a given risk level. The toxicity factors used in the model were updated to match the current (November 2011) EPA Regional Screening Level Table. The values used are shown in the table below.

Table E-2. Toxicity Values

	Unit Risk Factor, URF $(\mu g/m^3)^{-1}$	Reference Concentration RfC (mg/m^3)
Tetrachloroethene	5.9 E-6	0.27
Trichloroethene	4.1 E-6	0.002

The table below shows the site-specific parameters used for each scenario. With the exception of the residence, the exterior dimensions were determined using a wheel measuring tape. The dimensions of the residence were estimated using an aerial photograph.

Table E-3. Model Input Parameters

	Midtown	Gas Station	Convenience Store	Residence
Average Temperature	20° C	20° C	20° C	20° C
Depth below grade to bottom of enclosed space floor	15 cm (slab)	15 cm (slab)	15 cm (slab)	15 cm (slab) 200 cm (basement)
Depth below grade to water table	930 cm	930 cm	930 cm	930 cm
Assume one soil stratum with thickness	930cm	930cm	930cm	930 cm
Soil type	SC	SC	SC	SC
Enclosed space floor thickness	10 cm (default)	10 cm (default)	10 cm (default)	10 cm (default)
Enclosed space floor length	2257 cm	876.5 cm	3962 cm	2134 cm
Enclosed space floor width	1580 cm	876.5 cm	853 cm	1067 cm
Enclosed space height	366 cm	244 cm	366 cm	244 cm (slab) 366 cm (basement)
Indoor air exchange rate	1/hr (for commercial)	1/hr (for commercial)	1/hr (for commercial)	0.25/hr (default)
NC averaging time	25 years (commercial)	25 years (commercial)	25 years (commercial)	30 years (commercial)
ED	25 yrs	25 yrs	25 yrs	30 yrs
EF	250 d/yr	250 d/yr	250 d/yr	350 d/yr
TR	10^{-5}	10^{-5}	10^{-5}	10^{-6}

Midtown, the gas station and convenience store are all slabs on grade. The residence is in a crawl space; however, this model is not designed to work for crawl space construction. According to the IRTC guidance (IRTC, 2007), homes in warmer, humid regions built over crawl spaces may be an unlikely candidate for vapor entering the living spaces of the home for

two reasons: 1) in warmer, humid regions home built over crawl spaces are often well ventilated to prevent rotting, which would result in less of an opportunity for soil vapors to accumulate; and 2) studies indicate that only 10-25% of air in living spaces enter by way of the crawl space. By extrapolation, modeling based on the assumption of a slab or basement construction would necessarily be more conservative than modeling for a crawl space. Thus, modeling for the residence was conducted based on a slab and basement. The input and output sheets for the modeling are attached.

The results of the modeling are shown in the table below. The output of the model was a risk-based groundwater concentration that is protective of human health at a given risk level (10^{-5} for the commercial properties and 10^{-6} for residential). Also shown on this table are the groundwater concentrations observed in 2010 at the wells nearest each building. None of the actual groundwater concentrations are higher than the risk-based screening values for the current scenarios. Thus, the current groundwater concentrations do not pose an unacceptable risk.

Table E-4 Results of Soil Vapor Intrusion Modeling (µg/L)

Receptor	Nearest Well	Risk-based PCE Screening Value	Groundwater PCE Concentration	Risk-based TCE Screening Value	Groundwater TCE Concentration
Midtown	MW-1	5,490	180	2,880	ND
Gas Station	MW-8	3,510	890	1,840	9
Convenience Store	MW-3	5,440	6.2	2,850	ND
Resident – Slab	MW-10	53.8	ND	96.2	ND
Resident – Basement	MW-10	52.8	ND	94.1	ND

Midtown - PCE Input

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES: x

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES:

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
127184		Tetrachloroethylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
20	15	930	930	0	0	A	SC	SC		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
SC	1.63	0.385	0.197		1.63	0.385	0.197		1.63	0.385	0.197

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	2257	1580	366	0.1	1	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1
				Used to calculate risk-based groundwater concentration.	

END

Midtown - PCE Results

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
5.49E+03	3.12E+05	5.49E+03	2.00E+05	5.49E+03

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)

MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

Midtown - TCE Input

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES: x

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES:

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
79016		Trichloroethylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
20	15	930	930	0	0	A	SC	SC		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
SC	1.63	0.385	0.197		1.63	0.385	0.197		1.63	0.385	0.197

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	2257	1580	366	0.1	1	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1
				Used to calculate risk-based groundwater concentration.	

END

Midtown - TCE Results

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
9.84E+03	2.88E+03	2.88E+03	1.47E+06	2.88E+03

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

Gas Station - PCE Input

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES: x

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES:

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
127184		Tetrachloroethylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
20	15	930	930	0	0	A	SC	SC		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
SC	1.63	0.385	0.197		1.63	0.385	0.197		1.63	0.385	0.197

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	876.5	876.5	244	0.1	1	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1
				Used to calculate risk-based groundwater concentration.	

END

Gas Station - PCE Results

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
3.51E+03	2.00E+05	3.51E+03	2.00E+05	3.51E+03

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

Gas Station - TCE Input

GW-ADV Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES: x

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES:

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
79016		Trichloroethylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
20	15	930	930	0	0	A	SC	SC		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
SC	1.63	0.385	0.197		1.63	0.385	0.197		1.63	0.385	0.197

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	876.5	876.5	244	0.1	1	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1
				Used to calculate risk-based groundwater concentration.	

END

Gas Station - TCE Results

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
6.27E+03	1.84E+03	1.84E+03	1.47E+06	1.84E+03

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

Convenience Store- PCE Input

GW-ADV Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES: x

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES:

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
127184		Tetrachloroethylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
20	15	930	930	0	0	A	SC	SC		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
SC	1.63	0.385	0.197		1.63	0.385	0.197		1.63	0.385	0.197

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	3962	853	366	0.1	1	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1
				Used to calculate risk-based groundwater concentration.	

END

Convenience Store- PCE Results

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
5.44E+03	3.09E+05	5.44E+03	2.00E+05	5.44E+03

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

Convenience Store- TCE Input

GW-ADV Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES: x

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES:

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
79016		Trichloroethylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
20	15	930	930	0	0	A	SC	SC		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
SC	1.63	0.385	0.197		1.63	0.385	0.197		1.63	0.385	0.197

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	3962	853	366	0.1	1	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	25	25	250	1.0E-05	1
				Used to calculate risk-based groundwater concentration.	

END

Convenience Store- TCE Results

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
9.74E+03	2.85E+03	2.85E+03	1.47E+06	2.85E+03

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

Residence Slab - PCE Input

GW-ADV Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES: x

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES:

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
127184		Tetrachloroethylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
20	15	930	930	0	0	A	SC	SC		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
SC	1.63	0.385	0.197		1.63	0.385	0.197		1.63	0.385	0.197

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	2134	1067	244	0.1	0.25	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based groundwater concentration.	

END

Residence Slab - PCE Results

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
5.38E+01	3.67E+04	5.38E+01	2.00E+05	5.38E+01

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

Residence Basement - PCE Input

GW-ADV
Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES: x

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES:

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
127184		Tetrachloroethylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
20	200	930	930	0	0	A	SC	SC		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
SC	1.63	0.385	0.197		1.63	0.385	0.197		1.63	0.385	0.197

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	2134	1067	366	0.1	0.25	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based groundwater concentration.	

END

Residence Basement - PCE Results

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
5.28E+01	3.61E+04	5.28E+01	2.00E+05	5.28E+01

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

SCROLL DOWN TO "END"

END

Residence Slab - TCE Input

GW-ADV Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES: x

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES:

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
79016		Trichloroethylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
20	15	930	930	0	0	A	SC	SC		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
SC	1.63	0.385	0.197		1.63	0.385	0.197		1.63	0.385	0.197

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm-s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	2134	1067	244	0.1	0.25	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based groundwater concentration.	

END

Residence Slab - TCE Results

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
9.62E+01	3.38E+02	9.62E+01	1.47E+06	9.62E+01

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

Residence Basement - TCE Input

GW-ADV Version 3.1; 02/04

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES: x

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES:

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
79016		Trichloroethylene

MORE ↓

ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER Thickness of soil stratum A, h_A (cm)	ENTER Thickness of soil stratum B, (Enter value or 0) h_B (cm)	ENTER Thickness of soil stratum C, (Enter value or 0) h_C (cm)	ENTER Soil stratum directly above water table, (Enter A, B, or C)	ENTER SCS soil type directly above water table	ENTER Soil stratum A SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined stratum A soil vapor permeability, k_v (cm^2)
			Totals must add up to value of L_{WT} (cell G28)							
20	200	930	930	0	0	A	SC	SC		

MORE ↓

ENTER Stratum A SCS soil type	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Stratum A soil total porosity, n^A (unitless)	ENTER Stratum A soil water-filled porosity, θ_w^A (cm^3/cm^3)	ENTER Stratum B SCS soil type	ENTER Stratum B soil dry bulk density, ρ_b^B (g/cm^3)	ENTER Stratum B soil total porosity, n^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	ENTER Stratum C SCS soil type	ENTER Stratum C soil dry bulk density, ρ_b^C (g/cm^3)	ENTER Stratum C soil total porosity, n^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^C (cm^3/cm^3)
Lookup Soil Parameters				Lookup Soil Parameters				Lookup Soil Parameters			
SC	1.63	0.385	0.197		1.63	0.385	0.197		1.63	0.385	0.197

MORE ↓

ENTER Enclosed space floor thickness, L_{crack} (cm)	ENTER Soil-bldg. pressure differential, ΔP ($g/cm\text{-}s^2$)	ENTER Enclosed space floor length, L_B (cm)	ENTER Enclosed space floor width, W_B (cm)	ENTER Enclosed space height, H_B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q_{soil} (L/m)
10	40	2134	1067	366	0.1	0.25	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based groundwater concentration.	

END

Residence Basement - TCE Results

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
9.41E+01	3.31E+02	9.41E+01	1.47E+06	9.41E+01

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	NA

MESSAGE AND ERROR SUMMARY BELOW: (DO NOT USE RESULTS IF ERRORS ARE PRESENT)
MESSAGE: The values of Csource and Cbuilding on the INTERCALCS worksheet are based on unity and do not represent actual values.

MESSAGE: Risk/HQ or risk-based groundwater concentration is based on a route-to-route extrapolation.

SCROLL DOWN TO "END"

END

APPENDIX F

Memo: Soil Vapor Intrusion and Groundwater Modeling

Memorandum

Date: **January 4, 2012**

To: **Ted Peyser**

From: **Timmerly Bullman**

Subject: **Soil Vapor Intrusion and Groundwater Modeling – Midtown Cleaners**

The EPD's letter dated December 12, 2011 contained comments related to Midtown's VRP Application and requested a revised VRP application. This memo summarizes the results and/or issues associated with the Soil Vapor Intrusion and groundwater modeling mentioned in the EPD's comment letter.

Comment 3 – The EPD requests additional groundwater monitoring and modeling to show the extent of the PCE plume and its possible movement. The purpose of the groundwater modeling is twofold: 1) to demonstrate that there is no current or future unacceptable risk due to the groundwater itself and 2) to demonstrate there is no future unacceptable risk of soil vapor intrusion.

Comment 4 – The EPD requested that the soil vapor intrusion modeling be conducted for all VOCs detected.

Comment 5 – The EPD requested the following changes to the soil vapor intrusion modeling:
1) confirm/justify dimensions of buildings; 2) verify the foundation of the residence; 3) update the toxicity factors to match the current (Nov 2011) RSL table.

In response to these comments, the remainder of this memo summarizes what actions have been taken and their results.

Soil Vapor Intrusion Modeling

EPS personnel measured the exterior dimensions of the gas station and convenience store using a wheel measuring tape and estimated the dimensions of the residence using an aerial photograph. EPS personnel confirmed that the residence is on a crawl space. Although it was closed at the time, it appears the gas station is being used as an office for emissions testing. Additionally, the toxicity factors used in the model were updated to match the November 2011 RSL table.

Per the EPD request, the detected VOCs were screened according to generic screening level tables from the EPA's draft guidance for evaluating vapor intrusion (USEPA, 2002). Of the 18 VOCs detected, 9 failed the screening process indicating that modeling is needed. These nine are PCE, TCE, 1,2-DCA, benzene, isopropylbenzene, 1,2-dibromoethane, ethylbenzene, methylcyclohexane and toluene. Soil vapor intrusion modeling was conducted for these nine VOCs using the Johnson and Ettinger model. Modeling was conducted for 5 building scenarios: 1) midtown cleaners, 2) the gas station/emissions testing building, 3) Buddy's convenience store, 4) residence assuming a slab, 5) residence assuming a basement.

Note: the EPD specifically mentioned that the J&E model is not appropriate for buildings with a crawlspace, which the residence has. According to the ITRC vapor intrusion guidance (ITRC, 2007), homes in warmer,

humid regions built over crawl spaces may be an unlikely candidate for vapor entering the living spaces of the home for two reasons: 1) in warmer, humid regions homes built over crawl spaces are often well ventilated to prevent rotting, which would result in less of an opportunity for soil vapors to accumulate; and 2) studies indicate that only 10-25% of air in living spaces enter by way of the crawl space. By extrapolation, modeling based on the assumption of a slab or basement construction would necessarily be more conservative that modeling for a crawl space. Thus, if modeling based on a slab or basement demonstrates that there is no soil vapor risk, then there would not be one for a crawl space. However, if there is a risk based on the slab or basement construction, then there may be a risk for a crawl space, but more investigation would be warranted to confirm that a risk exists. There is another model (Biovapor), which can be used for crawl spaces, but it is only applicable for hydrocarbons.

The model output consists of concentrations at which there is no risk. These values can be compared to groundwater concentrations to determine whether there is a potential risk. Accordingly, the model output was compared to concentrations found in groundwater collected from wells closest to each building (MW-1 for Midtown cleaners, MW-8 for the gas station, MW-3 for the convenience store, and MW-10 for the residence).

The results of this comparison indicate that there is no current potential risk due to the dry cleaner compounds (PCE, TCE); however there are potential risks to the residence for constituents attributable to releases from the gas station (1,2-dichloroethane, benzene, 1,2-dibromoethane and ethylbenzene). The next step could be to learn and use the Biovapor model for the residence. However, since the only potential risk issues are due to releases from the gas station, it is not Midtown's responsibility to incur the cost associated with learning and using a new model.

Groundwater Modeling

BIOCHLOR is an EPA fate and transport groundwater model for chlorinated ethenes and ethanes. This model was used to attempt to model the groundwater at the site. However, several problems were encountered. Several measurements collected over time are needed to calibrate a groundwater model. This is problematic at this site because the ISCO injections altered the subsurface. Thus it would be necessary to model either prior to the injections or after the injections. However, in both of these cases there are not enough data points collected prior to or after the injections to calibrate the model.

Despite this issue, a model pre-injection and a model post-injection was developed. However, a bigger problem was discovered. The model is highly sensitive to hydrogeologic parameters, specifically hydraulic conductivity. The CSR gives an average hydraulic conductivity of 6.93E-3 cm/s, which is typical of a silty sand formation. The older boring logs (e.g. MW- in 2003) also indicate that the saprolite consists of fine to medium sand and silt. However, a newer boring log for MW-10 indicates that the soil is clay. Regardless, when using the hydraulic conductivity from the CSR, the model results in minimal attenuation downgradient, in other words high concentrations are predicted downgradient. This does not match the actual groundwater concentrations observed in downgradient wells (MW-4 and MW-10), which were non-detect.

The hydraulic conductivity would need to be about two orders of magnitude smaller (e.g. E-5 instead of E-3) in order to have non-detected values at MW-10 and MW-4. A hydraulic conductivity on the order of E-5 would be indicative of a silty clay. The modeling will not work with the current hydraulic conductivity and we have no basis for arbitrarily changing the value. The short answer is we don't have enough "good" groundwater data and the right hydraulic conductivity.

PCE and TCE have not been detected in downgradient wells MW-4 and MW-10. Groundwater from MW-4 was sampled prior to the ISCO injections (in January 2002) and MW-10 was sampled during and after the injections. Thus, actual data collected during the last ten years (both before and after the injections) indicates that the plume has not migrated downgradient. It would be very expensive to collect enough additional data

(groundwater samples and hydraulic conductivity measurements) to attempt to develop an accurate model for the site. And the additional data collected still may not be sufficient to develop an accurate model.

APPENDIX G

Environmental Covenant

After Recording Return to:

Georgia Environmental Protection Division
Response and Remediation Program
2 Martin Luther King, Jr. Drive, SE
Suite 1462 East
Atlanta, Georgia 30334

Deed Book 52038 Pg 146
Filed and Recorded Dec-19-2012 03:35pm
2012-0366032
Cathelene Robinson
Clerk of Superior Court
Fulton County, Georgia

Environmental Covenant

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

Fee Owner of Property/Grantor:
North Highland Associates, LLC
2881 Peachtree Road N.E.
Suite 1901
Atlanta, GA 30305

Grantee/Holder:
North Highland Associates, LLC
2881 Peachtree Road N.E.
Suite 1901
Atlanta, GA 30305

Grantee/Entity with express power to enforce:
State of Georgia
Department of Natural Resources
Environmental Protection Division
2 Martin Luther King Jr. Drive, SE
Suite 1152 East Tower
Atlanta, GA 30334

Parties with interest in the Property:
Midtown Cleaners and Laundry, Inc.
Dinesh Desai
599 North Highland Avenue NE
Atlanta, Georgia 30307
(404)223-3622

Property:

The property subject to this Environmental Covenant is the Midtown Cleaners & Laundry, Inc. (hereinafter the "Property"), located on 599 North Highland Avenue in Atlanta, Fulton County, Georgia. This tract of land was conveyed on January 1, 1998, from numerous named individuals, estates, and trusts to North Highland Associates, LLC, and recorded in Deed Book 26617, Page 095, Fulton County Records. The area is located in Land Lot 15 of the 14th District of Fulton County, Georgia. The Property is approximately 0.15 acres and includes one building (currently operating as a dry cleaning

facility) and associated parking. A complete legal description of the area is attached as Exhibit A, and a map of the area is attached as Exhibit B.

Tax Parcel Number(s):

14 00 1500030274 of Fulton County, Georgia

Name and Location of Administrative Records:

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

- Compliance Status Report and Corrective Action Plan: March 2003
- Compliance Status Report (HSI# 10584): April 2006
- Corrective Action Plan Addendum No. 1: December 2006
- Corrective Action Plan Modification: Letter to EPD dated May 25, 2007
- Corrective Action Plan Progress Report: April 2008
- Corrective Action Plan Progress Report 2: October 2008
- Voluntary Remediation Program Application: March 2011
- Memorandum: Soil Vapor Intrusion and Groundwater Modeling – Midtown Cleaners: January 4, 2012
- Letter accepting the Midtown Cleaners Site into the VRP: From Georgia Environmental Protection Division to Jeff Vantosh: February 17, 2012
- Voluntary Remediation Program Compliance Status Report: October 2012

These documents are available at the following locations:

Georgia Environmental Protection Division
Response and Remediation Program
2 MLK Jr. Drive, SE, Suite 1462 East Tower
Atlanta, GA 30334
M-F 8:00 AM to 4:30 PM excluding state holidays

Description of Contamination and Corrective Action:

This Property has been listed on the state's hazardous site inventory and has been designated as needing corrective action due to the presence of hazardous wastes, hazardous constituents, or hazardous substances regulated under state law. Contact the property owner or the Georgia Environmental Protection Division for further information concerning this Property. This notice is provided in compliance with the Georgia Hazardous Site Response Act.

This Declaration of Covenant is made pursuant to the Georgia Uniform Environmental Covenants Act, O.C.G.A. § 44-16-1 *et seq.* by North Highland Associates, LLC, its successors and assigns, and the State of Georgia, Department of Natural Resources, Environmental Protection Division (hereinafter "EPD"), its successors and assigns. This Environmental Covenant is required because a release of tetrachloroethene occurred on the Property. The following "regulated substances" as defined under the Georgia Hazardous Site Response Act, O.C.G.A. § 12-8-90 *et seq.*, and the rules promulgated thereunder (hereinafter "HSRA" and "Rules", respectively), have been detected in soil and groundwater at the Property after the previous (2005-2008) corrective action: tetrachloroethene (soil and groundwater), and chloroform (groundwater).

The Corrective Action consists of the prohibition on the use or extraction of groundwater beneath the Property for drinking water or for any other non-remedial purposes to protect human health and the environment. No further corrective action is required for soil or source material.

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

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

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

Activity and/or Use Limitation(s)

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

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

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

4. Activity and Use Limitation(s). If the Property is to be used for residential purposes, it must first be demonstrated at that time that there is no risk due to soil vapor intrusion by one or more of the following: soil vapor intrusion modeling based on conditions at that time, soil vapor sampling, and/or soil vapor mitigation. Any activity on the Property that may result in the release or exposure

to the regulated substances that were contained as part of the Corrective Action, or create a new exposure pathway, is prohibited.

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

6. Right of Access. In addition to any rights already possessed by EPD, North Highland shall allow authorized representatives of EPD the right to enter the Property at reasonable times for the purpose of evaluating the Corrective Action; to determine compliance with this Environmental Covenant; and to inspect records that are related to the Corrective Action.

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

8. Termination or Modification. The Environmental Covenant shall remain in full force and effect in accordance with O.C.G.A. §44-5-60, unless and until the Director determines that the Property has met residential cleanup standards, as defined in Section 391-3-19-.07 of the Rules, whereupon the Environmental Covenant may be amended or revoked in accordance with Section 391-3-19-08(7) of the Rules and O.C.G.A. §44-16-1 *et seq.*

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

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

Representations and Warranties.

Grantor hereby represents and warrants to the other signatories hereto:

a) That the Grantor has the power and authority to enter into this Environmental Covenant, to grant the rights and interests herein provided and to carry out all obligations hereunder;
b) That the Grantor is the sole owner of the Property and holds fee simple title which is free, clear and unencumbered;
c) That the Grantor has identified all other parties that hold any interest (e.g., encumbrance) in the Property and notified such parties of the Grantor's intention to enter into this Environmental Covenant;
d) That this Environmental Covenant will not materially violate, contravene, or constitute a material default under any other agreement, document or instrument to which Grantor is a party, by which Grantor may be bound or affected;
e) That the Grantor has served each of the people or entities referenced in Activity 10 above with an identical copy of this Environmental Covenant in accordance with O.C.G.A. § 44-16-4(d).

f) That this Environmental Covenant will not materially violate or contravene any zoning law or other law regulating use of the Property; and
g) That this Environmental Covenant does not authorize a use of the Property that is otherwise prohibited by a recorded instrument that has priority over the Environmental Covenant.

Notices.

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

Georgia Environmental Protection Division
Branch Chief
Land Protection Branch
2 Martin Luther King Jr. Drive SE
Suite 1154 East Tower
Atlanta, GA 30334

North Highland Associates, LLC
2881 Peachtree Road N.E.
Suite 1901
Atlanta, GA 30305

Grantor has caused this Environmental Covenant to be executed pursuant to The Georgia Uniform Environmental Covenants Act, on the 19th day of December, 20 12.

NORTH HIGHLAND ASSOCIATES, LLC (Grantor)

Name: Jeffrey Vantosh Dated: 10/3/2012
Title: Property Manager

NORTH HIGHLAND ASSOCIATES, LLC (Holder)

Name: Jeffrey Vantosh Dated: 10/3/2012
Title: Property Manager

STATE OF GEORGIA
ENVIRONMENTAL PROTECTION DIVISION

Name: JUDSON H. TURNER Dated: 12-19-2012
Title: DIRECTOR

[CORPORATE ACKNOWLEDGMENT]

STATE OF GEORGIA
COUNTY OF FULTON

On this 3 day of October, 2012, I certify that Jeffrey Vantosh personally appeared before me, and acknowledged that **he/she** is the individual described herein and who executed the within and foregoing instrument and signed the same at **his/her** free and voluntary act and deed for the uses and purposes therein mentioned.

HEMANT PIDURU NOTARY PUBLIC FULTON COUNTY EXPIRES GEORGIA Dec. 8, 2015

Notary Public in and for the State of Georgia, residing at Fulton Co.
My appointment expires 12/8/15.

[CORPORATE ACKNOWLEDGMENT]

STATE OF GEORGIA
COUNTY OF FULTON

On this 3 day of October, 2012, I certify that Jeffrey Vantosh personally appeared before me, acknowledged that **he/she** is the Property Manager of the corporation that executed the within and foregoing instrument, and signed said instrument by free and voluntary act and deed of said corporation, for the uses and purposes therein mentioned, and on oath stated that **he/she** was authorized to execute said instrument for said corporation.

HEMANT PIDURU NOTARY PUBLIC FULTON COUNTY EXPIRES GEORGIA Dec. 8, 2015

Notary Public in and for the State of Georgia, residing at Fulton Co.
My appointment expires 12/8/15.

[REPRESENTATIVE ACKNOWLEDGEMENT]

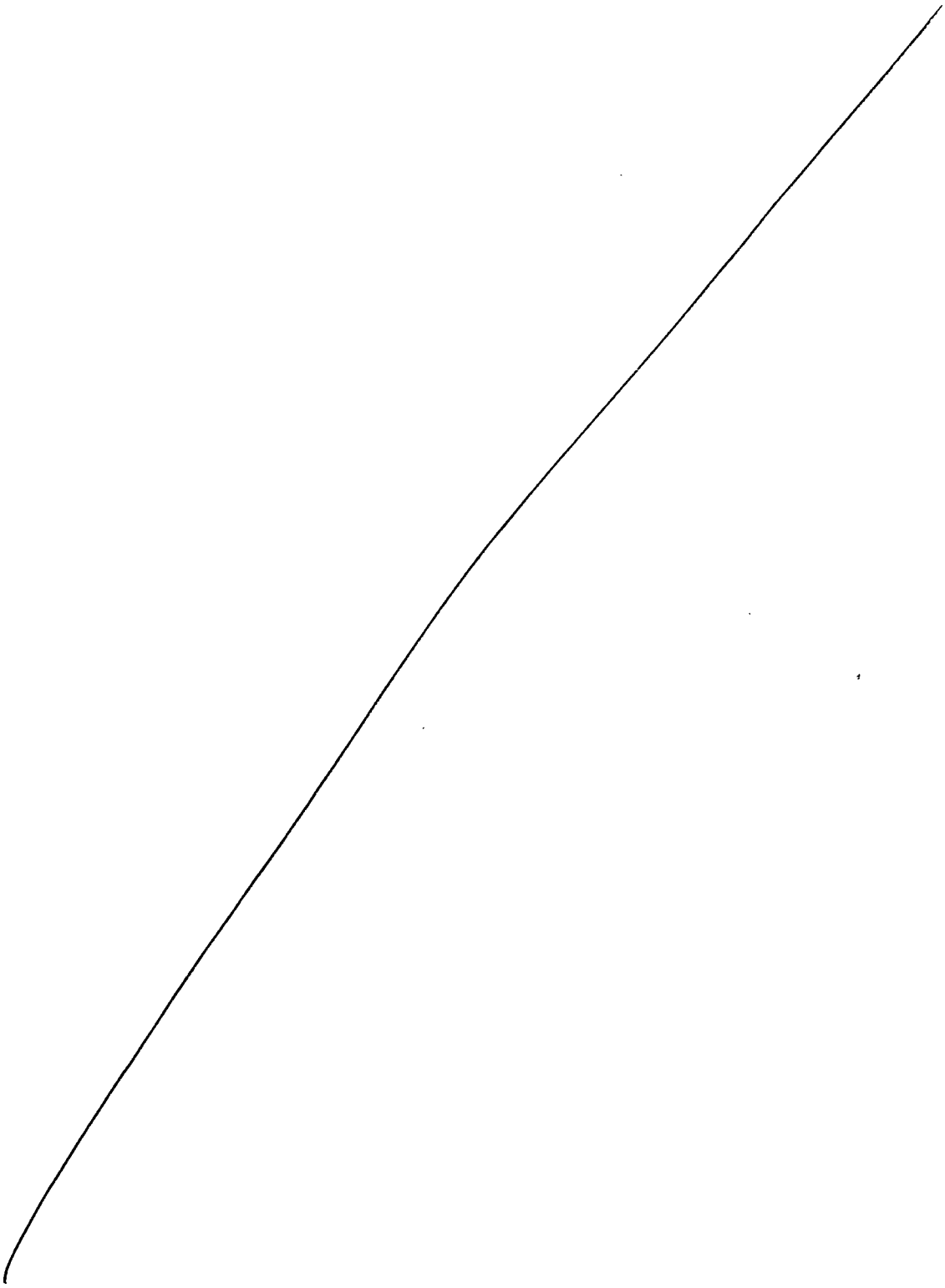
STATE OF Georgia
COUNTY OF Fulton

On this 19th day of December, 2012, I certify that Judson H. Turner personally appeared before me, acknowledged that **he/she** signed this instrument, on oath stated that **he/she** was authorized to execute this instrument, and acknowledged it as the Director [type of authority] of Georgia EPD [name of party being represented] to be the free and voluntary act and deed of such party for the uses and purposes mentioned in the instrument.

YOLANDA P. FANNING NOTARY PUBLIC HENRY COUNTY EXPIRES GEORGIA SEPT. 29, 2013

Notary Public in and for the State of Georgia, residing at Henry Co.
My appointment expires Sept. 29, 2013

Exhibit A
Legal Description



26617
0095

Fulton County, Georgia
Real Estate Transfer Tax
Paid $ 0
Date 5/12/99
JUANITA HICKS
Clerk, Superior Court
By: B Beaudet

GEORGIA, FULTON COUNT :
FILED AND RECORDED
99 MAY 12 PM 4:36
JUANITA HICKS
CLERK, SUPERIOR COURT

After recordation, return to:
Troutman Sanders
NationsBank Plaza, Suite 5200
600 Peachtree Street, N.E.
Atlanta, Georgia 30308-2216
Attn: Alan E. Serby, Esq.

STATE OF GEORGIA

COUNTY OF FULTON

LIMITED WARRANTY DEED

THIS INDENTURE, made as of the 1st day of January, in the year one thousand nine hundred ninety-eight, between

VICTORIA M. ALEMBIK as Co-Trustee and AARON I. ALEMBIK as Co-Trustee of the MICHAEL D. ALEMBIK TRUST, U/W of MICHAEL D. ALEMBIK, deceased, as to 2.5% undivided interest; VICTORIA M. ALEMBIK as to 2.5% undivided interest; AARON I. ALEMBIK as to 1.6% undivided interest; JULIUS ALEMBIK as Executor of the Estate of MYRA FAITH ABRAMS, deceased, as to 7.5% undivided interest; RITA BARON as to 5% undivided interest; DAVID N. CUNNINGHAM as to 25% undivided interest, HARRY HOUSEN as to 5.4% undivided interest; PAULA F. ROSENHAFT as to 5% undivided interest, CATHY SELIG as to 7.5% undivided interest; VERNON R. RAY as to 7.5% undivided interest; JILL W. VANTOSH as to 20.5% undivided interest; STEVE WARONKER as to 5% undivided interest; MITZI H. WEITZ, Trustee, NORMAN A. WEITZ FAMILY TRUST as to 5% undivided interest.

of the County of Fulton, and State of Georgia, as party or parties of the first part, hereinafter called Grantor, and

NORTH HIGHLAND ASSOCIATES, L.L.C,
a Georgia Limited Liability Company

as party or parties of the second part, hereinafter called Grantee (the words "Grantor" and "Grantee" to include their heirs, successors and assigns where the context requires or permits).

WITNESSETH that. Grantor, for and in consideration of the sum of TEN DOLLARS ($10 00) in hand paid at and before the sealing and delivery of these presents, the receipt whereof is hereby acknowledged, has granted, bargained, sold, aliened, conveyed and confirmed, and by these presents does grant, bargain, sell, alien, convey and confirm unto the said Grantee her heirs and assigns,

All that tract or parcel of land lying in Land Lot 15 of the 14th District of Fulton County, Georgia consisting of Tract I, Tract II, Tract III and Tract IV, and being more particularly described in Exhibit "A" which has been attached hereto and made a part herein.

It is the intent of the Grantor to convey all of their rights, title and interest in and to the property herein described to the herein named Grantee

TO HAVE AND TO HOLD the said tract or parcel of land, with all and singular the rights, members and appurtenances thereof, to the same being, belonging, or in anywise appertaining, to the only proper use, benefit and behoof of the said Grantee forever in FEE SIMPLE.

AND THE SAID Grantor will warrant and forever defend the right and title to the above described property unto the said Grantee against the claims of all persons owning, holding, or claiming by, through or under the said Party of the First Part.

IN WITNESS WHEREOF, the Grantor has signed and sealed this deed, the day and year above written.

Victoria M. Alembik (SEAL)
Victoria M. Alembik as Co-Trustee of the Michael D. Alembik Trust, U/W of Michael D. Alembik, deceased, as to 2.5% undivided interest

Signed, sealed and delivered in the presence of:

Unofficial Witness

Notary Public
My Commission expires: 2/27/2000
[Notary Seal]

WANDA TAYLOR
Notary Public, Cobb County, Georgia
My Commission Expires Feb. 27, 2000

(SEAL)
Aaron I. Alembik as Co-Trustee of the Michael D. Alembik Trust, U/W of Michael D. Alembik, deceased, as to 2.5% undivided interest

Signed, sealed and delivered in the presence of:

N.P. SEAL

Unofficial Witness

Notary Public
Notary Public, Gwinnett County, Georgia
My Commission Expires Sept. 13, 2001
My Commission expires:
[Notary Seal]

26617
0097

Victoria M. Alembik (SEAL)
Victoria M. Alembik as to 2.5% undivided interest

Signed, sealed and delivered in the presence of:

Unofficial Witness

Notary Public
My Commission expires: 2/27/2000
[Notary Seal]

NOTARY PUBLIC
LINDA A TAYLOR
Notary Public, Cobb County, Georgia
My Commission Expires Feb. 27, 2000

(SEAL)
Aaron I. Alembik as to 1.6% undivided interest

Signed, sealed and delivered in the presence of:

Unofficial Witness

Notary Public
My Commission expires
[Notary Seal]

Notary Public, Gwinnett County, Georgia
My Commission Expires Sept. 13, 2003

N.P. SEAL

(SEAL)
Julius Alembik as Executor of the Estate of Myra Faith Abrams, deceased, as to 7.5% undivided interest

Signed, sealed and delivered in the presence of:

Unofficial Witness

Notary Public
My Commission expires 5-10-99
[Notary Seal]

Notary Public, Fulton County, Georgia
My Commission Expires

N.P. SEAL

BOOK 26617PG097

Signed, sealed and delivered in the presence of:

Rita Baron (SEAL)
Rita Baron as to 5% undivided interest

Unofficial Witness

Notary Public
My Commission expires: 2/27/2000
[Notary Seal]

WANDA TAYLOR
Notary Public, Cobb County, Georgia
My Commission Expires Feb. 27, 2000

Signed, sealed and delivered in the presence of:

David N. Cunningham (SEAL)
David N. Cunningham as to 25% undivided interest

Unofficial Witness

Notary Public
My Commission expires: 2/27/2000
[Notary Seal]

Attorneys at Law
3033 Royal Drive N.E.
ATLANTA, GEORGIA 30305

WANDA TAYLOR
Notary Public, Cobb County, Georgia
My Commission Expires Feb. 27, 2000

Signed, sealed and delivered in the presence of:

Harry Housen (SEAL)
Harry Housen as to 5.5% undivided interest

Unofficial Witness

Notary Public
My Commission expires: 2-27-2000
[Notary Seal]

WANDA TAYLOR
Notary Public, Cobb County, Georgia
My Commission Expires Feb. 27, 2000

(SEAL)
Paula F. Rosenhall as to 5% undivided interest

Signed, sealed and delivered in the presence of:

Unofficial Witness

Notary Public
My Commission expires: 2-22-2000
[Notary Seal]

WANDA TAYLOR
Notary Public, Cobb County, Georgia
My Commission Expires Feb. 27, 2000

(SEAL)
Cathy Selig as to 7.5% undivided interest

Signed, sealed and delivered in the presence of:

Unofficial Witness

Notary Public
My Commission expires: 2-27-2000
[Notary Seal]

WANDA TAYLOR
Notary Public, Cobb County, Georgia
My Commission Expires Feb. 27, 2000

(SEAL)
Vernon R. Ray as to 7.5% undivided interest

Signed, sealed and delivered in the presence of:

Unofficial Witness

Notary Public
My Commission expires:
[Notary Seal]

Notary Public, Clayton County, Georgia
My Commission Expires September 16, 2000

N.P. SEAL

BOOK 26617PG099

Jill W. Vantosh (SEAL)
Jill W. Vantosh as to 20.5% undivided interest

Signed, sealed and delivered in the presence of:

Unofficial Witness

Notary Public
SUZZETTE RILEY
Notary Public, FultonCounty, Georgia
My Commission Expires July 30, 2002
My Commission expires: _____
[Notary Seal]

N.P. SEAL

NORMAN A. WEITZ FAMILY TRUST

By: Mitzi H. Weitz (SEAL)
MITZI H. WEITZ, Trustee, as to 5% undivided interest

Signed, sealed and delivered in the presence of:

Unofficial Witness

Notary Public
My Commission expires: 2/27/2000
[Notary Seal]

NOTARY PUBLIC
WANDA TAYLOR
Notary Public, Cobb County, Georgia
My Commission Expires Feb. 27, 2000

BOOK 26617PG100

By: _____ (SEAL)
STEVE WARONKER, as to 5% undivided interest

Signed, sealed and delivered in the presence of:

Cindy Park
Unofficial Witness

Madeline H Wallace
Notary Public
My Commission expires:

Notary Public, Fulton County, Georgia
My Commission Expires April 1, 2001

[Notary Seal]

N.P. SEAL

C:\RE\WORD\DEAL\TOWARR.WD

EXHIBIT "A"

TRACT I

ALL that tract or parcel of land lying and being in Land Lot 15, of the 14th District of Fulton County, Georgia, and being more particularly described as follows:

BEGINNING at a point on the east side of North Highland Avenue ninety-six and five tenths (96.5) feet south of the southeast corner of North Highland Avenue and North Avenue, said beginning point being at the south side of an eighteen (18) foot alley; running thence south along the east side of North Highland Avenue sixty-five and fifteen hundredths (65.15) feet; thence east one hundred twenty (120) feet to the southwest side of said eighteen (18) foot alley; thence northwesterly along the southwestern side of said alley ninety-nine (99) feet to a point where said alley turns; thence west along the south side of said alley sixty-three and three-tenths (63.3) feet to the point of beginning; being improved property known as 597-601 North Highland Avenue, N.E., according to the present system of numbering houses in the City of Atlanta.

TRACT II

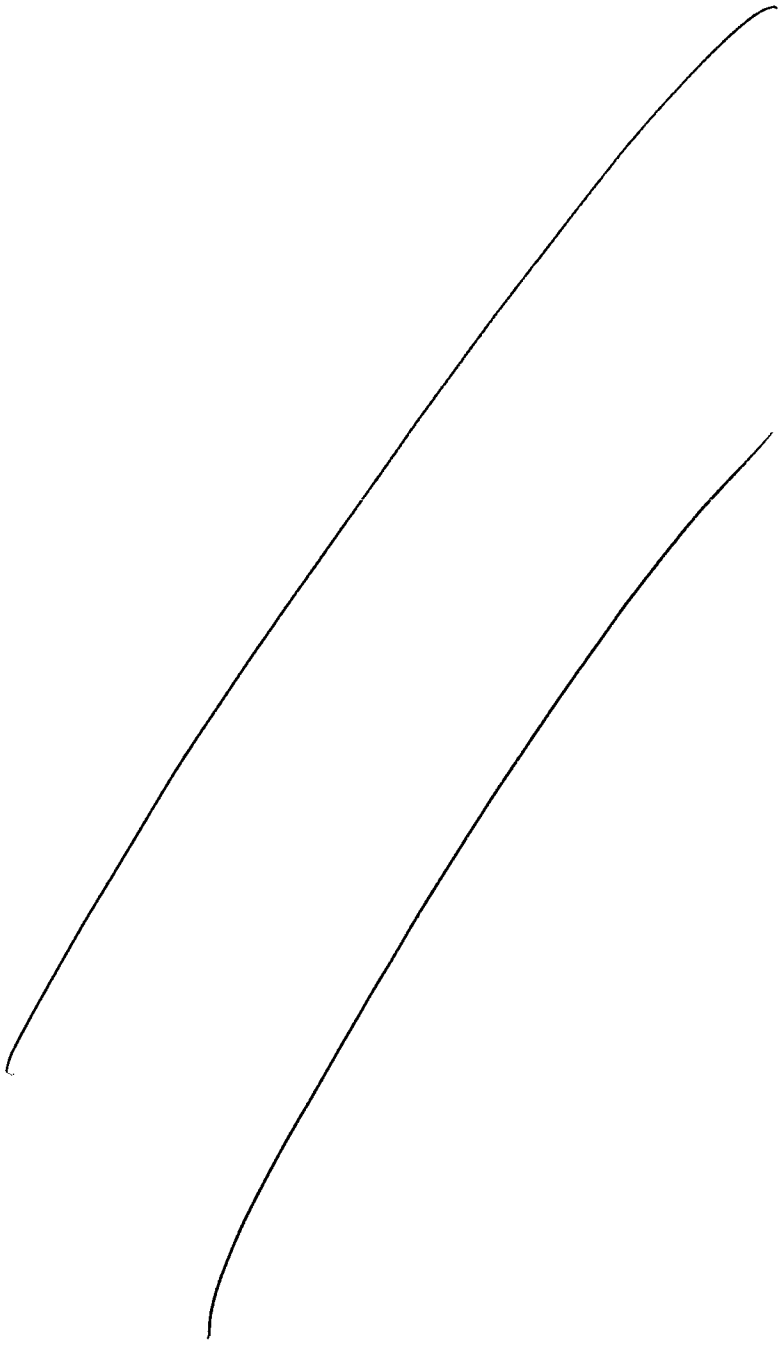
ALL that tract or parcel of land lying and being in Land Lot 15, 14th District, Fulton County, Georgia, and being more particularly described as follows:

BEGINNING at an iron pin placed on the easterly side of North Highland Avenue two hundred seventy-seven (277) feet northerly as measured along the easterly side of North Highland Avenue from the corner formed by the intersection of the easterly side of North Highland Avenue with the northerly side of Vaud Avenue; run thence easterly along the line that forms an interior angle of 90 degrees 08 minutes with the easterly side of North Highland Avenue one hundred fifty-six (156) feet to an iron pin found on the southwesterly side of a 15-foot alley; run thence northwesterly along the southwesterly side of said 15-foot alley sixty-two (62) feet to an iron pin found; run thence westerly one hundred twenty (120) feet to an iron pin found on the easterly side of North Highland Avenue; run thence southerly along the easterly side of North Highland Avenue fifty (50) feet to the iron pin placed at the point of beginning, being improved property having a one-story frame house thereon known as 591 North Highland Avenue according to the present system of numbering houses in the City of Atlanta, Georgia, and being more particularly shown on survey prepared by Georgia Land Surveying Co., dated September 23, 1980.

BOOK 13120PG215

BOOK 26517/0102

Exhibit B
Fulton County Tax Parcel Map



Deed Book 52038 Pg 162
Cathelene Robinson
Clerk of Superior Court
Fulton County, Georgia