FINAL
OPERABLE UNIT 2
REMEDIAL INVESTIGATION / FEASIBILITY STUDY REPORT
DIAMOND CLEANERS
SITE NO. 808030

WORK ASSIGNMENT NO. D004434-11

Prepared for:

New York State Department of Environmental Conservation
Albany, New York

Prepared by:

MACTEC Engineering and Consulting, P.C.
Portland, Maine

PROJECT NO: 3612062070

DECEMBER 2009

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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

ASP	Analytical Services Protocol
ASTM	Association for Testing and Materials
ATRS	Associated Textile Rental Services
bgs	below ground surface
Chemtech	Chemtech Consulting Group, Inc.
COCs	contaminants of concert
DC site	Diamond Cleaners site
1,2-DCE	cis-1,2-dichloroethene
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
Dhc	dehalococcoides
DNAPL	dense non-aqueous phase liquid
DO	dissolved oxygen
DUSR	data usability summary report
ºF	degrees Fahrenheit
FDR	field data record
FS	Feasibility Study
g/kg	gram(s) per kilogram
HRC™	Hydrogen Release Compound™
HSA	hollow stem auger
IRM	Interim Remedial Measure
MACTEC	MACTEC Engineering and Consulting, P.C.

GLOSSARY OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

mg/Kg	milligrams per kilogram
MNA	monitored natural attenuation
msl	mean sea level
NAVD	North American Vertical Datum
NOD	natural oxidant demand
NPW	net present worth
NYCRR	New York Codes, Rules and Regulations
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSPC	New York State Plane Coordinates
O&M	operation and maintenance
OMB	Office of Management and Budget
ORP	oxidation-reduction potential
OU	operable unit
PCB	polychlorinated biphenyls
PCE	tetrachloroethene
PNOD	permanganate natural oxidant demand
PSA	Pine & Swallow Associates, Inc.
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
QEA	Qualitative Exposure Assessment
RAOs	Remedial Action Objectives
Report	Diamond Cleaners OU-2 Remedial Investigation/Feasibility Study report
RGs	remediation goals
RI	remedial investigation
ROD	Record of Decision

GLOSSARY OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

SCO	soil cleanup objective
SCG	standards, criteria and guidance
SVOC	semi-volatile organic compound
TAGM	Technical and Administrative Guidance Memorandum
1,1,1-TCA	1,1,1-trichloroethane
TCE	trichloroethene
TCL	target compound list
TES	Teeter Environmental Services, Inc.
TICs	tentatively identified compounds
TOC	total organic carbon
µg/L	microgram(s) per liter
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VC	vinyl chloride
VOC	volatile organic compound
WA	work assignment

1.0 INTRODUCTION

MACTEC Engineering and Consulting, P.C. (MACTEC), under contract to the New York State Department of Environmental Conservation (NYSDEC), is submitting this Operable Unit 2 (OU-2) Remedial Investigation (RI) and Feasibility Study (FS) Report (Report) for the groundwater located beneath and downgradient of the Former Diamond Cleaners (DC) site in the City of Elmira, Chemung County, New York (Figure 1.1). The DC site, site No. 8-08-030, is listed as a Class 2 hazardous waste site, in the Registry of Hazardous Waste Sites in New York State (NYS). This Report has been prepared in accordance with the NYSDEC requirements in Work Assignment (WA) No. D003826-16, dated November 12, 2004 and WA No. D004434-11, dated April 12, 2007, and with the July 1997 Superfund Standby Contract between MACTEC and the NYSDEC. The OU-2 RI/FS presents groundwater findings and remedial alternatives.

The RI activities for the DC site were conducted using a phased approach in accordance with the WA, as well as with the United States Environmental Protection Agency (USEPA) RI guidance (USEPA, 1988); NYSDEC Technical and Administrative Guidance Memorandum (TAGM) #4025 entitled “Guidelines for Remedial Investigations/Feasibility Studies” (NYSDEC, 1989); TAGM #4030 entitled “Selection of Remedial Actions at Inactive Hazardous Waste Sites” (NYSDEC, 1990); and the NYSDEC Draft DER-10 “Technical Guidance for Site Investigation and Remediation” (NYSDEC, 2002). This approach integrates the RI and quality exposure assessment (QEA) with the screening and evaluation of alternatives performed during the FS.

The Record of Decision (ROD) for Diamond Cleaners Operable Unit-1 (OU-1) - Source Area was signed on March 31, 2008 (NYSDEC, 2008). An operable unit represents a portion of the site remedy that for technical or administrative reasons can be addressed separately to eliminate or mitigate a release, threat of release or exposure pathway resulting from the site contamination. OU-1 consists of the on-site source area at the former Diamond Cleaners property. The selected remedy for OU-1, as outlined in the ROD, included: 1) the demolition of the on-site building, and 2) excavation of contaminated soils exceeding remediation goals and transportation and offsite disposal of contaminated soil and building debris. The remaining operable unit for this site and the subject of this document is OU-2, on-site/off-site contaminated groundwater. The objectives of the OU-2 RI are to determine the nature and extent of groundwater contamination associated with the

DC site. This Report presents results of the RI field activities and potential risks to human health and the environment as related to OU-2.

The objectives of the FS are to evaluate potential remedial alternatives from an engineering, environmental, public health, and economic perspective and to identify a preferred alternative based on that evaluation.

1.1 REPORT ORGANIZATION

This OU-2 RI/FS Report is structured in general in accordance with the NYSDEC TAGM 4025 (NYSDEC, 1989) and DER-10 (NYSDEC, 2002), as well as the Suggested RI Report Format memo from the NYSDEC, dated June 2004. The Sections of the RI/FS report are outlined below.

Section 1.0 - Introduction: Discusses the purpose of the Report, the DC site's history, and previous investigations conducted at and in the vicinity of the DC site.

Section 2.0 - Scope of Work: Presents the specific scopes of work performed at, and in the vicinity of the DC site.

Section 3.0 - Physical Setting: Summarizes the physical characteristics of the DC site and surrounding area.

Section 4.0 - Nature and Extent of Contamination: Presents results of the analytical data and discusses the nature and extent of the groundwater contamination at and in the vicinity of the DC site.

Section 5.0 - Contaminant Fate and Transport: Discusses the fate and transport of the DC site's groundwater contamination.

Section 6.0 - Qualitative Exposure Assessment (QEA): Presents the QEA.

Section 7.0 - Summary and Conclusions: Presents a summary and conclusions of the RI.

Section 8.0 - Development of Remedial Action Objectives, General Response Actions, and Contamination Requiring Remediation: Presents the Remedial Action Objectives (RAOs) and General Response Actions which apply to groundwater contamination at the DC site and identifies the extent of contamination to be addressed through remedial action.

Section 9.0 - Identification and Screening of Technologies: Identifies and screens potential remedial technologies which will be used to develop remedial alternatives for the DC site in Section 10.0.

Section 10.0 - Development and Screening of Alternatives: Combines the retained remedial technologies into Remedial Alternatives for the DC site.

Section 11.0 - Detailed Analysis of Alternatives: Presents a detailed analysis of the Remedial Alternatives developed for groundwater at the DC site. The detailed analysis is intended to provide decision-makers with the relevant information with which to compare the Remedial Alternatives and aid in selection of a site remedy.

Section 12.0 - Comparative Analysis of Alternatives: Evaluates the relative performance of each alternative using the same criteria by which the detailed analysis of each alternative was conducted. The purpose of the comparative analysis is to identify the advantages and disadvantages of each alternative relative to one another to aid in selecting a remedy for the DC site.

Section 13.0 – References: Presents a list of references used in the preparation of this Report.

Field data sheets and supporting information are included in the Appendices attached to this Report.

1.2 PURPOSE OF REPORT AND RI/FS OBJECTIVES

The purpose of the Report is to present findings of the RI, the evaluation of RAOs, as well as potential IRMs, and to present the development and comparison of Remedial Alternatives for groundwater at the DC site and to present the RAOs.

Based on previous investigations and data, the DC site poses a significant threats to public health and the environment as defined in 6 NYCRR 375 (NYSDEC, 2006). However, existing data reviewed was not sufficient to fully characterize the DC site and therefore the RI field program was performed. The objectives of the RI/FS are to:

- define the historical source area(s) and potential continuing source areas for chlorinated solvent contaminants
- define the areal and vertical extent of contaminants in site groundwater
- evaluate potential present and future human health exposure to contaminated groundwater; this included the collection of sufficient data to enable the completion of a QEA
- collect sufficient data to evaluate the remedial action alternatives for the DC site to mitigate the potential exposure to site related contaminants in groundwater
- gather data to determine if additional IRMs are appropriate, and what remedies are the most applicable

1.3 SITE BACKGROUND

On March 2, 2005 MACTEC personnel visited the City of Elmira municipal offices (including Code Enforcement, Fire Department, Public Works/Engineering and Tax Assessment Office), the Elmira Public Library, and the Chemung County Real Property Office. Information pertaining to the history of DC operations and past releases of contamination was reviewed to help prepare the Work Plan for the RI/FS field investigation. The information collected, as well as information provided in the WA, is summarized below.

1.3.1 Site Description

The DC site is located at 717 Lake St. in the north-central section of the City of Elmira in Chemung County, New York (Figure 1.2). The DC site consists of a 1 acre lot in a commercial and residential area. The lot contains a one story building with a grassy area in the rear (west) of the building along with a gravel parking area south of the building and a paved parking area north of the building. The building was constructed in the 1950’s and is currently unoccupied and in disrepair. The office and storage yard for a former construction company lies to the west of the DC site across Benjamin Street, and the Associated Textile Rental Services (ATRS) site (NYSDEC Class 2 site number 8-08-041) lies west of the former construction company across Dickinson Street, approximately 300 feet west of the DC site. West of the ATRS site lies Clemens Center

Parkway, which was formerly a railroad right of way and round house, as well as the reported historic location of Elmira Canal.

1.3.2 Site History

Although the property was developed prior to 1878, the first buildings located on the property were constructed in the early 1900's and consisted of repair shops, workshops, and storage. These were part of the Elmira Blind Center and Board of Education, which was located to the north of the current property. By the mid-1900's these buildings were used by the City of Elmira Highway and Bridges Department workshops. The current site building was constructed in the 1950's. The DC site operated as a dry cleaner under various names from the mid-1950's until at least the mid-1990's. The cleaning room was located in the southwest corner of the DC site building (MACTEC, 2007).

Existing records indicate the property was owned by Custard and Kistler Laundry, Inc, until 1995 when it was sold to Earl D. Coleman. Subsequently, it was seized by Chemung County and purchased back from the county by Mr. Coleman in 1998. According to the Chemung County Real Property Office, the property has again been seized by the county and remains in the possession of Chemung County.

The use of adjacent properties varied throughout the years, consisting of both residential and industrial use. The Elmira City Atlas from 1878 shows a canal which follows the present day railroad spur. By the late 1800's, the canal had been filled and railroad spur built in its footprint. The land east of the DC site, across Lake Street, has historically been occupied by oil companies and building supply companies (MACTEC, 2007).

1.3.3 Previous Field Investigations

Previous groundwater investigations have been conducted at the DC site property, as well as at the ATRS property located approximately 300 feet west of the DC site. To better understand groundwater contamination in the vicinity of the DC site, investigation results from both sites are discussed below.

DC site. In 2001 Teeter Environmental Services, Inc. (TES) performed a limited subsurface investigation of the property at 717 Lake St. and an adjacent property at 706-710 Benjamin St., owned by the same party. Potential contaminants of concern included chlorinated and non-chlorinated solvents used in the dry cleaning industry as well as petroleum contaminants potentially related to an underground storage tank (UST) formerly located at the DC site.

TES performed 15 soil borings to depths ranging from 14 to 24 feet below ground surface (bgs) and six water sample borings using direct push methods (see Figure 1.3). Results indicate that the soil and groundwater were impacted by both chlorinated and non-chlorinated solvents. Details of the soil analytical results can be found in the Diamond Cleaners RI/FS completed in 2007 (MACTEC, 2007). Chlorinated solvents were detected at concentrations in excess of the NYS Class GA groundwater standards in all 6 groundwater boring locations. Maximum exceedances in groundwater include cis-1,2-DCE at 1,070 micrograms per liter (µg/L) in SB4 (NYS groundwater standard = 5 µg/L), PCE at 158 µg/L in SB11 (NYSDEC GW Standard = 5 µg/L), and VC at 280 µg/L in SB4 (NYS groundwater standard = 2 µg/L). Non-chlorinated hydrocarbons in excess of the NYS groundwater standards were detected at 3 of the 6 groundwater boring locations. Maximum exceedances in groundwater include n-Butylbenzene at 16.4 µg/L and 1,2,4-Trimethylbenzene at 25.7 µg/L in SB6 (NYSDEC GW Standard = 5 µg/L). Teeter groundwater results are presented in Table 1.1.

In June 2007, MACTEC submitted an RI/FS Report for the DC site (MACTEC, 2007) describing RI investigation activities and results/conclusions of data collected at the DC site. Due to apparent data gaps, the FS portion of that Report addressed the on-site soil source only, and not groundwater. The 2007 RI/FS is henceforth referred to as the DC OU-1 (site soil) RI/FS.

The DC OU-1 RI/FS Report states that chlorinated solvents were used at the DC dry cleaning facility, and that chlorinated solvent source areas identified on site include the former cleaning room of the dry cleaning facility (southwest corner of building) and spills to the ground surface to the rear (west) of the DC site building. Additionally, a fuel-related source area, consisting of a former UST located on the southwest corner of the building, was identified. Contaminants of concern include chlorinated solvents and fuel related volatile organic compounds (VOCs) (primarily PCE, TCE, cis-1, 2-DCE, VC, and xylene). These contaminants have migrated from soils to groundwater and residual VOC contaminants in soils are a continuing source of groundwater contamination.

The OU-1 RI groundwater investigation field program is discussed in more detail in Section 2, and analytical results from OU-1 RI are presented in Section 4.

The OU-1 RI/FS indicated that site soil contamination is a continuing source of groundwater contamination, a clear relationship between the DC source area and groundwater contamination detected in the vicinity of the DC site could not be developed. Groundwater flow conditions could not be adequately determined based on available groundwater elevation data and analytical results. In addition, the extent of groundwater contamination could not been defined. The Report recommended that additional information be collected and analyzed to more accurately assess the groundwater flow conditions and extent of the groundwater contamination on and around the DC site.

ATRS site. Investigations have also been conducted at the ATRS site, located approximately 300 feet west of the DC site. Investigations conducted by the former ATRS site owner have identified the presence of fuel related compounds and chlorinated solvents in site groundwater. The fuel related compounds are associated with past activities at the ATRS site and are being addressed under the NYSDEC Spills numbers 9210608 and 9803233. MACTEC, under contract to the NYSDEC, conducted a Site Characterization to evaluate the likelihood of the DC site being the source of the chlorinated solvent contamination.

In January 2008, MACTEC submitted a Site Characterization Report (MACTEC, 2008) summarizing findings of the physical and chemical data collected during a Site Characterization performed at the ATRS site. TCE and PCE were detected at concentrations up to 68 times and two times, respectively, their respective NYSDEC Soil Cleanup Objectives (SCOs) for unrestricted use in a soil sample collected from seven to nine feet bgs adjacent to the east side of the DC site building. Additional soil sampling on the eastern side of the DC site property indicates that chlorinated solvent contamination appears to be limited to the soil near the DC site building. The trace concentrations of chlorinated solvents detected elsewhere were collected near the water table and may represent groundwater contamination, and not actual soil contamination.

PCE was detected at concentrations above NYS standards in groundwater samples from 24 of the 56 well/Geoprobe® boring locations across the DC site and vicinity. The detected concentration of PCE in groundwater ranged from 1.2 µg/L to 4300 µg/L. TCE was detected at concentrations above NYS standards in groundwater samples from 22 of the 56 well/Geoprobe® boring locations across the DC site and vicinity. The detected concentration of TCE in groundwater ranged from 1.3 µg/L to 200 µg/L. The two samples with the highest detections of PCE and TCE were collected from borings located adjacent to and south of the DC site building.

The ATRS groundwater investigation field program is discussed in more detail in Section 2, and analytical results from the ATRS Site Characterization are presented in Section 4.

Based on groundwater concentrations detected, the report indicated that a source of PCE contamination exists at the ATRS site. It was determined that more information was needed to define the PCE source area and to determine if the DC site is contributing to the PCE detected in the ATRS site groundwater. As a result of the investigation, the ATRS site was listed as a Class 2 inactive hazardous waste site. Contamination at the ATRS site will be addressed in a decision document to be issued in the future by the NYSDEC.

2.0 INVESTIGATION ACTIVITIES

This OU-2 RI/FS Report presents groundwater information previously submitted in two separate reports; the OU-1 RI/FS for the DC site (MACTEC, 2007) and the Site Characterization conducted at the ATRS site (MACTEC, 2008), as well as results of additional field sampling conducted under OU-2.

2.1 DC OU-1 RI/FS

PHASE ONE

Phase One of the field program included a detailed evaluation of the area surrounding and within the DC site building, as well as the area immediately downgradient from the DC site. The groundwater investigations included:

1) Geoprobe® groundwater sampling at 18 locations (GW-1 thru GW-18) to evaluate potential and known source areas and characterize the vertical distribution of contaminants in groundwater.
2) Installation of 4 microwells to evaluate site groundwater flow conditions.

Detailed description of these activities is included in the following sections.

Geoprobe® Groundwater Sampling – June 2005

Field investigation activities included the completion of borings using a rubber track-mounted Geoprobe® drill rig and drive sampling device to collect groundwater samples to identify potential chlorinated solvents and fuel contaminants.

The first round of samples was collected over an eight-day period beginning on June 21, 2005 and ending on June 28, 2005 during which 32 groundwater samples were collected from 18 borings for off-site analysis. Approximate boring locations are shown on Figure 2.1. Locations were chosen based on field conditions and previous investigation results. Three duplicate samples and one matrix spike/matrix spike duplicate were collected from the groundwater samples for quality control (QC). Boring depths ranged from 20 to 33 ft. bgs with no borings advanced to bedrock.

The deepest boring encountered refusal at 33’ bgs. One soil boring was completed inside the DC building. Geoprobe® sampling data sheets are included in Appendix A of the OU-1 RI/FS (MACTEC, 2007).

Groundwater Microwell Installation. To evaluate groundwater flow direction at the DC site, four Geoprobe® borings (GW-2, GW-10, GW-13, and GW-14, shown on Figure 2.1) were completed as 1-inch outside diameter schedule 40 polyvinyl chloride (PVC) microwells. Microwell screens have 0.010-inch wide machine slot with # 0 sand pack to 3 feet above the screen, a two foot bentonite seal above the sand pack and a bentonite grout backfill to the ground surface. The microwells were completed with a locking cap and a six-inch flush mount cover. Microwell installation logs are provided in Appendix A of the OU-1 RI/FS Report. Groundwater at the DC site was encountered at approximately 11 ft. bgs.

PHASE TWO

Upon completion of Phase One, Phase Two activities at the DC site were initiated. Phase Two included:

1) Installation of five monitoring wells to provide additional groundwater analytical data and permanent groundwater monitoring points.
2) Groundwater sampling of new wells to evaluate groundwater conditions and provide data for evaluating the potential for natural attenuation

Detailed descriptions of these activities are included in the following sections.

Groundwater Monitoring Well Installation – October 2005

To further characterization groundwater flow conditions and distribution of contamination at the DC site, and northwest of the DC site, five 2-inch overburden monitoring wells (MW-1 to MW-5) were installed from October 3, 2005 to October 5, 2005 (Figure 2.1). Well locations were based on presumed groundwater flow direction and analytical results of the Phase One sampling program.

Each monitoring well boring was advanced using hollow stem auger (HSA) drilling techniques. Borings were logged on field data records (FDRs); included in the Diamond Cleaners OU-1 RI/FS Report. One unsaturated soil sample from each boring was collected and shipped to Mitkem

Corporation and analyzed for VOC using USEPA OLM04.2 methods. In addition, one sample was collected from each well boring at the well screen interval and shipped to Mitkem Corporation for total organic carbon (TOC) and grain size analyses by USEPA Method 415.1 and Association for Testing and Materials (ASTM) Method D422, respectively.

The monitoring wells were constructed of 2-inch inside diameter schedule 40 PVC with 10-foot well screens. Well screens have 0.010-inch wide machine slots with # 0 sand pack to three feet above the screen, a two foot bentonite seal above the sand pack and a bentonite grout backfill to the ground surface. The wells were completed with a locking cap and a six inch flush mount cover. Well installation logs are provided in the Diamond Cleaners OU-1 RI/FS Report.

Each of the newly installed monitoring wells was developed using pump and surge techniques. The wells were developed until the turbidity of the well water discharge was less than 50 nephelometric turbidity units, or for a maximum duration of 2 hours. Wells were allowed to equilibrate for at least two weeks before sampling.

Phase Two - Round 1 Groundwater Sampling - November 2005

The five newly installed monitoring wells at the DC site were sampled November 1, 2005 to November 3, 2005, using low-flow sampling procedures. Samples were collected using a geopump and dedicated tubing for each well. Field measurements for pH, temperature, specific conductivity, oxidation reduction potential (ORP), dissolved oxygen (DO), and turbidity were collected from each well during pre-sample purging.

Groundwater samples were analyzed for VOCs by USEPA OLM04.2 methods as described in the NYSDEC ASP of June 2000. In addition, all of the wells were sampled for monitoring natural attenuation (MNA) parameters. These include TOC by USEPA Method 415.1, Nitrate by NYSDEC ASP Method 352.1, Nitrite by NYSDEC ASP Method 354.1, Sulfate by NYSDEC ASP Method 375.4, Sulfide by NYSDEC ASP Method 376.2, Methane/Ethane/Ethene by ASTM Method 1945, carbon dioxide by HACH test kit method, Alkalinity by Method 310.1, chloride by Method 325.3, and iron and manganese by USEPA Method 6010B. The laboratory provided NYSDEC Category B deliverables for the VOC analysis and Category A deliverables for the MNA analyses.

Phase Two - Round 2 Groundwater Sampling-March 2006

A second round of groundwater sampling at the DC site was conducted on each of the five monitoring wells using low-flow sampling procedures on March 23, 2006. Samples were collected using a geopump and dedicated tubing for each well. Field measurements for pH, temperature, specific conductivity, ORP, DO, and turbidity were collected from each well during pre-sample purging.

Groundwater samples were analyzed for VOCs by USEPA OLM04.2 methods as described in the NYSDEC ASP of June 2000.

2.3 ATRS SITE CHARACTERIZATION

The ATRS Site Characterization was conducted at the former ATRS business which is located downgradient from the DC site (Figure 2.2). The objective of this work was to determine whether the chlorinated VOCs previously detected in ATRS site groundwater originated from the ATRS site, and if so, whether that contamination poses a significant threat to public health or the environment. The results of this fieldwork were previously submitted to the NYSDEC in the Site Characterization Report (MACTEC, 2008). The well IDs used in the ATRS Site Characterization Report (i.e. adding the prefix “DC” for wells related to the DC property) were retained in this section of the Report, as well as on the correlating figures and tables.

Groundwater field investigations associated with the ATRS site included:

1) Existing Monitoring Well Sampling
2) Geoprobe® Groundwater Sampling – On-site Groundwater VOC Analysis
3) Microwell Installation
4) Well Development
5) Three rounds of Synoptic Groundwater Measurements

The existing monitoring well sampling, and groundwater sample collection, groundwater microwell installation and well development activities were conducted from November 6 through

November 10, 2006. Based on field results, seven additional borings were completed on November 17, 2006 and 18 additional borings were completed from August 27 to 29, 2007. Sample locations are shown on Figures 2.2 and 2.3.

The synoptic groundwater measurement rounds were conducted on November 16, 2006, May 9, 2007, and August 29, 2007. A site land survey was completed by Joseph Lu Engineers on February 6, 2007.

Existing Monitoring Well Sampling - November 2006

To assess groundwater conditions at and adjacent to the ATRS site, fifteen existing monitoring wells and two existing microwells were sampled in November 2006. These included ten monitoring wells installed on the former ATRS property (MW-1R and MW-1 through MW-9) and five monitoring wells installed by MACTEC on the adjacent Diamond Cleaners property (DCMW-1 through DCMW-5). Two microwells were also sampled on the Diamond Cleaners property (DCGW-2 and DCGW-10). These existing monitoring wells were sampled in accordance with the USEPA "low flow" guidance. Groundwater parameters including water levels, turbidity, temperature, DO, specific conductance, pH and redox potential were recorded in a field log and on an FDR. All low flow sampling requirements were met while sampling these existing wells. Groundwater FDRs are available in the ATRS SC Report (MACTEC, 2008).

Samples were submitted to Chemtech Consulting Group, Inc. (Chemtech) and analyzed for TCL VOCs using USEPA OLM04.3 methods as described in the NYSDEC ASP of June 2000. In addition, the ten monitoring wells sampled from the ATRS site (MW-1R, and MW-1 through MW-9) were submitted to Chemtech for semi-volatile organic compounds (SVOCs) analyses using USEPA OLM04.3 Methods. Off-site laboratory analysis included Category B deliverables.

Geoprobe® Borings and Sampling - November 2006 and August 2007

Field investigation activities included the drilling of Geoprobe® borings, the collection and analysis of groundwater, and the installation of microwells. Geoprobe® sampling was conducted over a five day period from November 6, 2006 to November 10, 2006. Additional days of Geoprobe® work were added to fill in data gaps on November 17, 2006, and from August 27 to 29, 2007. The purpose of the activities was to provide groundwater data for comparison to NYS Class GA Groundwater Quality Standards set forth under 6 NYCRR Parts 700-705 (NYS, 1999), and for assisting the NYSDEC in evaluating significant threat to public health and the environment as defined by 6 NYCRR Part 375 (NYSDEC, 2006).

MACTEC used a Geoprobe® 66 DT rubber mounted track rig sampling device to collect groundwater, soil, and soil vapor samples to identify potential chlorinated solvents. A total of 49 borings were completed during this investigation (GW-12, GW-16, and GW-17 were not advanced due to utility conflicts). Of these 49 borings, three were soil vapor borings and four were completed as microwells. A total of 54 groundwater samples, (plus associated QC) were collected from the DC site area. Boring locations are shown on Figures 2.2 and 2.3 (GS locations correspond to GW locations).

MACTEC worked closely with the NYSDEC, the DC site property owner, neighboring property owners, and utility companies while obtaining access to these exploration locations. These locations were chosen to determine groundwater conditions upgradient and downgradient of, as well as adjacent to, the ATRS site building.

Groundwater Sampling. Groundwater samples were collected using a one-inch diameter stainless steel wire wound screen which was exposed to the aquifer after being pushed to the desired depth interval. A minimum of one tubing volume of water was purged and one set of field parameters, including temperature, conductivity, pH, and turbidity, was collected prior to sampling. Groundwater parameters and sample observations were recorded on a FDR in the ATRS SC Report (MACTEC, 2008). VOC samples were collected at a purge rate of 100 milliliters per minute to minimize any potential volatilization.

To assess the vertical extent of contamination, MACTEC attempted to collect groundwater samples from two depth intervals at many of the borings; at the water table and 10 feet into the water table (10 feet below the first sample). Each boring was completed to at least 10 feet into the water table, which was encountered from 5 to 14 feet bgs across the study area. The actual number of samples per boring and sample collection depths varied due to field conditions (e.g., dense/tight soils). Only one groundwater sample was collected from 25 borings (GW-2, GW-3, GW-4, GW-15, GW-18, GW-19, GW-21 through GW-30, GW-39 to GW-46, and GW-49). No groundwater samples were collected from 10 of the boring locations (GW-12, GW-16, GW-17, GW-31 to GW-34, and GW-36 to GW-38). Two groundwater samples were collected at varying depth intervals at the remaining boring locations (numbers do not include QC).

One sample collected from each of the first 20 completed locations (GW-1 to GW-23, with the exception of GW-12, GW-16, and GW-17) was screened on-site for VOCs using an on-site Photovac GC. Based on field screening VOC data, seven additional borings were advanced on November 17, 2006 (GW-24 through GW-30) to help assess the horizontal extent of contamination. One groundwater sample was collected from approximately four feet into the water table from each of the additional borings. Based on off-site laboratory results, 16 additional samples were collected from 12 borings advanced on August 28 and 29, 2007 (GW-35 and GW-39 to GW-49).

Groundwater samples were shipped to Chemtech for analyses of TCL VOCs using USEPA OLM04.3 Methods as described in the NYSDEC ASP of June 2000. Additionally, four groundwater samples (from borings GW-4, GW-9, GW-13 and GW-20) were analyzed for SVOCs using USEPA OLM04.3 Methods. Off-site laboratory analysis included Category B deliverables.

Microwell Installation. To assist the assessment of groundwater flow direction at the ATRS site, four Geoprobe® borings were completed as microwells (GW-4, GW-13, GW-15, and GW-19). Microwell locations are shown on Figure 2.3. Groundwater was encountered from between 5 to 14 feet bgs. The one-inch diameter microwells were installed after groundwater samples were collected from each boring. The microwells were installed as piezometers, primarily for water level measurements. Microwells were constructed using one-inch inside diameter schedule 40 PVC, with 10 foot lengths of 0.01-inch machine slotted well screens. The wells were screened across the water table to determine water table elevations and create a potentiometric surface map. The wells were constructed with a #00 sand pack to two feet above the screen, a minimum of two feet of bentonite seal placed above the sand pack, native soil as backfill and sealed at the ground surface with either Portland Cement or blacktop patch. The wells were fit with a 1.5-inch PVC cap and a six-inch flush mount road box. All wells were developed for a minimum of twenty minutes using a peristaltic pump to clean the screen and ensure that the wells were conductive with groundwater. Well construction diagrams are included in the ATRS SC Report (MACTEC, 2008).

Water Level Surveys

Three rounds of synoptic groundwater level measurements were conducted for the ATRS site investigation; one on November 6, 2006, one on May 9, 2007, and one on August 29, 2007. Wells selected for water level measurements consisted of the four new microwells wells (GW-4, GW-13, GW-15, and GW-19) and the ten existing monitoring wells on the former ATRS property (MW-1, MW-1R, and MW2 to MW-9), along with the four microwells (DCGW-2, DCGW-10, DCGW-13, and DCGW-14) and five monitoring wells at the Diamond Cleaners property (DCMW-1 TO DCMW-5). Due to access issues, water levels were not able to be collected from all of the selected wells for each round. Well caps were opened and the wells were allowed to equilibrate to atmospheric pressure. The depths to water were measured from the top of well risers using a conductivity probe.

In addition to water level measurements, slug tests were conducted on two of the ATRS site wells (MW-3 and MW-9) and on three of the Diamond Cleaners wells (DCMW-3 to DCMW-5). Tests were conducted by measuring the speed of well water level recovery after displacing water with a solid mass of PVC (i.e., the slug). Two rising head tests were conducted on each well and measured with a Hermit 3000 data logger. Data was imported into Aqtesolv and used to calculate hydraulic conductivity and estimate groundwater flow velocity.

2.4 DC SITE OU-2 FIELD INVESTIGATIONS

Subsequent to the ATRS site characterization, additional investigations were conducted for the OU-2 RI. These investigations included groundwater sampling at both the DC and ATRS sites to better evaluate the flow of chlorinated solvent groundwater contamination from the DC site. These activities included the following tasks:

1) Direct Push Investigation including groundwater sampling and on-site analysis of 13 microwell locations (GPN-1through GPN-4, and GPS-1 through GPS-9); these were installed to further evaluate the physical and chemical conditions downgradient of the DC site and to allow for better placement of additional wells to augment the existing wells at the DC site.
2) Installation of six monitoring wells (MW-6 through MW-11) to provide for additional groundwater analytical data and groundwater monitoring points.

3) Groundwater sampling of 18 monitoring wells (the six newly installed wells, nine existing wells associated with the DC site, and three wells associated with the ATRS site) to further evaluate groundwater conditions.

Detailed descriptions of these activities are included in the following sections.

Direct Push Groundwater Sampling-July 2008

Field investigation activities included the completion of borings using a rubber track-mounted direct push drill rig. MACTEC employed the services of Pine & Swallow Associates, Inc. (PSA) to install a series of 13 MicroWells along a transect and to extract groundwater samples for on-site gas chromatographic analysis for selected VOC. Selected sample zones also had displacement recovery measurements taken to estimate hydraulic conductivities. The purpose of the activities was to provide groundwater data for comparison to NYS Class GA Groundwater Quality Standards and to evaluating the best locations for the installation of groundwater monitoring wells. PSA submitted a report to MACTEC on this subsurface investigation (Included in Appendix A).

Thirteen temporary MicroWells were installed downgradient of the DC site on a transect parallel to Benjamin Street (Figure 2.4) from July 7 to 11, 2008. A total of 50 groundwater samples were collected from five-foot sequential zones that were sampled in intervals down to termination depths to permit vertical profiling of groundwater quality for chlorinated solvent contamination (previous sampling did not indicate fuel related contamination along Benjamin Street, the target area for this investigation). The samples were analyzed in PSA's field laboratory using a Hewlett Packard 5890 gas chromatograph for VC, 1,1-dichloroethene (1,1-DCE), trans-1,2-dichloroethene (Trans-1,2-DCE), cis-1,2-dichloroethene (Cis-1,2-DCE), 1,1-dichloroethane, 1,1,1-trichloroethane (1,1,1-TCA), 1,2-dichloroethane (1,2-DCA), TCE and PCE.

Thirteen MicroWells were installed at the locations as shown on Figure 2.4 by using a high frequency vibratory hammer mounted on a VibraDrill® all-terrain drilling machine. MicroWell depths ranged from 28.3 feet to 40 feet bgs. Refusal depths at four locations were interpreted as being caused by very dense till. The MicroWells consist of 1.32-inch outside diameter steam-cleaned steel pipe whose leading section was fitted with a drive point. The leading five-foot section of pipe was also modified to act as a well screen and was manufactured from the same material. The well screen consists of rows of longitudinal, 0.015-inch wide slots on the pipe. The pipes above the screen, or riser pipes, were driven in solid 10-foot sections. To drive deeper, additional sections of riser pipe were welded together at joints fitted with an external steel collar.

Once the pipes were driven into the groundwater table a sufficient distance to collect water samples, wells were developed with an inertial pump to remove silt and fine sand that had entered the pipe through the screened slots. Development continued until the discharge water was clear and a minimum of three well volumes were removed, or until the wells were purged dry. Once the wells were developed or had recharged enough to allow sample collection, water samples were collected from each of the separate five-foot zones using single-use, new polyethylene tubing dedicated to each sample. Samples were collected in two lab-cleaned 40-milliliter vials and delivered to the on-site laboratory for analysis. Pump valves were decontaminated using soap and water wash and a rinse of distilled water between samples.

At the end of the investigation, the MicroWells were pulled out of the ground, or cut below grade and filled with bentonite, capped with plugs and abandoned in place.

Groundwater Monitoring Well Installation and Sampling - July/August 2008

Six 2-inch overburden monitoring wells (MW-6 through MW-11 see Figure 2.4) were installed from July 21, 2008 to July 23, 2008 to further characterization groundwater flow conditions and distribution of contamination upgradient and downgradient of the DC site. Permanent monitoring wells provide additional groundwater analytical data points to evaluate the extent of chlorinated solvent contamination in the vicinity of the DC site, and to allow monitoring of that contamination, as well as to evaluate potential receptors. Wells were installed to quantitatively characterize groundwater quality, and locations were based on presumed groundwater flow direction and upon the analytical results of earlier sampling.

Each monitoring well boring was advanced using HSA drilling techniques. Borings were logged on FDRs, included in Appendix B. In addition to the monitoring well borings, one boring was completed on the west side of the DC building in the source area. Two samples were collected from this boring from below the water table. The samples were submitted to SiRem laboratories of Ontario, Canada for natural oxidant demand testing.

The monitoring wells were constructed of 2-inch inside diameter schedule 40 PVC with 10-foot well screens. Well screens have 0.010-inch wide machine slots with # 00 sand pack to approximately three feet above the screen, an approximate two foot bentonite seal above the sand pack and a cement/bentonite grout backfill to the ground surface. The wells were completed with a locking cap and a six inch flush mount cover. Well installation logs are provided in Appendix B.

The newly installed monitoring wells were developed using pump and surge techniques over a two day period; July 23 to July 24, 2008. The turbidity of the purge water was continuously measured during well development. The wells were developed until the turbidity of the well water discharge was less than 50 nephelometric turbidity units, or for a maximum duration of 2 hours. Wells were allowed to equilibrate for at least two weeks before sampling.

The six newly installed monitoring wells, nine existing monitoring wells around the DC site, and three monitoring wells associated with the ATRS site were sampled August 12, 2008 to August 14, 2008, using low-flow sampling procedures. Wells were sampled from the least contaminated to the most contaminated as determined from the hydrogeology and known site conditions. Samples were collected using a geopump and dedicated tubing for each well. Field measurements for pH, temperature, specific conductivity, ORP, DO, and turbidity were collected from each well during pre-sample purging.

Groundwater samples were analyzed for VOCs by USEPA method 8260 as described in the NYSDEC ASP of June 2000. The laboratory provided NYSDEC Category B deliverables for the VOC analysis. In addition, samples from MW-5 and MW-7 were submitted to SiRem Laboratories of Ontario, Canada for quantitative dehalococcoides (Dhc) assay. This test is used to determine the presence of the Dhc group organisms, which are the microorganisms that are known to biologically dechlorinate PCE and TCE through to ethene (SiRem, 2008).

Additional Groundwater Sampling-April 2009

To evaluate VOC data over time, as well as to evaluate the potential for non-VOC contamination in groundwater, DC site monitoring wells MW-5, MW-6, MW-7, and GW-10 were sampled on April 2, 2009. Samples were shipped to Chemtech, New Jersey and analyzed for VOCs via USEPA

Method 8260, SVOCs by USEPA Method 8270, Pesticides by USEPA Method 8081, and dissolved Metals by USEPA Methods 6010B/7470. FDRs are included in Appendix B.

Elevation Survey

MACTEC's survey subcontractor surveyed the new monitoring wells. Monitoring well locations were added to the existing base map (see previous Survey Subsection). Vertical elevation accuracy was 0.01 foot and horizontal accuracy was 0.1 foot. Horizontal positions are tied into the NYSPC System. Vertical elevations are tied to msl, NAVD 1988. Surveyed items included the horizontal locations and vertical elevations of six new monitoring wells, including top of the riser, top of the protective casing, and the ground surface. See Appendix C.

3.0 SITE PHYSICAL SETTING

The physical characteristics of the DC site study area are discussed in this section. Information collected during both Task 1; preparation of the RI Work Plan and Task 2; the RI Field Investigation, are summarized below.

3.1 TOPOGRAPHY

The DC site is located in the Newtown Creek Valley, which runs north-south, joining the Chemung River Valley to the south, which runs east-west. The DC site is located approximately 0.6 miles northeast of the center of the City of Elmira, New York (Figure 1.1), at approximately 860 feet above msl. The City of Elmira is situated in a relatively flat flood plain formed by the confluence of the Chemung River to the south and the Newtown Creek to the east. The flood plain is bordered on the west and east by sharp ridges, apparently formed by the down cutting of Newtown Creek.

The topography at the DC site slopes generally to the confluence of the Chemung River and Newtown Creek located approximately 1.3 miles southeast at an approximate elevation of 840 feet above msl.

The topography is relatively flat for approximately one mile to the east of the DC site, before rising sharply up a ridge to an elevations over 1600 feet msl. The topography is also relatively flat to the west of the DC site before similarly rising up a ridge to over 1600 feet above msl.

3.2 CLIMATE

The climate of the area is characterized by moderately warm summers and cold winters. Mean monthly temperatures range from 24 degrees Fahrenheit (ºF) in January to 70°F in July. Average annual precipitation is 35 inches. Average annual snowfall is 43 inches (National Climatic Data Center, 2004).

3.3 GEOLOGY

Overburden at the DC site is greater than 33 feet thick according to data collected during the field investigations. Overburden consists of dark brown sand, silt, and gravel associated with a glacial outwash depositional environment. Based on regional geologic mapping (Rickard and Fisher, 1970) bedrock is expected to consist of shale and siltstones associated with the Upper Devonian West Falls Group., specifically the Beers Hill Shale; Grimes Siltstone; Dunn Hill, Millport, and Moreland Shales (Rickard and Fisher, 1970).

3.4 SURFACE WATER HYDROLOGY

The surface area in the vicinity of the DC site consists of lawns, gravel lots, paved areas, and assorted buildings. Rainwater from the roofs flows via downspouts to the ground, where it either infiltrates or flows to storm sewers located on streets near the DC site. According to the Elmira Engineering Department, storm drainage from the DC site ultimately discharges to the Chemung River.

3.5 GROUNDWATER HYDROLOGY

Based on regional groundwater flow and topography, that the Chemung River and, to a lesser extent Newtown Creek, are local groundwater discharge areas. Groundwater has been encountered at 5 to 15 ft. bgs beneath, and in the vicinity of, the DC site and is interpreted to flow west to south-west. The groundwater table appears to be relatively flat in the vicinity of the DC site, with slight fluctuations in groundwater flow direction.

The presence of the historic Chemung Canal and Junction Canal in the vicinity of the DC site may be influencing groundwater flow; Figure 3.1 shows the approximate canal locations presented over a 2002 aerial photograph of the DC site area. The Chemung Canal operated from 1833 to 1878 and water within the canal was reportedly four feet deep (Chemungcanal.netfirms.com, 2007). The Junction Canal reportedly operated from 1854 to 1871. The two canals were reportedly given/sold to various entities (City of Elmira, railroads, abutting property owners) and filled in the late 1800’s. The fill material used in the canals may be more permeable than the native lacustrine material, allowing the canal to act as a preferential flow path for local groundwater flow.

Water level measurements and groundwater flow are described in the following paragraphs.

DC OU-1 RI/FS Phase One and Phase Two Water Measurements.

Water level measurements and groundwater elevations from the DC OU-1 RI/FS are presented on Table 3.1. March 2006 and May 2006 potentiometric surface maps are shown on Figures 3.2 and 3.3, respectively. Based on groundwater measurements collected from installed monitoring wells and microwells, local groundwater flow for the measured rounds approaches the DC site from the south, and then flows in a northwesterly direction under the DC site, then bend towards the west just beyond the DC site. Groundwater gradients are relatively flat across most of the DC site, varying by a maximum of 1.7 feet over 400 feet of distance, or a groundwater elevation of 842.65 feet above msl to 844.45 feet above msl (May 2006), for a gradient of 0.004 feet per feet. Water elevations varied by only 0.68 feet over 400 feet of distance as measured in November 2005, or a gradient of 0.002 feet per feet. Local groundwater flow direction and gradients appear to be affected by the varying silt layers encountered beneath the DC site, and may also be affected by the presence of underground utilities.

ATRS Site Investigation Water Measurements

Vertical elevations and water level measurements of the ATRS and Diamond Cleaners wells measured during the ATRS site investigation are included on Table 3.2, and interpretive groundwater contours for November 2006, May 2007, and August 2007 are shown on Figures 3.4, 3.5, and 3.6, respectively.

Around the immediate area of the ATRS site, depth to water across the survey area varied from approximately 5.9 feet bgs to 14.4 feet bgs in May 2007. Measured groundwater elevations varied from 841.49 feet above msl, to 843.99 feet above msl in May 2007. The groundwater table measurements continued to show relatively flat gradients around the ATRS property, varying by 0.7 feet in elevation over 475 feet of distance (MW-7 to GW-15), or 0.001 feet/feet in May 2007.

Based on the water level data, the interpreted groundwater flow (as shown on Figures 3.4 through 3.6) is in a westerly direction near the DC site with a more pronounced south westerly flow direction as it moves under and beyond the ATRS site.

Hydraulic data was also calculated during the ATRS site investigation. Based on slug test data and an average hydraulic gradient of 0.0011 feet per foot, groundwater velocity in the vicinity of the DC site appears to be relatively slow, ranging from 4.5 to 42 feet per year in the five wells measured, with an average calculated velocity of 15 feet per year. Hydraulic conductivity calculations are presented in Table 3.3. Aqtesolv slug test plots are included in Appendix D.

OU-2 Investigation Water Measurements

Groundwater elevations measured in August 2008 are presented in Table 3.4 and interpreted potentiometric surface is presented on Figure 3.7. The interpreted groundwater flow for this time period is essentially the same as measured during the November 2006 to August 2007 time frame. Regional groundwater flow is interpreted to flow under the DC site in a generally westerly direction and then bends to a more southwesterly direction as it passes under the ATRS site.

3.6 GROUNDWATER USE

The DC site is located within the Elmira/Horseheads/Big Flats public drinking water aquifer. This aquifer, as well as the Chemung River provide drinking water to most of the local population through public supply lines. Water is treated prior to distribution. The closest operational public water supply wells are located along the shore of the Chemung River, approximately 1.2 miles southwest of the DC site.

4.0 NATURE AND EXTENT OF CONTAMINATION

This section presents results of the field investigations. The subsections below describe results of laboratory analyses for groundwater collected during the various field events. To determine whether the laboratory data met the project specific criteria for data quality and data use Data Usability Summary Reports (DUSRs) were prepared in accordance with the "Guidance for the Development of Data Usability Reports" (NYSDEC, 1997). The DUSRs for the August 2008 groundwater sampling and for the April 2009 groundwater sampling are included in Appendix E. The DUSRs and complete analytical results for the Diamond Cleaners sampling conducted prior to these events can be found in the DC OU-1 RI/FS (MACTEC, 2007) and the DUSRs and complete analytical results for the ATRS site investigations can be found in the ATRS site Characterization Report (MACTEC, 2008). Tentatively identified compounds (TICS) were not evaluated as part of the DUSRs. TICs identified in the August 2008 and April 2009 samples are presented in Appendix E. The data presented in this Report meets the data quality objectives. Reported concentrations of individual analytes indicating contravention of standards or guidelines are summarized in the following sections.

Based on laboratory or data usability review, some of the data was qualified with a J, B, and/or D. Compounds were qualified J if the concentration listed was an estimated value, which was less than the specified minimum reporting limit but greater than the instrument detection limit. Compounds qualified J were analyzed for and determined to be present in the sample and the mass spectrum of the compound met the identification criteria of the method. The majority of the samples were analyzed for VOCs using the USEPA OLM methods. The reporting limits for most target VOCs using the OLM Methods, including the target chlorinated solvents compounds were 10 µg/L. This is above most of the NYS Class GA groundwater standards; however, the actual instrument detection limit was below the NYS Class GA groundwater standards.

Compounds qualified B indicated that the compound was found in the trip blank, or laboratory blank, and in the sample. It indicates possible sample contamination and warns the data user to use caution when applying the results of this analyte.

Compounds qualified D indicated that the compound was reported from an analytical run that required a dilution due to concentrations greater than the highest calibration standard.

Groundwater analytical results were compared to: (1) the NYS Class GA Groundwater Quality Standards from 6 NYCRR Parts 700-706 (NYS, 1999) or, where applicable, (2) the NYS Class GA Groundwater Quality Guidance Values from the Division of Water Technical and Operational Guidance Series 1.1.1 "Ambient Water Quality Standards and Guidance Values" (NYSDEC, 1998).

4.1 SOURCE AREAS

A primary source of contamination (i.e. leaking drums or equipment, active floor drains, etc.) at the DC site was not encountered during the field investigations.

Source areas include the former cleaning room located in the southwest corner of the main building at the DC site. Residual (i.e., secondary) source areas in soils below this room were confirmed during the RI. PCE was detected at a maximum concentration of 540 D milligrams per kilogram (mg/Kg) in a soil sample collected approximately 9 feet below this room (GW-19), compared to the SCO for unrestricted use of 1.3 mg/Kg. Borings GS-6 and MW-5 also had high detections of PCE with detected concentrations of 17 mg/Kg and 4.8 D mg/Kg, respectively. Both of these locations are in the vicinity of the former DC cleaning room. PCE in groundwater near the source area was detected at a maximum concentration of 730 µg/L at Geoprobe sample location GW-4.

In addition to the DC site source area, soil and groundwater sampling results from the ATRS site suggest an off-site source area for chlorinated solvents is located adjacent to and south of the ATRS site building. TCE was detected at a concentrations of 32 D mg/kg (SCO for unrestricted use for TCE is 0.47 mg/Kg) and PCE was detected at a concentration of 2.7 mg/Kg (SCO for unrestricted use for PCE is 1.3 mg/Kg) in the soil sample collected from seven to nine feet bgs at a location on the ATRS property adjacent to the east side of the DC site building. Soil sampling indicated that chlorinated solvent contamination is limited to the soil near the east side of the ATRS site building.

Soil analytical results are described in more detail in the Diamond Cleaners OU-1 RI/FS Report (MACTEC, 2007) and in the ATRS site Characterization Report (MACTEC, 2008).

4.2 GROUNDWATER

Field investigation activities included multiple sampling efforts designed to collect physical and chemical groundwater information to assess conditions at the DC site.

4.2.1 DC OU-1 RI/FS Phase One Geoprobe® Groundwater Samples

Groundwater samples were collected in June 2005 from 18 Geoprobe® borings around the DC site during Phase One (GW-1 to GW-18) (Figure 4.1). Detected VOCs are presented in Table 4.1. A subset of samples was also analyzed for metals, SVOCs, and Pesticides/PCBs; detected concentrations of these analytes are presented in Table 4.2. Exceedances of PCE, TCE, and Cis 1,2-DCE from Phase One Geoprobe® groundwater samples and Round One monitoring well samples are also presented on Figure 4.1. Complete analytical results are presented in the Diamond Cleaners OU-1 RI/FS (MACTEC, 2007).

VOCs

1,1-DCE was detected at a concentration exceeding the Class GA criterion of 5 µg/L in the groundwater sample from GW-009 at a concentration of 8 µg/L.

Benzene was detected at a concentration exceeding the Class GA criterion of 1 µg/L in the groundwater sample from GW-009 at 58 µg/L.

Cis 1,2-DCE was detected at concentrations exceeding the Class GA criterion of 5 µg/L in 12 of the 18 Geoprobe® borings completed with concentrations ranging from 8 µg/L to 20,000 µg/L.

Isopropylbenzene was detected at a concentration exceeding the Class GA criterion of 5 µg/L in 7 of the 18 Geoprobe® borings completed with concentrations ranging from 6 µg/L to 280 µg/L.

Methyl Tertbutyl Ether was detected at a concentration exceeding the Class GA criterion of 10 µg/L in groundwater samples from GW-002 at a concentration of 17 µg/L and GW-004 at a concentration of 23 µg/L.

PCE was detected at a concentration exceeding the Class GA criterion of 5 µg/L in 14 of the 18 Geoprobe® borings completed with detected concentrations ranging from 9 µg/L to 730J µg/L.

Trans 1,2-DCE was detected at a concentration exceeding the Class GA criterion of 5 µg/L in the groundwater sample from GW-003 at a concentration of 8 µg/L.

TCE was detected at a concentration exceeding the Class GA criterion of 5 µg/L in 9 of the 18 Geoprobe® borings completed. Detected concentrations ranged from 7 mg/L to 120 mg/L.

VC was detected at a concentration exceeding the Class GA criterion of 2 µg/L in 7 of the 18 Geoprobe® borings completed. Detected concentrations ranged from 3 µg/L to 3,400 µg/L.

Total Xylenes were detected at concentrations exceeding the Class GA criterion of 5 µg/L in 5 of the 18 Geoprobe® borings completed. Detected concentrations ranged from 10 µg/L to 600 µg/L.

SVOCs

Nine groundwater samples (plus two duplicates) were analyzed for SVOCs. Samples from borings GW-006 and GW-009 were the only two where exceedances of SVOC groundwater criteria were noted. Groundwater from GW-006 had exceedances of Bis(2-Ethylhexyl)phthalate (13 µg/L) and Naphthalene (11 µg/L) compared to their criteria of 5 and 10 µg/L, respectively. Naphthalene's criterion of 10 µg/L is a Guidance Value where Bis(2-Ethylhexyl)phthalate has a Standard of 5 µg/L. Groundwater from GW-009 also had exceedances of Bis(2-ethylhexyl)phthalate (8 µg/L) and Naphthalene (22 µg/L).

PESTICIDES

Four groundwater samples (plus one duplicate) were analyzed for Pesticides. 4,4-dichlorodiphenyldichloroethane (4,4-DDD) was the only pesticide that exceeded the Class GA Standard of 0.3 µg/L. Exceedance concentrations were 1.2 µg/L (GW-004), 3.6 µg/L (GW-005), and 2.3 µg/L (GW-016).

METALS

To evaluate the DC site groundwater for metals contamination, groundwater samples were collected from borings GW-006 and GW-009 for Metals analyses. Although a number of metals were detected at concentrations that exceeded their Class GA groundwater Standards and Guidance values in these two soil borings (see Table 4.2), these samples were collected from direct push borings, which are typically silty, and detections may be attributed to the general inorganic nature of the suspended soil particles and may not represent metals dissolved in groundwater. Additional sampling for metals analysis from monitoring wells was conducted in April 2009 (see Section 4.2.4).

4.2.2 DC OU-1 RI/FS Phase Two Groundwater Sample Events

Phase Two groundwater analytical results for the DC site are discussed below for both monitoring well sampling events which took place in November 2005 (Round 1) and in March 2006 (Round 2). Round 1 analytical results for VOCs are presented in Table 4.1. Round 1 groundwater natural attenuation parameters are presented in Table 4.3. Round 2 analytical results for VOCs are presented in Table 4.4. Complete analytical results are presented in the DC OU-1 RI/FS (MACTEC, 2007).

Phase Two/Round 1 Low-flow Groundwater Samples

Monitoring wells MW-001 to MW-005 were sampled for VOCs and natural attenuation parameters during the Phase Two Round 1 field sampling. See Figure 2.1 for sample locations and Tables 4.1 and 4.3 for analytical results. All five wells had exceedances of Class GA criteria for one or more of the following compounds (associated criteria in parenthesis): cis-1,2-DCE (5 µg/L), Ethyl benzene (5 µg/L), Isopropylbenzene (5 µg/L), PCE (5 µg/L), Toluene (5 µg/L), TCE (5 µg/L), VC (2 µg/L), and Xylene (5 µg/L).

MW-001 had exceedances of cis-1,2-DCE, PCE, and TCE with detected concentrations of 16, 35 and 12 µg/L, respectively.

MW-002 had exceedances of cis-1,2-DCE, PCE, TCE and VC with detected concentrations of 120, 260, 23 and 4 µg/L, respectively.

MW-003 had exceedances of cis-1,2-DCE, PCE, and TCE with detected concentrations of 76, 190 and 18 µg/L, respectively.

MW-004 had exceedances of cis-1,2-DCE, PCE and TCE with detected concentrations of 33, 1,700 and 16 µg/L, respectively.

MW-005 had exceedances of the chlorinated compounds cis-1,2-DCE, PCE, TCE, and VC with detected concentrations of 690, 420, 23 and 81 µg/L, respectively. In addition, fuel related compounds were also detected in exceedance of their associated criteria, including Ethyl benzene, Isopropylbenzene, Toluene, and Total Xylenes with detected concentrations of 6, 14, 6, and 80 µg/L, respectively.

Phase Two/ Round 2 Low Flow Groundwater Sampling

Monitoring wells MW-001 to MW-005 were only sampled for VOCs during the Phase Two Round 2 field sampling event. All five had exceedances of one or more of the following compounds: cis-1, 2-DCE, PCE, TCE, VC and Total Xylenes. See Table 4.4 and previous paragraphs for Class GA criteria, and Figure 4.2 for locations and results of PCE, TCE, and 1,2-DCE.

MW-001 had exceedances of cis-1, 2-DCE, PCE and TCE with detected concentrations of 24, 60 and 14 µg/L, respectively.

MW-002 had exceedances of cis-1,2-DCE, PCE and TCE with detected concentrations of 240, 1,000, 53 and 30 µg/L, respectively.

MW-003 had exceedances of cis-1, 2-DCE, PCE and TCE with detected concentrations of 35, 100 and 9 µg/L, respectively.

MW-004 had exceedances of cis-1, 2-DCE, PCE and TCE with detected concentrations of 86, 3,900 and 26 µg/L, respectively.

MW-005 had exceedances of cis-1,-2 DCE, PCE, TCE, VC and Total Xylenes with detected concentrations of 190, 310, 20, 25 and 10 µg/L, respectively.

4.2.3 ATRS Site Characterization Groundwater Sampling Events

A summary of target VOCs detected in groundwater samples collected during the ATRS Site Characterization is presented in Table 4.5 (November 2006) and Table 4.6 (August 2007) and maximum detections of PCE and TCE per boring are presented on Figure 4.3. Complete analytical results are included in the ATRS Site Characterization Report (MACTEC, 2008).

Fifty four groundwater samples were collected from the ATRS site vicinity for VOC analysis from various depths within 39 Geoprobe® borings. Chlorinated and/or fuel related Target VOCs were detected in exceedance of standards, criteria and guidance (SCGs) values at 30 of the 39 Geoprobe® groundwater boring locations. In addition to the Geoprobe® borings, chlorinated and/or fuel related Target VOCs were detected in exceedance of SCGs in 7 of the 10 existing ATRS site monitoring wells. Maximum detections of target VOCs in samples from the Geoprobe® borings and on-site wells in exceedance of criteria are presented in the following table (concentrations in µg/L).

Parameter	GW Standard	Minimum Detection	Maximum Detection	Frequency of Exceedance
1,1-Dichloroethane	5	1.2	27	1/64
1,1-Dichloroethene	5	0.83	6.8	1/64
1,1,1-Trichloroethane	5	1.1	17	4/64
Benzene	1	1.3	2100	8/64
Cis-1,2-Dichloroethene	5	0.93	250	24/64
Ethyl benzene	5	3.7	1700	5/64
Isopropylbenzene	5	5.1	70	5/64
Methylene Chloride	5	0.87	54	2/64
Methyl Tertbutyl Ether	10	0.83	26	7/64
o-Xylene	5	2.6	1200	3/64
Tetrachloroethene	5	1.2	4300	18/64
Toluene	5	1.4	1100	4/64
trans-1,2-Dichloroethene	5	1	6.2	2/64
Trichloroethene	5	1.3	200	18/64
Vinyl chloride	2	0.88	9	11/64
Xylene, m/p	5	0.89	5800	5/64

Seven samples were collected from existing wells/microwells related to the Diamond Cleaners property for VOC analysis; five monitoring wells (DCMW-1 through DCMW-5) and two microwells (DCGW-2 and DCGW-10). Chlorinated and/or fuel related Target VOCs were detected in exceedance of SCGs in all seven of the sample locations. Maximum detections of Target VOCs in exceedance of criteria are presented in the following table (concentrations in µg/L).

Parameter	GW Standard	Minimum Detection	Maximum Detection	Frequency of Exceedance
Benzene	1	1.8	1.8	1/7
Cis-1,2-Dichloroethene	5	1.2	1500	6/7
Ethyl benzene	5	7.1	7.1	1/7
Isopropylbenzene	5	14	14	1/7
o-Xylene	5	80	80	1/7
Tetrachloroethene	5	9.9	890	7/7
Toluene	5	6.3	6.3	1/7
Trichloroethene	5	4.1	27	5/7
Xylene, m/p	5	31	31	1/7
Vinyl chloride	2	0.98	130	1/7

Additional target VOCs were detected, but at concentrations below their associated criteria (see Tables 4.5 and 4.6).

Results of the maximum PCE and TCE detections in groundwater in the ATRS Site Characterization sampling events are presented in Figure 4.3. For PCE, the results show three distinct areas containing elevated detections, these being the DC building (PCE at 210 µg/L in GW-2) (PCE at 220 µg/L in the sample from DCMW-2 is interpreted to represent the downgradient portion of the plume from the DC building), the south side of the former ATRS building (PCE at 4300 µg/L), and at the MW-4 well located southwest of the DC site (PCE at 890 µg/L). For TCE, a breakdown product of PCE, results suggest two distinct plumes as being present below the ATRS and DC sites. One is associated with the DC site in which elevated TCE detections extend in a west to northwest direction away from the DC site. In this area, the highest detection of TCE is 27 µg/L collected from the GW-2 well located north of the DC building. The second distinct and separate area is centered at the south side of the ATRS building where TCE was detected as high as 200 µg/L. Contaminant concentrations for TCE tail off in the downgradient direction from the DC site and pick up again at the ATRS site. It is unknown how far downgradient TCE extends beyond the ATRS site.

SVOC results indicated that 2,4-Dimethylphenol (detection of 22 µg/L compared to Aesthetic Groundwater Standard of 1 µg/L), Naphthalene (detection of 240 µg/L compared to TOGs Guidance Value of 10 µg/L) and phenol (detection of 17 µg/L compared to Class GA groundwater standard of 1 µg/L) exceeded groundwater criteria at MW-2. In addition, 4-Methylphenol, although not listed individually in the TOGs, is in the phenol family and thus exceeds the Aesthetic Groundwater Standard of 1 µg/L for total phenols (NYSDEC, 1998).

Several TICs were also detected in the VOC groundwater samples collected. TICs are reported in Appendix E.

4.2.4 DC Site OU-2 Investigation Groundwater Results

Direct Push Investigation Groundwater Sampling Results

Figure 4.4 presents the placement of the 13 temporary Micro Wells installed during the Direct Push Investigation as well as the reported highest detections at each location for PCE, TCE, and cis-1,2-DCE obtained by the on-site laboratory. Also shown are monitoring well results for PCE, TCE, and cis-1,2-DCE obtained during the OU-2 Investigation monitoring well sampling effort. Table 4.7 presents the on-site laboratory results of the groundwater samples obtained during the Direct Push Investigation. Water samples were collected from multiple depths at each of the Micro Well locations, producing a total of 50 water samples that were analyzed by the on-site mobile laboratory. The mobile lab was used as a screening tool to determine the general areal and vertical extent of chlorinated VOCs in the groundwater along Benjamin Street.

The primary contaminants detected at the DC site were PCE, TCE, and cis-1,2-DCE, with the highest detections being from the northern locations of the survey at GPN-2 through GPN-4; the highest concentrations for PCE (740 D µg/L), TCE (74 D µg/L), and cis-1,2-DCE (940 D µg/L) were recorded at the GPN-3 location (see Figure 4.4). The 740 D µg/L result for PCE is actually higher than the historical high recorded at MW-5 located near the source area at the southwest corner of the Diamond Cleaners Building. The concentrations for PCE appear to diminish north of

GPN-3, as shown by the results from GPN-4 where PCE was detected at 200 D µg/L. Although concentrations of other chlorinated solvents detected in groundwater also diminish from GPN-3 to GPN-4, total chlorinated VOC concentrations detected at GPN-4 were approximately 985 µg/L.

All but one of the detections for TCE recorded above the NYS Standard of 5 µg/L were obtained from the northern portion of the direct push survey.

Although detected at lower concentrations, the breakdown products trans-1,2 DCE and VC were also detected across the study area above regulatory concentrations, and 1,1-DCE was detected at several locations, but below its respective standard.

During the Direct Push investigation a relative assessment of the permeability of the sampled zones was made. As mentioned, 13 Direct Push borings were installed at the DC site with nine locations being designated as south locations (e.g., GPS-1) and four locations being designated as north locations (e.g., GPN-1). A relative correlation between the permeabilities of each of the sampled zones was obtained by noting how easily each of the zones produced water. Prior to the collection of water samples, notes were kept as to how each zone responded when the zones were developed. Zones that quickly lost water during development procedures were noted as “Dewatered”. Likewise, zones that produced a steady stream of groundwater throughout development were rated as being “Very Good”, while other zones that responded between these two extremes were rated as being “Good”. A review of the field notes shows that of the 35 zones tested in the southern locations of the survey, 11 of them produced water at what was termed as “very good” production. This relates to 31% of the tested zones as having very good relative permeable zones. For the northern locations of the survey, of the 15 zones tested, 10 of them produced “very good” water production, for a rate of 67% having very good relative permeable zones. These ratings for each zone are as shown in Table 4.7. Although this is a subjective analysis, the relative permeabilities are corroborated by the chemical results which show higher contaminant concentrations residing within the more permeable zones. Of the total of 13 Direct Push locations all but three locations show that the zones with the highest observed permeabilities also had the highest detections for PCE and TCE. Contamination in groundwater is found below areas where spills occurred or where contaminated groundwater has flowed. The observed contaminants in the groundwater at the northern portion of the Direct Push Investigation are interpreted to be present due to the transport of these contaminants from the source at the DC building via groundwater flow. This is also corroborated by looking at the interpreted local potentiometric surfaces in Figures 3.2 and 3.3. Therefore, local groundwater movement in this portion of the study area may be controlled by channelized and sorted zones in the water-laid sediments which impart a preferred movement of groundwater through the area.

Groundwater Monitoring Well Sampling – August 2008

Groundwater samples were collected from 18 monitoring wells from August 12 through August 14, 2008; three existing monitoring wells at the ATRS site (ATGW-4, ATMW-8, and ATMW-9), nine existing monitoring wells at the DC site (MW-1 to MW-5, GW-2, GW-10, GW-13, and GW-14), and the six newly installed monitoring wells at the DC site (MW-6 to MW-11). Groundwater samples were analyzed for VOCs. Results for detected compounds are presented in Table 4.8, and monitoring well locations and analytical results for PCE, TCE, and cis-1,2-DCE are shown on Figure 4.4. Complete analytical results and the DUSR are included in Appendix E. In addition, the natural oxidant demand test results and dehalococcoides assay are included in Appendix F.

Although there have been some fluctuations over time, the August 2008 groundwater analytical results for VOCs from the 12 existing wells correspond fairly well with results obtained in the previous sampling rounds. The August 2008 results for PCE and TCE show a consistency in their relative values when compared with previous results. The one noticeable exception is at MW-5, located at the DC site, where PCE was most recently reported at an estimated concentration of 590 D µg/L versus the estimated concentration of 79 J µg/L detected in November 2006, 310 D in March of 2006, and 420 D µg/L in November 2005. Other compounds were also detected at relatively similar concentrations as previous results, such as 1,1,1-TCA (which is not present in wells associated with the DC site), which was detected at ATGW-4 at 21 µg/L versus the previous result of 17 µg/L obtained in November 2006.

VOC results from the six new monitoring wells (MW-6 through MW-11) help confirm the conceptual model of contamination obtained through past sampling rounds and from the Direct Push Investigation. For example, MW-7 corresponds fairly well with the Direct Push results obtained from the location GPN-3, with elevated results for PCE, TCE, and Cis-1,2-DCE being present in both the well and Direct Push samples. Also, VC was detected at its' highest reported value during this sample round in MW-7 at 230 D µg/L, versus the NYS standard of 2 µg/L.

In addition to this data, analyses were conducted to determine the potential presence of the Dhc bacteria in groundwater at and downgradient of the DC site. Dhc group organisms are the only known microorganisms capable of complete dechlorination of chloroethenes (i.e., PCE, TCE, cis-1,2-DCE, VC) to non-toxic ethene (SiRem, 2008). The Dhc result from MW-7 indicates that the sample contains moderate concentrations of Dhc which may, or may not, be associated with observable dechlorination impacts (i.e., ethene). This data was collected to determine if populations of this bacteria would need to be added to the DC site for enhanced bioremediation of the chlorinated solvents. The Dhc bacteria was not detected in the sample from MW-5, adjacent to the presumed source area.

Groundwater Monitoring Well Sampling – April 2009

To collect additional VOC groundwater data from the DC site monitoring wells, as well as to evaluate if contaminants other than VOCs are present in DC site groundwater above SCGs, four wells at the DC site (MW-5, MW-6, MW-7, and GW-10) were sampled on April 2, 2009. Analytical results are reported on Table 4.9.

VOCs

VOC data was fairly consistent with previous data for MW-6, MW-7, and GW-10. Concentrations of PCE detected at MW-5 (51 µg/L) were less than detected in August 2008 (590 D µg/L) and detections of cis-1,2-DCE (6,600 D µg/L) and vinyl chloride (1,800 D µg/L) were higher that previously detected at that location. Several fuel related VOCs were detected in MW-5 and are related to the former UST that was located in the vicinity of MW-5. These fuel related compounds do not appear to be migrating off-site in groundwater.

PESTICIDES

Pesticide data indicated the presence of one pesticide, 4,4-DDD, at a concentration of 0.26 µg/L compared to a Class GA groundwater standard of 0.3 µg/L. No other pesticides were detected.

SVOCs

Naphthalene was the only target compound list SVOC detected, and the concentration, 1 µg/L, was less than the class GA groundwater criteria of 10 µg/L. Several tentatively identified SVOCs were detected in MW-5 (totaling approximately 175 µg/L). These are primarily fuel related compounds and their presence is anticipated to be a result of spills at the former fuel UST. The SVOCs that were not detected in the background well were not detected in groundwater samples collected downgradient of MW-5.

METALS

Several metals were detected above the groundwater SCGs. Although sodium and iron were detected in samples from MW-5 at concentrations above SCGs, concentrations were less than those detected in the background well MW-6. Barium and manganese were detected above SCGs in the sample collected from MW-5. Manganese was detected at a concentration of 1240 µg/L compared to the groundwater guidance value for aesthetics of 300 µg/L. Barium was detected in a sample collected from MW-5 at a concentration of 4110 µg/L compared to a groundwater standard of 1000 µg/L. Barium was detected below its groundwater standard in the background sample and the two downgradient groundwater samples. Barium is not anticipated to be related to the dry cleaning operations, was not detected in the downgradient wells, and was not detected in soil samples collected from the DC site during the 2007 RI above the 6 NYCRR part 375 soil cleanup objective for unrestricted use (MACTEC, 2007).

5.0 CONTAMINANT FATE AND TRANSPORT

This section presents an assessment of contaminant movement and disposition within the groundwater at the DC site.

5.1 SITE CONCEPTUAL MODEL

The Conceptual Site Model takes into consideration sources of contamination, fate and transport processes, potential receptors, exposure pathways, and exposure points. The table below is from the DC OU-1 RI/FS (MACTEC, 2007) and provides a summary of the contamination sources, migration pathways, and potential receptors.

Conceptual Site Model

Media	Known or Suspected Source of Contamination	Type of Contamination (General)	COPCs (Specific)	Primary or Secondary Source Release mechanism	Migration Pathways	Potential Receptors
Soil	1) Cleaning Area 2) Releases to ground surface 3) Former UST Area (Primary Sources Gone)	Solvents; fuels;	PCE; TCE; 1,2-DCE, vinyl chloride, xylene; ethylbenzene	Leaks and or Spills	Infiltration / percolation	Human: direct contact if excavation occurs in contaminated area(s)
Groundwater	Contaminated Soil (Secondary Source)	Solvents; fuels	PCE; TCE; 1,2-DCE, vinyl chloride, xylene; ethylbenzene	Infiltration / percolation from soils	Groundwater flow / utility trenches (sewer lines)	Human or ecological receptors are not expected to be exposed
Air / Soil Vapor	1) Contaminated soil or groundwater at and/or under the DC building. 2) Contaminated groundwater down gradient from the DC building.	Solvents; fuels	TCE; PCE; Benzene; xylene; ethylbenzene	Volatilization of contaminated groundwater and/or soil	Migration into buildings / residences Partitioning to air during intrusive soil excavation	Human: Inhalation – human receptors are not anticipated based on current analytical data.

Media	Known or Suspected Source of Contamination	Type of Contamination (General)	COPCs (Specific)	Primary or Secondary Source Release mechanism	Migration Pathways	Potential Receptors
Surface Water and Sediment	Erosion or discharge mechanisms and pathways are not currently expected to exist.	NA	NA	Contaminants in groundwater are expected to attenuate prior to potential discharge point(s) (e.g. Newtown Creek, Chemung River)	NA	Human or ecological receptors are not expected to be exposed
Building	No continuing sources of contamination related to site operations are expected to exist	NA	NA	Site operations have ceased.	NA	NA

As outlined above, the source of the chlorinated solvent contamination was spills to soils both below the DC site building, as well as discharge to soils to the west side of the DC site building. Soil contamination at the DC site and the potential exposures associated with that contamination are being addressed under the current Record of Decision (ROD). This DC OU-2 RI/FS is focused on the potential exposure to contaminated groundwater associated with the DC site.

Chlorinated solvent contamination in the source area has migrated to groundwater via percolation and infiltration with rainwater. Analytical data indicates that chlorinated solvents are migrating off-site in groundwater at concentrations above SCGs. The DC site and surrounding residential and commercial properties located within the groundwater plume path are serviced by public water. Therefore, there is no direct exposure to groundwater associated with the DC site through domestic or other uses. Although the groundwater plume path has not been fully defined at the downgradient location, groundwater samples collected to date indicate that chlorinated solvents in groundwater may be at or near SCGs by the time groundwater reaches Clemens Center Parkway and East Fifth Streets. Analytical data collected to date indicates that the contamination detected on this downgradient edge is likely the result of several sources, and not just the spills at the DC site. Based on the downgradient groundwater concentrations, as well as on distances to local surface waters (Newtown Creek and the Chemung River), and attenuation processes (e.g., diffusion, dispersion, biological degradation), discharge of contaminants from groundwater to surface water is not expected.

Although chlorinated solvents can volatilize to soil vapor, and migrate to indoor air, this exposure pathway was evaluated during the DC OU-1 RI/FS.

5.2 CONTAMINANT PERSISTANCE

The following sections discuss contaminant persistence and characteristics of contaminants of concern at the DC site.

VOCs

The primary VOC contaminants of concern detected at concentrations greater than their associated NYS groundwater SCG values include PCE, TCE, cis-1,2-DCE and VC. These contaminants are classified as halogenated hydrocarbons and are present in groundwater at the DC site. The processes that likely control the fate of VOCs at the DC site include volatilization, dissolution, and biodegradation. These processes are briefly discussed below.

Volatilization. The fate of VOCs in surface soils and shallow groundwater is likely volatilization, as VOCs partition rapidly to the atmosphere, and neither biodegradation nor hydrolysis (a photolytic decomposition due to exposure to sunlight) occurs at a rapid rate. (Agency for Toxic Substances and Disease Registry [ATSDR], 1997)

Dissolution. Dissolution of VOCs from site sources to groundwater is a significant transport mechanism for VOCs at the DC site. Factors affecting dissolution of VOCs likely are: (1) water table elevation in comparison to source areas; (2) flow rate (residence time) of the groundwater in the contaminated material; (3) solubility of the compound; (4) amount of recharge through VOCs in the unsaturated zone; and (5) the degree of partitioning to soils and sediments.

Biodegradation. Biodegradation reactions can reduce the total mass of VOCs in groundwater. Naturally occurring bacteria in soil are capable of degrading VOCs. The microorganisms require oxygen to aerobically biodegrade VOCs and the concentration of DO is an indicator of the potential for aerobic biologic activity in groundwater. Aerobic biodegradation is particularly effective for aromatic hydrocarbons, such as benzene and toluene, and may be effective in mineralizing chlorinated solvent daughter products such as 1,2-DCE and VC.

Under aerobic conditions, parent compounds PCE and TCE are relatively stable and persistent in the environment. Under suitable anaerobic conditions, however, PCE and TCE may undergo biologic transformation as the dominant fate process. Although TCE may be a parent compound, PCE is the primary contaminant of concern from dry cleaner sites, including the DC site, and the TCE detected is expected to be a daughter product of PCE. It has been shown that biodegradation of PCE and TCE in groundwater increases with the organic content of the soil.

The complete anaerobic biologic transformation pathway for PCE is:
PCE→TCE→1,2-DCE→VC→ethene→carbon dioxide and water. Degradation pathways may not be complete, however, depending on the presence of suitable conditions to complete the process. Analytical data collected from the DC site indicates that the Dhc organisms, which are the microorganism that dechlorinate the PCE to ethene, are present downgradient of the DC site; although data indicates that the population should be increased to more effectively dechlorinate the PCE and TCE all the way to ethene.

Persistence of VOCs in Site Groundwater

Chlorinated solvents, the primary contaminants of concern at the DC site, are fairly persistent in the environment. The chlorinated solvents associated with the dry cleaning process were reportedly no longer used at the DC site after 1995.

Although the primary source of contamination, PCE used in the dry cleaning process, was released to the environment over 14 years ago, concentrations were detected in soil during the RI investigation for OU-1 as high as 540 mg/kg at the DC site (PCE was also detected at 32 mg/kg at the ATRS site). Based on the solubility (150 mg/L), Henry's Constant (0.754) and organic carbon partition coefficient (364 mg/g) of PCE and the detected concentrations in soil, soil vapor, and groundwater, the presence of PCE as a dense non-aqueous phase liquid (DNAPL) is possible at the DC site (calculations included in Appendix D). The highest concentration of PCE detected at the DC site was from a soil sample collected from 9 to 11 ft. bgs, or within the capillary fringe zone. Soils below the DC site exhibit a high silt content and the majority of the remaining mass of PCE may have diffused into the soil silt matrix. As stated above, the primary mechanisms of concentration reduction of VOCs are typically through volatilization into soil gas (for unsaturated soil or water table surface concentrations), and dispersion and diffusion in groundwater, as well as through biological degradation. If the mass of PCE is bound up within the soil matrix (i.e., adsorbed to the soils), then dispersion through advection will be less of a factor in concentration reduction. Calculations completed for cis-1,2-DCE using detected concentrations in soil did not indicate the presence of cis-1,2-DCE as non-aqueous phase liquid.

Comparing groundwater results from three sampling events, MW-3 and MW-5 had slightly higher concentrations of the contaminants of concern during the RI Round 2 event and MW-1, MW-2, and MW-4 had relatively equal concentrations of the contaminants of concern (cis-1,2-DCE, PCE and TCE) during the three rounds of sampling. The greatest difference in concentration from the Round 1 event to the Round 2 event was of PCE in MW-4 where there was an increase in concentration of 2,200 µg/L (from 1,700 µg/L). In this same well, however, PCE was detected during the ATRS site sampling event at a concentration of 1,300 ug/L, a decrease of 2,600 ug/L from the previous round. Seasonal fluctuations in the movement of groundwater may account for these varied results.

Evaluation of Biological Degradation/Natural Attenuation of VOCs at the DC Site

Natural attenuation refers to the presence of microorganisms which are capable of degrading chlorinated solvents. Anaerobic conditions occur under reducing conditions and with little to no DO. Aerobic conditions occur under oxygenated conditions or with high levels of DO.

Natural Attenuation Screening Protocol questionnaires were filled out for each of five monitoring wells (MW-1 thru MW-5) at the conclusion of the Round Two sampling event. Each monitoring well location received points based on concentrations of compounds, natural attenuation, and field parameters. These points are tallied up and a score is given to each well. Scores of 0-5 mean that there is inadequate evidence for anaerobic biodegradation of chlorinated organics. Scores of 6-14 mean that there is limited evidence for anaerobic biodegradation of chlorinated organics. Scores of 15-20 mean that there is adequate evidence for anaerobic biodegradation of chlorinated organics, and scores over 20 mean that there is strong evidence for anaerobic biodegradation of chlorinated organics.

MW-1 received a score of 7, MW-2 received a score of 9, MW-3 received a score of 7, and MW-5 received a score of 14. These all are between 6 and 14 which means there is limited evidence for anaerobic biodegradation of chlorinated organics at these well locations. However, MW-5 is located in the vicinity of the DC source area and was close to a score of 15 which means it is close to having adequate evidence for anaerobic biodegradation of chlorinated organics. MW-4, the most contaminated monitoring well, received a score of 17 which means there is adequate evidence for anaerobic biodegradation of chlorinated organics at this well location. Based on the ability to add additional parameters that were not collected to the scoring sheets, these scores may be conservatively low. See Appendix D for the Natural Attenuation Screening Protocol forms.

SVOCs

Processes that are likely to control the fate of SVOCs (primarily polycyclic-aromatic hydrocarbons) at the DC site include adsorption, biodegradation, and dissolution. The SVOCs detected in source materials at the DC site are expected to be relatively immobile because of strong adsorption of these compounds to the organic carbon fraction of the soil and the typically low solubility in water. Overall, adsorption to soil and sediment is the expected fate of SVOCs at the DC site, while some biodegradation may occur in favorable locations (primarily aerobically).

Several SVOC were detected in groundwater at concentrations above their applicable SCG values in samples from direct push points that had high turbidity. These contaminants are not expected to be related to the dry cleaning process and likely represent the general industrial activities in the area and not historic site specific activities. In addition, concentrations of SVOCs collected from permanent monitoring wells with low turbidity were below SCGs. It is therefore likely that the detections of SVOCs represent analytes adsorbed to soil particles and are not representative of dissolved groundwater constituents. SVOCs are therefore not considered a DC site related contaminant of concern in groundwater.

PESTICIDES

Pesticides in soils that exceeded SCOs were Dieldrin, 4,4- dichlorodiphenyltrichloroethane (4,4-DDT), 4,4-DDD, and 4,4- dichlorodiphenyldichloroethylene (4,4-DDE); and the only pesticide detected in groundwater was 4,4-DDD. The 4,4-DDD was detected in a Geoprobe boring with high turbidity. Pesticides were not detected in the samples collected from the permanent monitoring wells. It is therefore anticipated that the 4,4-DDD detection likely represents the analyte adsorbed to soil particles and is not representative of dissolved groundwater constituents.

Pesticides can be long lasting in the environment, particularly in soil or sediment. Studies have shown that half the 4,4-DDT in soil breaks down within 2 years, while other studies show that it may take more than 15 years (Habeck, 2005). 4,4-DDT attaches tightly to soil and does not move down through the soil quickly to underground water supplies. 4,4-DDT in surface soils may attach to small particles and be carried by the wind. 4,4-DDT in soil usually breaks down to form 4,4-DDE or 4,4-DDD. All of these forms may undergo further degradation, but typically quite slowly in the environment. 4,4-DDE is only found in the environment as a result of contaminant release or of breakdown of 4,4-DDT. Concern for pesticides such as 4,4-DDT and daughter products arises from their persistence, toxicity, and tendency to bioaccumulate through the food chain. Although detected in soil at low concentrations, pesticides are not considered a contaminant of concern in groundwater.

INORGANICS

Inorganics include metals and other non-carbon compounds, such as chlorides, sulfates and nitrates. Metals are not destroyed by chemical or biological processes, but may exhibit different properties such as mobility and toxicity depending on the geochemical conditions existing at the DC site. Geochemical conditions may mobilize naturally occurring metals such as iron or arsenic and it may be difficult to determine if observed concentrations of some constituents are due to factors such as ORPs and naturally present or due to a contaminant source. Under some pH and ORP conditions, some metals may exhibit strong soil absorption partitioning coefficients. Further, soil cation exchange capacity may retard migration of metal ions. Although detected in soil at low concentrations, inorganics are not considered a contaminant of concern in groundwater.

5.3 CONTAMINANT MIGRATION

Sources and Migration Pathways

Contaminants detected in groundwater at concentrations above associated regulatory SCG values included metals and VOCs.

Although several metals were detected in groundwater in the Diamond Cleaners wells at concentrations in excess of Class GA SCG values, these are not related to dry cleaning operations at the DC site. The DC site is located in an industrialized area and the metals detected in the DC site groundwater may be attributed to general urban/industrial contamination, and not from a site source of metals contamination.

Historical documentation and previously collected data indicate chlorinated solvents typically used in the dry cleaning industry were released to the environment. In addition, fuel related VOCs were also reportedly released to the environment. Elevated concentrations of chlorinated solvents in soil beneath the Diamond Cleaners building slab suggest one mechanism for release to be spills to the floor and to floor drains. Additionally, the existence of chlorinated solvents in soils outside the Diamond Cleaners building suggests a release in exterior locations as a result of handling. Concentrations of PCE detected in DC site soils are a continuing source of groundwater contamination via diffusion, dissolution, or soil gas migration. The presence of petroleum contaminants are potentially related to a gasoline UST formerly located at the DC site. Chlorinated solvents detected in soils outside the ATRS site buildings indicate that this site is also contributing to the general chlorinated solvent groundwater plume downgradient of the DC site.

VOCs can readily leach from soil with infiltration of precipitation, and migrate to groundwater. Once dissolved in groundwater, solvents can migrate with groundwater flow. Groundwater at and in the vicinity of the DC site is located at approximately 13 feet bgs. Localized groundwater beneath the DC site is interpreted to flow to the west and northwest across the DC site, and to then bend towards the west and southwest downgradient of the DC site. Although this appear to be the dominant groundwater flow path based on numerous water level rounds, the generally flat groundwater gradient in the vicinity of the DC site, as well as the stratified river and glacial overburden and potential man made preferential flow paths (i.e. underground utilities and historic

Chemung canal) likely result in varied flow patterns over time. Some of the lower concentrations of contaminants detected in apparent upgradient or cross gradient locations may be the result of this fluctuation in groundwater flow direction.

Groundwater data collected during the OU-2 RI and previous investigations indicate that VOCs are present in wells to the north, west, and south of the Diamond Cleaners building. The maximum detected concentrations per sample location of PCE, TCE, and cis-1,2-DCE are presented on Figure 5.1. Although PCE is the primary contaminant of concern at the DC site, the highest concentrations of PCE detected are associated with sample locations to the west and southwest of the Diamond Cleaners property. As shown on Figure 5.1, results also show that contaminants from the Diamond Cleaners do not as yet significantly impact groundwater quality located below the ATRS site. Although petroleum-related VOCs were detected in groundwater, concentrations were generally below groundwater standards, suggesting that the principal contaminants in groundwater are PCE and degradation products (e.g., TCE and cis-1,2-DCE).

Although shallow groundwater can discharge to surface water, there are no nearby surface water bodies. Due to the distance to area surface waters and expected attenuation of solvent contamination, migration of groundwater contamination to surface water is not anticipated to be a complete migration pathway. Although the groundwater flow path and contaminant plume in the vicinity of the DC site has not been fully defined, it is anticipated, based on analytical data collected south and east of the ATRS site (Figure 5.1), that groundwater concentrations in the vicinity of the DC site diminish to at or near SCGs by the time they reach Clemens Center Parkway and East Fifth Street.

VOCs, including the chlorinated solvents and petroleum constituents detected in groundwater, can partition from groundwater to soil vapor and then migrate through the soil column. Detections of VOCs in soil vapor samples collected at soil vapor sampling points indicate that VOCs are partitioning from soil and groundwater to soil vapor. Soil vapor can be drawn into buildings through seams and cracks in foundations and floor slabs. Given the proximity of occupied buildings to locations where soil vapor samples indicated the presence of VOCs in soil gas, soil vapor samples and indoor air samples were collected at on- and off-property locations during the OU-1 RI field program and evaluated as part of the OU-1 RI/FS Report (MACTEC, 2007). Air samples collected from beneath building floors and from within buildings located over the VOC-impacted groundwater indicate that the soil vapor intrusion to indoor air pathway is complete at the DC site building (DC building is currently abandoned). The soil vapor intrusion pathway was evaluated and determined not to be complete at properties surrounding the DC site (MACTEC, 2007).

6.0 QUALITATIVE EXPOSURE ASSESSMENT

This section provides a QEA for the DC site. The QEA is performed in accordance with NYSDEC Technical Guidance (NYSDEC, 2002), which indicates that the QEA should evaluate the populations of humans that may potentially occur at and in the vicinity of the DC site, the mechanisms or exposure pathways by which those humans may be potentially exposed to contamination associated with the DC site, and the significance of exposure that may occur through the potential exposure pathways. This process involves two steps:

1. Characterization of the exposure setting in terms of physical characteristics, current and future uses of the DC site, and the populations that may be potentially exposed to site-related contamination under the current and future land uses;
2. Identification of potential exposure pathways and exposure points to which the populations may be exposed; and

Exposure Pathway Evaluation and Qualitative Exposure Assessment

Potentially complete exposure pathways were identified in the DC OU-1 RI/FS (MACTEC, 2007) for direct contact with soil, and inhalation of vapors that may migrate from groundwater to air within buildings. The significance of exposure pathways associated with these media was evaluated in the DC OU-1 RI/FS through comparison of analytical data to guideline concentrations published by NYSDEC and/or background concentrations. As a result of the OU-1 RI/FS, a ROD was issued to address the remediation of soil contamination at the DC site. The soil vapor intrusion pathway was evaluated in the OU-1 RI/FS and determined not to be a complete exposure pathway at properties surrounding the DC site. This DC OU-2 RI/FS addresses the groundwater contamination identified at the DC site.

Groundwater

There are no direct exposures to groundwater associated with the DC site under the current or foreseeable land uses. However, a comparison of groundwater analytical data to NY State drinking water standards provides information concerning constituents that would be of concern from a health risk perspective if the groundwater was used as potable water under existing conditions. A review of the analytical data indicates that chlorinated solvents (e.g., PCE and breakdown products, methyl tert-butyl ether, xylene, ethylbenzene, and isopropylbenzene) were detected at concentrations that exceed drinking water standards. Detections in excess of drinking water standards were associated with most of the groundwater sampling points to the immediate north the DC building, as well as locations to the west and southwest, including locations that are interpreted down-gradient of the DC property.

As discussed previously, groundwater that has been affected by releases from the DC site is not being used as a source of water due to the availability of public water supply and, consequently, there are no direct contact exposures to constituents in groundwater. Therefore, although constituent concentrations in groundwater exceed drinking water standards, the groundwater drinking/direct contact pathway is not an exposure pathway of concern from a health risk perspective under the existing and foreseeable land use conditions.

Although groundwater is not used in the vicinity of the DC site, VOCs in groundwater have the potential to partition to soil vapor and migrate to indoor air. Although not determined to be a complete expose pathway at the present time because the DC Building is not in use, the existence of groundwater contamination has the potential to result in a soil vapor intrusion exposure pathway in the future (e.g., construction of additional buildings in the vicinity of the DC site).

7.0 SUMMARY AND CONCLUSIONS

This section presents a summary of the RI and outlines conclusions.

7.1 SUMMARY

The DC site is located at 717 Lake St. in the north-central section of Elmira in Chemung County, New York (Figure 1.1). The DC site housed many different buildings throughout history including a school, Blind Center and Board of Education building, Highway and Bridges Department workshops, storage buildings, and lastly a dry cleaning facility. The dry cleaning facility operated from approximately 1950 to the mid-1990s and used PCE as a dry cleaning solvent. The DC facility has been inactive for over 11 years.

Investigations conducted to date at, and in the vicinity of, the DC site have identified source areas on site include the former cleaning room of the dry cleaning facility (southwest corner of building), spills to the ground surface to the rear (west) of the DC site building, and a former fuel UST located on the southwest corner of the building. Contaminants of concern at the DC site include chlorinated solvents and fuel related VOCs (primarily PCE, TCE, cis-1, 2-DCE, VC, and xylene). These contaminants have migrated from soils to groundwater and residual VOC contaminants in soils appear to be a continuing source of groundwater contamination. Although a ROD was signed March 31, 2008 to address this soil contamination (OU-1-Source Area), remedial alternatives for groundwater have not been evaluated.

Chlorinated solvents detected in groundwater at the DC site include PCE (maximum on-site detection of 730 µg/L at temporary point GW-4), TCE (maximum on-site detection of 120 J µg/L at temporary point GW-4), cis-1,2-DCE (maximum on-site detection of 20,000 µg/L at temporary point GW-6), and VC (maximum on-site detection 3,400 µg/L at temporary point GW-9). These locations are located around the western side of the former DC site building near the former cleaning room. The VOC detected at the highest concentration in groundwater samples collected from the permanent monitoring well network was PCE, detected at MW-4, located approximately 175 feet southwest of the DC site source area, at 3,900 µg/L (March 2006 sample).

Groundwater samples collected to date indicate three distinct locations of elevated PCE concentrations in groundwater in the vicinity of the DC site; the west side of the DC building (max PCE detection of 730 µg/L at GW-4), MW-4, located on the former construction company property (max PCE detection of 3,900 µg/L), and the southeast corner of the former ATRS building (max PCE detection of 4,300 µg/L at the ATRS investigation location GW-26) (PCE detected at MW-2, located northwest of the DC site, at 1000 µg/L is interpreted as being part of the plume from the DC source area). Although groundwater gradients at the DC site are relatively flat and may vary seasonally, as well as the indication that flow is likely controlled by depositional channeling in the overburden, groundwater flow from the DC site is interpreted to flow primarily to the west-northwest with an average velocity of 15 feet per year. Based on this analytical and flow data as well as lower concentrations detected in groundwater between these of areas high PCE concentrations, there appear to be two separate sources of PCE contamination, although there may be some co-mingling of the groundwater plumes. Current data indicates that the chlorinated solvents present in groundwater may be attenuating to at or near groundwater SCGs by the time groundwater reaches East Fifth Street and Clemens Center Parkway.

Based on data imputed into the Biochlor Model there is adequate evidence for anaerobic biodegradation of chlorinated organics in groundwater at MW-004, the well with the highest detected concentration of PCE. Furthermore, there is some evidence for anaerobic biodegradation of chlorinated organics at MW-005, located in close proximity to the former DC main site building. Dhc testing also indicated that the microorganisms necessary for the biological dechlorination of PCE to ethene are present in the groundwater column downgradient of the DC site, although at low numbers.

7.2 CONCLUSIONS

Historic practices at the DC site have resulted in the discharge of chlorinated solvents to the ground surface, both within and outside of the facility building. Data indicates that DNAPL is likely present in soil at the DC site. DC site soil contamination is being addressed under a separate ROD, which was signed by the NYSDEC on March 31, 2008. The DC site soil contamination is a continuing source of on-site groundwater contamination. Down-gradient groundwater contamination appears to be impacted by an off-site source at the ATRS property.

It is recommended that an additional monitoring well be installed north-west of MW-7 to bound the extent of groundwater contamination migrating from the DC site to the northwest of the DC site.

The primary exposure route for groundwater contamination from the DC site is through the migration of contaminants from soil to groundwater and from soil and groundwater to soil vapor. The DC site soil source area contamination is currently being addressed by the Source Area ROD.

8.0 DEVELOPMENT OF REMEDIAL ACTION OBJECTIVES, GENERAL RESPONSE ACTIONS, AND CONTAMINATION REQUIRING REMEDIATION

RAOs form the basis for identifying remedial technologies and developing remedial alternatives. This section identifies RAOs for the contaminated site groundwater, general response actions to address the RAOs, and the extent of contamination requiring remedial action. Site soil, identified as OU-1 – Source Area in the ROD for the DC site (NYSDEC, 2008), has been addressed in the 2007 DC OU-1 RI/FS. The selected remedial alternative to be implemented for site soil is Excavation and Off-site Disposal, which will include demolition of the building at the DC property, excavation and off-site disposal of contaminated soil within an approximate 3,300 square foot area and backfilling with clean soil. The majority of the OU-1 RI/FS excavation would take place above the groundwater table. The selected remedy of OU-1 RI/FS also addresses potential indoor air issues at the DC site because there will no longer be a building. Indoor air mitigation was offered at a neighboring property, which, based on analytical data, was the only structure that exhibited indoor air issues attributable to the DC site; however, the property owner declined the mitigation system. Therefore, this FS will focus only on groundwater contamination at the DC site, OU-2, and will not address soil, soil vapor, or indoor air contamination.

Site-specific remedial objectives for groundwater were developed with consideration for the chemical and toxicological properties of the Contaminants of Concern (COCs); existing or potential exposure pathways; the present or projected future use; and existing wildlife, their habitats, and other natural resources.

8.1 IDENTIFICATION OF REMEDIAL ACTION OBJECTIVES

RAOs consist of medium-specific or OU-specific goals for protecting human health and the environment (USEPA, 1988). RAOs specify the COCs, exposure pathway(s) and receptor(s), and remediation goals (RGs), which are the acceptable contaminant levels or range of levels for each exposure route.

Site-specific COCs were determined by comparison of contaminant levels to Chemical-Specific SCG values, but site-specific exposure pathways were not considered. RAOs presented below were developed for the specific media and receptors identified in the qualitative exposure QEA presented in Section 6.0.

The QEA for OU-2 concluded that there are no direct exposures to groundwater associated with the DC site under the current or foreseeable land uses. Groundwater at and in the vicinity of the DC site is not used for drinking water. However, the VOC-contaminated groundwater is above SCGs. Therefore, the following RAOs were identified for site groundwater:

- prevent ingestion of groundwater with contaminant levels exceeding drinking water standards
- prevent contact with, or inhalation of volatiles, from contaminated groundwater

Groundwater is the only media addressed in this FS. The RGs for groundwater contaminants which exceeded one or more SCGs are presented in Table 8.1.

8.2 IDENTIFICATION OF GENERAL RESPONSE ACTIONS AND EXTENT OF CONTAMINATION REQUIRING REMEDIAL ACTION

General response actions describe those actions that will satisfy the RAOs (USEPA, 1988). General response actions may include treatment, containment, excavation, disposal, institutional controls, or a combination of these. Like RAOs, general response actions are medium-specific. The general response actions presented in the following subsections include those identified to address potential threats to human health and the environment from contamination of Site groundwater. Based upon the current understanding and characterization of the DC site, and because site soils (the source of contamination) will be addressed before or concurrently with groundwater remediation, no known additional potential threats exist at the DC site.

Site-specific RAOs have been developed to address groundwater contamination requiring remedial action. The following paragraphs present a discussion of general response actions to address the RAOs.

8.2.1 General Response Actions for Groundwater

The following general response actions address the RAOs identified for groundwater:

- No Action
- Institutional Controls
- Containment
- Collection
- In-Situ Treatment
- On-site Ex-Situ Treatment and Disposal

8.2.2 Contamination Requiring Remedial Action

This subsection identifies the extent of contaminated groundwater to which the RAOs and general response actions identified above, and the remedial alternatives to be developed in Section 10.0, will apply. As discussed in Section 7.2, additional investigations are required to determine the downgradient edge of the plume northwest of the DC site. However, based on maximum concentrations detected at each monitoring location the extent of groundwater contamination exceeding total chlorinated VOC concentrations of 1,000 µg/l and 100 µg/l associated with the DC site source area are depicted on Figure 8.1. As shown in this figure there are two distinct areas with total chlorinated VOC concentrations in excess of 1,000 µg/l.

Although fuel-related VOCs are present in the groundwater in the vicinity of the DC site, fuel-related VOC contamination is primarily co-located with the areas of elevated chlorinated VOC contamination. Fuel-related concentrations are low enough that they will not impede on treatment of the chlorinated VOCs using the remedial alternatives discussed in this RI/FS report, and some of the treatment alternatives would also treat the fuel-related VOCs concurrently with chlorinated VOCs.

Each of the proposed remedial alternatives will include: a pre-design investigation component to define the extent of site-related groundwater contamination; the remediation of groundwater containing greater than 1,000 µg/l of total chlorinated VOCs; and natural attenuation of residual VOC groundwater contamination to meet the NYS Class GA Groundwater Standards.

The primary location where total chlorinated VOC concentrations in groundwater exceed 1,000 µg/l is within and downgradient of the area to be excavated under the implementation of the DC OU-1 remedy and includes monitoring well locations MW-5 and MW-7, as well as geoprobe locations GW-3, GW-4, GW-5, GW-6, and GW-9, as shown on Figure 8.1.

The area to be actively remediated, as shown on Figure 8.1 has an approximate areal extent of 11,000 square feet. Depth to groundwater at the DC site ranges from 9 to 13 feet below grade depending upon location and time of year. It is assumed, based on existing boring logs and monitoring well logs, that the contaminated groundwater zone is from 10 feet below grade to 30 feet below grade in the area where soil will be excavated as part of the DC OU-1 remedy (this area will hereafter be referred to as the "source zone"), and is from 10 feet below grade to 35 feet below grade in the remaining treatment area. Therefore the treatment scenarios will be to address contaminated groundwater within an approximately 9,600 cubic yard saturated area.

Although active remediation will be focused on the primary location where VOC concentrations in groundwater exceed 1,000 µg/l, downgradient areas where VOCs in groundwater exceed the NYS Class GA groundwater standards will also benefit from the remediation since treated groundwater, rather than impacted groundwater, will be migrating to these areas. In addition, these areas are expected to meet NYS Class GA groundwater standards over time by means of monitored natural attenuation.

The remedial alternatives will be developed with consideration for the distribution of contaminants both horizontally and vertically and co-location of various types of contaminants.

9.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

This section presents the identification and screening of potential remedial technologies to achieve the RAOs established in Subsection 8.1. Identified technologies correspond to the categories of general response actions described in Subsection 8.2.

Following identification, candidate technologies are screened based on their applicability to site- and contaminant-limiting characteristics. The purpose of the screening is to produce an inventory of suitable technologies that can be assembled into remedial alternatives capable of mitigating actual or potential risks at the DC site. Potential technologies representing a range of general response actions (e.g., no action, collection, containment, in-situ treatment) are considered. The result of the technology screening is a list of potential remedial technologies which may be developed into candidate remedial alternatives.

9.1 TECHNOLOGY IDENTIFICATION

Remedial technologies and specific process options applicable to hazardous waste sites are identified in USEPA's guidance for Conducting RI/FS (USEPA, 1988). This guidance was used to generate the list of applicable remedial technologies and associated process options identified for each general response action presented in Table 9.1. General response actions were developed for groundwater in Subsection 8.2.

9.2 TECHNOLOGY SCREENING

The technology screening process reduces the number of potentially applicable technologies and process options by evaluating factors that may influence process-option effectiveness and implementability. This overall screening is consistent with guidance for conducting an FS under Comprehensive Environmental Response, Compensation, and Liability Act (USEPA, 1988). Effectiveness and implementability are incorporated into two screening criteria: waste- and site-limiting characteristics. Waste-limiting characteristics consider the suitability of a technology based on contaminant types, individual compound properties (e.g., volatility, solubility, specific gravity, adsorption potential, and biodegradability), and interactions that may occur between mixtures of compounds. Site-limiting characteristics consider the effect of site-specific physical features on the implementability of a technology, such as site topography and geology, the location of buildings and underground utilities, available space, and proximity to sensitive operations. Technology screening serves a two-fold purpose of screening out technologies whose applicability is limited by site-specific waste or site considerations, while retaining as many potentially applicable technologies as possible.

Table 9.1 presents the technology-screening process. Technologies and process options judged ineffective or prohibitively difficult to implement were eliminated from further consideration. The technologies retained following screening (see Table 9.1) represent an inventory of technologies considered most suitable for remediation of groundwater at the DC site and may be used alone or integrated with other technologies to develop remedial alternatives. Pilot-scale treatability studies may be required prior to final technology selection to confirm the effectiveness of a given technology.

10.0 DEVELOPMENT AND PRELIMINARY SCREENING OF ALTERNATIVES

The retained technologies for groundwater identified in Table 9.1 are considered technically feasible and applicable to the waste types and physical conditions at the DC site. The groundwater specific technologies were assembled into potential alternatives capable of achieving the RAOs for the contaminated groundwater requiring remediation.

10.1 DEVELOPMENT OF GROUNDWATER REMEDIAL ALTERNATIVES

The retained remedial technologies for groundwater have been combined into the following remedial alternatives:

- Alternative 1: No Action
- Alternative 2: In-Situ Enhanced Biodegradation
- Alternative 3: In-Situ Chemical Oxidation
- Alternative 4: Combined In-Situ Enhanced Biodegradation and Chemical Oxidation / Reduction
- Alternative 5: Groundwater Extraction and Treatment

These alternatives are described briefly below and are described in greater detail in Section 11. Alternatives 2 through 5. These alternatives focused on the approximate 11,000 square foot area where total VOC concentrations are greater than 1,000 µg/l. Impacted areas outside of the treatment area will undergoe longtern monitored natural attenuation.

10.1.1 Alternative 1: No Action

Alternative 1 will be used as a baseline for comparison to other remedial alternatives. No action would be taken to address protection of human health or the environment against the groundwater contamination on site.

10.1.2 Alternative 2: In-Situ Enhanced Biodegradation

Alternative 2 consists of:

- pre-design investigations
- full-scale injection implementation of enhanced biodegradation
- performance monitoring
- annual reporting
- long-term monitoring

Pre-design investigations would be conducted to refine the extent of groundwater contamination to be addressed under this alternative.

Full-scale implementation of in-situ enhanced biodegradation would consist of the addition of the chosen biological reagent into the contaminated aquifer. Following full-scale implementation, performance monitoring would be conducted approximately quarterly for two years, semi annually for another two years, then annually thereafter to ascertain the effectiveness of the remedy and whether additional reagents are warranted.

Long-term monitoring would be conducted to evaluate the effectiveness of the enhanced biodegradation remedy within the treatment area and to evaluate monitored natural attenuation outside of the treatment area.

10.1.3 Alternative 3: In-Situ Chemical Oxidation

Alternative 3 consist of similar components as Alternative 3, described in Subsection 10.2.3 above, including:

- pre-design investigations
- treatability studies
- full-scale injection implementation of in-situ chemical oxidation
- performance monitoring
- annual reporting
- long-term monitoring

Pre-design investigations would be conducted to refine the extent of groundwater contamination to be addressed under this alternative. Laboratory and field studies would be conducted to determine the appropriate chemical oxidant(s), oxidant dosage, and implementation methodology for the full-scale program.

Full-scale implementation of in-situ chemical oxidation would consist of the addition of the chosen chemical oxidant into the contaminated aquifer. Following full-scale implementation, performance monitoring would be conducted approximately quarterly for two years, semi annually for another two years, then annually thereafter to ascertain the effectiveness of the remedy and whether additional oxidants are warranted.

Long-term monitoring would be conducted to evaluate the effectiveness of the chemical oxidation remedy within the treatment area and to evaluate monitored natural attenuation outside of the treatment area.

10.1.4 Alternative 4: Combined In-Situ Chemical Oxidation and Enhanced Biodegradation

Alternative 4 consist of similar components as Alternative 2 & 3, described in Subsection 10.2.3 above, since it is a combination of the two alternative, including:

- pre-design investigations
- treatability studies
- full-scale implementation of in-situ chemical oxidation and enhanced biodegradation
- performance monitoring
- annual reporting
- long-term monitoring

Pre-design investigations would be conducted to refine the extent of groundwater contamination to be addressed under this alternative. Laboratory and field studies would be conducted to determine the appropriate oxidants, their respective dosages, and implementation methodology for the full-scale program.

Full-scale implementation of this alternative would consist of the addition of the chosen chemical oxidant and biological reagent into the contaminated aquifer. Following full-scale implementation, performance monitoring would be conducted approximately quarterly for two years, semi annually for another two years, then annually thereafter to ascertain the effectiveness of the remedy and whether additional reagents and/or oxidants are warranted.

Long-term monitoring would be conducted to evaluate the effectiveness of the combined enhanced biodegradation and chemical oxidation remedy within the treatment area and to evaluate monitored natural attenuation outside of the treatment area.

10.1.5 Alternative 5: Groundwater Extraction and Treatment

Alternative 5 consists of:

- pre-design investigations
- full-scale construction and system start-up
- annual reporting;
- long-term monitoring
- operation and maintenance (O&M) activities

Pre-design investigations would be conducted to refine the extent of groundwater contamination to be addressed under this alternative. Laboratory and field studies would be conducted to determine appropriate location and construction of extraction wells, the necessary pumping rates for hydraulic capture, and the appropriate groundwater treatment methods to be implemented.

Full scale implementation would include installation of extraction wells and conveyance piping and construction of a groundwater treatment system. It has been assumed that treated effluent from the groundwater treatment system could be discharged to a local storm sewer, which would require permitting and sampling. There are several options for treatment of the extracted groundwater once; this FS assumes treatment of chlorinated VOCs using an air stripper. It is also assumed that the system will include a settling tank and/or bag filter to remove suspended solids from the groundwater, as well as vapor phased carbon to treat the air emissions from the air stripper.

Long-term groundwater monitoring and treatment system monitoring programs to evaluate the effectiveness of the pump and treat system would be conducted in compliance with applicable permits. The long-term groundwater monitoring program is assumed to include groundwater sampling approximately quarterly for two years, semi-annually for another two years, and then annually thereafter.

11.0 DETAILED ANALYSIS OF ALTERNATIVES

This section presents the detailed analyses of remedial action alternatives for groundwater at the DC site. The detailed analysis is intended to provide decision-makers with the relevant information with which to aid in selection of a site remedy. The detailed description of technologies or processes used for each alternative includes, where appropriate, a discussion of limitations, assumptions, and uncertainties for each component. The descriptions provide a conceptual design of each alternative and are intended to support alternatives-comparison and cost-estimation.

The detailed analysis of each alternative including evaluation using the first seven evaluation criteria identified in DER-10 (NYSDEC, 2002) and §375-1.8(f) (NYSDEC, 2006) is presented in the following paragraphs. Table 8.1 summarized the list of applicable SCGs used in the evaluation of alternatives.

Compliance with Standards, Criteria, and Guidance. Compliance with SCGs addresses whether or not a remedy will meet applicable environmental laws, regulations, standards, and guidance. SCGs for the DC site will be listed and a determination made as to whether or not the remedy will achieve compliance. For those SCGs that will not be met, there will be a discussion and evaluation of the impacts of each, and whether waivers are necessary. Chemical-specific SCGs were previously identified in this FS Report. Location- and action-specific SCGs will be identified for each alternative in this section.

Overall Protection of Public Health and the Environment. This criterion is an evaluation of the remedy's ability to protect public health and the environment, assessing how each existing or potential pathway of exposure is eliminated, reduced or controlled through removal, treatment, engineering controls or institutional controls. The remedy's ability to achieve each of the RAOs will be evaluated.

Short-term Effectiveness. The potential short-term adverse impacts of the remedy upon the community, workers, and environment during the construction and/or implementation are evaluated. A discussion of how the identified adverse impacts and health risks to the community or workers at the DC site will be controlled, and the effectiveness of the controls, will be presented along with a discussion of engineering controls that will be used to mitigate short-term impacts (e.g., dust control measures). The length of time needed to achieve the remedial objectives will be estimated.

Long-term Effectiveness and Permanence. This criterion evaluates the long-term effectiveness of the remedy following implementation. If wastes or treated residuals remain on-site after the selected remedy has been implemented, the following items will be evaluated:

1. magnitude of human exposures to contamination remaining at the site
2. adequacy of the engineering and institutional controls in place
3. reliability of these controls
4. ability of the remedy to continue to meet RAOs in the future

Effectiveness of alternatives in protecting human health and the environment after RAOs are met will be evaluated. This will include an evaluation of the permanence of the alternative, the magnitude of human exposure to remaining contamination, and the adequacy and reliability of controls required to manage wastes or residuals remaining at the DC site.

Reduction of Toxicity, Mobility, or Volume with Treatment. The remedy's ability to reduce the toxicity, mobility or volume of site contamination will be evaluated. Preference should be given to remedies that permanently and significantly reduce the toxicity, mobility, or volume of the wastes at the DC site.

Implementability. The technical and administrative feasibility of implementing the remedy will be evaluated. Technical feasibility includes the difficulties associated with the construction and the ability to monitor the effectiveness of the remedy. For administrative feasibility, the availability of the necessary personnel and material will be evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, or other issues.

Cost. Capital, O&M costs will be estimated for the remedy and presented on a present worth basis.

11.1 COST ANALYSIS PROCEDURES

Estimated costs presented in this Report are intended to be within the target accuracy range of minus 30 to plus 50 percent of actual cost (USEPA, 1988). Costs are presented as a present worth and as a total cost for up to a 30-year period.

A summary of the costs for each alternative identifying capital and net present worth (NPW) costs are included in each alternative's cost description. Each cost estimate includes a present worth analysis to evaluate expenditures that occur over different time periods. The analysis discounts future costs to a NPW and allows the cost of remedial alternatives to be compared on an equal basis. NPW represents the amount of money that, if invested now and disbursed as needed, would be sufficient to cover costs associated with the remedial action over its planned life. A discount rate of 2.7 percent, as published by the Office of Management and Budget (OMB), was used to prepare the cost estimates (OMB, 2008).

Consistent with USEPA FS cost estimating guidance (USEPA, 2000), the remedial alternative cost estimates include costs for project management, remedial design, construction management, technical support, and scope contingency.

Project management includes planning and reporting, community relations support during construction or O&M, bid or contract administration, permitting (not already provided by the construction or O&M contractor), and legal services outside of institutional controls.

Remedial design applies to capital cost and includes services to design the remedial action. Activities that are part of remedial design include pre-design collection and analysis of field data, engineering survey for design, treatability study/pilot-scale testing, and the various design components such as design analysis, plans, specifications, cost estimate, and schedule.

Construction management applies to capital cost and includes services to manage construction or installation of the remedial action, except similar services provided as part of regular construction activities. Activities include review of submittals, design modifications, construction observation or oversight, engineering survey for construction, preparation of O&M manual, documentation of QC/quality assurance (QA), and record drawings.

Technical support during O&M includes services to monitor, evaluate, and report progress of remedial action. This includes oversight of O&M activities, update of O&M manual, and progress reporting and is generally between 10 percent and 20 percent of total annual O&M costs depending on complexity of the remedial action (USEPA, 2000).

Scope contingency represents project risks associated with the feasibility-level of design presented in this Report. This type of contingency represents costs, unforeseeable at the time of estimate preparation, which are likely to become known as the remedial design proceeds. Scope contingency ranges from 10 to 25 percent, with higher values appropriate for alternatives with greater levels of cost growth potential (USEPA, 2000). For the purpose of the FS a scope contingency of 15% for all alternatives was used.

Project management, remedial design, and construction management costs presented in this Report are based upon the following matrix presented in the USEPA FS cost estimating guidance (USEPA, 2000).

Professional and Technical Costs as Percentage of Direct Costs

Indirect Cost	< $100K (%)	$100K-$500K (%)	$500K-$2M (%)	$2M-$10M (%)	>$10M (%)
Project Management	10	8	6	5	5
Remedial Design	20	15	12	8	6
Construction Management	15	10	8	6	6

11.2 GENERAL ASSUMPTIONS

Details and assumptions pertaining to the cost estimates are included in each alternative's cost description. In addition to the alternative-specific assumptions, the following cost assumptions were applied, as applicable:

- implementation of each selected remedy for groundwater (candidate alternatives are presented herein) would occur after or concurrently with the DC OU-1 remedy for soil remediation, therefore the source of groundwater contamination would be removed.
- long-term activities would be conducted for no more than 30 years
- quarterly monitoring of groundwater would be required for the first two years following full scale remedy implementation, after which the frequency would be reduced. It is

assumed that after the first two years the frequency would be reduced to semi-annually for years three and four and to annually thereafter up to a total of 30 years.

- ten percent of samples would be collected in duplicate, or for QA/QC purposes, and analyzed off-site.

The following remedial alternatives developed in Section 10.0 were retained for detailed analysis.

- Alternative 1: No Action
- Alternative 2: In-Situ Enhanced Biodegradation
- Alternative 3: In-Situ Chemical Oxidation
- Alternative 4: Combined In-Situ Chemical Oxidation and Enhanced Biodegradation
- Alternative 5: Groundwater Extraction and Treatment

The following subsections present a conceptual design and cost estimate for each of the alternatives and a discussion of each alternative relative to the first seven evaluation criteria from DER-10 (NYSDEC, 2002).

11.3 ALTERNATIVE 1: NO ACTION

Alternative 1 would not include any additional actions at the site beyond the DC OU-1 remedy for soil (excavation and off-site disposal); therefore, site-related groundwater contamination would not be addressed.

Compliance with Standards, Criteria, and Guidance. Alternative 1 would not comply with NYS Chemical –Specific SCGs.

Overall Protection of Public Health and the Environment. Site-specific RAOs for protection of human health and the environment were developed for contaminated groundwater. Alternative 1 would not provide any additional protection of human health and the environment compared to present conditions.

Short-term Effectiveness. Because no actions would be taken, implementation of this alternative would not result in short-term adverse impacts to the community, site workers, or the environment.

Long-term Effectiveness and Permanence. The RAOs would not be met if Alternative 1 were implemented at the DC site. This alternative would not provide long-term effectiveness.

Reduction of Toxicity, Mobility, or Volume with Treatment. This alternative would not result in the reduction of toxicity, mobility, or volume of groundwater contamination through treatment.

Implementability. Although no services or materials would be required to implement the No Action Alternative, obtaining regulatory and/or public approval for this Alternative at the DC site would be difficult.

Cost. The cost of this Alternative is $0. No remedial actions, institutional controls, or environmental monitoring would be conducted.

11.4 ALTERNATIVE 2: IN-SITU ENHANCED BIODEGRADATION

Alternative 2 consists of the following components:

- pre-design investigations
- full-scale implementation of in-situ enhanced biodegradation
- long-term monitoring in the treatment areas and natural attenuation areas, and associated reporting
- periodic O&M activities, if needed

This alternative includes in-situ enhanced biodegradation of groundwater where total chlorinated VOC concentrations in groundwater exceed 1,000 µg/l, as shown on Figure 8.1, along with monitored natural attenuation of the surrounding impacted areas with total chlorinated VOC concentrations greater than 100 µg/l in groundwater. It is assumed that this alternative will be implemented concurrently with the DC OU-1 soil remedy.

In-situ enhanced biodegradation involves inoculation of micro-organisms (i.e., fungi or bacteria, and other microbes) and/or addition of carbon sources (reagents) to the subsurface for use by indigenous micro-organisms capable of degrading organic contaminants found in soil and/or groundwater. Carbon sources (organic substrates) for enhanced biodegradation include, but are not limited to:

- sodium lactate

- propionate/butyrate
- methanol
- ethanol
- emulsified vegetable oil
- chitin
- the Regenesis product Hydrogen Release Compound™ (HRC^{TM}), a slow release lactate
- molasses

The unit costs for these materials vary widely; however, the required quantities and delivery methods for implementation also vary widely and are best determined through site-specific laboratory and/or field studies. A discussion of several commercially available amendments is presented in Appendix G. Data collected during the RI indicate that dehalococcoides (the only known microorganisms capable of complete dechlorination of chloroethenes to non-toxic ethene.) exist in groundwater at MW-7 at the DC site at a population density of 8 x 10^4/liter, which is consider moderate and may, or may not, be associated with observable dechlorination impacts. Additionally, the pH of groundwater at the DC site is approximately neutral and reducing conditions exist in the treatment area. All three of these conditions would suggest that enhanced biodegradation would be an appropriate treatment approach. Additionally, a gene track analysis was conducted on the groundwater from MW-7 and concluded that the dehalococcoides that are present contain the vinyl chloride reductase gene, the necessary gene to completely degrade chloroethenes through vinyl chloride. Given the results of these tests, which are presented in Appendix F, no additional testing of site media in support of this remedial alternative is proposed.

For purposes of the FS conceptual design; it has been assumed that in-situ enhanced biodegradation would be conducted using the Regenesis product HRC^{TM}.

Pre-design Investigations. Pre-design investigations would be conducted to refine the extent of contamination to be addressed. For this alternative, it is assumed that pre-design investigations would include the installation of a monitoring well northwest of MW-7, to bound the edge of the groundwater plume migrating from the DC site to the northwest. A groundwater sample would be collected from the newly installed monitoring well and would be tested for VOCs. Additionally, this alternative includes a pilot-test using a track mounted geoprobe rig to assess the ability to inject reagents into the subsurface at the DC site using direct push technology. Test injection points would be advanced up to 35 feet deep and potable water would be injected from 35 feet deep up to 10 feet deep to assess the capability for injections. Up to 1,000 gallons of water will be injected, and observations will be made to record required time to inject and whether water daylights up the sides of the injection rods or to the surrounding ground surface.

Full-scale Implementation. Full-scale implementation of in-situ enhanced biodegradation would consist of a combination of adding the chosen amendment into the open excavation during the implementation of the DC OU-1 soil remedy in the source zone and injecting the chosen amendment into the groundwater via direct push methods in the remaining treatment area. Prior to excavating the soil under the DC OU-1 remedy, steel sheeting would be placed around portions the perimeter of the excavation (soil excavation area for OU-1 remedy extends beyond the groundwater treatment area) and would be advanced to about 40 feet below grade. The source soil would be excavated and disposed off-site as per the DC OU-1 remedy. Additional soil below the source soil would also be excavated and staged on-site. Dewatering would be required during excavation. Once the excavation has reached a depth of approximately 30 feet below grade, groundwater pumping would cease and the excavation will be left to fill with water to the static groundwater elevation (approximately 10 feet below grade). The chosen reagent (assumed HRC^{TM}) would then be added and mixed in with the water.

It is assumed that the additional excavated soil (from 10-30 feet) will be suitable for use as backfill material. The backfill material that would require purchasing for the DC OU-1 soil remedy would be upgraded to crushed stone. The sequence of backfilling the excavation would be to use approximately half of the excavated/re-usable soil at the bottom of the excavation followed by the crushed stone until the crushed stone is above the static groundwater elevation, then followed by the remaining re-usable backfill which would be compacted in 6-inch lifts (as indicated in the DC OU-1 RI/FS). For costing purposes, the costs associated with installation of the sheet piling and the additional excavation and backfilling activities are included in the costs for this alternative. The costs associated with groundwater pumping and the costs to upgrade the backfill material to crushed stone will be captured in the engineer's estimate for the implementation of the OU-1 soil remedy.

The remaining portions of the treatment area would be treated by injecting the chosen reagent via temporary injection points advanced using direct push or a similar technology. For FS costing purposes, it has been assumed that the reagent used for these injections would also be HRC^{TM}. Approximately 60 injection points would be required and would be placed on a grid pattern (with the exception of areas where structures exist).

In addition to the reagent addition to the open excavation and the temporary injection points, seven permanent monitoring wells would be installed within the treatment area to provide means for monitoring the effectiveness of the treatment and to determine whether additional injections would be required.

Design software available from Regenesis has been used in support of conceptual cost analysis (refer to Appendix H). Appendix H provides the supporting documentation for the design software input variables used. Based on the Regenesis software, it is estimated that approximately 3,600 pounds of HRC^{TM} would be added to the open excavation to treat groundwater from 10-30 feet below grade in the source zone, and that approximately 10,300 pounds of HRC^{TM} would be injected into the remaining treatment area (approximately 172 pounds per injection point) to treat groundwater from 10-35 feet below grade.

It should be noted that the reagent delivery method within the source zone is dependent on the assumption that the implementation of this remedy will be conducted at the same time as DC OU-1 soil remedy. There is a possibility that additional savings could be realized if the two remedies are conducted concurrently, from one or more of the following scenarios:

1. soil generated from some of the monitoring well installations in the vadose zone could potentially be used for backfill in the open excavation rather than being drummed and disposed of off-site
2. soil generated from monitoring well installations in the saturated zone could be managed/disposed with soil generated from the excavation activities

Long-term Monitoring. Long-term monitoring would be conducted to evaluate the effectiveness of the enhanced biodegradation remedy as well as the effects of natural attenuation in untreated areas. Periodic O&M, including but not limited to re-injection activities, would be conducted as needed based upon long-term monitoring results. Results of the long-term monitoring and overall performance of the remedial alternative will be summarized in an annual report. Long-term monitoring will begin following the first injection and will occur on a quarterly basis for years one and two, on a semi-annual basis for years three and four, and annually thereafter through year 30.

Periodic O&M Activities. Subsequent to full-scale implementation, monitoring of groundwater conditions would be conducted to determine the effectiveness of the initial implementation of in-situ enhanced biodegradation, as discussed in the previous section, and whether or not additional injections are warranted. For FS costing purposes, it has been assumed that no additional applications of HRC^{TM} would be required. However, the need for additional injections will be evaluated during the 5-year review of the DC site.

Compliance with Standards, Criteria, and Guidance. Chemical-specific SCGs for groundwater include the NYS drinking water standards. Alternative 2 would comply with Chemical-specific SCGs in-situ treatment to reduce contaminant concentrations within the plume, thereby reducing the time necessary to meet SCGs. Location- and Action-specific SCGs associated with this alternative includes 40 CFR Part 144 – Underground Injection Control Program.

Overall Protection of Public Health and the Environment. This alternative would protect public health and the environment by providing in-situ treatment of contaminated groundwater emanating from the DC site to reduce levels of total VOCs in groundwater on and downgradient of the DC site.

Short-term Effectiveness. This alternative includes the addition of reagents into an open excavation and injection of reagents using direct push technology at the DC site, as well as installation of additional monitoring wells; therefore, there would be potential short-term adverse impacts of the remedy upon site occupants. These potential impacts would be addressed through coordination and communication with the property owner(s) and preparation and implementation of a construction health and safety plan. This alternative would decrease the level of contamination in the groundwater both on-site and off-site and would therefore reduce the migration of impacted groundwater further off-site.

Long-term Effectiveness and Permanence. This alternative includes in-situ treatment of the VOC groundwater plume. Long-term effectiveness of this alternative would rely upon the effectiveness of the in-situ treatment, which contains uncertainties regarding the potential magnitude of mass reduction that could be achieved. Unlike other sites where this alternative has been implemented, the known source area will have been removed prior to implementation under the OU-1 remedy, therefore decreasing the potential for rebounding due to chemicals adsorbed to soil.

Reduction of Toxicity, Mobility, or Volume with Treatment. This alternative reduces the toxicity, mobility and volume of groundwater contamination through in-situ treatment.

Implementability. The technologies used for implementation of enhanced biodegradation are well developed and would not be difficult to implement. Special considerations would need to be employed due to the location of a building at the downstream end of the groundwater contaminant plume and proximity to underground utilities. In general, the reagents used for in-situ enhanced biodegradation are long-lasting and travel with groundwater flow, and with time would be expected to reach the area under the building. A comprehensive utility survey would be conducted prior to the installation of injections wells, and wells that are within or near a suspected utility area would be pre-cleared either by hand or with vacuum excavation prior to well installation. Services or materials required to implement this alternative are readily available.

Cost. The capital cost of this Alternative is $492,000. The NPW of this Alternative is $1,259,000. A summary of the costs associated with this alternative is presented in Table 11.1. Detailed cost analysis backup is provided in Appendix I.

11.5 ALTERNATIVE 3: IN-SITU CHEMICAL OXIDATION

Alternative 3 consists of the following components:

- pre-design investigations
- treatability studies
- full-scale injection implementation of in-situ treatment
- long-term monitoring in treatment areas and natural attenuation areas, and associated reporting
- periodic O&M activities.

This alternative includes in-situ chemical oxidation of the treatment area where total chlorinated VOC concentrations in groundwater exceed 1,000 µg/l, as shown on Figure 8.1, along with monitored natural attenuation of impacted areas surrounding the treatment area with total chlorinated VOC concentrations greater than 100 µg/l in groundwater. It is assumed that this alternative will be implemented concurrently with the DC OU-1 soil remedy.

Pre-design Investigations. Pre-design investigations would be conducted to refine the extent of contamination to be addressed. For this alternative, it is assumed that pre-design investigations would include the installation of a monitoring well northwest of MW-7 to bound the edge of the groundwater plume migrating from the DC site to the northwest. Additionally a track mounted geoprobe rig would be used to access the ability to inject the chemical oxidant into the subsurface at the DC site. A test injection point would be advanced up to 35 feet deep and potable water would be injected from 35 feet deep up to 10 feet deep to assess the capability for injections. Up to 1,000 gallons of water will be injected, and observations will be made to record required time to inject and whether water percolates up the sides of the injection rods or through the soil. Finally, soil and groundwater samples will be collected from the source zone and from the remaining treatment area for the purpose of VOC testing and bench-scale testing to determine the appropriate oxidants and dosages to use as described in the following paragraph.

Treatability Studies. Laboratory and field studies would be conducted to determine the appropriate chemical oxidant associated dosage, and approach for the full-scale program. Common chemical oxidation reagents used in practice include permanganate (MnO_4^-), hydrogen peroxide (H_2O_2), ozone, calcium peroxide, activated (iron) persulfate, and a Regenesis product known as RegenOx™, a percarbonate.

The unit costs for these materials vary; however, the required quantities for implementation vary widely and are best determined through site-specific laboratory and field studies. A discussion of several commercially available reagents is presented in Appendix G. Preliminary investigations have included conducting permanganate natural oxidant demand (PNOD) testing at two intervals within the source zone. Results of these test indicated PNOD values of approximately 10 and 15 grams per kilogram (g/kg) for potassium permanganate and 9 and 14 g/kg for sodium permanganate. The results of the PNOD testing are included in Appendix F. These values are considered to be relatively high for the types of soil present at the DC site. However, given that permanganate is relatively long-lasting in the subsurface and has been proven to be effective for destruction of ethene-based chlorinated solvents, it has been assumed for cost estimating purposes that permanganate would be used. Additional collection and analysis of site media will be performed to confirm the PNOD results from 2007 in both the source zone and the remaining treatment area, and testing would also be conducted to evaluate whether another oxidant may be better suited for application at the DC site.

Full-scale Implementation. Full-scale implementation of in-situ chemical oxidation would consist of both adding the chosen oxidant to the open excavation during the implementation of the OU-1 soil remedy and injecting the chosen oxidant into the groundwater via direct push methods in the remaining treatment area. As with Alternative 2, the addition of reagents in the source area would be conducted concurrently with the OU-1 soil remedy and would include installation of steel sheeting, additional excavation of soil to 30 feet, and allowing groundwater to fill the open excavation before adding the oxidant. It is assumed that potassium permanganate would be used for the source zone treatment. Approximately 30,000 pounds of potassium permanganate would be added and mixed with the groundwater in the open excavation prior to backfilling. This quantity was calculated by XDD, LLC (see email contained in Appendix H) based on the total VOC concentrations in the groundwater and also took into consideration the natural oxidant demand of the soil at the bottom of the excavation (the PNOD values from 2007 were used). The excavation would then be left open for up to two weeks to treat the groundwater prior to backfilling. If backfilling is conducted to early the natural oxidant demand of the backfill soil would consume the oxidants before they have the chance to treat the groundwater. Backfilling would be conducted using the same methodology as described in Alternative 2.

The remaining treatment area would be treated by injecting the chosen oxidant via temporary injection points advanced using direct push or similar technology. For FS costing purposes, it has been assumed that sodium permanganate would be used for these injections, since potassium permanganate has a low solubility and the required injection volume would likely prohibit use for this approach. Since PNOD values for soil outside of the source zone were not available, and since the PNOD values from the source zone were considered relatively high for the type of soil at the DC site, it has been assumed for the purposes of this FS that the remaining treatment area would have PNOD values of approximately 6 g/kg, which is still considered to be elevated for the nature of the soil at the DC site. Given this assumed PNOD, approximately 300,000 pounds of sodium permanganate (40%) would be required and would be injected in a grid pattern (with adjustments made for areas where obstructions exist). The assumed application quantity of permanganate using the assumed PNOD is high. If, based on the results of additional sampling and analysis, the PNOD in this area is determined to be higher than 6 g/kg, this alternative would be considered to have low feasibility, since it would require quantities of permanganate that could not be injected without significant day lighting of reagents and uncontrolled contaminant mobilization

In addition to the addition of oxidant to the open excavation and temporary injection points, seven permanent monitoring wells would be installed within the treatment area to provide means for monitoring the effectiveness of the treatment and to determine whether additional injections would be required.

Calculations used to quantify the quantities of permanganate required for treatment based upon available and assumed PNOD values for soil, as well as correspondences with vendors regarding the required quantities to treat groundwater in an open excavation are included in Appendix H.

It should be noted that the oxidant delivery method within the source zone is dependent on the assumption that the implementation of this alternative will be conducted at the same time as the DC OU-1 soil remedy. There is a possibility that additional savings could be realized if the two remedies are conducted concurrently, from one or more of the following scenarios:

1. soil generated from some of the monitoring well installations in the vadose zone could potentially be used for backfill in the open excavation rather than being drummed and disposed of off-site
2. soil generated from monitoring well installations in the saturated zone could be managed/disposed with soil generated from the excavation

Long-term Monitoring. Long-term monitoring would be conducted to evaluate the effectiveness of the chemical oxidation remedy, as well as to evaluated natural attenuation in un-treated areas. Periodic O&M, including but not limited to re-injection activities, would be conducted as needed based upon long-term monitoring results. Results of the long-term monitoring and overall performance of the remedial alternative will be summarized in annual reports. Long-term monitoring will begin following the addition of the chemical oxidants and will occur on a quarterly basis for years one and two, on a semi-annual basis for years three and four, and annually thereafter through year 30.

Periodic O&M Activities. Subsequent to full-scale implementation, monitoring of groundwater conditions would be conducted to determine the effectiveness of the initial implementation of in-situ chemical oxidation, as discussed in the previous section, and whether or not additional injections are warranted. For FS costing purposes, it has been assumed that no additional applications of permanganate would be required. However, the need for additional injections will be evaluated during the 5-year review of the DC site.

Compliance with Standards, Criteria, and Guidance. Chemical-specific SCGs for groundwater include the NYS drinking water standards. Alternative 3 would comply with Chemical-specific SCGs by implementing in-situ treatment to reduce contaminant concentrations within the plume, thereby reducing the time necessary to meet SCGs. Location- and Action-specific SCGs associated with this alternative includes 40 CFR Part 144 – Underground Injection Control Program.

Overall Protection of Public Health and the Environment. This alternative would protect public health and the environment by providing in-situ treatment of contaminated groundwater emanating from the DC site to reduce levels of VOCs in groundwater on and downgradient of the DC site.

Short-term Effectiveness. This alternative includes the injection/mixing of permanganate inside an open excavation, and direct push technologies for permanganate injections, as well as installation of permanent monitoring wells at the DC site; therefore, there would be potential short-term adverse impacts of the remedy upon site occupants. These potential impacts would be addressed through coordination and communication with the property owner(s) and preparation and implementation of a construction health and safety plan. In-situ chemical oxidation results in chemical destruction of contaminants in the short term, which would decrease the level of contamination in the groundwater on-site and would therefore reduce the migration of impacted groundwater further off-site.

Long-term Effectiveness and Permanence. This alternative includes in-situ treatment of the VOC groundwater plume. Long-term effectiveness of this alternative would rely upon the effectiveness of the in-situ treatment, which contains uncertainties regarding the potential magnitude of mass reduction that could be achieved. Unlike other sites where this alternative has been implemented, the known source area will have been removed prior to implementation, therefore decreasing the potential for rebounding due to chemicals adsorbed to soil.

Reduction of Toxicity, Mobility, or Volume with Treatment. This alternative reduces the toxicity, mobility and volume of groundwater contamination through in-situ treatment. The chemical reaction that destroys the contaminants occurs quickly upon contact with the contaminated media.

Implementability. The technologies used for implementation of in-situ chemical oxidation are well developed and would not be difficult to implement. Special considerations would need to be employed due to the location of a building at the downstream end of the groundwater contaminant plume, proximity to underground utilities, The oxidant assumed for use for in-situ chemical oxidation is permanganate, which is longer lasting than most oxidants and travels with groudwater flow, thus would be expected to infiltrate the area under the building. A comprehensive utility survey would be conducted prior to the installation of injections wells, and wells that are within or near a suspected utility area would be pre-cleared either by hand or with vacuum excavation prior to well installation. The comprehensive utility survey would also include inquiries regarding the materials used for existing underground structures such as piping, to ensure that there are no compatibility issues with the chosen chemical oxidant. Services or materials required to implement this alternative are readily available. However, the implementability of this remedy the the remainding treatment area (area outside of the source zone) is highly dependent upon the PNOD of the soil in the area since it will dictate whether the quantities of permanganate required for treatment are too high to make this alternative feasible.

Cost. The capital cost of this Alternative is $1,760,000. The NPW of this Alternative is $2,527,000. A summary of the costs associated with this alternative is presented in Table 11.2. Detailed cost analysis backup is provided in Appendix I.

11.6 ALTERNATIVE 4: COMBINED IN-SITU CHEMICAL OXIDATION AND ENHANCED BIODEGRADATION

Alternative 4 consists of the following components:

- pre-design investigations
- treatability studies
- full-scale injection implementation of in-situ treatment
- long-term monitoring in treatment areas and natural attenuation areas, and associated reporting
- periodic O&M activities.

This alternative includes a combination of in-situ chemical oxidation and enhanced biodegradation in the treatment area where total chlorinated VOC concentrations in groundwater exceed 1,000 µg/l, as shown on Figure 8.1, along with monitored natural attenuation of impacted areas surrounding the treatment area with total chlorinated VOC concentrations greater than 100 µg/l in groundwater. It is assumed that this alternative would be implemented concurrently with the DC OU-1 soil remedy.

Pre-design Investigations. Pre-design investigations would be conducted similar to Alternatives 2 and 3. These pre-design investigations would include an additional monitoring well upgradient of MW-7, an injection test within the treatment area with potable water, and additional testing in the source zone to determine the appropriate chemical oxidant and associated dosage to be used.

Treatability Studies. Laboratory testing for VOCs would be conducted on groundwater from the newly installed well and also on the soil and groundwater samples collected for chemical oxidant testing. As described in Alternative 2, it is assumed that no additional laboratory testing is required to determine the effectiveness of biological reagents. For the purpose of this FS we have assumed that a combination of permanganate (quick acting chemical oxidant) and HRC^{TM} (long lasting biological reagent) will be used. The permanganate will be used in the source area and the HRC^{TM} will be used in the remaining treatment area.

Full-scale Implementation. Full-scale implementation of combined in-situ chemical oxidation and enhanced biodegradation alternative would consist of adding the chosen oxidant (potassium permanganate is assumed) to the open excavation as described in Alternative 3 and by injecting the chosen reagent (HRC^{TM} is assumed) into the remaining treatment area via temporary injection points as described in Alternative 2.

In addition to the temporary injection points and addition of oxidants into the open excavation, seven permanent monitoring wells will be installed within the treatment area to provide means for monitoring the effectiveness of both treatments and to determine whether additional injections will be required.

It should be noted that it has been assumed that the oxidant injections within the source zone would be completed concurrently with the DC OU-1 soil remedy. It is possible that additional costs savings could be realized if additional full-scale activities are conducted during this time, including:

1. soil generated from some of the monitoring well installations in the vadose zone could potentially be used for backfill in the open excavation
2. soil generated from monitoring well installations in the saturated zone could be managed/disposed with soil generated from the excavation

Long-term Monitoring. Long-term monitoring would be conducted to evaluate the effectiveness of the combined chemical oxidation and enhanced biodegradation remedy, as well as to evaluated natural attenuation in un-treated areas. Periodic O&M, including but not limited to re-injection activities, would be conducted as needed based upon long-term monitoring results. Results of the long-term monitoring and overall performance of the remedial alternative will be summarized in annual reports. Long-term monitoring will begin following the first injection and will occur on a quarterly basis for years one and two, on a semi-annual basis for years three and four, and annually thereafter through year 30.

Periodic O&M Activities. Subsequent to full-scale implementation, monitoring of groundwater conditions would be conducted to determine the effectiveness of the implementation of the combined remedy, as discussed in the previous section, and whether or not additional injections are warranted. For FS costing purposes, it has been assumed that no additional applications of permanganate or HRC^{TM} would be required. However, the need for additional injections will be evaluated during the 5-year review of the DC site.

Compliance with Standards, Criteria, and Guidance. Chemical-specific SCGs for groundwater include the NYS drinking water standards. Alternative 4 would comply with Chemical-specific SCGs by implementing in-situ treatment to reduce contaminant concentrations within the plume, thereby reducing the time necessary to meet SCGs. Location- and Action-specific SCGs associated with this alternative includes 40 CFR Part 144 – Underground Injection Control Program.

Overall Protection of Public Health and the Environment. This alternative would protect public health and the environment by providing in-situ treatment of contaminated groundwater emanating from the DC site to reduce levels of VOCs in groundwater on and downgradient of the DC site.

Short-term Effectiveness. This alternative includes the addition of permanganate inside an open excavation, and direct push technologies for HRC^{TM} injections, as well as installation of permanent monitoring wells at the DC site; therefore, there would be potential short-term adverse impacts of the remedy upon site occupants. These potential impacts would be addressed through coordination and communication with the property owner(s) and preparation and implementation of a construction health and safety plan. In-situ chemical oxidation results in chemical destruction of contaminants in the short term, which would decrease the level of contamination in the groundwater within the source zone and would therefore reduce the migration of impacted groundwater to the remaining treatment area and further off-site.

Long-term Effectiveness and Permanence. This alternative includes in-situ treatment of the VOC groundwater plume. Long-term effectiveness of this alternative would rely upon the effectiveness of the in-situ treatments, which contains uncertainties regarding the potential magnitude of mass reduction that could be achieved. Unlike other sites where this alternative has been implemented, the known source (DC OU-1 soil) will have been removed prior to implementation, therefore decreasing the potential for rebounding due to chemicals adsorbed to soil.

Reduction of Toxicity, Mobility, or Volume with Treatment. This alternative reduces the toxicity, mobility and volume of groundwater contamination through in-situ treatment. The chemical reaction from the permanganate treatment will destroy the contaminants quickly upon contact with the contaminated media. The areas using HRC^{TM} treatment will also reduce toxicity, mobility and volume of groundwater contamination through in-situ treatment, but may be more time consuming.

Implementability. The technologies used for implementation of both in-situ chemical oxidation and enhanced biodegradation are well developed and would not be difficult to implement. Special field studies and design considerations will be required to ensure that the conbination of the two in-situ treatment methods can be implemented successfully. Special considerations would need to be employed due to the location of a building at the downstream end of the groundwater contaminant plume, proximity to underground utilities, and means and methods conducted to effectively mix the oxidants into the groundwater within the open excavation. The reagants assumed for use for in-situ enahanced biodegradation, HRC^{TM}, is long lasting and travels with groundwater flow, thus would be expected to infiltrate the area under the building. A comprehensive utility survey would be conducted prior to the installation of injections wells, and wells that are within or near a suspected utility area would be pre-cleared either by hand or with vacuum excavation prior to well installation. The comprehensive utility survey would also include inquiries regarding the materials used for existing underground structures such as piping, to ensure that there are no compatibility issues with the chosen chemical oxidant. Services or materials required to implement this alternative are readily available.

Cost. The capital cost of this Alternative is $640,000. The NPW of this Alternative is $1,407,000. A summary of the costs associated with this alternative is presented in Table 11.3. Detailed cost analysis backup is provided in Appendix I.

11.7 ALTERNATIVE 5: GROUNDWATER EXTRACTION AND TREATMENT

Alternative 5 consists of:

- pre-design investigations
- laboratory and field studies
- full-scale construction and system start-up
- long-term monitoring in treatment areas and natural attenuation areas, and associated reporting
- O&M activities

This alternative includes extraction and treatment of groundwater within the DC site-related contaminated aquifer where total chlorinated VOC concentrations in groundwater are in excess of 1,000 µg/l, as shown on Figure 8.1. This remedial alternative would provide hydraulic containment of the groundwater plume until the SCGs can be met. The hydraulic containment would result in decreasing concentration downgradient of the extraction zone. It is assumed that this alternative would take place after or concurrently with the soil excavation to be conducted as the chosen OU-1 remedy.

Pre-design Investigations. Pre-design investigations would be conducted to refine the extent of contamination to be addressed. For this alternative, it is assumed that pre-design investigations would be implemented to install a monitoring well northwest of MW-7, to bound the edge of the groundwater plume migrating from the DC site to the northwest. In addition, to determine the number of extraction wells and appropriate size and spacing; a pumping test would be performed. The test would involve installing one 4-inch well (that could later be used as an extraction well) and one 2-inch observation well. A pump test would be conducted on the 4-inch well, with monitoring for drawdown conducted at the new 2-inch well. Collected data would be evaluated through groundwater modeling to predict the extent of capture and determine appropriate locations, quantities, and sizes of extractions well(s) and associated pumping rates. In addition, water quality for the newly installed well would be used during design of the groundwater treatment components.

Full-scale Implementation. Pump and treat operations involve the extraction of contaminated groundwater to prevent continued migration of contaminants Extracted contaminants are then treated by various methods prior to discharge or discharged to another facility for subsequent treatment. For chlorinated VOC contamination in groundwater, available treatment technologies include, but are not limited to, air stripping, activated carbon treatment, and treatment with chemical oxidants. For the purpose of this FS, it is assumed that extracted groundwater would be treated through air stripping. The air stripping provides reliable results with less labor and/or waste stream than many other treatment methods. Unlike treatment of contaminated water using filtration (e.g., activated liquid-phase carbon), air stripping does not require the generation, handling, transportation, and disposal of spent media. However, depending upon influent contaminant concentrations and flow rates, air permit requirements, may require treatment of air emissions, at least for some time period following initial start-up. Furthermore, unlike chemical oxidants, air stripping does not require the purchase and handling of potentially hazardous chemicals such as hydrogen peroxide.

Discharge options include re-injection into the subsurface, discharge to surface water, and discharge to another treatment facility (e.g., via the sanitary sewer). For the purpose of this FS, it is assumed that the treated effluent would be discharged to a local sanitary sewer for subsequent treatment by the municipality, because there are no nearby water bodies and because there are uncertainties with re-injecting water into the subsurface. It is assumed that discharge of the treated groundwater would require a discharge permit, which would require testing for multiple parameters including site COCs, as well as total solids and various other analytes that might impact treatment.

For purposes of the FS conceptual design, it has been assumed that the pump and treat system would include a solids settling tank and several bag filters, an air stripper, vapor phase carbon treatment unit, and associated controls and alarms.

Full-scale implementation of a pump and treat system would consist of the construction of extraction wells within the contaminated saturated zone as depicted on Figure 8.1. Extraction pumps would be placed inside the wells, and well vaults would be constructed to place pumps and instrumentation at each well header. Conveyance piping from each well would be installed at the appropriate depth below ground surface (including beneath the paved parking area) to prevent the groundwater influent from freezing. The conveyance piping would convey water from the extraction wells to a centralized location, assumed to be within the footprint of the existing building on the DC property, where the treatment components would be located inside a secure building with climate control and telephone and electrical utility connections.

It should be noted that if remedial activities for OU-2 can successfully be scheduled concurrently with remedial activities for OU-1 (soil excavation), that there could be cost savings realized from one or more of the following scenarios:

1. soil generated from some of the monitoring well and extraction well installations in the vadose zone could potentially be used for backfill in the open excavation, as well as soil generated from trenching activities related to conveyance piping
2. soil generated from monitoring well and extraction well installations in the saturated zone could be managed/disposed with soil generated from the excavation
3. the excavation contractors for OU-1 could be used for the trenching portion of OU-2, providing reduce costs for mobilization and demobilization

Long-term Monitoring. Long-term monitoring would be conducted to evaluate the effectiveness of the groundwater treatment during its operation period, as well as to evaluate the effects of natural attenuation outside of the treatment area. Results of the long-term monitoring and overall performance of the remedial alternative would be summarized in annual reports. Long-term monitoring will begin following start up of the groundwater extraction system and will occur on a quarterly basis for years one and two, on a semi-annual basis for years three and four, and annually thereafter through year 30.

Periodic O&M Activities. Subsequent to full-scale construction activities, O&M of the groundwater treatment system would be required. O&M activities would include, but not be limited to: treatment plant inspections, routine cleaning and maintenance of pumps and treatment equipment, discharge sampling as required by permit, replacement of bags filters and vapor phase carbon, and purchase of new equipment or instrumentation as needed. It is anticipated that O&M would require 8 hrs of labor per week, and that the treatment system would operate for 30 yrs.

Compliance with Standards, Criteria, and Guidance. Chemical-specific SCGs for groundwater include the NYS drinking water standards. Alternative 5 would comply with Chemical-specific SCGs by providing hydraulic control until the SCGs are met. Effluent would be monitored to ensure that it meets required discharge permit requirements.

Overall Protection of Public Health and the Environment. This alternative would protect public health and the environment by providing pumping and treatment of contaminated groundwater, thus reducing contaminant levels on-site and reducing off-site migration.

Short-term Effectiveness. This alternative includes the installation of permanent extraction wells, a water treatment system, and several monitoring wells; therefore, there would be potential short-term adverse impacts of the remedy upon site occupants. These potential impacts would be addressed through coordination and communication with the property owner(s) and preparation and implementation of a construction health and safety plan. This alternative would provide hydraulic control while treating contaminants on-site.

Long-term Effectiveness and Permanence. This alternative includes ex-situ treatment of the VOC groundwater plume. Long-term effectiveness of this alternative would rely upon the effectiveness of the pump and treat system. It is assumed that the source of contamination would have been removed prior to installation of the treatment plan via implementation of the OU-1 remedy to excavate and dispose of soil off-site; therefore there is no reason to believe that VOC concentrations would increase. There are some uncertainties regarding the magnitude of mass reduction that could be achieved based on local geology that could affect the pumping capture zone, but these anomalies should more or less be captured during the additional investigations and field tests. The natural groundwater flow and gradient are relatively slow and gentle, and the impacted zone to be treated is relatively small, therefore the desired contaminant capture is expected to be accomplished.

Reduction of Toxicity, Mobility, or Volume with Treatment. This alternative reduces the toxicity, mobility and volume of groundwater contamination through ex-situ treatment within the impacted zone to be treated. Other areas would be expected to naturally attenuate during the 30 years of operation of the system.

Implementability. The technologies used for implementation of groundwater extraction and treament systems are not difficult to implement. The most difficult tasks associated with this alternative would be obtaining access agreements, contracts and permits for installation of extraction wells and underground conveyance piping on neighboring properties and around buildings. Services or materials required to implement this alternative are readily available.

Cost. The capital cost of this Alternative is $628,000. The NPW of this Alternative is $3,746,000. A summary of the costs associated with this alternative is presented in Table 11.4. Detailed cost analysis backup is provided in Appendix I.

12.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

The comparative analysis evaluates the relative performance of each alternative using the same criteria by which the detailed analysis of each alternative was conducted. The purpose of the comparative analysis is to identify the advantages and disadvantages of each alternative relative to one another to aid in selecting an overall remedy for the DC site.

The comparative analysis includes a narrative discussion of the strengths and weaknesses of the alternatives relative to one another with respect to each criterion, and how reasonable variations of key uncertainties could change the expectations of their relative performance, as applicable. The comparative analysis presented in this document uses a qualitative approach to comparison, with the exceptions of comparing alternative costs and the required time to implement each alternative.

A comparison of the capital and long-term costs associated with the remedial alternatives is presented in Table 12.1. Table 12.2 provides a summary of the comparative analysis of the groundwater remedial alternatives, respectively, to the first six evaluation criteria. Detailed cost analysis backup is provided in Appendix I.

12.1 COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES FOR GROUNDWATER

The following paragraphs present a comparison of the remedial alternatives for groundwater which were evaluated in detail in Section 11.0, relative to the first six evaluation criteria.

Compliance with Standards, Criteria, and Guidance. Although there is no current direct exposure pathway to groundwater, Alternative 1 would not comply with Chemical-specific SCGs, and would not decrease contaminant concentrations or off-site migration. Alternatives 2, 3 and 4 would provide in-situ treatment while complying with 40 CFR Part 144 – Underground Injection Control Program and the Effluent Limitations. Alternative 5 provides groundwater extraction and treatment to provide hydraulic control, while effectively reducing contaminant concentrations and complying with monitoring requirements for discharge of treated groundwater under applicable permit requirements.

Alternatives 2, 3, 4 and 5 rate similarly at meeting this evaluation criterion.

Overall Protection of Public Health and the Environment. Alternative 1 does not provide protection of public health and the environment because no actions would be conducted to reduce or control groundwater contamination; however, the groundwater is not currently being used as a drinking water source and does not discharge to any surface water bodies. Alternatives 2, 3 and 4 are protective of public health and the environment because they reduce groundwater contamination by means of in-situ treatment. Alternative 5 is protective of public health and the environment by reducing groundwater contamination by virtue of ex-situ treatment while also providing hydraulic control to reduce off-site migration

Alternatives 5 rates highest at meeting this evaluation criteria since it will both reduce and control groundwater contamination.

Short-term Effectiveness. Alternative 1 would not include any construction activities; therefore, there would be no potential for short-term adverse impacts of the remedy upon the community, the workers, and the environment during the construction. This alternative would not, however, reduce contaminant concentrations in the groundwater or the potential for off-site migration. Alternative 1does not prevent future use of the groundwater for drinking purposes, however, in the short-term this is not an issue since groundwater is not currently being used as a source of potable water. Alternatives 2, 3 and 4 would require the use of temporary injection points for reagent application, which could be completed relatively quickly (injection of chemical oxidants would require more time than the biological reagents since larger quantities are required) and each would also require the installation of steel sheeting and additional excavation prior to introducing chemical oxidants or biological reagents to the open excavation. Chemical oxidants, once added under Alternative 3 or Alternative 4, are quick acting, whereas enhanced biodegradation (part of Alternatives 2 and 4) takes more time for the reactions and subsequent contamination reduction to occur. Alternative 5 would require time to install extraction wells as well as additional time to install the treatment system which may have the potential for short-term adverse impacts upon the community, workers and the environment. Alternative 5 would take the most time implement, and would rely upon long-term operation, maintenance, and monitoring to achieve contaminant reduction.

Alternative 3 would best meet this evaluation criteria, as it could be implemented in a relatively short period of time, would utilize less dangerous reagents than Alternative 3 and 4, and would not require the use of as much heavy equipment as Alternative 5.

Long-term Effectiveness and Permanence. Alternative 1 does not provide long-term effectiveness since it does not include any actions to reduce contamination or any means of preventing future use of contaminated groundwater. Because the source of contamination is to be removed under the OU-1 remedy, in-situ treatment of groundwater would provide long-term effectiveness and permanence for reducing contaminant concentrations. Alternatives 2, 3 and 4 would each result in the decrease, to vary degrees and at varying rates, of groundwater contaminant concentrations, therefore less impacted groundwater would migrate off-site. However, only Alternative 5 would result in both long-term reduction in groundwater contaminant levels and prevent continued off-site migration of groundwater contamination.

Alternatives 2, 3 and 4 would require long term monitoring within and around the treatment area to monitor the effectiveness of the remedies and to monitor natural attenuation. Alternative 5 would require long-term operation, monitoring and maintenance of the treatment system to ensure hydraulic capture throughout the treatment process.

Alternatives 2, 3, 4 and 5 would all potentially meet this evaluation criterion; however, Alternative 5 would best meet this evaluation criterion since it relies upon a reliable remedial technology relative to the other alternatives, which either rely upon chemical destruction of all contamination above SCGs or the long-term biological destruction of these contaminants.

Reduction of Toxicity, Mobility, or Volume with Treatment. Alternative 1 would not reduce the toxicity, volume and mobility of groundwater contamination. Alternatives 2, 3 and 4 include treatment to reduce the toxicity, mobility, and volume of groundwater contamination. Chemical-oxidation destroys contaminants upon contact, but site-specific conditions may limit the ability to achieve adequate distribution of chemical-oxidants. Enhanced biodegradation involves the enhancement of natural biological processes to destroy the target contaminants.

Alternative 5 would reduce the mobility of groundwater contamination via extraction, but would not meet the requirement of reduction in toxicity and volume unless it included the use of vapor phase carbon and the subsequent treatment of any spent carbon.

Alternatives 2, 3 and 4 would best meet this evaluation criterion.

Implementability. Alternative 1 does not require any activities to be implemented; however, it would be difficult to obtain regulatory approval of this alternative.

The technologies used for implementation of Alternatives 2, 3 and 4 are generally becoming more widely used and accepted, and would not be significantly difficult to implement. Services and materials required to implement these alternatives are readily available. Some difficulties in implementation of in-situ treatment would occur due to the location of the active roadways and structures located at the proposed off-site treatment areas. In general, the reagents used for in-situ enhanced biodegradation are long-lasting and travel with groundwater flow, in comparison with chemical oxidants. However, the conceptual design of Alternative 3 includes the injection of permanganate, which is longer lasting than other oxidants and therefore will travel with groundwater flow. Injections could be conducted upgradient of impacted areas if structures, roadways, and associated access agreements require it. Alternative 2 relies upon biological reactions which can be time consuming. Alternative 3 requires that the injected chemical oxidants are in direct contact with contaminated media in order to destroy contaminants. Alternative 4 is a combination of the approaches of Alternatives 2 and 3. Based on preliminary site investigations, site conditions are favorable for enhanced biodegradation since micro-organism currently exist and the pH conditions are about neutral. Preliminary investigations also suggest high PNOD values, which indicate that a large quantity of chemical oxidants might be required for successful injections. Large quantities of oxidants may be difficult to inject into the formation using direct push technologies, but is relatively easy to mix into an open excavation full of groundwater. The chemical oxidants are fast acting once in contact with groundwater and the soil oxidant demand would not consume the oxidants since the soil would be removed from the excavation.

Alternative 5 relies upon technology and construction methods that are well developed and accepted and are relatively easy to implement; however, Alternative 5 would likely require multiple access agreements for construction of the extraction wells and piping trenches. This alternative also relies primarily on hydraulic control of contaminated groundwater to be effective and would have to be monitored closely.

Alternatives 2 and 4 rate highest at implementability, followed by Alternative 5.

Cost. A comparison of the capital and long-term costs associated with the remedial alternatives is presented in Table 12.1. The costs for Alternative 1 is $0 per year, with no costs for capital improvements, however, the alternative does not provide any remediation of existing conditions. The most cost effective approach to meet the SCGs is Alternative 2 followed by Alternative 4. The following is a summary of the capital costs and NPW for the various alternatives.

Alternative No / Name	Capital Costs	Net Present Worth
1 – No Action	$ 0	$ 0
2 – In-situ Enhanced Bio	$ 492,000	$ 1,259,000
3 – In-situ Chem-Ox	$ 1,760,000	$ 2,527,000
4 – Combined In-situ Chem-Ox & Enhanced Bio	$ 640,000	$ 1,407,000
5 – GW Extraction & Treatment	$ 628,000	$ 3,746,000

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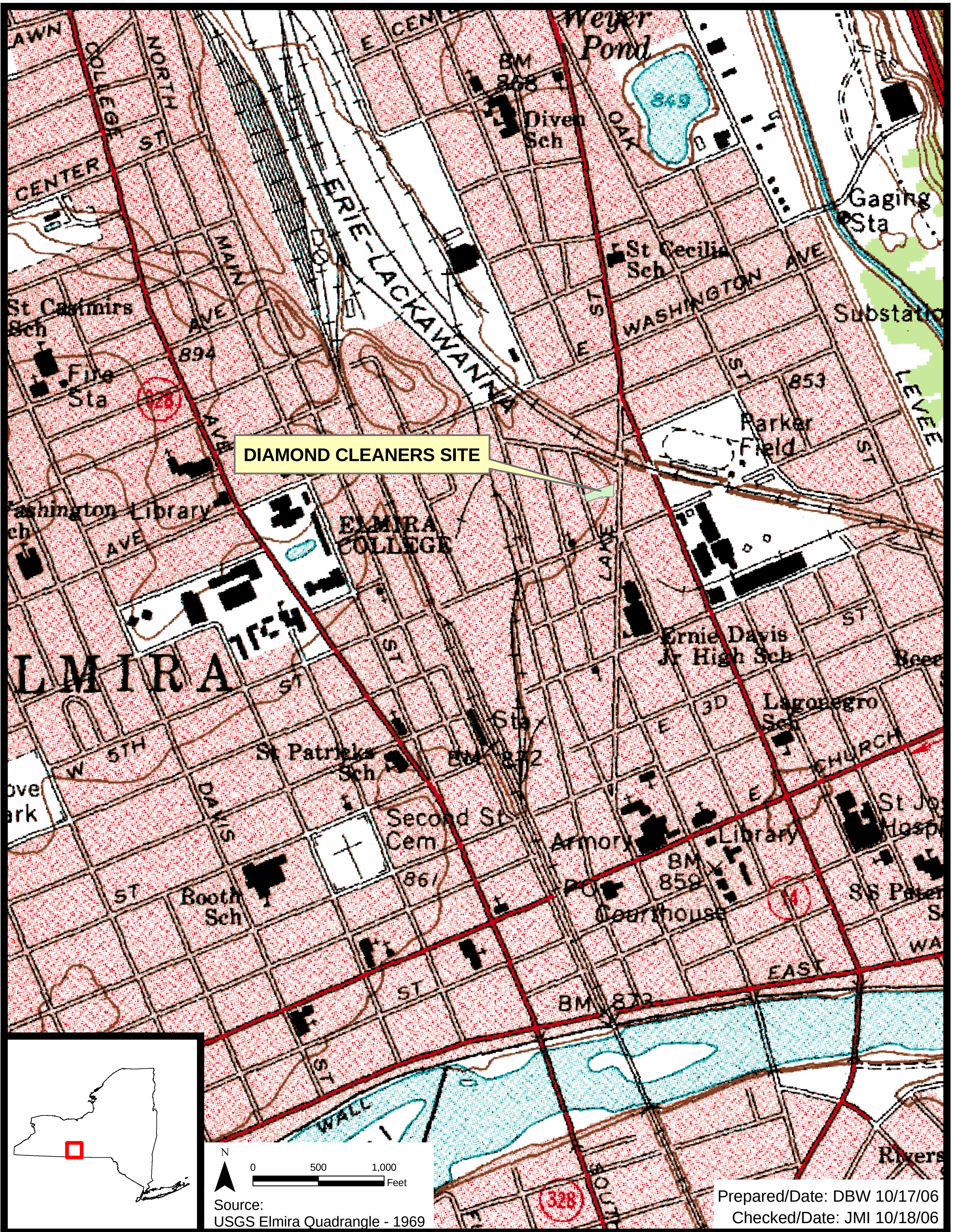
FIGURES



Source:
USGS Elmira Quadrangle - 1969

Prepared/Date: DBW 10/17/06
Checked/Date: JMI 10/18/06

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Elmira, New York

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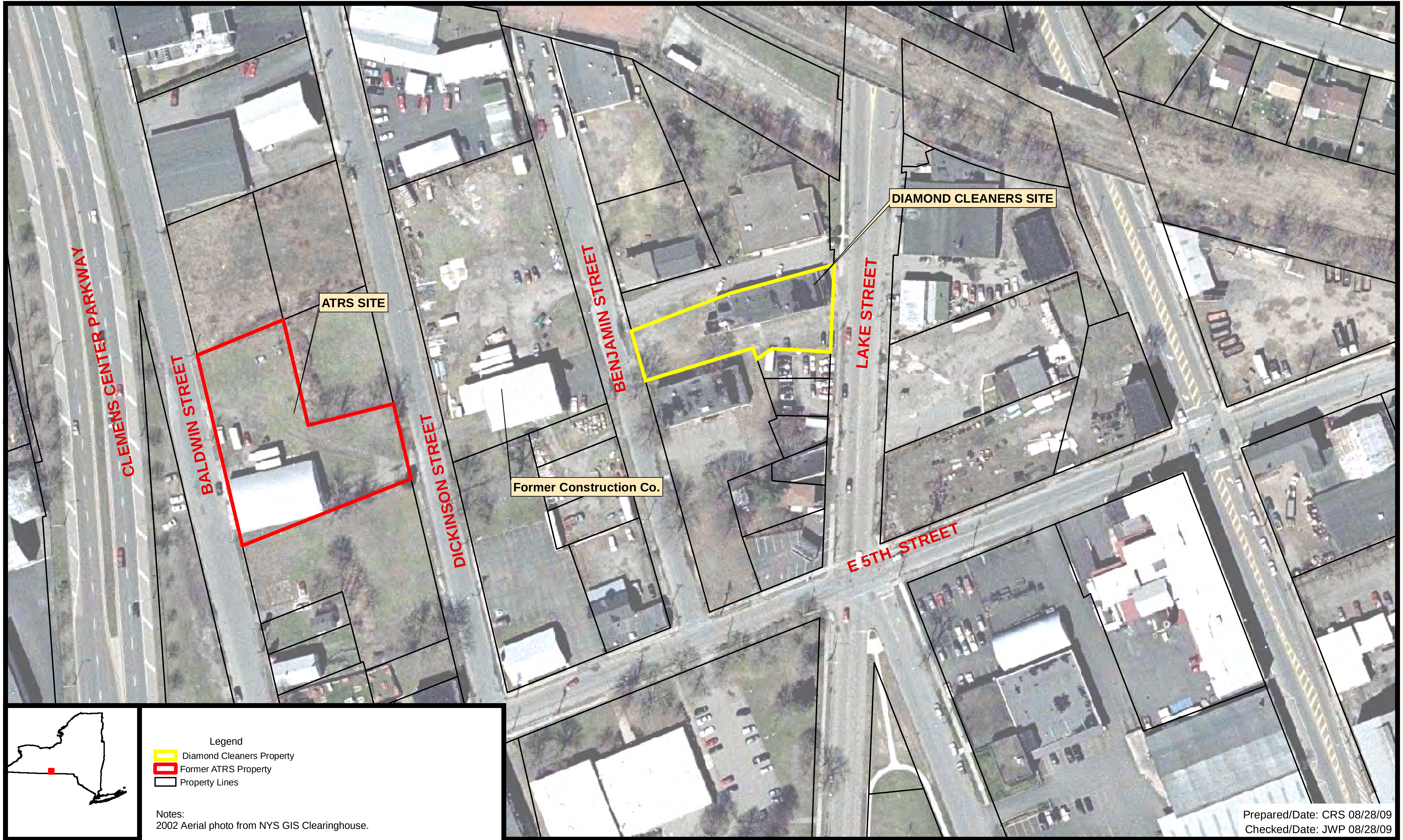
Site Location
Project 3612-05-2028
Figure 1.1



Legend

🟨 Diamond Cleaners Property

🟥 Former ATRS Property

☐ Property Lines

Notes:
2002 Aerial photo from NYS GIS Clearinghouse.

Prepared/Date: CRS 08/28/09
Checked/Date: JWP 08/28/09

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Elmira, New York

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Site Features

Project 3612-06-2070

Figure 1.2

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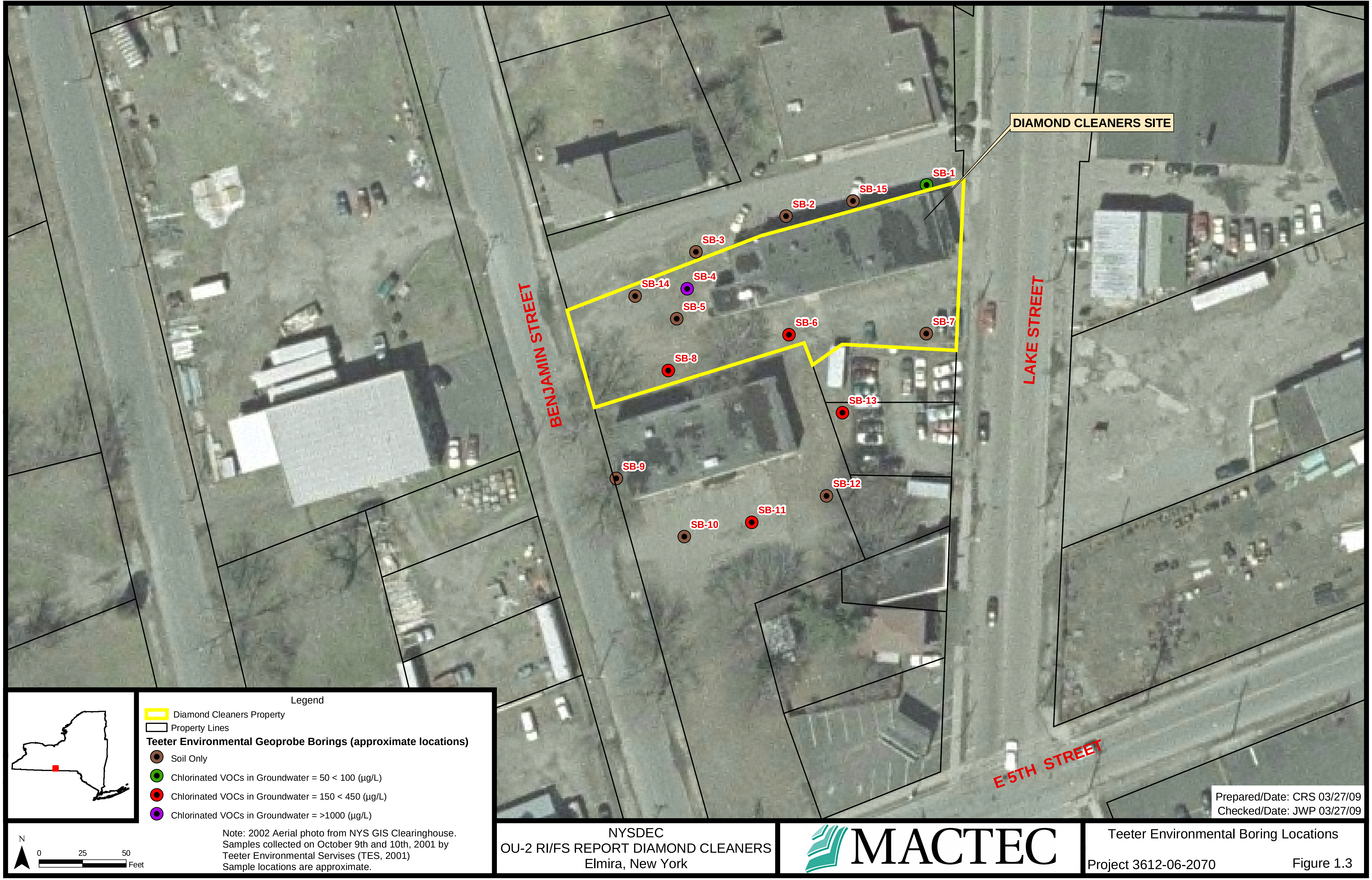

Legend

- ▭ Diamond Cleaners Property
- ▭ Property Lines

Teeter Environmental Geoprobe Borings (approximate locations)

- ● Soil Only
- ● Chlorinated VOCs in Groundwater = 50 < 100 (µg/L)
- ● Chlorinated VOCs in Groundwater = 150 < 450 (µg/L)
- ● Chlorinated VOCs in Groundwater = >1000 (µg/L)

Note: 2002 Aerial photo from NYS GIS Clearinghouse.
Samples collected on October 9th and 10th, 2001 by
Teeter Environmental Servises (TES, 2001)
Sample locations are approximate.

Prepared/Date: CRS 03/27/09
Checked/Date: JWP 03/27/09

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Teeter Environmental Boring Locations

Project 3612-06-2070

Figure 1.3

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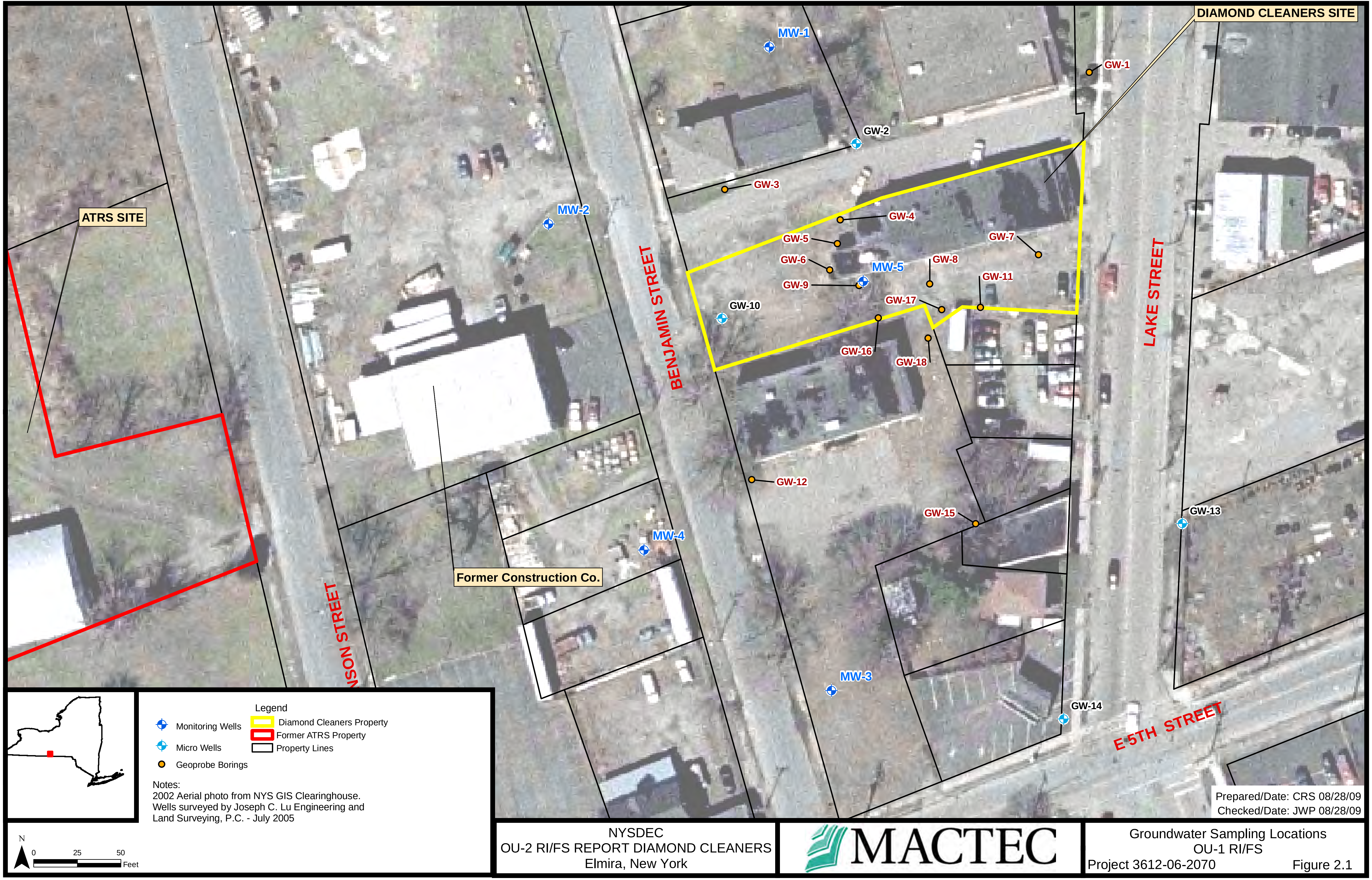

Legend

⌖	Monitoring Wells	🟨	Diamond Cleaners Property
⌖	Micro Wells	🟥	Former ATRS Property
●	Geoprobe Borings	☐	Property Lines

Notes:
2002 Aerial photo from NYS GIS Clearinghouse.
Wells surveyed by Joseph C. Lu Engineering and
Land Surveying, P.C. - July 2005

Prepared/Date: CRS 08/28/09
Checked/Date: JWP 08/28/09

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Groundwater Sampling Locations
OU-1 RI/FS
Project 3612-06-2070

Figure 2.1

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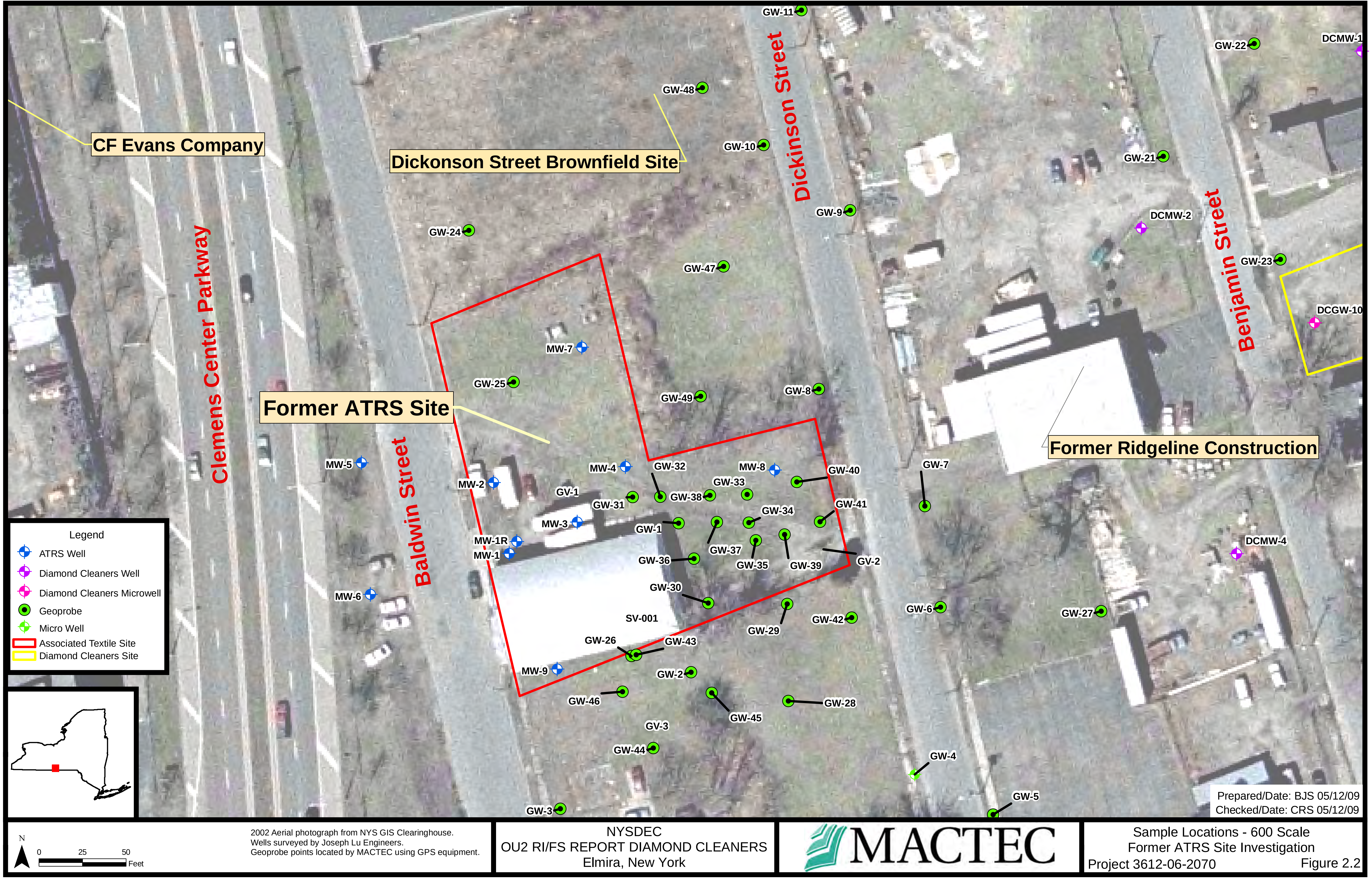

Prepared/Date: BJS 05/12/09
Checked/Date: CRS 05/12/09

2002 Aerial photograph from NYS GIS Clearinghouse.
Wells surveyed by Joseph Lu Engineers.
Geoprobe points located by MACTEC using GPS equipment.

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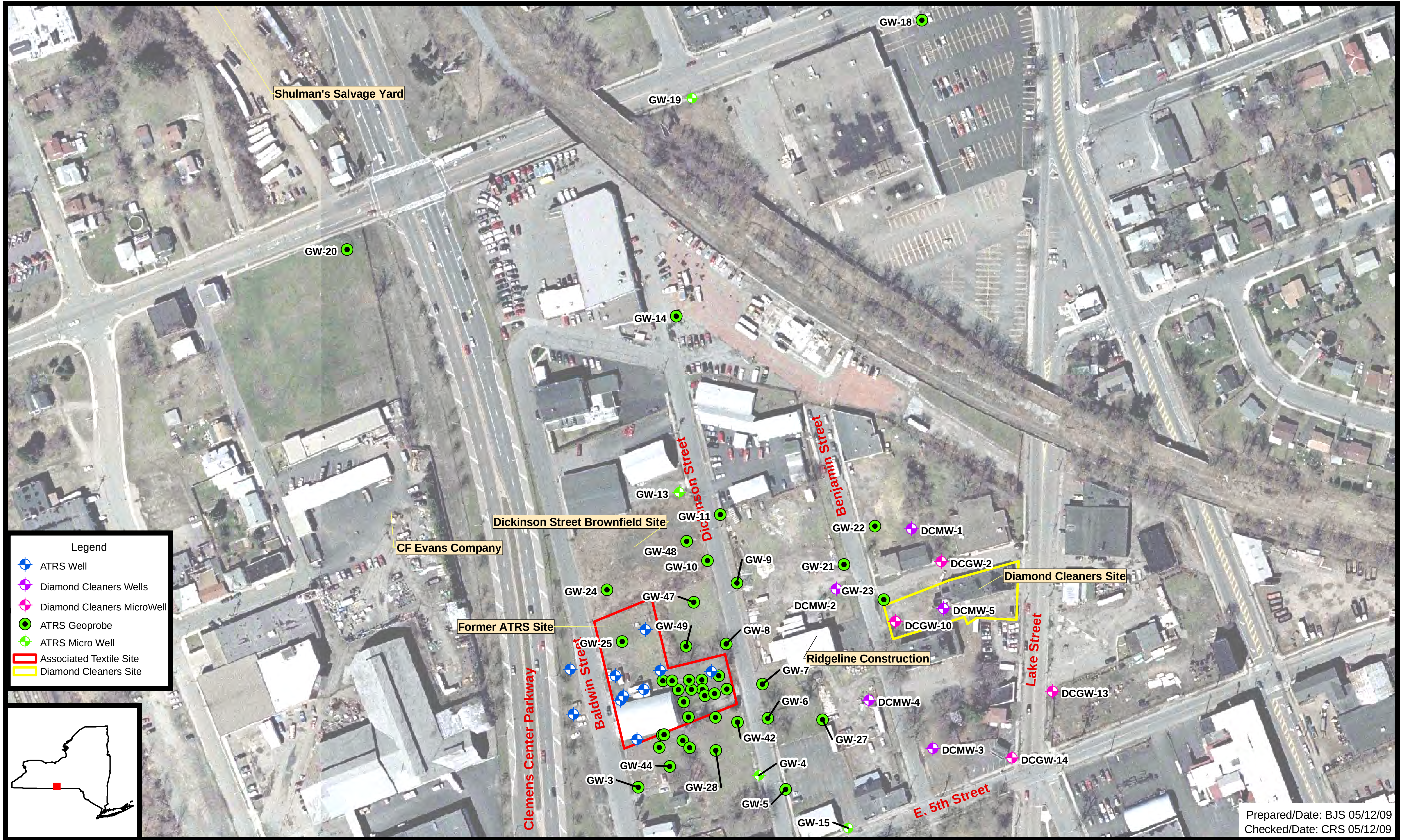
Sample Locations - 600 Scale
Former ATRS Site Investigation
Project 3612-06-2070 Figure 2.2

E. 5



N
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Feet

2002 Aerial photograph from NYS GIS Clearinghouse.
Wells surveyed by Joseph Lu Engineers.
Geoprobe points located by MACTEC using GPS equipment.

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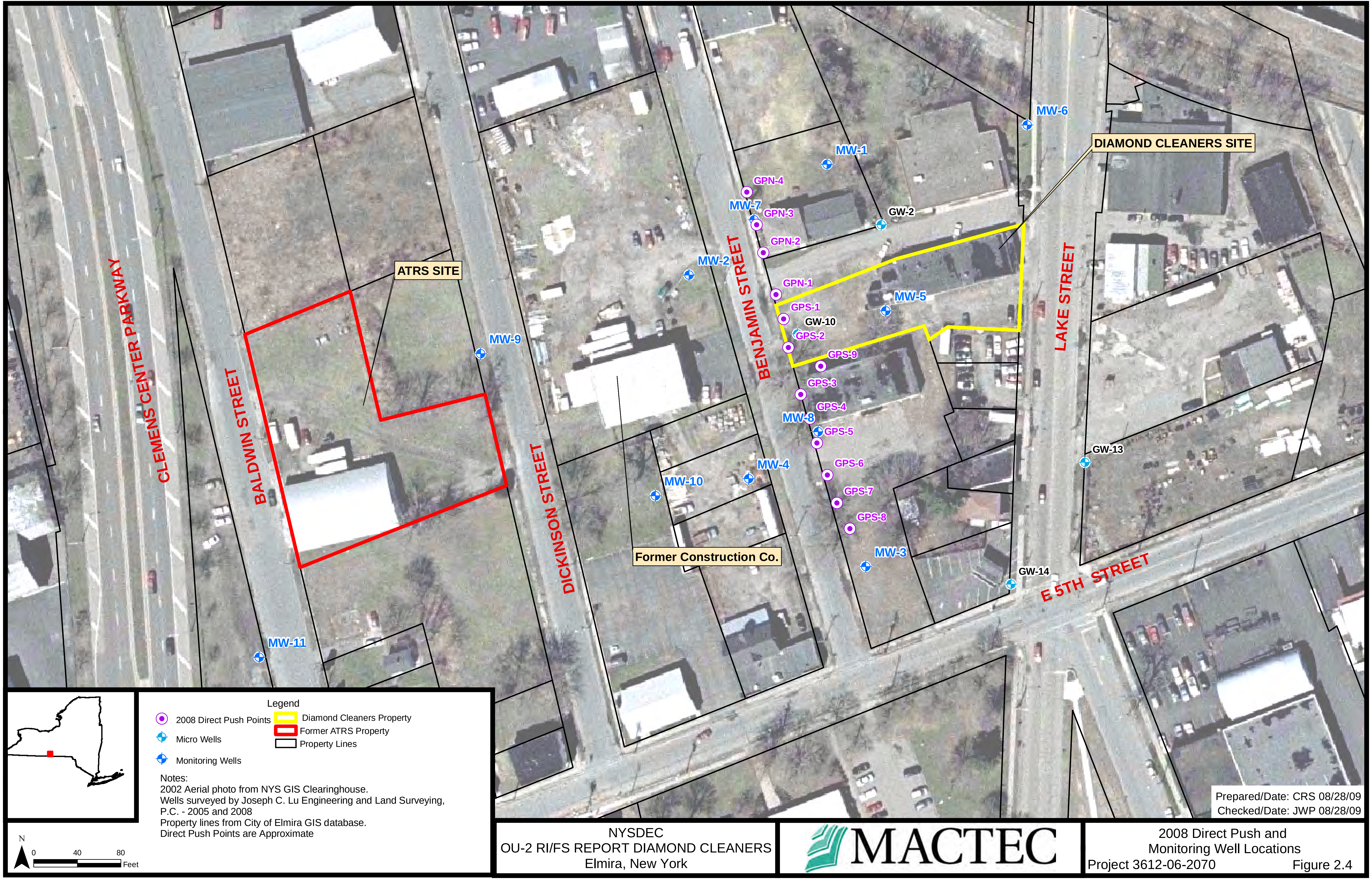
Sample Locations - 1800 Scale
Former ATRS Site Investigation
Project 3612-06-2070 Figure 2.3



Legend

◉ 2008 Direct Push Points	🟨 Diamond Cleaners Property
✦ Micro Wells	🟥 Former ATRS Property
✦ Monitoring Wells	☐ Property Lines

Notes:
2002 Aerial photo from NYS GIS Clearinghouse.
Wells surveyed by Joseph C. Lu Engineering and Land Surveying, P.C. - 2005 and 2008
Property lines from City of Elmira GIS database.
Direct Push Points are Approximate

Prepared/Date: CRS 08/28/09
Checked/Date: JWP 08/28/09

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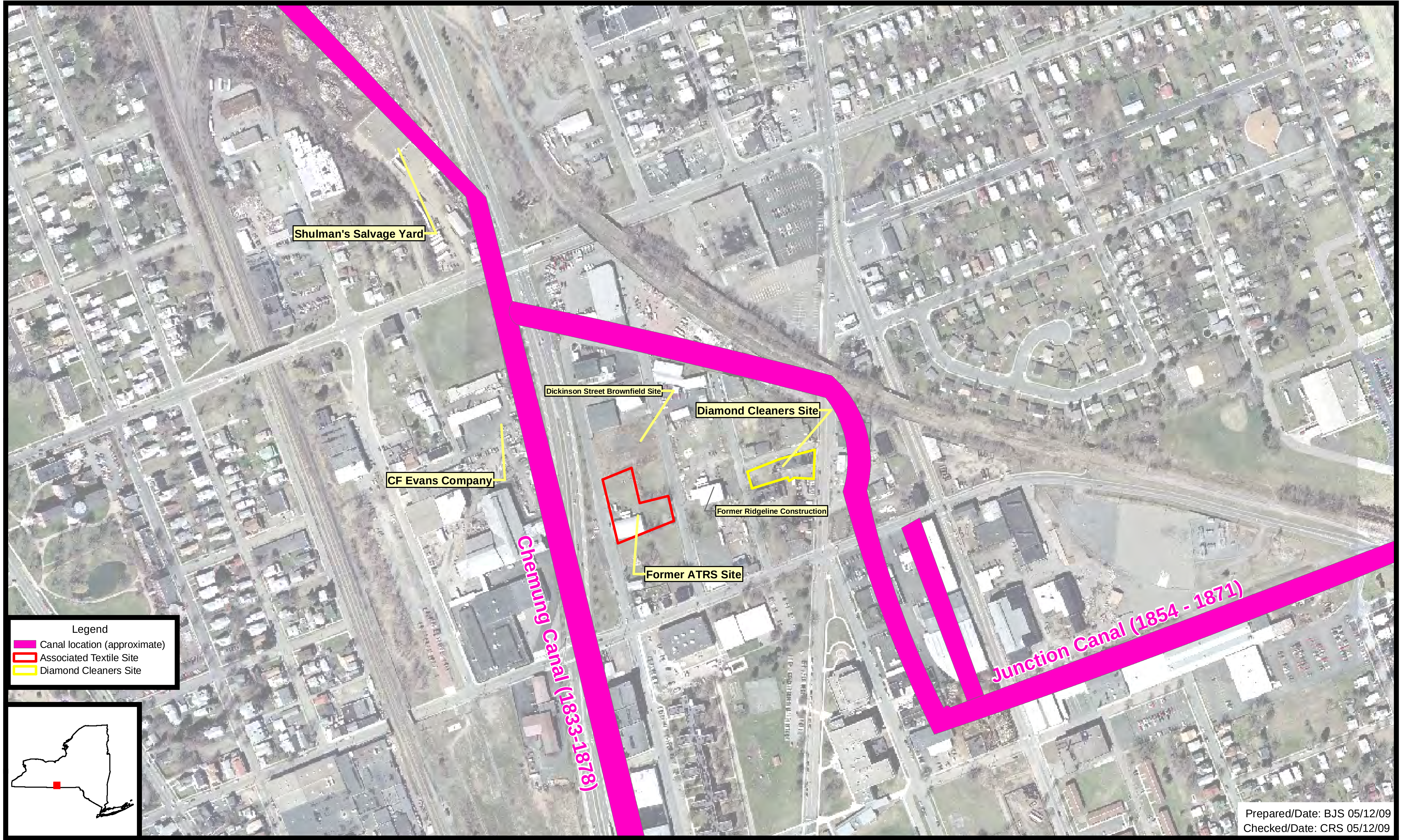
2008 Direct Push and
Monitoring Well Locations
Project 3612-06-2070 Figure 2.4



Prepared/Date: BJS 05/12/09
Checked/Date: CRS 05/12/09

2002 Aerial photograph from NYS GIS Clearinghouse.
Location of canals approximated from 1869 City of Elmira map.
(Canal dates approximated from http:/en.wikipedia.org)

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Appoximate Location of Chemung Canal
and Junction Canal
Project 3612-06-2070

Figure 3.1

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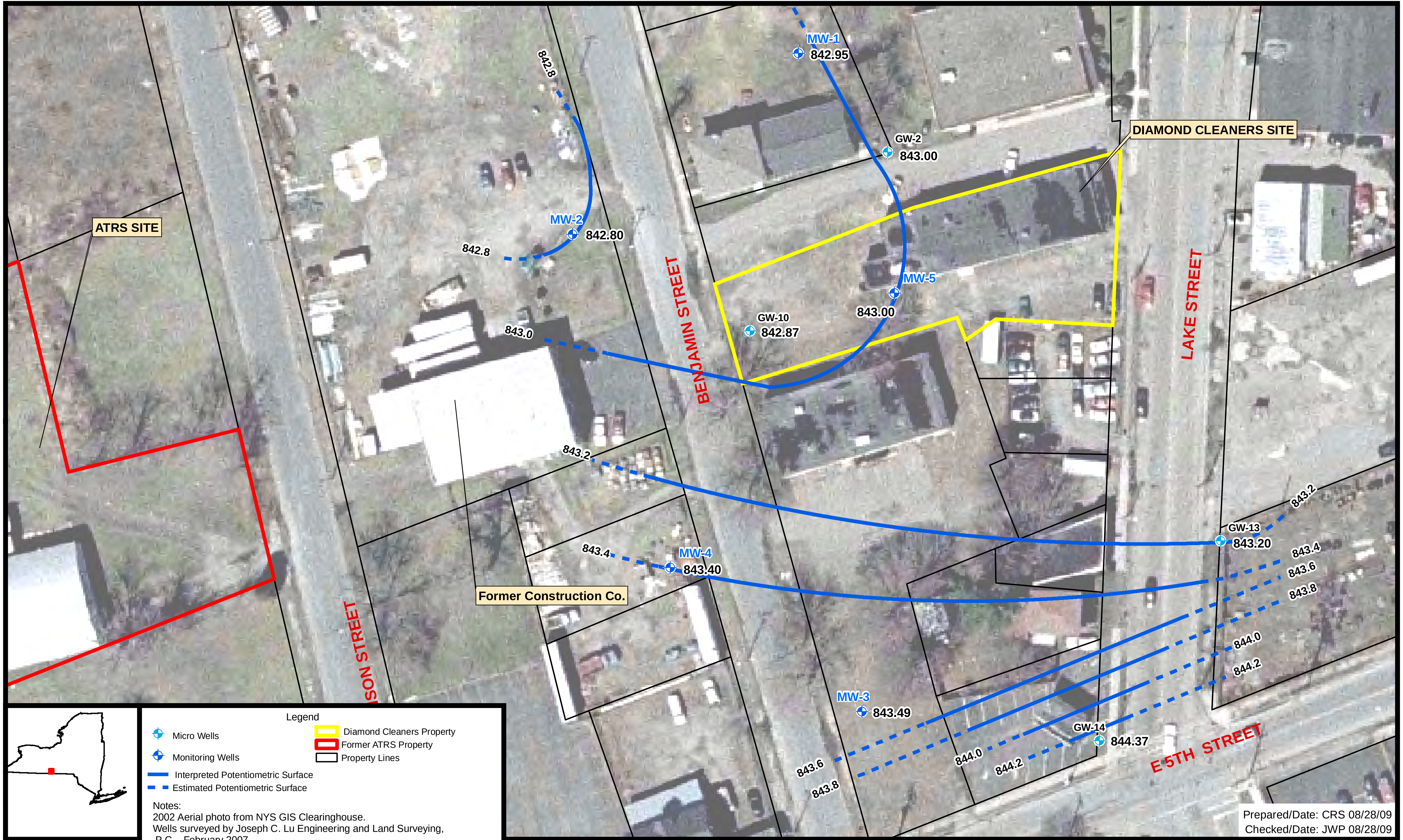

Notes:
2002 Aerial photo from NYS GIS Clearinghouse.
Wells surveyed by Joseph C. Lu Engineering and Land Surveying, P.C. - February 2007
Water levels measured by MACTEC on March 23, 2006.

N
0 25 50
Feet

Prepared/Date: CRS 08/28/09
Checked/Date: JWP 08/28/09

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Elmira, New York

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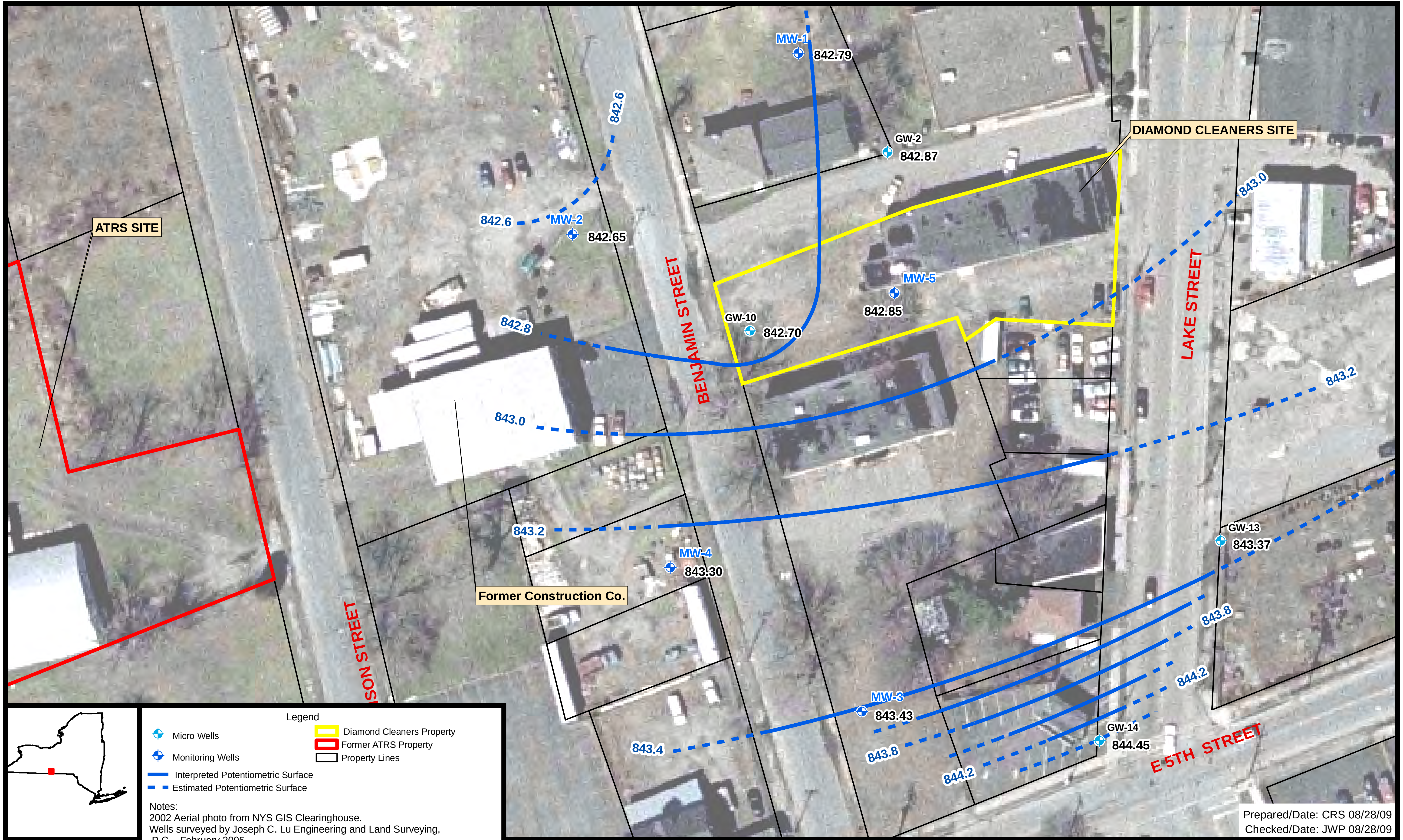
Groundwater and Potentiometric Surface Map
March 2006
Project 3612-06-2070 Figure 3.2



Legend

⌖ Micro Wells	🟨 Diamond Cleaners Property
⌖ Monitoring Wells	🟥 Former ATRS Property
	☐ Property Lines

━ Interpreted Potentiometric Surface
╍ Estimated Potentiometric Surface

Notes:
2002 Aerial photo from NYS GIS Clearinghouse.
Wells surveyed by Joseph C. Lu Engineering and Land Surveying, P.C. - February 2005
Water levels measured by MACTEC on May 3, 2006.

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Groundwater and Potentiometric Surface Map
May 2006
Project 3612-06-2070 Figure 3.3

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Legend

🟢	Micro Well
🔵	Monitoring Well
━	Interpreted Groundwater Contours- 11/2006
🟥	Associated Textile Site
🟨	Diamond Cleaners Site

Notes:
Elevations in Feet above mean see level, NAVD 1983.
NM = Not Measured.
Contour lines dashed where inferred -some wells not used in contouring based on professional judgement (DCGW-14).

Prepared/Date: BJS 05/12/09
Checked/Date: CRS 05/12/09

N
0 75 150
Feet

2002 Aerial photograph from NYS GIS Clearinghouse.
Wells surveyed by Joseph Lu Engineers.

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Interpreted Groundwater Contours
November 2006
Project 3612-06-2070

Figure 3.4

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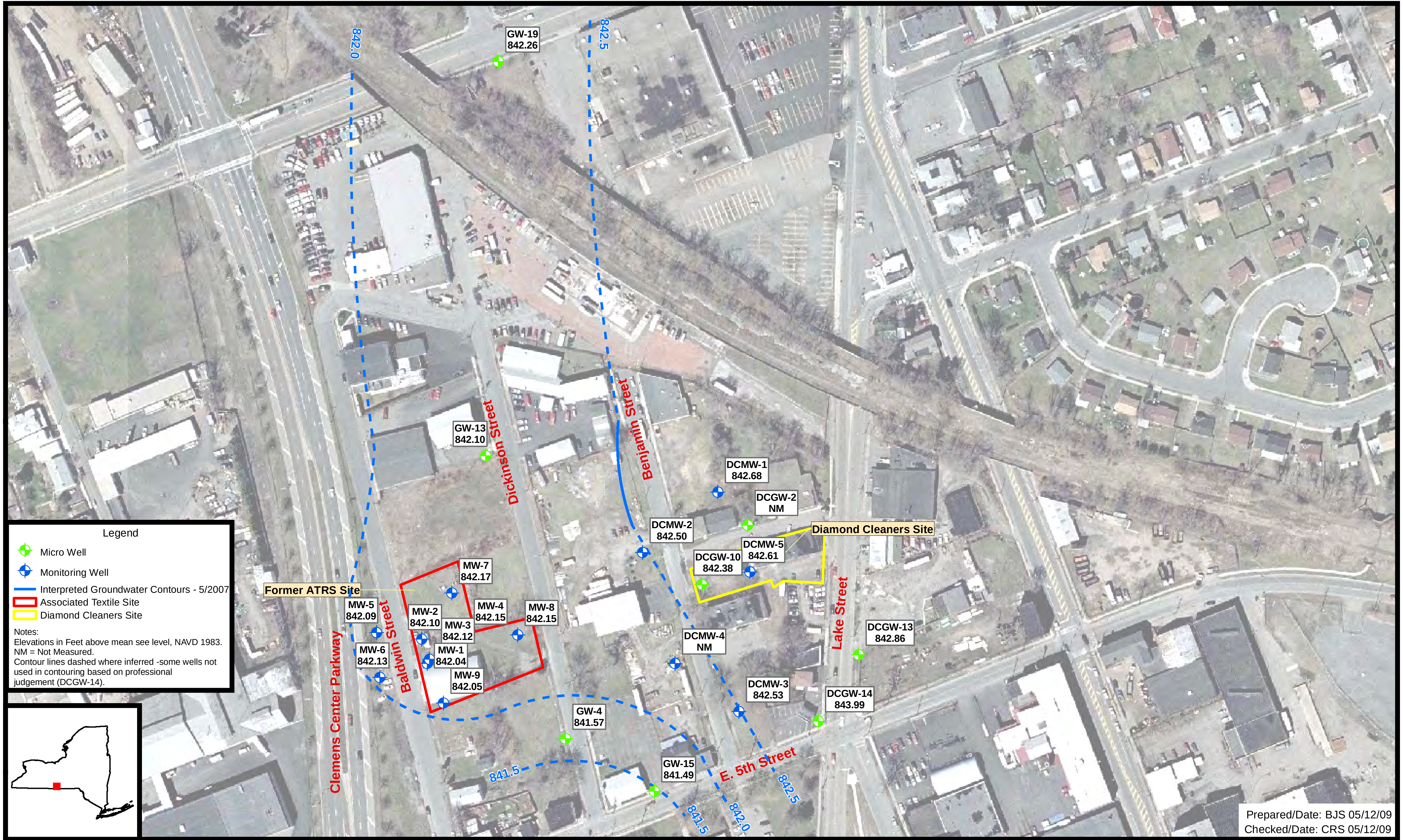

Legend

- Micro Well
- Monitoring Well
- Interpreted Groundwater Contours - 5/2007
- 🟥 Associated Textile Site
- 🟨 Diamond Cleaners Site

Notes:
Elevations in Feet above mean see level, NAVD 1983.
NM = Not Measured.
Contour lines dashed where inferred -some wells not used in contouring based on professional judgement (DCGW-14).

Prepared/Date: BJS 05/12/09
Checked/Date: CRS 05/12/09

N
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Feet

2002 Aerial photograph from NYS GIS Clearinghouse.
Wells surveyed by Joseph Lu Engineers.

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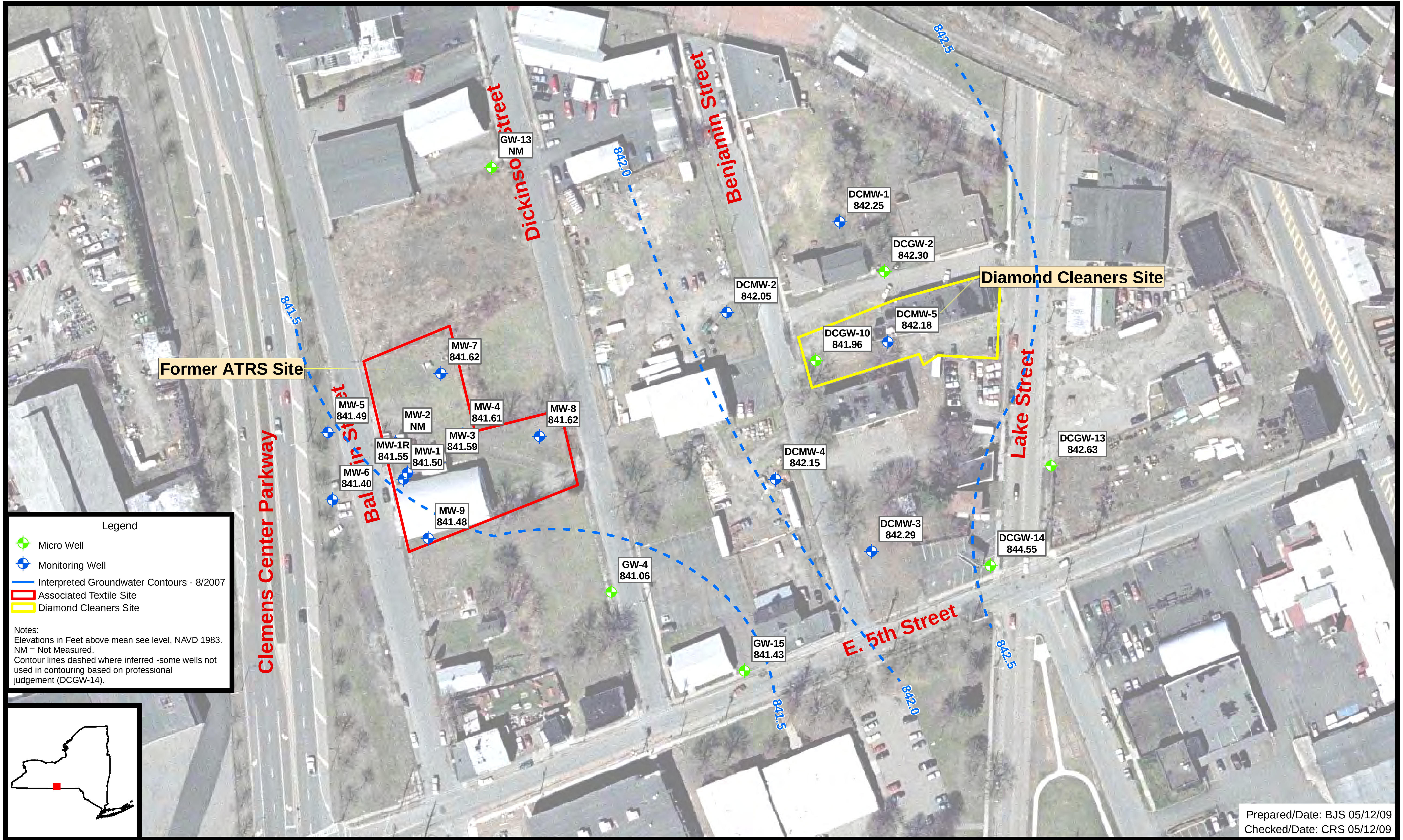
Interpreted Groundwater Contours
May 2007
Project 3612-06-2070

Figure 3.5



Legend

- ⊕ Micro Well
- ⊕ Monitoring Well
- — Interpreted Groundwater Contours - 8/2007
- 🟥 Associated Textile Site
- 🟨 Diamond Cleaners Site

Notes:
Elevations in Feet above mean see level, NAVD 1983.
NM = Not Measured.
Contour lines dashed where inferred -some wells not used in contouring based on professional judgement (DCGW-14).

Prepared/Date: BJS 05/12/09
Checked/Date: CRS 05/12/09

N
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Feet

2002 Aerial photograph from NYS GIS Clearinghouse.
Wells surveyed by Joseph Lu Engineers.
Groundwater measurements collected by MACTEC on 8/29/07.

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Interpreted Groundwater Contours
August 2007
Project 3612-06-2070 Figure 3.6

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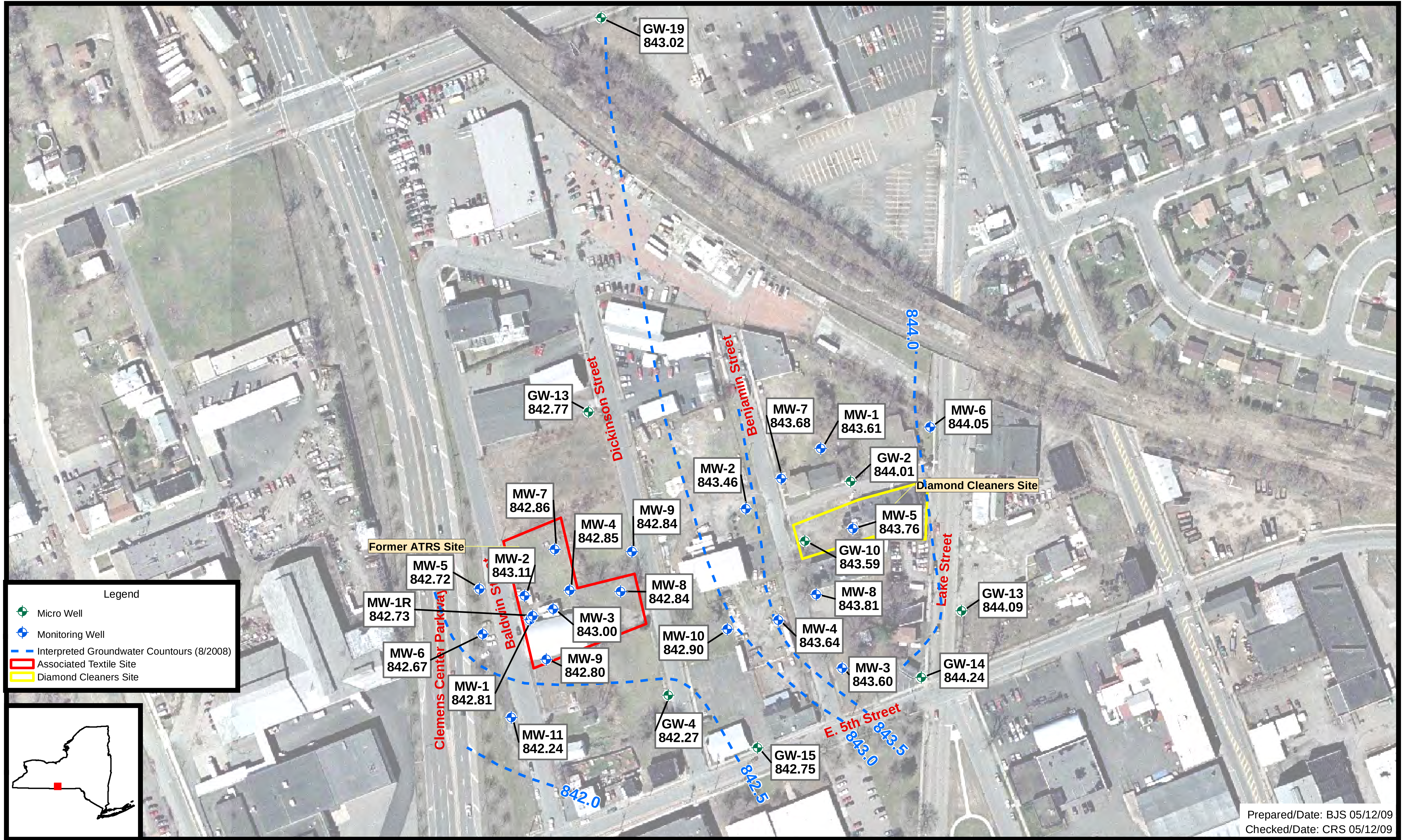

Prepared/Date: BJS 05/12/09
Checked/Date: CRS 05/12/09

N
0 75 150
Feet

2002 Aerial photograph from NYS GIS Clearinghouse.
Wells surveyed by Joseph Lu Engineers.
Groundwater measurements collected by MACTEC on 8/11/2008.
Elevations in Feet above mean see level, NAVD 1983.

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Interpreted Groundwater Contours
August 2008
Project 3612-06-2070

Figure 3.7

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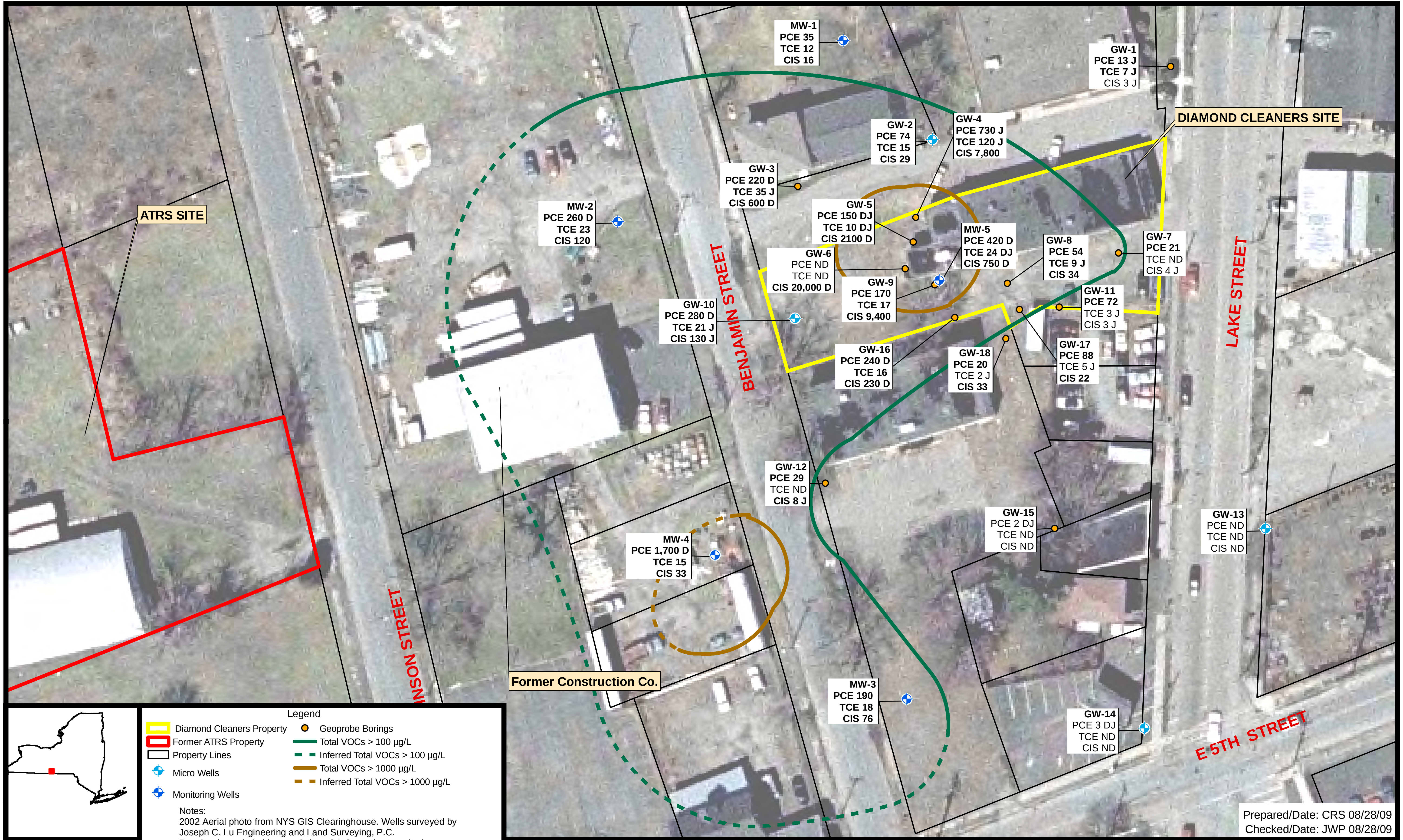

Notes:
2002 Aerial photo from NYS GIS Clearinghouse. Wells surveyed by
Joseph C. Lu Engineering and Land Surveying, P.C.
Results shown in bold exceed class GA Groundwater criteria.
(results in µg/L; ND = Not Detected)
CIS= Cis-1,2-Dichloroethene PCE= Tetrachloroethene TCE= Trichloroethene
Samples collected by MACTEC in June and November - 2005.
Only results for PCE, TCE and CIS are shown.

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Checked/Date: JWP 08/28/09

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PCE, TCE, and Cis-1,2-DCE Detections
in Groundwater - June and November 2005
Project 3612-06-2070 Figure 4.1

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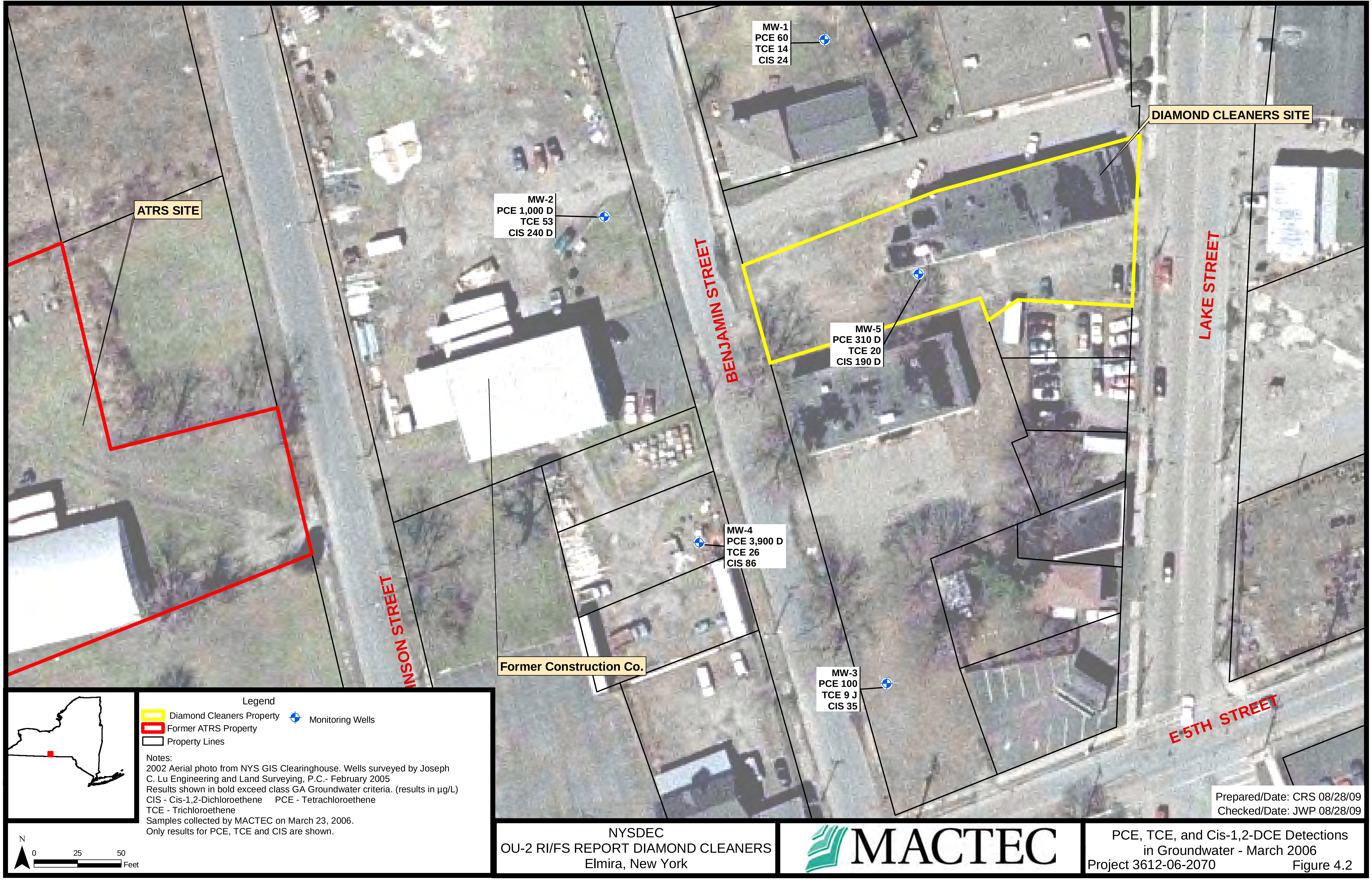

Notes:
2002 Aerial photo from NYS GIS Clearinghouse. Wells surveyed by Joseph C. Lu Engineering and Land Surveying, P.C.- February 2005
Results shown in bold exceed class GA Groundwater criteria. (results in µg/L)
CIS - Cis-1,2-Dichloroethene PCE - Tetrachloroethene
TCE - Trichloroethene
Samples collected by MACTEC on March 23, 2006.
Only results for PCE, TCE and CIS are shown.

Prepared/Date: CRS 08/28/09
Checked/Date: JWP 08/28/09

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Elmira, New York

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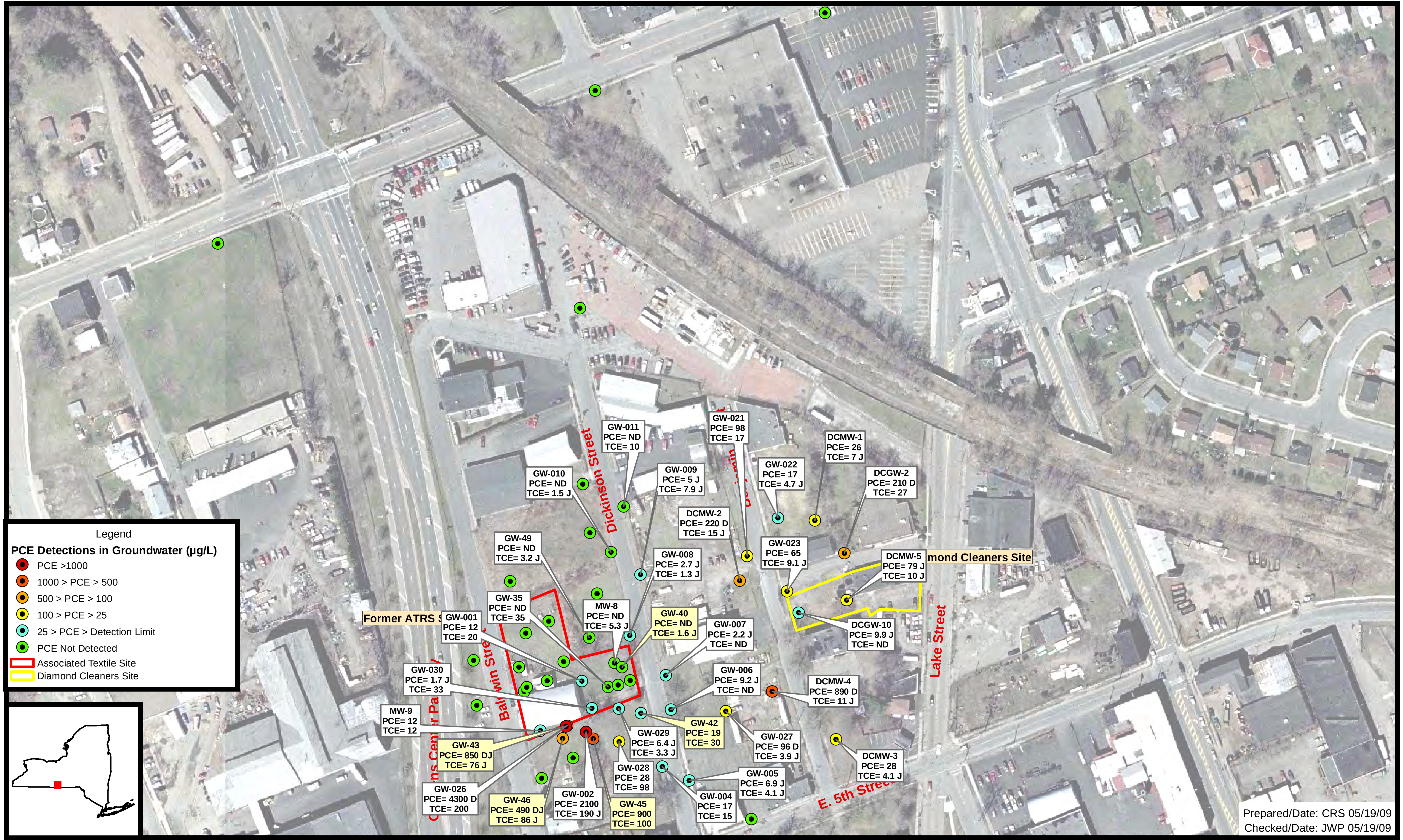
PCE, TCE, and Cis-1,2-DCE Detections
in Groundwater - March 2006
Project 3612-06-2070 Figure 4.2



N
0 75 150
Feet

2002 Aerial photograph from NYS GIS Clearinghouse.
Wells surveyed by Joseph Lu Engineers, February 6, 2007.
Geoprobe points located by MACTEC using GPS equipment.
Samples collected by MACTEC between 10/31/06 and 11/17/06 and on 8/28 and 29/07 (2007 sample results are highlighted in yellow).

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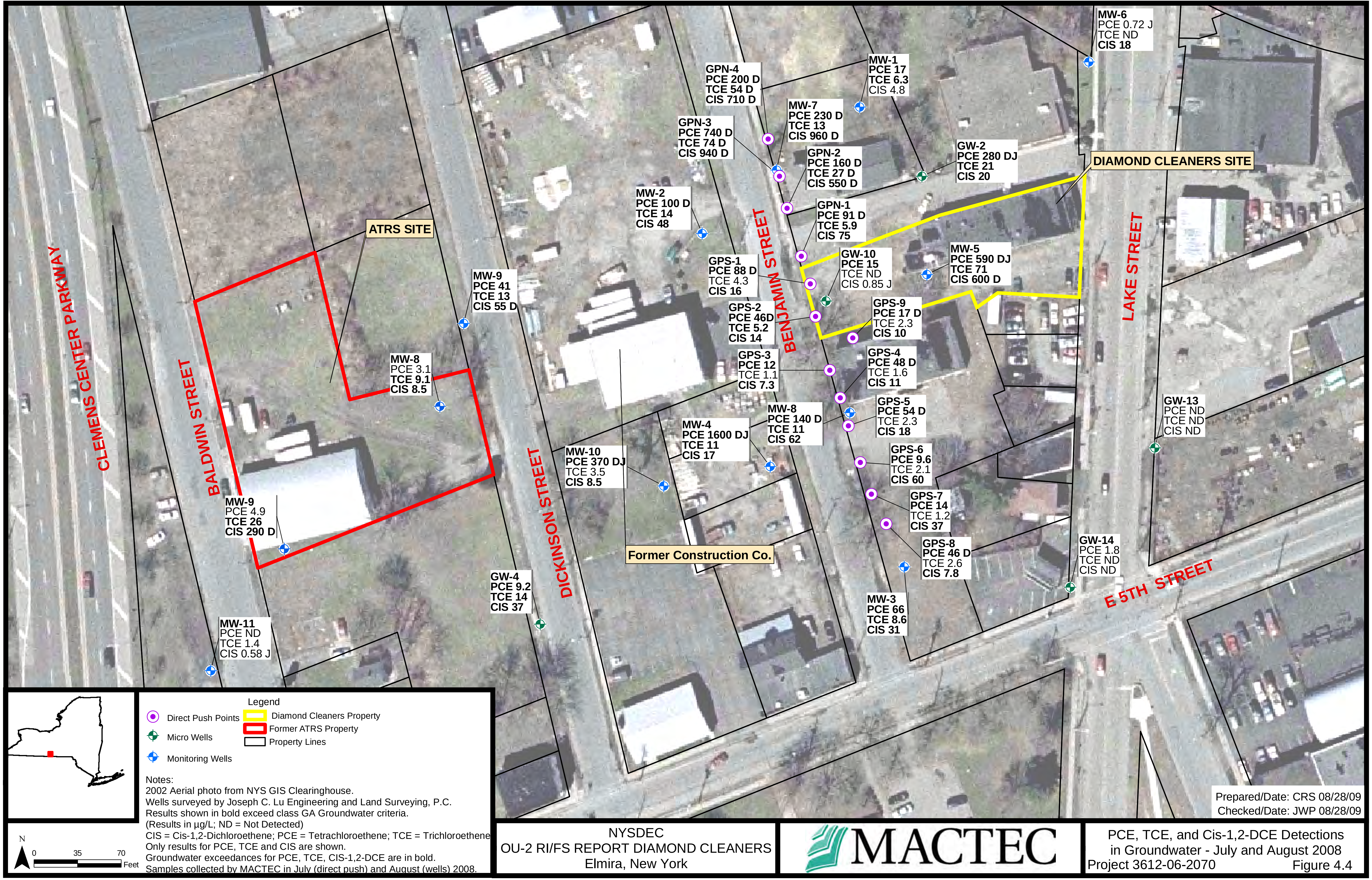
Maximum PCE and TCE Detections in Groundwater
October/November 2006 and August 2007

Project 3612-06-2070

Figure 4.3



Legend

- ◉ Direct Push Points
- ⊕ Micro Wells
- ⊕ Monitoring Wells
- 🟨 Diamond Cleaners Property
- 🟥 Former ATRS Property
- ☐ Property Lines

Notes:
2002 Aerial photo from NYS GIS Clearinghouse.
Wells surveyed by Joseph C. Lu Engineering and Land Surveying, P.C.
Results shown in bold exceed class GA Groundwater criteria.
(Results in µg/L; ND = Not Detected)
CIS = Cis-1,2-Dichloroethene; PCE = Tetrachloroethene; TCE = Trichloroethene
Only results for PCE, TCE and CIS are shown.
Groundwater exceedances for PCE, TCE, CIS-1,2-DCE are in bold.
Samples collected by MACTEC in July (direct push) and August (wells) 2008.

Prepared/Date: CRS 08/28/09
Checked/Date: JWP 08/28/09

NYSDEC
OU-2 RI/FS REPORT DIAMOND CLEANERS
Elmira, New York

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PCE, TCE, and Cis-1,2-DCE Detections
in Groundwater - July and August 2008
Project 3612-06-2070 Figure 4.4

Notes:
2002 Aerial photo from NYS GIS Clearinghouse. Wells (MW) surveyed by Joseph C. Lu Engineering and Land Surveying, P.C. Direct push locations (GW) surveyed by GPS.
Results are maximum detection of each compound per location over time. (results in µg/L; ND = Not Detected)
CIS= Cis-1,2-Dichloroethene PCE= Tetrachloroethene TCE= Trichloroethene
Samples collected by MACTEC between June 2005 and August 2008.
Only results for PCE, TCE and CIS are shown.

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OU-2 RI/FS REPORT DIAMOND CLEANERS
Elmira, New York

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Maximum PCE, TCE, and Cis-1,2-DCE Detections in Groundwater - 2005 to 2008
Project 3612062070
Figure 5.1

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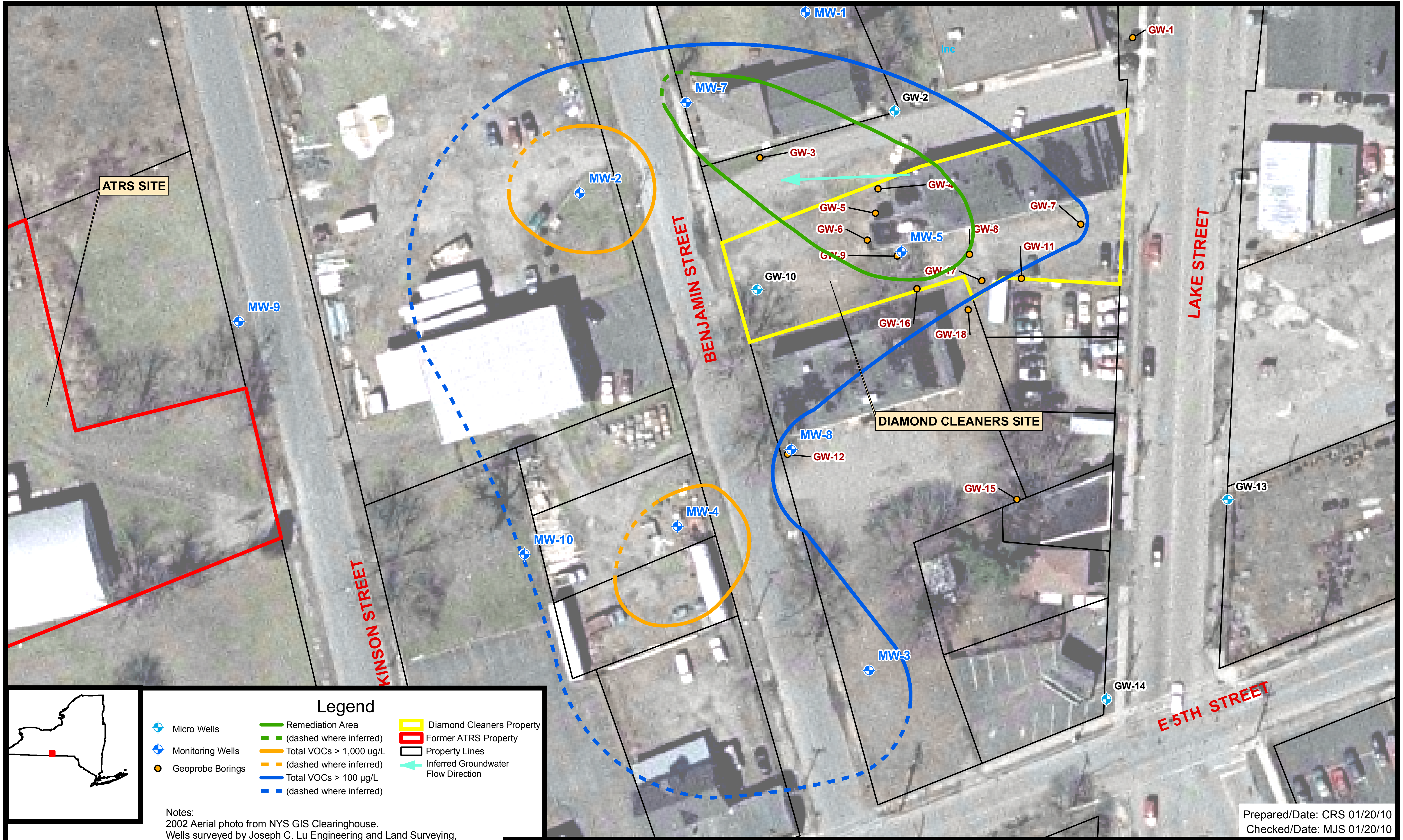
Document: P:\Projects\nysdec1\projects\Diamond Cleaners\4.0 Project Deliverables\4.5 Databases\GIS Data\Map Documents\FS_Report_LS_11X17.mxd PDF: P:\Projects\nysdec1\projects\Diamond Cleaners\4.0 Project Deliverables\4.1 Reports\2009-OU-2-RI-FS\Figures\Figure 8.1_updated-1.20.2010.pdf 01/20/2010 5:03 PM crstaples



Notes:
2002 Aerial photo from NYS GIS Clearinghouse.
Wells surveyed by Joseph C. Lu Engineering and Land Surveying, P.C. - 2005 and 2008
Property lines from City of Elmira GIS database.
Direct Push Points are Approximate

Prepared/Date: CRS 01/20/10
Checked/Date: MJS 01/20/10

NYSDEC
OU-2 RI/FS REPORT DIAMOND CLEANERS
Elmira, New York

MACTEC

Groundwater Remediation Area
Project 3612-06-2070

Figure 8.1

TABLES

Table 1.1: Teeter Groundwater Results

	Boring	**SB1**	**SB4**	**SB6**	**SB8**	**SB11**	**SB13**
	Depth (ft bgs)	**20'-24'**	**20'-24'**	**18'-22'**	**16'-20'**	**14'-18'**	**16'-20'**
		Result (µg/L)	**Result (µg/L)**	**Result (µg/L)**	**Result (µg/L)**	**Result (µg/L)**	**Result (µg/L)**
Analyte	**GW Standard (µg/L)**						
Chlorinated Hydrocarbons							
cis-1,2-Dichloroethene	5	**5.2**	**1,070.0**	**19.9**	**282.0**	**72.2**	**57.3**
trans-1,2-Dichloroethene	5	ND<0.5	ND<2.5	ND<1.0	2.5	ND<0.5	ND<0.5
Methylene Chloride	5	ND<0.5	2.5	ND<1.0	ND<0.5	ND<0.5	ND<0.5
Tetrachloroethene	5	**43.3**	**115.0**	**136.0**	**98.5**	**158.0**	**116.0**
Trichloroethene	5	**13.4**	**20.4**	**12.8**	**20.7**	**12.1**	**16.0**
Vinyl Chloride	2	ND<0.5	**280.0**	1.5	**3.1**	ND<0.5	**2.6**
Non-Chlorinated Hydrocarbons							
Benzene	1	0.7	ND<2.5	ND<1.0	ND<0.5	0.6	0.5
n-Butylbenzene	5	ND<0.5	ND<2.5	**16.4**	4.8	0.7	0.5
sec-Butylbenzene	5	ND<0.5	**6.5**	**7.7**	2.6	ND<0.5	ND<0.5
Ethylbenzene	5	ND<0.5	**7.7**	**6.7**	ND<0.5	ND<0.5	ND<0.5
Isopropylbenzene	5	ND<0.5	4.9	3.3	0.7	ND<0.5	ND<0.5
4-Isopropyltoluene	5	ND<0.5	**7.0**	4.9	ND<0.5	ND<0.5	ND<0.5
n-Propylbenzene	5	ND<0.5	ND<2.5	ND<1.0	ND<0.5	ND<0.5	ND<0.5
Styrene	5*	ND<0.5	**5.3**	ND<1.0	ND<0.5	ND<0.5	ND<0.5
Toluene	5	1.1	2.6	ND<1.0	0.6	1.0	0.7
1,2,4-Trimethylbenzene	5	0.8	**5.2**	**25.7**	**9.5**	0.8	0.7
1,3,5-Trimethylbenzene	5	ND<0.5	ND<2.5	**7.1**	2.7	ND<0.5	ND<0.5
Xylenes	5	0.9	**11.8**	4.0	1.7	1.3	0.5
MTBE	10	1.4	ND<5.0	2.0	ND<1.0	ND<1.0	ND<1.0
Napthalene	10	ND<0.5	ND<2.5	ND<1.0	ND<0.5	1.6	ND<0.5

Prepared/Date: DB / 10/06/06
Checked/Date: CRS/ 10/20/06

Notes:
Depth (ft bgs) = Sample depth in feet below ground surface.
µg/L = micrograms per liter
GW Standard = Values from NYS Technical and Operational Guidance Series 1.1.1.
Values in **BOLD** excede the Standard or Guidance value.
Samples analyzed for Volatile Aromatic and Aliphatic Hydrocarbons by EPA Method 8021.
ND = Not detected
* = guidance value, not standard
Data from Teeter Environmental Services, 2001-samples collected on October 9th and 10th, 2001.

Table 3.1: DC OU-1 RI/FS Monitoring Well and Groundwater Elevation Data

Well ID	**Riser Elevation**	**DTW TOC (10/3/05)**	**Water Elevation (10/3/05)**	**DTW TOC (11/1/05)**	**Water Elevation (11/1/05)**	**DTW TOC (3/23/06)**	**Water Elevation (3/23/06)**	**DTW TOC (5/3/06)**	**Water Elevation (5/3/06)**
GW-2	855.47	13.17	842.30	12.10	843.37	NA	NA	12.60	842.87
GW-10	854.17	12.10	842.07	11.00	843.17	11.30	842.87	11.47	842.70
GW-13	854.05	11.54	842.51	10.31	843.74	10.85	843.20	10.68	843.37
GW-14	853.79	11.50	842.29	10.16	843.63	9.42	844.37	9.34	844.45
MW-1	854.64	NA	NA	11.44	843.20	11.69	842.95	11.85	842.79
MW-2	854.57	NA	NA	11.51	843.06	11.77	842.80	11.92	842.65
MW-3	853.81	NA	NA	10.55	843.26	10.32	843.49	10.38	843.43
MW-4	853.90	NA	NA	10.56	843.34	10.50	843.40	10.60	843.30
MW-5	853.77	NA	NA	10.53	843.24	10.77	843.00	10.92	842.85

Note:
Elevations in Feet above mean sea level-NAVD-1983. Piezometers surveyed by Lu Engineers on July 13, 2005.
Monitoring wells surveyed by Lu Engineers on January 27, 2006.
DTW=depth to water from top of casing, in feet.
TOC= top of casing

Prepared/Date: JMI 9/07/06
Checked/Date: CRS 9/11/06

Table 3.2: Former ATRS Site Investigation Monitoring Well and Groundwater Elevation Data

Site	Location	Casing Elevation	Riser Elevation	Installation Date	Screen Length	Depth (BTOR) (11/2/2006)	Depth to Water (11/2/06)	Water Elevation (11/2/06)	Depth to Water (11/16/06)	Water Elevation (11/16/06)	Depth to Water (5/9/07)	Water Elevation (5/9/07)	Depth to Water (8/30/07)	Water Elevation (8/30/07)
Associated	GW-4	854.69	854.46	11/8/2006	10	19.6	not installed	not installed	12.42	842.04	12.89	841.57	13.4	841.06
Associated	GW-13	855.03	854.87	11/7/2006	10	19.3	not installed	not installed	12.23	842.64	12.77	842.10	NM	NM
Associated	GW-15	854.40	854.20	11/8/2006	10	17.5	not installed	not installed	11.49	842.71	12.71	841.49	12.77	841.43
Associated	GW-19	848.36	848.12	11/9/2006	10	14.5	not installed	not installed	5.28	842.84	5.86	842.26	NM	NM
Associated	MW-1	856.98	856.72	Unknown	Unknown	18.7	NM	NM	NM	NM	14.68	842.04	15.22	841.50
Associated	MW-1R	856.85	856.41	Unknown	Unknown	19.8	NM	NM	13.92	842.49	14.31	842.10	14.86	841.55
Associated	MW-2	857.04	856.41	Unknown	Unknown	NM	14.05	842.36	13.94	842.47	14.31	842.10	NM	NM
Associated	MW-3	856.85	856.54	Unknown	Unknown	19.9	14.29	842.25	13.93	842.61	14.42	842.12	14.95	841.59
Associated	MW-4	856.96	856.58	Unknown	Unknown	17.8	14.31	842.27	13.98	842.60	14.43	842.15	14.97	841.61
Associated	MW-5	856.02	855.59	Unknown	Unknown	19.6	13.53	842.06	13.21	842.38	13.50	842.09	14.1	841.49
Associated	MW-6	856.34	855.84	Unknown	Unknown	19.1	13.42	842.42	13.33	842.51	13.71	842.13	14.44	841.40
Associated	MW-7	856.82	856.26	Unknown	Unknown	19.4	13.98	842.28	13.62	842.64	14.09	842.17	14.64	841.62
Associated	MW-8	856.41	856.10	Unknown	Unknown	19.2	NM	NM	13.42	842.68	13.95	842.15	14.48	841.62
Associated	MW-9	856.70	856.45	Unknown	Unknown	19.5	14.29	842.16	14.02	842.43	14.40	842.05	14.97	841.48
Diamond	GW-2	855.91	855.47	6/27/2005	10	19.3	NM	NM	NM	NM	NM	NM	13.17	842.30
Diamond	GW-10	854.58	854.17	6/23/2005	10	19.4	NM	NM	10.97	843.20	11.79	842.38	12.21	841.96
Diamond	GW-13	854.46	854.05	6/27/2005	10	25.8	NM	NM	9.78	844.27	11.19	842.86	11.42	842.63
Diamond	GW-14	854.20	853.79	6/27/2005	10	24	NM	NM	8.74	845.05	9.80	843.99	9.24	844.55
Diamond	MW-1	855.59	854.64	10/3/2005	10	24.5	11.77	842.87	11.22	843.42	11.96	842.68	12.39	842.25
Diamond	MW-2	855.02	854.57	10/4/2005	10	24.5	11.87	842.70	no access	no access	12.07	842.50	12.52	842.05
Diamond	MW-3	854.19	853.81	10/4/2005	10	24.5	10.91	842.90	10.33	843.48	11.28	842.53	11.52	842.29
Diamond	MW-4	854.18	853.90	10/5/2005	10	22	11.09	842.81	no access	no access	no access	no access	11.75	842.15
Diamond	MW-5	854.15	853.77	10/5/2005	10	24.5	10.90	842.87	10.32	843.45	11.16	842.61	11.59	842.18

Notes:
Wells surveyed by Joseph Lu Engineers. Horizontal locations are tied to the New York State Plane Coordinate System using NAD of 1983. Vertical elevations were tied to msl, NAVD of 1988.
BTOR - Below top of riser
NM = Not Measured.

Created by: BAS 10/1/2007
Checked by: CRS 11/9/07

Table 3.3: Hydraulic Conductivity Calculations

Well	Test #	Method	K values (ft/min)	Geometric mean	K values (ft/day)	V = Ki/n (ft/day)	V (ft/year)
MW-3	RHT-1	Bouwer-Rice	0.001349	0.001551	2.2	0.01	4.5
MW-3	RHT-1	Hvorslev	0.002498				
MW-3	RHT-2	Bouwer-Rice	0.001007				
MW-3	RHT-2	Hvorslev	0.001707				
MW-9	RHT-1	Bouwer-Rice	0.003071	0.004455	6.4	0.04	12.9
MW-9	RHT-1	Hvorslev	0.005495				
MW-9	RHT-2	Bouwer-Rice	0.003611				
MW-9	RHT-2	Hvorslev	0.006462				
DCMW-3	RHT-1	Bouwer-Rice	0.008756	0.013236	19.1	0.10	38.3
DCMW-3	RHT-1	Hvorslev	0.01268				
DCMW-3	RHT-2	Bouwer-Rice	0.01458				
DCMW-3	RHT-2	Hvorslev	0.01896				
DCMW-4	RHT-1	Bouwer-Rice	0.0007326	0.003157	4.5	0.03	9.1
DCMW-4	RHT-1	Hvorslev	0.001483				
DCMW-4	RHT-2	Bouwer-Rice	0.0009719				
DCMW-4	RHT-2	Hvorslev	0.001934				
DCMW-5	RHT-1	Bouwer-Rice	0.007072	0.014538	20.9	0.12	42.0
DCMW-5	RHT-1	Hvorslev	0.01056				
DCMW-5	RHT-2	Bouwer-Rice	0.02051				
DCMW-5	RHT-2	Hvorslev	0.02916				

Average Velocity = 15 (ft/year)

FHT = Falling Head Slug Test
RHT = Rising Head Slug Test
ft/min = feet per minute
ft/day = feet per day
K = Hydraulic Conductivity
V = Velocity
i = Hydraulic gradient (average hydraulic gradient = 0.0011 feet per foot)
n = porosity (used 0.2)

Created by: CRS 11/15/07
Checked by: RAL 11/19/07

Table 3.4: DC OU-2 Monitoring Well and Groundwater Elevation Data

Site	Location	Northing	Easting	Casing Elevation	Riser Elevation	Installation Date	Screen Length	Well Depth (ft BTOR) (11/2/2006)	Well Depth (ft BTOR) (8/11/2008)	Depth to Water (BTOR) (8/11/2008)	Water Elevation (8/11/2008)
Associated	GW-4	764422.15	759735.37	854.69	854.46	11/8/2006	10	19.6	18.40	12.19	842.27
Associated	GW-13	764898.10	759601.29	855.03	854.87	11/7/2006	10	19.3	19.20	12.10	842.77
Associated	GW-15	764333.77	759885.13	854.40	854.20	11/8/2006	10	17.5	17.10	11.45	842.75
Associated	GW-19	765561.08	759622.50	848.36	848.12	11/9/2006	10	14.5	13.21	5.10	843.02
Associated	MW-1	764548.87	759502.73	856.98	856.72	Unknown	Unknown	18.7	18.55	13.91	842.81
Associated	MW-1R	764555.81	759507.05	856.85	856.41	Unknown	Unknown	19.8	18.65	13.68	842.73
Associated	MW-2	764589.62	759493.77	857.04	856.41	Unknown	Unknown	NM	18.60	13.30	843.11
Associated	MW-3	764566.98	759541.70	856.85	856.54	Unknown	Unknown	19.9	19.50	13.54	843.00
Associated	MW-4	764598.80	759569.38	856.96	856.58	Unknown	Unknown	17.8	17.45	13.73	842.85
Associated	MW-5	764600.99	759417.90	856.02	855.59	Unknown	Unknown	19.6	19.20	12.87	842.72
Associated	MW-6	764525.40	759423.11	856.34	855.84	Unknown	Unknown	19.1	18.80	13.17	842.67
Associated	MW-7	764667.29	759544.45	856.82	856.26	Unknown	Unknown	19.4	19.10	13.40	842.86
Associated	MW-8	764596.84	759655.03	856.41	856.10	Unknown	Unknown	19.2	18.95	13.26	842.84
Associated	MW-9	764482.61	759530.17	856.70	856.45	Unknown	Unknown	19.5	19.40	13.65	842.80
Diamond	GW-2	764781.61	760041.85	855.91	855.47	6/27/2005	10	19.3	18.00	11.46	844.01
Diamond	GW-10	764681.35	759964.90	854.58	854.17	6/23/2005	10	19.4	17.65	10.58	843.59
Diamond	GW-13	764563.66	760228.71	854.46	854.05	6/27/2005	10	25.8	19.80	9.96	844.09
Diamond	GW-14	764451.76	760160.74	854.20	853.79	6/27/2005	10	24	14.65	9.55	844.24
Diamond	MW-1	764837.05	759991.92	855.59	854.64	10/3/2005	10	24.5	23.30	11.03	843.61
Diamond	MW-2	764735.59	759865.46	855.02	854.57	10/4/2005	10	24.5	23.88	11.11	843.46
Diamond	MW-3	764468.08	760027.58	854.19	853.81	10/4/2005	10	24.5	23.80	10.21	843.60
Diamond	MW-4	764548.73	759920.06	854.18	853.90	10/5/2005	10	22	20.90	10.26	843.64
Diamond	MW-5	764702.72	760045.78	854.15	853.77	10/5/2005	10	24.5	23.30	10.01	843.76
Diamond	MW-6	764873.30	760175.71	852.71	852.25	7/22/2008	10	19.8	19.30	8.20	844.05
Diamond	MW-7	764786.09	759925.09	855.08	854.58	7/23/2008	10	22	20.90	10.90	843.68
Diamond	MW-8	764597.74	759983.96	854.50	853.97	7/23/2008	10	22	21.50	10.16	843.81
Diamond	MW-9	764663.53	759674.17	854.28	853.71	7/21/2008	10	21.7	20.80	10.87	842.84
Diamond	MW-10	764533.08	759834.54	854.69	854.15	7/22/2008	10	22	21.50	11.25	842.90
Diamond	MW-11	764384.59	759471.21	856.39	855.89	7/21/2008	10	22.3	21.77	13.65	842.24

Notes:
Wells surveyed by Joseph Lu Engineers. Horizontal locations are tied to the New York State Plane Coordinate System using NAD of 1983. Vertical elevations were tied to msl, NAVD of 1988.
BTOR - Below top of riser
NM = Not Measured.

Prepared by: CRS 6/2/09
Checked by: RTB 12/28/09

Table 4.1: DC OU-1 RI/FS Geoprobe/Round 1 Groundwater Results for VOCs

	Location Name	**GW-001**		**GW-002**		**GW-003**		**GW-004**		**GW-004**		**GW-005**	
	Field Sample ID	**DCGW00101605XX**		**DCGW00202405XX**		**DCGW00302005XX**		**DCGW00401405XX**		**DCGW00402305XX**		**DCGW00501605DUP**	
	Field Sample Date	**6/24/2005**		**6/27/2005**		**6/24/2005**		**6/22/2005**		**6/22/2005**		**6/23/2005**	
	Technical Task Name	**June Investigation 05**		**June Investigation 05**		**June Investigation 05**		**June Investigation 05**		**June Investigation 05**		**June Investigation 05**	
	QC Code	**FS**		**FS**		**FS**		**FS**		**FS**		**FD**	
Paramater	**Class GA Criteria**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
Volatile Organic Compounds													
1,1-Dichloroethene	5	10	UJ	10	U	10	UJ	1000	U	10	U	200	U
2-Butanone	50 (G)	10	UJ	10	UJ	10	UJ	1000	U	10	U	200	U
Acetone	50 (G)			10	UJ	10	UJ	1000	U	10	UJ	200	U
Benzene	1	10	UJ	10	U	10	UJ	1000	U	10	U	200	U
Chloroform	7	10	UJ	10	U	10	UJ	1000	U	10	U	200	U
Cis-1,2-Dichloroethene	5	3	J	**29**		**600**	**D**	**7,800**		**200**		**2,100**	**D**
Ethyl benzene	5	10	UJ	10	U	10	UJ	1000	U	2	J	200	U
Isopropylbenzene	5	10	UJ	10	U	10	UJ	**280**	**J**	**18**		2	J
Methyl cyclohexane	NL	1	J	1	J	10	UJ	1000	U	10	U	200	U
Methyl Tertbutyl Ether	10	1	J	**17**		10	UJ	1000	U	**23**		200	U
Methylene chloride	5	10	UJ	10	U	10	UJ	1000	U	10	U	200	U
Tetrachloroethene	5	**13**	**J**	**74**		**220**	**D**	**730**	**J**	**86**		**150**	**DJ**
Toluene	5	10	UJ	10	U	10	UJ	1,000	U	10	U	200	U
trans-1,2-Dichloroethene	5	10	UJ	10	U	**8**	**J**	1,000	U	10	U	2	J
Trichloroethene	5	**7**	**J**	**15**		**35**	**J**	**120**	**J**	**23**		**7**	**J**
Vinyl chloride	2	10	UJ	10	U	**18**	**J**	1,000	U	**39**		**370**	**D**
Xylenes, Total	5	10	UJ	10	U	10	UJ	**320**	**J**	**18**		200	U

NOTES:

Methods:

Volatile Organic Compounds analyzed by USEPA Method OLM4.2

Only detected compounds shown.

Samples analyyzed by Mitkem Corporation.

Class GA Criteria = Cleanup Objectives from TOGS 1.1.1, NYS Ambient Water Quality Standards or Guidance Values for GA classified groundwater; (G) signifies a guidance value.

All results in micrograms per liter.

NL = No Standard or Guidance value listed

Shaded and bolded values indicate detected concentration greater than the New York State Class GA Ambient Water Quality Standard or Guidance value.

Location Code:

GW = Groundwater sample from geoprobe location
MW = Monitoring Well sample from low flow sampling

QC Code:

FS = Field Sample
FD = Field Duplicate

Qualifiers:

U = Not detected at a concentration greater than the reporting limit
J = Result is estimated
D = Analyte quantified in an analysis performed at a secondary dilution factor
R = Result was rejected

Prepared/Date: JMI 8/02/06
Checked/Date: RTB 8/10/06

Table 4.1: DC OU-1 RI/FS Geoprobe/Round 1 Groundwater Results for VOCs

	Location Name	**GW-005**		**GW-005**		**GW-005**		**GW-005**		**GW-006**		**GW-007**	
	Field Sample ID	**DCGW00501605XX**		**DCGW00502605DUP**		**DCGW00502605XX**		**DCGW00503305XX**		**DCGW00601605XX**		**DCGW00701505XX**	
	Field Sample Date	**6/23/2005**		**6/23/2005**		**6/23/2005**		**6/23/2005**		**6/21/2005**		**6/21/2005**	
	Technical Task Name	**June Investigation 05**		**June Investigation 05**		**June Investigation 05**		**June Investigation 05**		**June Investigation 05**		**June Investigation 05**	
	QC Code	**FS**		**FD**		**FS**		**FS**		**FS**		**FS**	
Paramater	**Class GA Criteria**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
Volatile Organic Compounds													
1,1-Dichloroethene	5	10	U	25	U	40	U	20	U	2,000	U	10	U
2-Butanone	50 (G)	10	U	25	U	40	U	4	DJ	2000	U	10	U
Acetone	50 (G)	10	UJ	25	U	40	UJ	20	U	2000	U	6	J
Benzene	1	10	U	25	U	40	UJ	20	U	2000	U	10	U
Chloroform	7	10	U	25	U	40	UJ	20	U	2000	U	10	U
Cis-1,2-Dichloroethene	5	**1,900**	**D**	**370**	**D**	**440**	**D**	**13**	**DJ**	**20,000**	**D**	4	J
Ethyl benzene	5	10	U	25	U	40	UJ	20	U	2,000	U	5	J
Isopropylbenzene	5	2	J	**7**	**DJ**	**8**	**DJ**	20	U	**250**	**DJ**	**39**	
Methyl cyclohexane	NL	10	U	25	U	40	UJ	20	U	2000	U	1	J
Methyl Tertbutyl Ether	10	10	U	25	U	40	UJ	20	U	2,000	U	10	U
Methylene chloride	5	10	U	25	U	40	UJ	20	U	2000	U	10	U
Tetrachloroethene	5	**75**		**57**	**D**	**59**	**D**	20	U	2,000	U	**21**	
Toluene	5	10	U	25	U	40	UJ	20	U	2,000	U	2	J
trans-1,2-Dichloroethene	5	3	J	3	DJ	40	UJ	20	U	2,000	U	10	U
Trichloroethene	5	**8**	**J**	**9**	**DJ**	**10**	**DJ**	20	U	2,000	U	10	U
Vinyl chloride	2	**190**		**250**	**D**	**380**	**D**	20	U	**1,900**	**DJ**	10	U
Xylenes, Total	5	10	U	3	DJ	40	UJ	20	U	**310**	**DJ**	**35**	

NOTES:

Methods:

Volatile Organic Compounds analyzed by USEPA Method OLM4.2

Only detected compounds shown.

Samples analyyzed by Mitkem Corporation.

Class GA Criteria = Cleanup Objectives from TOGS 1.1.1, NYS Ambient Water Quality Standards or Guidance Values for GA classified groundwater; (G) signifies a guidance value.

All results in micrograms per liter.

NL = No Standard or Guidance value listed

Shaded and bolded values indicate detected concentration greater than the New York State Class GA Ambient Water Quality Standard or Guidance value.

Location Code:

GW = Groundwater sample from geoprobe location
MW = Monitoring Well sample from low flow sampling

QC Code:

FS = Field Sample
FD = Field Duplicate

Qualifiers:

U = Not detected at a concentration greater than the reporting limit
J = Result is estimated
D = Analyte quantified in an analysis performed at a secondary dilution factor
R = Result was rejected

Prepared/Date: JMI 8/02/06
Checked/Date: RTB 8/10/06

Table 4.1: DC OU-1 RI/FS Geoprobe/Round 1 Groundwater Results for VOCs

	Location Name	**GW-007**		**GW-008**		**GW-009**		**GW-009**		**GW-010**		**GW-010**	
	Field Sample ID	**DCGW00702505XX**		**DCGW00801405XX**		**DCGW00901405XX**		**DCGW00902205XX**		**DCGW01001605XX**		**DCGW01002405DUP**	
	Field Sample Date	**6/21/2005**		**6/21/2005**		**6/21/2005**		**6/21/2005**		**6/24/2005**		**6/23/2005**	
	Technical Task Name	**June Investigation 05**		**June Investigation 05**		**June Investigation 05**		**June Investigation 05**		**June Investigation 05**		**June Investigation 05**	
	QC Code	**FS**		**FS**		**FS**		**FS**		**FS**		**FD**	
Paramater	**Class GA Criteria**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
Volatile Organic Compounds													
1,1-Dichloroethene	5	10	U	10	U	**8**	**J**	10	U	10	UJ	10	U
2-Butanone	50 (G)	6	J	10	U	10	U	10	U	10	UJ	10	U
Acetone	50 (G)	45		10	U	10	U	10	U	10	UJ	4	J
Benzene	1	10	U	10	U	**58**		10	U	10	UJ	10	U
Chloroform	7	10	U	10	U	10	U	10	U	10	UJ	10	U
Cis-1,2-Dichloroethene	5	1	J	**34**		**9,400**		**39**		**130**	**J**	**98**	
Ethyl benzene	5	10	U	**11**		**65**		2	J	10	UJ	10	U
Isopropylbenzene	5	4	J	**89**		**140**		**6**	J	10	UJ	10	U
Methyl cyclohexane	NL	10	U	2	J	2	J	10	U	10	UJ	10	U
Methyl Tertbutyl Ether	10	10	U	10	U	10	U	10	U	10	UJ	10	U
Methylene chloride	5	10	U	10	U	10	U	10	U	10	UJ	10	U
Tetrachloroethene	5	2	J	**54**		**9**	**J**	**170**		**280**	D	**150**	
Toluene	5	10	U	1	J	100		10	U	10	UJ	10	U
trans-1,2-Dichloroethene	5	10	U	2	J	22		10	U	10	UJ	1	J
Trichloroethene	5	10	U	**9**	**J**	10	U	**17**		**21**	J	**19**	
Vinyl chloride	2	10	U	**8**	**J**	**3,400**		**3**	**J**	10	UJ	10	U
Xylenes, Total	5	3	J	**18**		**600**		**10**		10	UJ	10	U

NOTES:

Methods:

Volatile Organic Compounds analyzed by USEPA Method OLM4.2

Only detected compounds shown.

Samples analyyzed by Mitkem Corporation.

Class GA Criteria = Cleanup Objectives from TOGS 1.1.1, NYS Ambient Water Quality Standards or Guidance Values for GA classified groundwater; (G) signifies a guidance value.

All results in micrograms per liter.

NL = No Standard or Guidance value listed

Shaded and bolded values indicate detected concentration greater than the New York State Class GA Ambient Water Quality Standard or Guidance value.

Location Code:

GW = Groundwater sample from geoprobe location
MW = Monitoring Well sample from low flow sampling

QC Code:

FS = Field Sample
FD = Field Duplicate

Qualifiers:

U = Not detected at a concentration greater than the reporting limit
J = Result is estimated
D = Analyte quantified in an analysis performed at a secondary dilution factor
R = Result was rejected

Prepared/Date: JMI 8/02/06
Checked/Date: RTB 8/10/06

Table 4.1: DC OU-1 RI/FS Geoprobe/Round 1 Groundwater Results for VOCs

	Location Name	**GW-010**		**GW-011**		**GW-011**		**GW-012**		**GW-012**		**GW-013**	
	Field Sample ID	**DCGW01002405XX**		**DCGW01101605XX**		**DCGW01102405XX**		**DCGW0120160502**		**DCGW01201605XX**		**DCGW01302805XX**	
	Field Sample Date	**6/23/2005**		**6/22/2005**		**6/22/2005**		**6/28/2005**		**6/23/2005**		**6/27/2005**	
	Technical Task Name	**June Investigation 05**		**June Investigation 05**		**June Investigation 05**		**June Investigation 05**		**June Investigation 05**		**June Investigation 05**	
	QC Code	**FS**		**FS**		**FS**		**FS**		**FS**		**FS**	
Paramater	**Class GA Criteria**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
Volatile Organic Compounds													
1,1-Dichloroethene	5	10	U	10	U	10	U	10	U	10	U	10	U
2-Butanone	50 (G)	10	U	10	U	10	U	1	J	10	U	10	UJ
Acetone	50 (G)	10	UJ	10	UJ	4	J	12	U	12		10	J
Benzene	1	10	U	10	U	10	U	10	U	10	U	10	U
Chloroform	7	10	U	10	U	10	U	10	U	10	U	10	U
Cis-1,2-Dichloroethene	5	**89**		2	J	3	J	10	U	**8**	**J**	10	U
Ethyl benzene	5	10	U	10	U	10	U	10	U	10	U	10	U
Isopropylbenzene	5	10	U	10	U	10	U	10	U	10	U	10	U
Methyl cyclohexane	NL	10	U	1	J	10	U	10	UJ	10	U	4	J
Methyl Tertbutyl Ether	10	10	U	10	U	10	U	10	UJ	10	U	10	UJ
Methylene chloride	5	10	U	10	U	10	U	10	U	10	U	10	U
Tetrachloroethene	5	**130**		**72**		**14**		4	J	**29**		10	U
Toluene	5	10	U	10	U	10	U	10	U	10	U	10	U
trans-1,2-Dichloroethene	5	2	J	10	U	10	U	10	U	10	U	10	U
Trichloroethene	5	**18**		3	J	1	J	10	U	10	U	10	U
Vinyl chloride	2	1	J	10	U	10	U	10	U	10	U	10	U
Xylenes, Total	5	10	U	10	U	10	U	10	U	10	U	10	U

NOTES:

Methods:

Volatile Organic Compounds analyzed by USEPA Method OLM4.2

Only detected compounds shown.

Samples analyyzed by Mitkem Corporation.

Class GA Criteria = Cleanup Objectives from TOGS 1.1.1, NYS Ambient Water Quality Standards or Guidance Values for GA classified groundwater; (G) signifies a guidance value.

All results in micrograms per liter.

NL = No Standard or Guidance value listed

Shaded and bolded values indicate detected concentration greater than the New York State Class GA Ambient Water Quality Standard or Guidance value.

Location Code:

GW = Groundwater sample from geoprobe location
MW = Monitoring Well sample from low flow sampling

QC Code:

FS = Field Sample
FD = Field Duplicate

Qualifiers:

U = Not detected at a concentration greater than the reporting limit
J = Result is estimated
D = Analyte quantified in an analysis performed at a secondary dilution factor
R = Result was rejected

Prepared/Date: JMI 8/02/06
Checked/Date: RTB 8/10/06

Table 4.1: DC OU-1 RI/FS Geoprobe/Round 1 Groundwater Results for VOCs

	Location Name	**GW-014**		**GW-015**		**GW-015**		**GW-016**		**GW-016**		**GW-017**	
	Field Sample ID	**DCGW01402405XX**		**DCGW0150160502**		**DCGW01501605XX**		**DCGW01601405XX**		**DCGW01602405XX**		**DCGW01701605XX**	
	Field Sample Date	**6/28/2005**		**6/28/2005**		**6/24/2005**		**6/21/2005**		**6/22/2005**		**6/22/2005**	
	Technical Task Name	**June Investigation 05**		**June Investigation 05**		**June Investigation 05**		**June Investigation 05**		**June Investigation 05**		**June Investigation 05**	
	QC Code	**FS**		**FS**		**FS**		**FS**		**FS**		**FS**	
Paramater	**Class GA Criteria**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
Volatile Organic Compounds													
1,1-Dichloroethene	5	20	U	10	U	20	UJ	10	U	10	U	10	U
2-Butanone	50 (G)	20	UJ	10	U	20	UJ	10	U	10	U	10	U
Acetone	50 (G)	20	UJ		R		R	8	J	10	UJ	5	J
Benzene	1	20	U	10	U	20	UJ	10	U	10	U	10	U
Chloroform	7	20	U	10	U	20	UJ	10	U	10	U	10	U
Cis-1,2-Dichloroethene	5	20	U	10	U	20	UJ	**230**	**D**	**26**		**22**	
Ethyl benzene	5	20	U	10	U	20	UJ	**51**		2	J	10	U
Isopropylbenzene	5	20	U	10	U	20	UJ	**99**		**6**	J	10	U
Methyl cyclohexane	NL	20	U	10	UJ	20	UJ	2	J	10	U	2	J
Methyl Tertbutyl Ether	10	20	U	10	UJ	20	UJ	10	U	10	U	10	U
Methylene chloride	5	20	U	10	U	20	UJ	10	U	10	U	10	U
Tetrachloroethene	5	3	DJ	10	U	2	DJ	**16**		**240**	D	**25**	
Toluene	5	20	U	10	U	20	UJ	5	J	10	U	1	J
trans-1,2-Dichloroethene	5	20	U	10	U	20	UJ	10	U	10	U	10	U
Trichloroethene	5	20	U	10	U	20	UJ	10	U	**16**		5	J
Vinyl chloride	2	20	U	10	U	20	UJ	**61**		**3**	**J**	10	U
Xylenes, Total	5	20	U	10	U	20	UJ	**430**		**13**		1	J

NOTES:

Methods:

Volatile Organic Compounds analyzed by USEPA Method OLM4.2

Only detected compounds shown.

Samples analyyzed by Mitkem Corporation.

Class GA Criteria = Cleanup Objectives from TOGS 1.1.1, NYS Ambient Water Quality Standards or Guidance Values for GA classified groundwater; (G) signifies a guidance value.

All results in micrograms per liter.

NL = No Standard or Guidance value listed

Shaded and bolded values indicate detected concentration greater than the New York State Class GA Ambient Water Quality Standard or Guidance value.

Location Code:

GW = Groundwater sample from geoprobe location
MW = Monitoring Well sample from low flow sampling

QC Code:

FS = Field Sample
FD = Field Duplicate

Qualifiers:

U = Not detected at a concentration greater than the reporting limit
J = Result is estimated
D = Analyte quantified in an analysis performed at a secondary dilution factor
R = Result was rejected

Prepared/Date: JMI 8/02/06
Checked/Date: RTB 8/10/06

Table 4.1: DC OU-1 RI/FS Geoprobe/Round 1 Groundwater Results for VOCs

	Location Name	**GW-017**		**GW-018**		**MW-001**		**MW-002**		**MW-003**		**MW-004**	
	Field Sample ID	**DCGW01702305XX**		**DCGW01802105XX**		**DCMW001XXX01XX**		**DCMW002XXX01XX**		**DCMW003XXX01XX**		**DCMW004XXX01XX**	
	Field Sample Date	**6/22/2005**		**6/22/2005**		**11/1/2005**		**11/1/2005**		**11/1/2005**		**11/2/2005**	
	Technical Task Name	**June Investigation 05**		**June Investigation 05**		**Monitoring Wells**		**Monitoring Wells**		**Monitoring Wells**		**Monitoring Wells**	
	QC Code	**FS**		**FS**		**FS**		**FS**		**FS**		**FS**	
Paramater	**Class GA Criteria**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
Volatile Organic Compounds													
1,1-Dichloroethene	5	10	U	10	U	10	U	10	U	10	U	10	U
2-Butanone	50 (G)	10	U	10	U	10	U	10	U	10	U	10	U
Acetone	50 (G)	8	J	4	J	10	UJ	10	U	10	U	10	U
Benzene	1	10	U	10	U	10	U	10	U	10	U	10	U
Chloroform	7	10	U	10	U	10	U	10	U	10	U	2	J
Cis-1,2-Dichloroethene	5	**9**	**J**	**33**		**16**		**120**		**76**		**33**	
Ethyl benzene	5	10	U	10	U	10	U	10	U	10	U	10	U
Isopropylbenzene	5	10	U	2	J	10	U	10	U	10	U	10	U
Methyl cyclohexane	NL	10	U	10	U	10	U	10	U	10	U	10	U
Methyl Tertbutyl Ether	10	10	U	10	U	10	U	10	U	10	U	10	U
Methylene chloride	5	10	U	10	U	10	U	10	U	10	U	10	U
Tetrachloroethene	5	**88**		**20**		**35**		**260**	D	**190**		**1,700**	**D**
Toluene	5	10	U	1	J	10	U	10	U	10	U	10	U
trans-1,2-Dichloroethene	5	10	U	10	U	10	U	10	U	10	U	10	U
Trichloroethene	5	5	J	2	J	**12**		**23**		**18**		**15**	
Vinyl chloride	2	10	U	10	U	10	U	**4**	**J**	10	U	10	U
Xylenes, Total	5	10	U	10	U	10	U	10	U	10	U	10	U

NOTES:

Methods:

Volatile Organic Compounds analyzed by USEPA Method OLM4.2

Only detected compounds shown.

Samples analyyzed by Mitkem Corporation.

Class GA Criteria = Cleanup Objectives from TOGS 1.1.1, NYS Ambient Water Quality Standards or Guidance Values for GA classified groundwater; (G) signifies a guidance value.

All results in micrograms per liter.

NL = No Standard or Guidance value listed

Shaded and bolded values indicate detected concentration greater than the New York State Class GA Ambient Water Quality Standard or Guidance value.

Location Code:

GW = Groundwater sample from geoprobe location
MW = Monitoring Well sample from low flow sampling

QC Code:

FS = Field Sample
FD = Field Duplicate

Qualifiers:

U = Not detected at a concentration greater than the reporting limit
J = Result is estimated
D = Analyte quantified in an analysis performed at a secondary dilution factor
R = Result was rejected

Prepared/Date: JMI 8/02/06
Checked/Date: RTB 8/10/06

Table 4.1: DC OU-1 RI/FS Geoprobe/Round 1 Groundwater Results for VOCs

	Location Name	**MW-005**		**MW-005**	
	Field Sample ID	**DCMW005XXX01XX**		**DCMW005XXX01XXD**	
	Field Sample Date	**11/2/2005**		**11/2/2005**	
	Technical Task Name	**Monitoring Wells**		**Monitoring Wells**	
	QC Code	**FS**		**FD**	
Paramater	**Class GA Criteria**	**Result**	**Qualifier**	**Result**	**Qualifier**
Volatile Organic Compounds					
1,1-Dichloroethene	5	40	U	80	U
2-Butanone	50 (G)	40	U	80	U
Acetone	50 (G)	40	U	80	U
Benzene	1	40	U	80	U
Chloroform	7	40	U	80	U
Cis-1,2-Dichloroethene	5	**690**	D	**750**	D
Ethyl benzene	5	**6**	DJ	80	U
Isopropylbenzene	5	**14**	DJ	80	U
Methyl cyclohexane	NL	40	U	80	U
Methyl Tertbutyl Ether	10	40	U	80	U
Methylene chloride	5	40	U	80	U
Tetrachloroethene	5	**420**	**D**	**410**	**D**
Toluene	5	**6**	DJ	80	U
trans-1,2-Dichloroethene	5	40	U	80	U
Trichloroethene	5	**23**	DJ	**24**	DJ
Vinyl chloride	2	**81**	D	**88**	D
Xylenes, Total	5	**80**	D	**84**	D

NOTES:

Methods:

Volatile Organic Compounds analyzed by USEPA Method OLM4.2

Only detected compounds shown.

Samples analyyzed by Mitkem Corporation.

Class GA Criteria = Cleanup Objectives from TOGS 1.1.1, NYS Ambient Water Quality Standards or Guidance Values for GA classified groundwater; (G) signifies a guidance value.

All results in micrograms per liter.

NL = No Standard or Guidance value listed

Shaded and bolded values indicate detected concentration greater than the New York State Class GA Ambient Water Quality Standard or Guidance value.

Location Code:

GW = Groundwater sample from geoprobe location
MW = Monitoring Well sample from low flow sampling

QC Code:

FS = Field Sample
FD = Field Duplicate

Qualifiers:

U = Not detected at a concentration greater than the reporting limit
J = Result is estimated
D = Analyte quantified in an analysis performed at a secondary dilution factor
R = Result was rejected

Table 4.2: DC OU-1 RI/FS Groundwater Results for SVOCs, Metals and Pesticides/PCBs

		Location Name	**GW-004**		**GW-005**		**GW-005**		**GW-006**	
		Field Sample ID	**DCGW00402305XX**		**DCGW00501605DUP**		**DCGW00501605XX**		**DCGW00601605XX**	
		Field Sample Date	**6/22/2005**		**6/23/2005**		**6/23/2005**		**6/21/2005**	
		Tech Task Name	**June Investigation 05**		**June Investigation 05**		**June Investigation 05**		**June Investigation 05**	
	Class GA	**QC Code**	**FS**		**FD**		**FS**		**FS**	
Paramater	**Criteria**	**Units**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
Semivolatile Organic Compounds										
2-Methylnaphthalene	NL	UG/L	10	U	10	U	10	U	19	DJ
Bis(2-Ethylhexyl)phthalate	5	UG/L	2	J	10	U	10	U	**13**	**DJ**
Naphthalene	10 (G)	UG/L	10	U	10	U	10	U	**11**	**DJ**
Pesticides										
4,4`-DDD	0.3	UG/L	**1.2**	**J**			**3.6**	**D**		
Metals										
Aluminum	NL	UG/L							53,300	
Antimony	3	UG/L							**7.4**	**J**
Arsenic	25	UG/L							**45.7**	
Barium	1,000	UG/L							**4,110**	
Beryllium	3 (G)	UG/L							2.7	B
Cadmium	5	UG/L							3.1	B
Calcium	NL	UG/L							379,000	
Chromium	50	UG/L							**70.1**	
Cobalt	NL	UG/L							33.2	B
Copper	200	UG/L							**449**	
Iron	300	UG/L							**89,100**	
Lead	25	UG/L								
Magnesium	35,000 (G)	UG/L							**105,000**	
Manganese	300	UG/L							**19,300**	
Nickel	100	UG/L							**122**	
Potassium	NL	UG/L							11,900	
Sodium	20,000	UG/L							**71,200**	
Thallium	0.5 (G)	UG/L							**6.8**	**B**
Vanadium	NL	UG/L							83.4	
Zinc	2,000 (G)	UG/L							1,040	
Mercury	0.7	UG/L							0.37	

Prepared/Date: JMI 8/02/06
Checked/Date: RTB 8/10/06

Table 4.2: Phase One Groundwater Results for SVOCs, Metals and Pesticides/PCBs - DC Site

		Location Name	**GW-007**		**GW-008**		**GW-009**		**GW-009**	
		Field Sample ID	**DCGW00701505XX**		**DCGW00801405XX**		**DCGW00901405XX**		**DCGW00902205XX**	
		Field Sample Date	**6/21/2005**		**6/21/2005**		**6/21/2005**		**6/21/2005**	
		Tech Task Name	**June Investigation 05**		**June Investigation 05**		**June Investigation 05**		**June Investigation 05**	
	Class GA	**QC Code**	**FS**		**FS**		**FS**		**FS**	
Paramater	**Criteria**	**Units**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
Semivolatile Organic Compounds										
2-Methylnaphthalene	NL	UG/L	4	J	100	U	15		50	U
Bis(2-Ethylhexyl)phthalate	5	UG/L	5	J	100	U	**8**	**J**	50	U
Naphthalene	10 (G)	UG/L	2	J	100	U	**22**		50	U
Pesticides										
4,4`-DDD	0.3	UG/L								
Metals										
Aluminum	NL	UG/L					13,200			
Antimony	3	UG/L					**6.2**	**J**		
Arsenic	25	UG/L					19.4			
Barium	1,000	UG/L					**12,100**			
Beryllium	3 (G)	UG/L					0.53	B		
Cadmium	5	UG/L					0.41	B		
Calcium	NL	UG/L					202,000			
Chromium	50	UG/L					14.6			
Cobalt	NL	UG/L					7.4	B		
Copper	200	UG/L					120			
Iron	300	UG/L					**22,400**			
Lead	25	UG/L					**54.2**			
Magnesium	35,000 (G)	UG/L					**40,300**			
Manganese	300	UG/L					**9,470**			
Nickel	100	UG/L					26	B		
Potassium	NL	UG/L					5,770			
Sodium	20,000	UG/L					**25,500**			
Thallium	0.5 (G)	UG/L					**2.2**	**B**		
Vanadium	NL	UG/L					19.1	B		
Zinc	2,000 (G)	UG/L					223			
Mercury	0.7	UG/L					0.26	U		

Prepared/Date: JMI 8/02/06
Checked/Date: RTB 8/10/06

Table 4.2: Phase One Groundwater Results for SVOCs, Metals and Pesticides/PCBs - DC Site

		Location Name	**GW-010**		**GW-010**		**GW-016**	
		Field Sample ID	**DCGW01002405DUP**		**DCGW01002405XX**		**DCGW01602405XX**	
		Field Sample Date	**6/23/2005**		**6/23/2005**		**6/22/2005**	
		Tech Task Name	**June Investigation 05**		**June Investigation 05**		**June Investigation 05**	
	Class GA	**QC Code**	**FD**		**FS**		**FS**	
Paramater	**Criteria**	**Units**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
Semivolatile Organic Compounds								
2-Methylnaphthalene	NL	UG/L	10	U	10	U	10	U
Bis(2-Ethylhexyl)phthalate	5	UG/L	10	U	10	U	1	J
Naphthalene	10 (G)	UG/L	10	U	10	U	10	U
Pesticides								
4,4`-DDD	0.3	UG/L	**0.043**	**J**	**0.053**	**J**	**2.3**	**D**
Metals								
Aluminum	NL	UG/L						
Antimony	3	UG/L						
Arsenic	25	UG/L						
Barium	1,000	UG/L						
Beryllium	3 (G)	UG/L						
Cadmium	5	UG/L						
Calcium	NL	UG/L						
Chromium	50	UG/L						
Cobalt	NL	UG/L						
Copper	200	UG/L						
Iron	300	UG/L						
Lead	25	UG/L						
Magnesium	35,000 (G)	UG/L						
Manganese	300	UG/L						
Nickel	100	UG/L						
Potassium	NL	UG/L						
Sodium	20,000	UG/L						
Thallium	0.5 (G)	UG/L						
Vanadium	NL	UG/L						
Zinc	2,000 (G)	UG/L						
Mercury	0.7	UG/L						

Table 4.2: DC OU-1 RI/FS Groundwater Results for SVOCs, Metals and Pesticides/PCBs

NOTES:

Methods:
- Sem-Volatile Organic Compouds analyzed by USEPA Method OLM4.2
- Inorganic Compounds analyzed by USEPA Method OLM4.2
- TAL Metals analyzed by USEPA Method ILM4.1

Class GA Criteria = Cleanup objectives from TOGS 1.1.1, NYS Ambient Water Quality Standards or Guidance Values for GA classified groundwater; (G) signifies a guidance value.

Samples analyzed by Mitkem Corporation.

Only detected compounds shown.

Blank result indicates paramter not analyzed for metals.

NL = No Standard or Guidance Value listed.

All Results in micrograms per liter

Shaded and bolded values indicate detected concentrations greater than the New York Sate Class GA Ambient Water Quality Standard or Guidance Value.

Location Name:
- GW = Groundwater sample from geoprobe drilling

QC Code:
- FS = Field Sample
- FD = Field Duplicate

Qualifiers:
- U = Not detected at a concentration greater than the reporting limit
- J = Result is estimated
- B = The reported result fell above the Instrument Detection Limit (IDL) but below the Contract Required Detection Limit (CRDL).
- D = Analyte quantified in an analysis performed at a secondary dilution factor

Prepared/Date: JMI 8/02/06
Checked/Date: RTB 8/10/06

Table 4.3: DC OU-1 RI/FS Groundwater Natural Attenuation Parameters

	Location Name	**MW-001**		**MW-002**		**MW-003**		**MW-004**		**MW-005**		**MW-005**	
	Field Sample ID	**DCMW001XXX01XX**		**DCMW002XXX01XX**		**DCMW003XXX01XX**		**DCMW004XXX01XX**		**DCMW005XXX01XX**		**DCMW005XXX01XXD**	
	Field Sample Date	**11/1/2005**		**11/1/2005**		**11/1/2005**		**11/2/2005**		**11/2/2005**		**11/2/2005**	
	Technical Task Name	**Monitoring Wells**		**Monitoring Wells**		**Monitoring Wells**		**Monitoring Wells**		**Monitoring Wells**		**Monitoring Wells**	
	QC Code	**FS**		**FS**		**FS**		**FS**		**FS**		**FD**	
Paramater	**Units**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
Groundwater Parameters													
Iron	UG/L	137	B	221		116	B	770		437		375	
Manganese	UG/L	579		449		568		1,440		1,000		994	
Total Alkalinity, as CaCO3	MG/L	350		240		280		250		430		410	
Chloride	MG/L	290		96		110		130		190		250	
Ethane	UG/L	27	U	27	U	27	U	27	U	27	U	26	U
Ethene	UG/L	36	U	36	U	36	U	36	U	36	U	35	U
Nitrate as N	MG/L	2.9		3.9		4		6.5	B	2.2	B	2.4	B
Nitrite as N	MG/L	0.025	U	0.025	U	0.032		0.15		0.025	U	0.025	U
Sulfate	MG/L	35		37		74		68		28		30	
Sulfide	MG/L	0.03	U	0.03	U	0.03	U	0.03	U	0.03	U	0.03	U
Carbon Dioxide	MG/L	62		26		33		35		82		130	
Methane	UG/L	14	U	14	U	14	U	65		210		200	
pH	SU	7.1		7.3		7.2		7.2		7		6.8	
DO	MG/L	0.34		0		0.1		0.1		0.1		0.1	
Redox	MV	112		114		106		-290		-90		-90	
Conductivity	MS/CM	1.89		0.77		1.1		0.856		1.66		0.856	
Total Organic Carbon	MG/L	10	U	10	U	10	U	10	U	10	U	10	U

NOTES:

Prepared/Date: JMI 8/02/06
Checked/Date: RTB 8/10/06

Methods:
Groundwater USEPA Methods include:
SW6010B, SM2320, E300, E415.1, SM4500-CO2, SM4500-S, RSK175 and SM4500-H.
Only detected compounds shown.
Samples analyzed by Mitkem Corporation.
Results in:
ug/L = micrograms per liter
mg/L = milligrams per liter
SU = Standard Unit
mv = Millivolt
mS/cm = mili siemens/centimeter
Location Code:
MW = Monitoring Well sample from low flow sampling
QC Code:
FS = Field Sample
FD = Field Duplicate
Qualifiers:
U = Not detected at a concentration greater than the reporting limit
J = Result is estimated
D = Analyte quantified in an analysis performed at a secondary dilution factor

Table 4.4: DC OU-1 RI/FS Round Two Groundwater Results for VOCs

	Location Name	**MW-001**		**MW-001**		**MW-002**		**MW-003**		**MW-004**		**MW-005**	
	Sample ID	**DCMW00101902XX**		**DCMW00101902XD**		**DCMW00201902XX**		**DCMW00301902XX**		**DCMW00401702XX**		**DCMW00501902XX**	
	Sample Date	**3/23/2006**		**3/23/2006**		**3/23/2006**		**3/23/2006**		**3/23/2006**		**3/23/2006**	
	QC Code	**FS**		**FD**		**FS**		**FS**		**FS**		**FS**	
	Task Name	**Round 2 Groundwater**		**Round 2 Groundwater**		**Round 2 Groundwater**		**Round 2 Groundwater**		**Round 2 Groundwater**		**Round 2 Groundwater**	
Parameter	**Class GA Standard**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
Volatile Organice Compounds													
Cis-1,2-Dichloroethene	5	**24**		**22**		**240**	**D**	**35**		**86**		**190**	**D**
Isopropylbenzene	5	10	U	10	U	10	U	10	U	10	U	3	J
Methyl Tertbutyl Ether	10	2	J	2	J	10	U	10	U	10	U	10	U
Tetrachloroethene	5	**60**		**58**		**1,000**	**D**	**100**		**3,900**	**D**	**310**	**D**
trans-1,2-Dichloroethene	5	10	U	10	U	2	J	10	U	10	U	10	U
Trichloroethene	5	**14**		**13**		**53**		**9**	**J**	**26**		**20**	
Vinyl chloride	2	10	U	10	U	**30**		10	U	10	U	**25**	
Xylenes, Total	5	10	U	10	U	10	U	10	U	10	U	**10**	

NOTES:

Prepared/Date: JMI 8/02/06
Checked/Date: RTB 8/10/06

Methods:

Volatile Organic Compounds analyzed by USEPA Method OLM4.2.

Only detected compounds shown.

Samples analyzed my Mitkem Corporation.

Class GA Standard = Cleanup objectives from TOGS 1.1.1, NYS Ambient Water Quality Standards or Guidance Values for GA classified groundwater.

Results in micrograms per liter.

Shaded and bolded values indicate detected concentration greater than the New York State Class GA Ambient Water Quality Standard or Guidance value.

Location Name:

MW = Monitoring Well sample from low flow sampling

QC Code:

FS = Field Sample
FD = Field Duplicate

Qualifiers:

U = Not detected at a concentration greater than the reporting limit
J = Result is estimated
D = Analyte quantified in an analysis performed at a secondary dilution factor

Table 4.5: Former ATRS Site 2006 Groundwater Results for VOCs

	Location	GW-1		GW-1		GW-1		GW-2		GW-3		GW-4		GW-5	
	Sample Date	11/6/2006		11/6/2006		11/6/2006		11/10/2006		11/10/2006		11/8/2006		11/7/2006	
	Sample ID	ATGW00102001XX		ATGW00102001XD		ATGW00102901XX		ATGW00201801XX		ATGW00301801XX		ATGW00401701XX		ATGW00501701XX	
	Sample Depth (ft bgs)	20		20		29		18		18		17		17	
	Qc Code	FS		FD		FS		FS		FS		FS		FS	
Parameter	**Criteria**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
1,1,1-Trichloroethane	5	**2.1**	**J**	**2.3**	**J**	**8.2**	**J**	250	U	10	U	**17**		**2.6**	**J**
1,1-Dichloroethane	5	10	U	10	U	10	U	250	U	10	U	**3**	**J**	**1.2**	**J**
1,1-Dichloroethene	5	10	UJ	10	UJ	10	UJ	250	U	10	U	**1.2**	**J**	10	UJ
1,4-Dichlorobenzene	3	10	U	10	U	10	U	250	U	10	U	10	U	10	UJ
2-Butanone	50*	50	U	50	U	50	U	1200	U	50	U	50	U	50	UJ
Acetone	50*	50	U	50	U	50	U	1200	U	50	U	50	U	50	UJ
Benzene	1	**1.3**	**J**	**1.4**	**J**	10	U	250	U	10	U	10	U	10	UJ
Chloroform	7	10	U	10	U	10	U	250	U	10	U	10	U	10	UJ
Cis-1,2-Dichloroethene	5	**34**		**37**	**J**	**48**		**250**	**J**	10	U	**47**		**22**	**J**
Cyclohexane	NA	10	U	10	U	10	U	250	U	10	U	10	U	10	UJ
Ethyl benzene	5	10	U	10	U	10	U	250	U	10	U	10	U	10	UJ
Isopropylbenzene	5	10	U	10	U	10	U	250	U	10	U	10	U	10	UJ
Methyl cyclohexane	NA	10	U	10	U	10	U	250	U	10	U	10	U	10	UJ
Methyl Tertbutyl Ether	10*	**2.9**	**J**	**3**	**J**	**15**		250	U	10	U	**3**	**J**	**1.3**	**J**
Methylene chloride	5	10	U	10	U	10	U	250	UJ	10	UJ	10	U	10	UJ
o-Xylene	5	10	U	10	U	10	U	250	U	10	U	10	U	10	UJ
Tetrachloroethene	5	**2.5**	**J**	**2.5**	**J**	**12**		**2100**		10	U	**17**		**3**	**J**
Toluene	5	10	U	10	U	10	U	250	U	10	U	10	U	10	UJ
trans-1,2-Dichloroethene	5	10	U	10	U	10	U	250	U	10	U	10	U	10	UJ
Trichloroethene	5	**20**		**20**	**J**	**13**		**190**	**J**	10	U	**15**		**1.5**	**J**
Vinyl chloride	2	**3.9**	**J**	**4**	**J**	10	U	250	U	10	U	**2.9**	**J**	**1.7**	**J**
Xylene, m/p	5	10	U	10	U	10	U	250	U	10	U	10	U	10	UJ

Notes:
Only Detected Compounds shown.
Samples analyzed for VOCs by USEPA Method OLM04.3.
Results in microgram per liter (µg/L)
ft bgs = feet below ground surface
QC Code:
  FS = Field Sample
  FD = Field Duplicate
Qualifiers:
  U = Not detected at a concentration greater than the RL
  J = Estimated value
  D = Result was reported from a diluted analytical run
  B = Analyte was detected in the method blank
Criteria = Values from Technical and Operational Guidance Series (TOGS) 1.1.1, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (NYSDEC, 2006).
*Criteria are New York State Groundwater Guidance Standards.
Highlighted results in **BOLD** exceed associated criteria

Table 4.5: Former ATRS Site 2006 Groundwater Results for VOCs

Location		**GW-5**		**GW-6**		**GW-6**		**GW-6**		**GW-7**		**GW-7**		**GW-8**	
Sample Date		**11/7/2006**		**11/7/2006**		**11/7/2006**		**11/7/2006**		**11/7/2006**		**11/7/2006**		**11/6/2006**	
Sample ID		**ATGW00502801XX**		**ATGW00601701XX**		**ATGW00602801XX**		**ATGW00602801XD**		**ATGW00701701XX**		**ATGW00702801XX**		**ATGW00802701XX**	
Sample Depth (ft bgs)		**28**		**17**		**28**		**28**		**17**		**28**		**27**	
Qc Code		**FS**		**FS**		**FS**		**FD**		**FS**		**FS**		**FS**	
Parameter	**Criteria**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
1,1,1-Trichloroethane	5	**5.2**	**J**	10	U	10	U	10	U	10	U	10	U	10	U
1,1-Dichloroethane	5	**2.8**	**J**	10	U	10	U	10	U	10	U	10	U	10	U
1,1-Dichloroethene	5	**1.1**	**J**	10	U	10	U	10	U	10	U	10	U	10	UJ
1,4-Dichlorobenzene	3	10	U	10	U	10	U	10	U	10	U	10	U	10	U
2-Butanone	50*	50	U	50	U	50	U	50	U	50	U	50	U	50	U
Acetone	50*	50	U	50	U	50	U	50	U	50	U	50	U	50	U
Benzene	1	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Chloroform	7	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Cis-1,2-Dichloroethene	5	**43**		10	U	10	U	10	U	**0.93**	**J**	10	U	**2.8**	**J**
Cyclohexane	NA	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Ethyl benzene	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Isopropylbenzene	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Methyl cyclohexane	NA	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Methyl Tertbutyl Ether	10*	**3**	**J**	10	U	10	U	10	U	10	U	10	U	10	U
Methylene chloride	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
o-Xylene	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Tetrachloroethene	5	**6.9**	**J**	**9.2**	**J**	10	U	10	U	**1.6**	**J**	**2.2**	**J**	**2.7**	**J**
Toluene	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
trans-1,2-Dichloroethene	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Trichloroethene	5	**4.1**	**J**	10	U	10	U	10	U	10	U	10	U	10	U
Vinyl chloride	2	**4.2**	**J**	10	U	**1.2**	**J**	**1**	**J**	**1.5**	**J**	**2.5**	**J**	10	U
Xylene, m/p	5	10	U	10	U	10	U	**2.8**	**J**	10	U	10	U	10	U

Notes:
Only Detected Compounds shown.
Samples analyzed for VOCs by USEPA Method OLM04.3.
Results in microgram per liter (µg/L)
ft bgs = feet below ground surface
QC Code:
FS = Field Sample
FD = Field Duplicate
Qualifiers:
U = Not detected at a concentration greater than the RL
J = Estimated value
D = Result was reported from a diluted analytical run
B = Analyte was detected in the method blank
Criteria = Values from Technical and Operational Guidance Series (TOGS) 1.1.1, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (NYSDEC, 2006).
*Criteria are New York State Groundwater Guidance Standards.
Highlighted results in **BOLD** exceed associated criteria

Table 4.5: Former ATRS Site 2006 Groundwater Results for VOCs

	Location	**GW-8**		**GW-9**		**GW-9**		**GW-10**		**GW-10**		**GW-11**		**GW-11**	
	Sample Date	**11/6/2006**		**11/7/2006**		**11/7/2006**		**11/6/2006**		**11/6/2006**		**11/7/2006**		**11/7/2006**	
	Sample ID	**ATGW00802001XX**		**ATGW00901701XX**		**ATGW00902801XX**		**ATGW01002201XX**		**ATGW01002901XX**		**ATGW01101701XX**		**ATGW01102801XX**	
	Sample Depth (ft bgs)	**20**		**17**		**28**		**22**		**29**		**17**		**28**	
	Qc Code	**FS**		**FS**		**FS**		**FS**		**FS**		**FS**		**FS**	
Parameter	**Criteria**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
1,1,1-Trichloroethane	5	10	U	10	U	10	U	10	UJ	10	U	10	U	10	U
1,1-Dichloroethane	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,1-Dichloroethene	5	10	UJ	10	U	10	U	10	UJ	10	UJ	10	U	10	U
1,4-Dichlorobenzene	3	10	U	10	U	10	U	10	U	10	U	10	U	10	U
2-Butanone	50*	50	U	50	U	50	U	50	UJ	50	U	50	U	50	U
Acetone	50*	50	U	50	U	50	U	50	U	50	U	50	U	50	U
Benzene	1	10	U	10	U	10	U	10	UJ	10	U	10	U	10	U
Chloroform	7	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Cis-1,2-Dichloroethene	5	**5.1**	**J**	**140**	**J**	**19**		**69**		**42**	**J**	**34**		**140**	
Cyclohexane	NA	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Ethyl benzene	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Isopropylbenzene	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Methyl cyclohexane	NA	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Methyl Tertbutyl Ether	10*	**4.9**	**J**	10	U	10	U	**2.2**	**J**	**2.9**	**J**	10	U	**3.7**	**J**
Methylene chloride	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
o-Xylene	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Tetrachloroethene	5	**2.6**	**J**	**5**	**J**	**1.2**	**J**	10	U	10	U	10	U	10	U
Toluene	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
trans-1,2-Dichloroethene	5	10	U	**1.3**	**J**	10	U	**3.6**	**J**	**1**	**J**	**1**	**J**	**6.2**	**J**
Trichloroethene	5	**1.3**	**J**	**7.9**	**J**	10	U	**1.5**	**J**	10	U	**10**		**3.7**	**J**
Vinyl chloride	2	10	U	**1.4**	**J**	**9**	**J**	**2.8**	**J**	**4.5**	**J**	10	U	**4.7**	**J**
Xylene, m/p	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U

Notes:
Only Detected Compounds shown.
Samples analyzed for VOCs by USEPA Method OLM04.3.
Results in microgram per liter (µg/L)
ft bgs = feet below ground surface
QC Code:
FS = Field Sample
FD = Field Duplicate
Qualifiers:
U = Not detected at a concentration greater than the RL
J = Estimated value
D = Result was reported from a diluted analytical run
B = Analyte was detected in the method blank
Criteria = Values from Technical and Operational Guidance Series (TOGS) 1.1.1, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (NYSDEC, 2006).
*Criteria are New York State Groundwater Guidance Standards.
Highlighted results in **BOLD** exceed associated criteria

Table 4.5: Former ATRS Site 2006 Groundwater Results for VOCs

	Location	**GW-13**		**GW-13**		**GW-14**		**GW-14**		**GW-15**		**GW-18**		**GW-19**	
	Sample Date	**11/7/2006**		**11/7/2006**		**11/7/2006**		**11/7/2006**		**11/8/2006**		**11/9/2006**		**11/9/2006**	
	Sample ID	**ATGW01301701XX**		**ATGW01302301XX**		**ATGW01401601XX**		**ATGW01402901XX**		**ATGW01501601XX**		**ATGW01801101XX**		**ATGW01901301XX**	
	Sample Depth (ft bgs)	**17**		**23**		**16**		**29**		**16**		**11**		**13**	
	Qc Code	**FS**		**FS**		**FS**		**FS**		**FS**		**FS**		**FS**	
Parameter	**Criteria**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
1,1,1-Trichloroethane	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,1-Dichloroethane	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,1-Dichloroethene	5	10	U	10	U	10	U	10	U	10	UJ	10	U	10	U
1,4-Dichlorobenzene	3	10	U	10	U	10	U	10	U	10	U	10	U	10	U
2-Butanone	50*	50	U	50	U	50	U	50	U	50	U	50	U	50	U
Acetone	50*	50	U	50	U	50	U	50	U	50	U	50	U	50	U
Benzene	1	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Chloroform	7	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Cis-1,2-Dichloroethene	5	**23**		**44**		**1.7**	**J**	**9.7**	**J**	10	U	10	U	10	U
Cyclohexane	NA	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Ethyl benzene	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Isopropylbenzene	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Methyl cyclohexane	NA	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Methyl Tertbutyl Ether	10*	**3.1**	**J**	**1.8**	**J**	10	U	**0.83**	**J**	10	U	10	U	10	U
Methylene chloride	5	10	U	10	U	10	U	10	U	10	U	10	U	10	UJ
o-Xylene	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Tetrachloroethene	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Toluene	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
trans-1,2-Dichloroethene	5	**2.1**	**J**	**3.9**	**J**	10	U	**1.2**	**J**	10	U	10	U	10	U
Trichloroethene	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Vinyl chloride	2	**1**	**J**	**1.2**	**J**	10	U	**0.88**	**J**	10	U	10	U	10	U
Xylene, m/p	5	10	U	10	U	**0.89**	**J**	10	U	10	U	10	U	10	U

Notes:
Only Detected Compounds shown.
Samples analyzed for VOCs by USEPA Method OLM04.3.
Results in microgram per liter (µg/L)
ft bgs = feet below ground surface
QC Code:
FS = Field Sample
FD = Field Duplicate
Qualifiers:
U = Not detected at a concentration greater than the RL
J = Estimated value
D = Result was reported from a diluted analytical run
B = Analyte was detected in the method blank
Criteria = Values from Technical and Operational Guidance Series (TOGS) 1.1.1, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (NYSDEC, 2006).
*Criteria are New York State Groundwater Guidance Standards.
Highlighted results in **BOLD** exceed associated criteria

Table 4.5: Former ATRS Site 2006 Groundwater Results for VOCs

Location		**GW-20**		**GW-20**		**GW-21**		**GW-22**		**GW-23**		**GW-24**		**GW-25**	
Sample Date		**11/9/2006**		**11/9/2006**		**11/9/2006**		**11/10/2006**		**11/10/2006**		**11/17/2006**		**11/17/2006**	
Sample ID		**ATGW02002601XX**		**ATGW02003401XX**		**ATDCG2101801XX**		**ATDCG2201801XX**		**ATDCG2301801XX**		**ATGW02401601XX**		**ATGW02501601XX**	
Sample Depth (ft bgs)		**26**		**34**		**18**		**18**		**18**		**16**		**16**	
Qc Code		**FS**		**FS**		**FS**		**FS**		**FS**		**FS**		**FS**	
Parameter	**Criteria**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
1,1,1-Trichloroethane	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,1-Dichloroethane	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,1-Dichloroethene	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,4-Dichlorobenzene	3	10	U	10	U	10	U	10	U	10	U	10	U	10	U
2-Butanone	50*	50	U	50	U	50	U	50	U	**3.5**	**J**	50	U	50	U
Acetone	50*	50	U	50	U	50	U	50	U	50	U	50	U	50	U
Benzene	1	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Chloroform	7	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Cis-1,2-Dichloroethene	5	10	U	10	U	**170**	**J**	**66**		**38**		10	U	10	U
Cyclohexane	NA	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Ethyl benzene	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Isopropylbenzene	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Methyl cyclohexane	NA	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Methyl Tertbutyl Ether	10*	10	U	10	U	10	U	10	U	10	U	**26**	**J**	**26**	**J**
Methylene chloride	5	10	UJ	10	UJ	10	UJ	10	U	10	U	10	UJ	10	UJ
o-Xylene	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Tetrachloroethene	5	10	U	10	U	**98**		**17**		**65**		10	U	10	U
Toluene	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
trans-1,2-Dichloroethene	5	10	U	10	U	**1.8**	**J**	10	U	10	U	10	U	10	U
Trichloroethene	5	10	U	10	U	**17**		**4.7**	**J**	**9.1**	**J**	10	U	10	U
Vinyl chloride	2	10	U	10	U	**1.1**	**J**	10	U	10	U	10	U	10	U
Xylene, m/p	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U

Notes:

Only Detected Compounds shown.

Samples analyzed for VOCs by USEPA Method OLM04.3.

Results in microgram per liter (µg/L)

ft bgs = feet below ground surface

QC Code:
- FS = Field Sample
- FD = Field Duplicate

Qualifiers:
- U = Not detected at a concentration greater than the RL
- J = Estimated value
- D = Result was reported from a diluted analytical run
- B = Analyte was detected in the method blank

Criteria = Values from Technical and Operational Guidance Series (TOGS) 1.1.1, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (NYSDEC, 2006).

*Criteria are New York State Groundwater Guidance Standards.

Highlighted results in **BOLD** exceed associated criteria

Table 4.5: Former ATRS Site 2006 Groundwater Results for VOCs

	Location	**GW-25**		**GW-26**		**GW-27**		**GW-28**		**GW-29**		**GW-30**		**GW-30**	
	Sample Date	**11/17/2006**		**11/17/2006**		**11/17/2006**		**11/17/2006**		**11/17/2006**		**11/17/2006**		**11/17/2006**	
	Sample ID	**ATGW02501601XD**		**ATGW02601601XX**		**ATGW02701501XX**		**ATGW02801401XX**		**ATGW02901601XX**		**ATGW03001401XX**		**ATGW03001401XD**	
	Sample Depth (ft bgs)	**16**		**16**		**15**		**14**		**16**		**14**		**14**	
	Qc Code	**FD**		**FS**		**FS**		**FS**		**FS**		**FS**		**FD**	
Parameter	**Criteria**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
1,1,1-Trichloroethane	5	10	U	10	U	10	U	10	U	**10**		10	U	10	U
1,1-Dichloroethane	5	10	U	10	U	10	U	10	U	**4.8**	**J**	10	U	10	U
1,1-Dichloroethene	5	10	U	10	U	10	U	10	U	10	U	**0.91**	**J**	**0.83**	**J**
1,4-Dichlorobenzene	3	10	U	10	U	10	U	10	U	10	U	10	U	10	U
2-Butanone	50*	50	U	50	U	50	U	50	U	50	U	50	U	50	U
Acetone	50*	50	U	50	U	50	U	50	U	50	U	50	U	50	U
Benzene	1	10	U	10	U	10	U	10	U	**6**	**J**	10	U	10	U
Chloroform	7	10	U	10	U	**3**	**J**	10	U	10	U	10	U	10	U
Cis-1,2-Dichloroethene	5	10	U	**16**		**2.6**	**J**	**98**		**11**		**47**		**51**	
Cyclohexane	NA	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Ethyl benzene	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Isopropylbenzene	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Methyl cyclohexane	NA	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Methyl Tertbutyl Ether	10*	**29**	**J**	10	U	10	U	10	UJ	**7.8**	**J**	10	U	10	U
Methylene chloride	5	10	UJ	10	U	10	U	10	UJ	10	U	10	U	10	U
o-Xylene	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Tetrachloroethene	5	10	U	**4300**	**D**	**96**	**D**	**28**		**6.4**	**J**	**1.7**	**J**	**1.4**	**J**
Toluene	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U
trans-1,2-Dichloroethene	5	10	U	10	U	10	U	**5.1**	**J**	10	U	10	U	10	U
Trichloroethene	5	10	U	**200**		**3.9**	**J**	**98**		**3.3**	**J**	**33**		**34**	
Vinyl chloride	2	10	U	10	U	10	U	**0.88**	**J**	**6.3**	**J**	**6.5**	**J**	**6**	**J**
Xylene, m/p	5	10	U	10	U	10	U	10	U	10	U	10	U	10	U

Notes:

Only Detected Compounds shown.

Samples analyzed for VOCs by USEPA Method OLM04.3.

Results in microgram per liter (µg/L)

ft bgs = feet below ground surface

QC Code:
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Qualifiers:
- U = Not detected at a concentration greater than the RL
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Criteria = Values from Technical and Operational Guidance Series (TOGS) 1.1.1, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (NYSDEC, 2006).

*Criteria are New York State Groundwater Guidance Standards.

Highlighted results in **BOLD** exceed associated criteria

Created By/Date: ASZ 4/12/07
Checked By/Date: CRS 5/29/07

Table 4.5: Former ATRS Site 2006 Groundwater Results for VOCs

Location		**MW-1**		**MW-1R**		**MW-2**		**MW-3**		**MW-4**		**MW-5**		**MW-6**	
Sample Date		**11/9/2006**		**11/7/2006**		**11/7/2006**		**11/6/2006**		**11/6/2006**		**11/8/2006**		**11/7/2006**	
Sample ID		**ATMW01R01701XX**		**ATMW00101701XX**		**ATMW00201601XX**		**ATMW00301601XX**		**ATMW00401601XX**		**ATMW00501601XX**		**ATMW00601601XX**	
Sample Depth (ft bgs)		**17**		**17**		**16**		**16**		**16**		**16**		**16**	
Qc Code		**FS**		**FS**		**FS**		**FS**		**FS**		**FS**		**FS**	
Parameter	**Criteria**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
1,1,1-Trichloroethane	5	100	U	10	U	250	U	10	U	10	U	10	U	10	U
1,1-Dichloroethane	5	100	U	10	U	250	U	10	U	10	U	10	U	10	U
1,1-Dichloroethene	5	100	U	10	U	250	U	10	U	10	U	10	U	10	U
1,4-Dichlorobenzene	3	100	U	10	U	250	U	10	U	10	U	10	U	**0.88**	**J**
2-Butanone	50*	500	U	50	U	1200	U	50	U	50	U	50	U	50	U
Acetone	50*	500	U	50	U	1200	U	50	U	50	U	50	U	50	U
Benzene	1	**70**	**J**	**1.5**	**J**	**2100**	**D**	10	U	**89**	**J**	10	U	**3.8**	**J**
Chloroform	7	100	U	10	U	250	U	10	U	10	U	10	U	10	U
Cis-1,2-Dichloroethene	5	100	U	10	U	250	U	10	U	**2.7**	**J**	10	U	10	U
Cyclohexane	NA	**87**	**J**	**10**		**220**	**JD**	10	U	**63**	**J**	10	U	**160**	
Ethyl benzene	5	**210**		**3.7**	**J**	**1700**	**D**	10	U	**5.2**	**J**	10	U	**9.4**	**J**
Isopropylbenzene	5	**19**	**J**	10	U	**70**	**JD**	10	U	**5.3**	**J**	10	U	**36**	
Methyl cyclohexane	NA	**67**	**J**	**6**	**J**	**110**	**JD**	10	U	**26**	**J**	10	U	**180**	
Methyl Tertbutyl Ether	10*	**19**	**J**	**6.4**	**J**	250	U	10	U	10	U	10	U	10	U
Methylene chloride	5	100	UJ	10	U	250	U	10	U	10	U	10	U	10	U
o-Xylene	5	**32**	**J**	**3.3**	**J**	**1200**	**D**	10	U	**2.6**	**J**	10	U	10	U
Tetrachloroethene	5	100	U	10	U	250	U	10	U	10	U	10	U	10	U
Toluene	5	**79**	**J**	**2.1**	**J**	**1100**	**D**	10	U	**6.1**	**J**	10	U	**1.4**	**J**
trans-1,2-Dichloroethene	5	100	U	10	U	250	U	10	U	10	U	10	U	**1.2**	**J**
Trichloroethene	5	100	U	10	U	250	U	10	U	10	U	10	U	10	U
Vinyl chloride	2	100	U	10	U	250	U	10	U	**3.1**	**J**	10	U	10	U
Xylene, m/p	5	**210**		**8.4**	**J**	**5800**	**D**	10	U	**6.8**	**J**	10	U	**2.8**	**J**

Notes:
Only Detected Compounds shown.
Samples analyzed for VOCs by USEPA Method OLM04.3.
Results in microgram per liter (µg/L)
ft bgs = feet below ground surface
QC Code:
FS = Field Sample
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*Criteria are New York State Groundwater Guidance Standards.
Highlighted results in **BOLD** exceed associated criteria

Created By/Date: ASZ 4/12/07
Checked By/Date: CRS 5/29/07

Table 4.5: Former ATRS Site 2006 Groundwater Results for VOCs

	Location	**MW-7**		**MW-8**		**MW-8**		**MW-9**		**DCGW-2**		**DCGW-10**		**DCMW-1**	
	Sample Date	**11/7/2006**		**11/8/2006**		**11/8/2006**		**11/9/2006**		**11/16/2006**		**11/10/2006**		**10/31/2006**	
	Sample ID	**ATMW00701601XX**		**ATMW00801601XX**		**ATMW00801601XD**		**ATMW00901701XX**		**ATDCGW201502XX**		**ATDCW1001501XX**		**ATDCMW101801XX**	
	Sample Depth (ft bgs)	**16**		**16**		**16**		**17**		**15**		**15**		**18**	
	Qc Code	**FS**		**FS**		**FD**		**FS**		**FS**		**FS**		**FS**	
Parameter	**Criteria**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
1,1,1-Trichloroethane	5	10	U	**1.1**	**J**	10	UJ	10	U	10	U	0.5	U	10	U
1,1-Dichloroethane	5	10	U	10	U	10	UJ	10	U	10	U	0.5	U	10	U
1,1-Dichloroethene	5	10	U	10	U	10	UJ	10	U	10	U	0.5	U	10	U
1,4-Dichlorobenzene	3	10	U	10	U	10	UJ	10	U	10	U	0.5	U	10	U
2-Butanone	50*	50	U	50	U	50	UJ	50	U	50	U	0.5	U	10	U
Acetone	50*	50	U	50	U	50	UJ	50	U	50	U	0.5	U	10	U
Benzene	1	10	U	10	U	10	UJ	**10**		10	U	0.5	U	10	U
Chloroform	7	10	U	10	U	10	UJ	10	U	10	U	0.5	U	10	U
Cis-1,2-Dichloroethene	5	10	U	**3**	**J**	**2.7**	**J**	**32**		**31**		**1.2**	**J**	**10**	
Cyclohexane	NA	10	U	10	U	10	UJ	**18**		10	U	0.5	U	10	U
Ethyl benzene	5	10	U	10	U	10	UJ	**31**		10	U	0.5	U	10	U
Isopropylbenzene	5	10	U	10	U	10	UJ	**5.1**	**J**	10	U	0.5	U	10	U
Methyl cyclohexane	NA	10	U	10	U	10	UJ	**5.7**	**J**	10	U	0.5	U	10	U
Methyl Tertbutyl Ether	10*	**20**	**J**	**10**	**J**	**11**	**J**	**14**		10	U	0.5	U	10	U
Methylene chloride	5	10	U	10	U	10	UJ	10	UJ	10	U	0.5	U	10	U
o-Xylene	5	10	U	10	U	10	UJ	**21**		10	U	0.5	U	10	U
Tetrachloroethene	5	10	U	10	U	10	UJ	**12**		**210**	**D**	**9.9**	**J**	**26**	
Toluene	5	10	U	10	U	10	UJ	**7.5**	**J**	10	U	0.5	U	10	U
trans-1,2-Dichloroethene	5	10	U	10	U	10	UJ	10	U	10	U	0.5	U	10	U
Trichloroethene	5	10	U	**5.3**	**J**	**5.8**	**J**	**12**		**27**		0.5	U	**7**	**J**
Vinyl chloride	2	10	U	10	U	10	UJ	10	U	10	U	0.5	U	10	U
Xylene, m/p	5	10	U	10	U	10	UJ	**54**		10	U	0.5	U	10	U

Notes:
Only Detected Compounds shown.
Samples analyzed for VOCs by USEPA Method OLM04.3.
Results in microgram per liter (µg/L)
ft bgs = feet below ground surface
QC Code:
FS = Field Sample
FD = Field Duplicate
Qualifiers:
U = Not detected at a concentration greater than the RL
J = Estimated value
D = Result was reported from a diluted analytical run
B = Analyte was detected in the method blank
Criteria = Values from Technical and Operational Guidance Series (TOGS) 1.1.1, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (NYSDEC, 2006).
*Criteria are New York State Groundwater Guidance Standards.
Highlighted results in **BOLD** exceed associated criteria

Table 4.5: Former ATRS Site 2006 Groundwater Results for VOCs

	Location	**DCMW-2**		**DCMW-3**		**DCMW-4**		**DCMW-5**	
	Sample Date	**11/10/2006**		**11/10/2006**		**11/9/2006**		**11/10/2006**	
	Sample ID	**ATDCMW202101XX**		**ATDCMW302101XX**		**ATDCMW401801XX**		**ATDCMW502001XX**	
	Sample Depth (ft bgs)	**21**		**21**		**18**		**20**	
	Qc Code	**FS**		**FS**		**FS**		**FS**	
Parameter	**Criteria**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
1,1,1-Trichloroethane	5	0.5	UJ	0.5	U	0.5	UJ	0.5	UJ
1,1-Dichloroethane	5	0.5	UJ	0.5	U	0.5	UJ	0.5	UJ
1,1-Dichloroethene	5	0.5	UJ	0.5	U	0.5	UJ	**1.6**	**J**
1,4-Dichlorobenzene	3	0.5	UJ	0.5	U	0.5	UJ	0.5	UJ
2-Butanone	50*	0.5	UJ	0.5	U	0.5	UJ	0.5	UJ
Acetone	50*	0.5	UJ	0.5	U	0.5	UJ	**4.8**	**JB**
Benzene	1	0.5	UJ	0.5	U	0.5	UJ	**1.8**	**J**
Chloroform	7	0.5	UJ	**2.3**	**J**	0.5	UJ	0.5	UJ
Cis-1,2-Dichloroethene	5	**65**	**J**	**18**		**33**	**J**	**1500**	**D**
Cyclohexane	NA	0.5	UJ	0.5	U	0.5	UJ	0.5	UJ
Ethyl benzene	5	0.5	UJ	0.5	U	0.5	UJ	**7.1**	**J**
Isopropylbenzene	5	0.5	UJ	0.5	U	0.5	UJ	**14**	**J**
Methyl cyclohexane	NA	0.5	UJ	0.5	U	0.5	UJ	0.5	UJ
Methyl Tertbutyl Ether	10*	0.5	UJ	0.5	U	0.5	UJ	0.5	UJ
Methylene chloride	5	0.5	UJ	0.5	U	**0.87**	**J**	0.5	UJ
o-Xylene	5	0.5	UJ	0.5	U	0.5	UJ	**80**	**J**
Tetrachloroethene	5	**220**	**D**	**28**		**890**	**D**	**79**	**J**
Toluene	5	0.5	UJ	0.5	U	0.5	UJ	**6.3**	**J**
trans-1,2-Dichloroethene	5	0.5	UJ	0.5	U	0.5	UJ	**2.2**	**J**
Trichloroethene	5	**15**	**J**	**4.1**	**J**	**10**	**J**	**11**	**J**
Vinyl chloride	2	0.5	UJ	0.5	U	0.5	UJ	**130**	**J**
Xylene, m/p	5	0.5	UJ	0.5	U	0.5	UJ	**31**	**J**

Notes:
Only Detected Compounds shown.
Samples analyzed for VOCs by USEPA Method OLM04.3.
Results in microgram per liter (µg/L)
ft bgs = feet below ground surface
QC Code:
  FS = Field Sample
  FD = Field Duplicate
Qualifiers:
  U = Not detected at a concentration greater than the RL
  J = Estimated value
  D = Result was reported from a diluted analytical run
  B = Analyte was detected in the method blank
Criteria = Values from Technical and Operational Guidance Series (TOGS) 1.1.1, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (NYSDEC, 2006).
*Criteria are New York State Groundwater Guidance Standards.
Highlighted results in **BOLD** exceed associated criteria

Table 4.6: Former ATRS Site 2007 Groundwater Results for VOCs

	Location	**GW-035**		**GW-035**		**GW-039**		**GW-039**		**GW-040**		**GW-041**	
	Sample Date	**8/28/2007**		**8/28/2007**		**8/28/2007**		**8/28/2007**		**8/28/2007**		**8/28/2007**	
	Sample ID	**ATGW03501701XX**		**ATGW03502701XX**		**ATGW03901801DU**		**ATGW03901801XX**		**ATGW04001701XX**		**ATGW04101701XX**	
	Sample Depth (ft bgs)	**17**		**27**		**18**		**18**		**17**		**17**	
	Qc Code	**FS**		**FS**		**FD**		**FS**		**FS**		**FS**	
Parameter	**Criteria**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
1,1,1-Trichloroethane	5	10	U	**78**		**3.7**	**J**	**3.3**	**J**	**1.6**	**J**	10	U
1,1-Dichloroethane	5	**4**	**J**	**27**		10	U	10	UJ	10	U	10	U
1,1-Dichloroethene	5	10	UJ	**6.8**	**J**	10	UJ	10	UJ	10	UJ	10	UJ
Benzene	1	**9.5**	**J**	**4.4**	**J**	10	U	10	UJ	**1.1**	**J**	**3.8**	**J**
Cis-1,2-Dichloroethene	5	**5.1**	**J**	**65**		**35**		**30**	**J**	**14**		**6.6**	**J**
Cyclohexane	NA	10	U	10	U	10	U	10	UJ	10	U	10	U
Methyl Tertbutyl Ether	10*	10	U	**6.5**	**J**	10	U	10	UJ	10	U	10	U
Methylene chloride	5	10	U	10	U	10	U	10	UJ	10	U	10	U
Tetrachloroethene	5	10	U	10	U	10	U	10	UJ	10	U	10	U
Trichloroethene	5	10	U	**15**		10	U	10	UJ	**1.6**	**J**	10	U

Notes:
Only Detected Compounds shown.
Samples analyzed for VOCs by USEPA Method OLM04.3.
Results in microgram per liter (µg/L)
ft bgs = feet below ground surface
QC Code:
FS = Field Sample
FD = Field Duplicate
Qualifiers:
U = Not detected at a concentration greater than the RL
J = Estimated value
D = Result was reported from a diluted analytical run

Criteria = Values from Technical and Operational Guidance Series (TOGS) 1.1.1, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (NYSDEC, 2006).
*Criteria are New York State Groundwater Guidance Values.
Highlighted results in **BOLD** exceed associated criteria

Table 4.6: Former ATRS Site 2007 Groundwater Results for VOCs

	Location	**GW-042**		**GW-043**		**GW-044**		**GW-045**		**GW-046**		**GW-046**	
	Sample Date	**8/28/2007**		**8/28/2007**		**8/28/2007**		**8/28/2007**		**8/29/2007**		**8/29/2007**	
	Sample ID	**ATGW04201701XX**		**ATGW04301701XX**		**ATGW04401901XX**		**ATGW04501901XX**		**ATGW04601901DU**		**ATGW04601901XX**	
	Sample Depth (ft bgs)	**17**		**17**		**19**		**19**		**19**		**19**	
	Qc Code	**FS**		**FS**		**FS**		**FS**		**FD**		**FS**	
Parameter	**Criteria**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
1,1,1-Trichloroethane	5	**9.3**	**J**	10	UJ	50	UJ	10	UJ	10	U	10	U
1,1-Dichloroethane	5	10	U	10	UJ	50	UJ	10	UJ	10	U	10	U
1,1-Dichloroethene	5	10	UJ	10	UJ	50	UJ	10	UJ	10	UJ	10	UJ
Benzene	1	10	U	10	UJ	50	UJ	10	UJ	10	U	10	U
Cis-1,2-Dichloroethene	5	**26**		**11**	**J**	50	UJ	**91**	**D**	**88**	**J**	**81**	**J**
Cyclohexane	NA	10	U	10	UJ	50	UJ	10	UJ	**5.1**	**J**	**5.5**	**J**
Methyl Tertbutyl Ether	10*	**3.3**	**J**	10	UJ	50	UJ	10	UJ	**5.7**	**J**	**5.5**	**J**
Methylene chloride	5	10	U	10	UJ	50	UJ	10	UJ	10	U	10	U
Tetrachloroethene	5	**19**		**850**	**DJ**	50	UJ	**900**	**D**	**490**	**DJ**	**470**	**DJ**
Trichloroethene	5	**30**		**76**	**J**	50	UJ	**100**	**D**	**86**	**J**	**82**	**J**

Notes:

Only Detected Compounds shown.

Samples analyzed for VOCs by USEPA Method OLM04.3.

Results in microgram per liter (µg/L)

ft bgs = feet below ground surface

QC Code:
- FS = Field Sample
- FD = Field Duplicate

Qualifiers:
- U = Not detected at a concentration greater than the RL
- J = Estimated value
- D = Result was reported from a diluted analytical run

Criteria = Values from Technical and Operational Guidance Series (TOGS) 1.1.1, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (NYSDEC, 2006).

*Criteria are New York State Groundwater Guidance Values.

Highlighted results in **BOLD** exceed associated criteria

Table 4.6: Former ATRS Site 2007 Groundwater Results for VOCs

Location		**GW-047**		**GW-047**		**GW-048**		**GW-048**		**GW-049**	
Sample Date		**8/29/2007**		**8/29/2007**		**8/29/2007**		**8/29/2007**		**8/29/2007**	
Sample ID		**ATGW04701701XX**		**ATGW04702701XX**		**ATGW04801701XX**		**ATGW04802701XX**		**ATGW04901701XX**	
Sample Depth (ft bgs)		**17**		**27**		**17**		**27**		**17**	
Qc Code		**FS**		**FS**		**FS**		**FS**		**FS**	
Parameter	**Criteria**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
1,1,1-Trichloroethane	5	10	U	10	U	10	U	50	U	**2**	**J**
1,1-Dichloroethane	5	10	U	10	U	10	U	50	U	10	U
1,1-Dichloroethene	5	10	UJ	10	UJ	10	UJ	50	UJ	10	UJ
Benzene	1	10	U	10	U	10	U	50	U	10	U
Cis-1,2-Dichloroethene	5	**3.7**	**J**	**3.8**	**J**	**43**		**45**	**J**	10	U
Cyclohexane	NA	10	U	10	U	10	U	50	U	10	U
Methyl Tertbutyl Ether	10*	**2.8**	**J**	**3.7**	**J**	10	U	50	U	10	U
Methylene chloride	5	**3.5**	**J**	**12**		10	U	**54**		**1.6**	**J**
Tetrachloroethene	5	10	U	10	U	10	U	50	U	10	U
Trichloroethene	5	10	U	10	U	10	U	50	U	**3.2**	**J**

Notes:

Only Detected Compounds shown.
Samples analyzed for VOCs by USEPA Method OLM04.3.
Results in microgram per liter (µg/L)
ft bgs = feet below ground surface
QC Code:
FS = Field Sample
FD = Field Duplicate
Qualifiers:
U = Not detected at a concentration greater than the RL
J = Estimated value
D = Result was reported from a diluted analytical run
Criteria = Values from Technical and Operational Guidance Series (TOGS) 1.1.1, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (NYSDEC, 2006).
*Criteria are New York State Groundwater Guidance Values.
Highlighted results in **BOLD** exceed associated criteria

Table 4.7: DC OU-2 Direct Push Investigation Groundwater Results for VOCs

	Depth in Feet	**Vinyl Chloride**	**1,1-Dichloroethene**	**trans-1,2-Dichloroethene**	**cis-1,2-Dichloroethene**	**1,1-Dichloroethane**	**1,1,1-Trichloroethane**	**1,2-Dichloroethane**	**Trichloroethene**	**Tetrachloroethene**	**Observed Relative Permeabilities**
GPS-1A	15'-20'	U	0.5J	4.8J	**13**	U	U	U	2.9	**44D**	D
GPS-1B	20'-25'	**2.9**	0.2J	4.9J	**16**	U	U	U	4.3	**88D**	VG
GPS-1C	25'-30'	**2.6**	0.1J	4.8J	**10**	U	U	U	0.9	4.4	D
GPS-1D	30'-35'	U	U	U	**5.5**	U	U	U	U	0.5	D
GPS-2A	15'-20'	**4.3**	0.3J	4.8J	**6.9**	U	U	U	0.9	**10**	G
GPS-2B	20'-25'	**2.7**	0.2J	4.9J	**14**	U	U	U	**5.2**	**46D**	VG
GPS-2C	25'-30'	U	U	U	U	U	U	U	U	0.3J	D
GPS-2C REDO	25'-30'	U	U	U	U	U	U	U	U	.3J	D
GPS-2D	30'-35'	U	U	U	U	U	U	U	U	0.3J	D
GPS-3A	15'-20'	**3.9**	0.3J	U	**6**	U	U	U	0.2J	4.4	D
GPS-3B	20'-25'	U	0.2J	U	**7.3**	U	U	U	1.1	**12**	VG
GPS-3C	25'-30'	U	0.2J	U	**6.3**	U	U	U	0.5	**7.3**	VG
GPS-3D	30'-35'	U	0.1J	U	**5.7**	U	U	U	U	2.9	D
GPS-4A	15'-20'	**4**	0.4J	4.8J	**7.9**	U	U	U	1.6	**48D**	VG
GPS-4B	20'-25'	**3.3**	0.3J	4.9J	**11**	U	U	U	0.4J	4.3	D
GPS-4C	25'-30'	U	U	U	U	U	U	U	U	0.3J	D
GPS-4D	30'-35'	U	U	U	U	U	U	U	U	0.3J	D
GPS-5A	15'-20'	**2.9**	0.2J	U	**7.3**	U	U	U	1	**39D**	VG
GPS-5B	20'-25'	**3.2**	0.3J	**5**	**16**	U	U	U	0.7	**9.2**	D
GPS-5C	25'-30'	U	U	U	U	U	U	U	U	0.3J	D
GPS-5D	30'-35'	**2.9**	0.3J	4.9J	**18**	U	U	U	2.3	**54D**	G
Detection limits		**1.0**	**1.0**	**5.0**	**5.0**	**5.0**	**0.5**	**5.0**	**0.5**	**0.5**	
New York State Standard (µg/L)		**2**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	

Notes:

All values are in µg/L (micrograms per liter)

U = Analyte not detected above sample quantitation limit.

E = Concentration of analyte exceeds the calibration range of instrument.

J = Analyte detected but less than the lowest calibration standards.

D = Result was reported from a diluted analytical run.

Highlighted result in **BOLD** equal or exceed associated criteria.

Groundwater guidance or standard values from Technical and Operational Guidance Series (TOGS) 1.1.1, "Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations" (NYSDEC, 1998).

Samples analyzed by Pine & Swallow Environmental on-site laboratory

Observed Relative Permeability: D = dewatered; G = good; VG = very good permeability

Table 4.7: DC OU-2 Direct Push Investigation Groundwater Results for VOCs

	Depth in Feet	**Vinyl Chloride**	**1,1-Dichloroethene**	**trans-1,2-Dichloroethene**	**cis-1,2-Dichloroethene**	**1,1-Dichloroethane**	**1,1,1-Trichloroethane**	**1,2-Dichloroethane**	**Trichloroethene**	**Tetrachloroethene**	**Observed Relative Permeabilities**
GPS-6A	15'-20'	U	U	U	**5.9**	U	U	U	U	2.7	D
GPS-6B	20'-25'	**2.8**	0.2J	4.9J	**21**	U	U	U	2.1	**9.6**	D
GPS-6C	25'-30'	**2.5**	0.2J	**5**	**60**	U	U	U	0.8	0.8	D
GPS-6D	30'-35'	**2.2**	0.3J	**5**	**20**	U	U	U	U	0.4J	D
GPS-7A	15'-20'	U	U	U	**6**	U	U	U	0.2J	**5.4**	D
GPS-7B	20'-25'	U	U	U	**7.8**	U	U	U	1.2	**14**	G
GPS-7C	25'-30'	**15**	0.2J	4.9J	**37**	U	U	U	0.6	2.8	VG
GPS-8A	15'-20'	U	0.5J	U	U	U	U	U	U	0.5	D
GPS-8B	20'-25'	U	U	U	**5.8**	U	U	U	0.03J	2.4	VG
GPS-8C	25'-30'	U	0.2J	U	**6.7**	U	U	U	0.8	**8.3**	VG
GPS-8D	29'-34'	U	U	U	**7.8**	U	U	U	2.6	**46D**	VG
GPS-9A	15'-20'	U	U	U	**5.7**	U	U	U	U	2.4	D
GPS-9B	20'-25'	U	U	U	**10**	U	U	U	2.3	**15**	VG
GPS-9C	25'-30'	U	U	U	U	U	U	U	U	0.4J	D
GPS-9D	30'-35'	U	U	U	U	U	U	U	U	0.3J	D
GPN-1A	15'-20'	**2.8**	0.1J	4.9J	**19**	U	U	U	1.9	**28D**	VG
GPN-1B	20'-25'	U	0.3J	4.9J	**35**	U	U	U	**5.9**	**42D**	VG
GPN-1C	23.3'-28.3'	**3.5**	0.1J	4.9J	**75**	U	U	U	4.4	**91D**	VG
Detection limits		**1.0**	**1.0**	**5.0**	**5.0**	**5.0**	**0.5**	**5.0**	**0.5**	**0.5**	
New York State Standard (µg/L)		**2**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	

Notes:

All values are in µg/L (micrograms per liter)

U = Analyte not detected above sample quantitation limit.

E = Concentration of analyte exceeds the calibration range of instrument.

J = Analyte detected but less than the lowest calibration standards.

D = Result was reported from a diluted analytical run.

Highlighted result in **BOLD** equal or exceed associated criteria.

Groundwater guidance or standard values from Technical and Operational Guidance Series (TOGS) 1.1.1, "Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations" (NYSDEC, 1998).

Samples analyzed by Pine & Swallow Environmental on-site laboratory

Observed Relative Permeability: D = dewatered; G = good; VG = very good permeability

Table 4.7: DC OU-2 Direct Push Investigation Groundwater Results for VOCs

	Depth in Feet	**Vinyl Chloride**	**1,1-Dichloroethene**	**trans-1,2-Dichloroethene**	**cis-1,2-Dichloroethene**	**1,1-Dichloroethane**	**1,1,1-Trichloroethane**	**1,2-Dichloroethane**	**Trichloroethene**	**Tetrachloroethene**	**Observed Relative Permeabilities**
GPN-2A	15'-20'	**3.5**	0.2J	**5**	**210D**	U	U	U	3.3	**29D**	G
GPN-2B	20'-25'	**27**	0.5	**5.3**	**550D**	U	U	U	**27D**	**160D**	VG
GPN-2C	25'-30'	**2.7**	0.5	U	**20**	U	U	U	0.1J	1.2	D
GPN-2D	30'-35'	U	U	U	**5.9**	U	U	U	U	0.3J	D
GPN-3A	15'-20'	U	U	U	**270D**	U	U	U	**40D**	**220D**	G
GPN-3B	20'-25'	**4.9**	0.6	**5.3**	**940D**	U	U	U	**74D**	**740D**	VG
GPN-3C	24.6'-29.6'	**6.3**	0.4J	**5.3**	**420D**	U	U	U	**46D**	**170D**	VG
GPN-4A	15'-20'	**4.8**	0.8	**5**	**90**	U	U	U	3.9	**50D**	D
GPN-4B	20'-25'	**9.3**	0.5	**5.2**	**710D**	U	U	U	**37D**	**200D**	VG
GPN-4C	25'-30'	**17**	0.4J	**5.2**	**230D**	U	U	U	**38D**	**54D**	VG
GPN-4D	30'-35'	**15**	0.4J	**5.2**	**260D**	U	U	U	**54D**	**86D**	VG
GPN-4E	35'-40'	**8.3**	0.2J	**5**	**160D**	U	U	U	**38D**	**39D**	VG
Detection limits		**1.0**	**1.0**	**5.0**	**5.0**	**5.0**	**0.5**	**5.0**	**0.5**	**0.5**	
New York State Standard (µg/L)		**2**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	

Notes:

All values are in µg/L (micrograms per liter)

U = Analyte not detected above sample quantitation limit.

E = Concentration of analyte exceeds the calibration range of instrument.

J = Analyte detected but less than the lowest calibration standards.

D = Result was reported from a diluted analytical run.

Highlighted result in **BOLD** equal or exceed associated criteria.

Groundwater guidance or standard values from Technical and Operational Guidance Series (TOGS) 1.1.1, "Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations" (NYSDEC, 1998).

Samples analyzed by Pine & Swallow Environmental on-site laboratory

Observed Relative Permeability: D = dewatered; G = good; VG = very good permeability

Prepared by: TDL 12/20/08
Checked by: CRS 3/25/09

Table 4.8: DC OU-2 Groundwater Monitoring Well Results for VOCs

	Location Name	ATGW-004		ATMW-008		ATMW-009		GW-002		GW-010	
	Sample Date	8/13/2008		8/14/2008		8/14/2008		8/12/2008		8/12/2008	
	Sample ID	ATGW00401508		ATMW00801508		ATMW00901508		DCGW00201508		DCGW01001408	
	QC Code	FS		FS		FS		FS		FS	
Paramater	**Criteria**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
1,1,1-Trichloroethane	5	**21**		**5**		0.46	U	0.46	U	0.46	U
1,1-Dichloroethane	5	3.5		1.9		0.55	U	0.55	U	0.55	U
1,1-Dichloroethene	5	1.4		0.55	U	0.55	U	0.55	U	0.55	U
1,2,4-Trichlorobenzene	5	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U
Acetone	50*	2.7	UJ	2.7	UJ	2.7	UJ	2.7	UJ	2.7	UJ
Benzene	1	**1.1**		0.52	U	0.52	U	0.52	U	0.52	U
Chloroform	7	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U
Cis-1,2-Dichloroethene	5	**37**		**8.5**		**290**	**D**	**20**		0.85	J
Ethyl benzene	5	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Isopropylbenzene	5	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U
Methyl Tertbutyl Ether	10	4.2		**20**		0.5	U	0.5	U	0.5	U
o-Xylene	5	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U
Tetrachloroethene	5	**9.2**		3.1		4.9		**280**	**DJ**	**15**	
Toluene	5	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U
trans-1,2-Dichloroethene	5	0.57	U	0.57	U	0.57	U	0.57	U	0.57	U
Trichloroethene	5	**14**		**9.1**		**26**		**21**		0.56	U
Vinyl chloride	2	**4.5**		1	J	0.46	U	0.46	U	0.46	U
Xylenes, m/p	5	0.97	U	0.97	U	0.97	U	0.97	U	0.97	U

NOTES:

Only Detected Compounds shown.
Samples analyzed for VOCs by USEPA Method 8260.
Results in microgram per liter (µg/L)
QC Code: FS = Field Sample
FD = Field Duplicate
Qualifiers:
U = Not detected at a concentration greater than the RL
J = Estimated value
D = Result was reported from a diluted analytical run

Criteria = Values from Technical and Operational Guidance Series (TOGS) 1.1.1, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (NYSDEC, 2006).
*Criteria are New York State Groundwater Guidance Values.
Highlighted results in **BOLD** exceed associated criteria

Table 4.8: DC OU-2 Groundwater Monitoring Well Results for VOCs

	Location Name	**GW-013**		**GW-014**		**MW-001**		**MW-002**		**MW-003**	
	Sample Date	**8/14/2008**		**8/13/2008**		**8/13/2008**		**8/12/2008**		**8/13/2008**	
	Sample ID	**DCGW01301508**		**DCGW01401308**		**DCMW00102008**		**DCMW00202108**		**DCMW00302008**	
	QC Code	**FS**		**FS**		**FS**		**FS**		**FS**	
Paramater	**Criteria**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
1,1,1-Trichloroethane	5	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U
1,1-Dichloroethane	5	0.55	U	0.55	U	0.55	U	0.55	U	0.55	U
1,1-Dichloroethene	5	0.55	U	0.55	U	0.55	U	0.55	U	0.55	U
1,2,4-Trichlorobenzene	5	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U
Acetone	50*	5.4		2.7	UJ	2.7	UJ	2.7	U	2.7	UJ
Benzene	1	0.52	U	0.52	U	0.52	U	0.52	U	0.52	U
Chloroform	7	0.46	U	0.46	U	0.46	U	0.46	U	0.69	J
Cis-1,2-Dichloroethene	5	0.53	U	1	U	4.8		**48**		**31**	
Ethyl benzene	5	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
Isopropylbenzene	5	0.8	J	0.44	U	0.44	U	0.44	U	0.44	U
Methyl Tertbutyl Ether	10	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
o-Xylene	5	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U
Tetrachloroethene	5	0.68	UJ	1.8		**17**		**100**	**D**	**66**	
Toluene	5	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U
trans-1,2-Dichloroethene	5	0.57	U	0.57	U	0.57	U	0.57	U	0.57	U
Trichloroethene	5	0.56	U	0.56	U	**6.3**		**14**		**8.6**	
Vinyl chloride	2	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U
Xylenes, m/p	5	0.97	U	0.97	U	0.97	U	0.97	U	0.97	U

NOTES:

Only Detected Compounds shown.
Samples analyzed for VOCs by USEPA Method 8260.
Results in microgram per liter (µg/L)
QC Code: FS = Field Sample
FD = Field Duplicate
Qualifiers:
U = Not detected at a concentration greater than the RL
J = Estimated value
D = Result was reported from a diluted analytical run

Criteria = Values from Technical and Operational Guidance Series (TOGS) 1.1.1, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (NYSDEC, 2006).
*Criteria are New York State Groundwater Guidance Values.
Highlighted results in **BOLD** exceed associated criteria

Table 4.8: DC OU-2 Groundwater Monitoring Well Results for VOCs

	Location Name	**MW-004**		**MW-004**		**MW-005**		**MW-006**		**MW-007**	
	Sample Date	**8/12/2008**		**8/12/2008**		**8/12/2008**		**8/13/2008**		**8/12/2008**	
	Sample ID	**DCMW00401708**		**DCMW00401708D**		**DCMW00502108**		**DCMW00601608**		**DCMW00701708**	
	QC Code	**FS**		**FD**		**FS**		**FS**		**FS**	
Paramater	**Criteria**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
1,1,1-Trichloroethane	5	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U
1,1-Dichloroethane	5	0.55	U	0.55	U	0.55	U	0.55	U	0.55	U
1,1-Dichloroethene	5	0.55	U	0.55	U	0.55	U	0.55	U	0.55	U
1,2,4-Trichlorobenzene	5	0.41	U	0.41	U	0.41	U	0.41	U	1.2	
Acetone	50*	2.7	U	2.7	U	2.7	U	2.7	UJ	2.7	UJ
Benzene	1	0.52	U	0.52	U	0.52	U	0.52	U	0.96	J
Chloroform	7	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U
Cis-1,2-Dichloroethene	5	**17**		**17**		**600**	**D**	**18**		**960**	**D**
Ethyl benzene	5	0.5	U	0.5	U	0.5	U	0.5	U	2.1	
Isopropylbenzene	5	0.44	U	0.44	U	0.44	U	0.44	U	3.3	
Methyl Tertbutyl Ether	10	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
o-Xylene	5	0.51	U	0.51	U	0.51	U	0.51	U	**15**	
Tetrachloroethene	5	**1300**	**DJ**	**1600**	**DJ**	**590**	**DJ**	0.72	J	**230**	**D**
Toluene	5	0.51	U	0.51	U	0.51	U	0.51	U	2.2	
trans-1,2-Dichloroethene	5	0.57	U	0.57	U	1.6		0.57	U	3.2	
Trichloroethene	5	**11**		**11**		**71**		0.56	U	**13**	
Vinyl chloride	2	0.46	U	0.46	U	**10**		0.46	U	**230**	**D**
Xylenes, m/p	5	0.97	U	0.97	U	0.97	U	0.97	U	**7.5**	

NOTES:

Only Detected Compounds shown.

Samples analyzed for VOCs by USEPA Method 8260.

Results in microgram per liter (µg/L)

QC Code: FS = Field Sample
FD = Field Duplicate

Qualifiers:
U = Not detected at a concentration greater than the RL
J = Estimated value
D = Result was reported from a diluted analytical run

Criteria = Values from Technical and Operational Guidance Series (TOGS) 1.1.1, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (NYSDEC, 2006).
*Criteria are New York State Groundwater Guidance Values.
Highlighted results in **BOLD** exceed associated criteria

Prepared/Date: TDL 12/19/08
Checked/Date: CRS 3/22/09

Table 4.8: DC OU-2 Groundwater Monitoring Well Results for VOCs

	Location Name	**MW-008**		**MW-009**		**MW-010**		**MW-011**	
	Sample Date	**8/12/2008**		**8/13/2008**		**8/13/2008**		**8/14/2008**	
	Sample ID	**DCMW00801808**		**DCMW00901708**		**DCMW01001808**		**DCMW01101908**	
	QC Code	**FS**		**FS**		**FD**		**FS**	
Paramater	**Criteria**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
1,1,1-Trichloroethane	5	0.46	U	0.46	U	0.46	U	0.46	U
1,1-Dichloroethane	5	0.55	U	0.55	U	0.55	U	0.55	U
1,1-Dichloroethene	5	0.55	U	0.55	U	0.55	U	0.55	U
1,2,4-Trichlorobenzene	5	0.41	U	0.41	U	0.41	U	0.41	U
Acetone	50*	**5.8**	**J**	2.7	UJ	2.7	UJ	2.7	UJ
Benzene	1	0.52	U	0.52	U	0.52	U	0.52	U
Chloroform	7	0.46	U	0.46	U	0.46	U	0.46	U
Cis-1,2-Dichloroethene	5	**62**		**55**	**D**	**8.5**		0.58	J
Ethyl benzene	5	0.5	U	0.5	U	0.5	U	0.5	U
Isopropylbenzene	5	0.44	U	0.44	U	0.44	U	0.44	U
Methyl Tertbutyl Ether	10	0.5	UJ	0.5	U	0.5	U	0.5	U
o-Xylene	5	0.51	U	0.51	U	0.51	U	0.51	U
Tetrachloroethene	5	**140**	**D**	**41**		**370**	**DJ**	0.68	U
Toluene	5	0.51	U	0.51	U	0.51	U	0.51	U
trans-1,2-Dichloroethene	5	0.57	U	0.57	U	0.57	U	0.57	U
Trichloroethene	5	**11**		**13**		3.5		1.4	
Vinyl chloride	2	1.4		0.46	U	0.46	U	0.46	U
Xylenes, m/p	5	0.97	U	0.97	U	0.97	U	0.97	U

NOTES:

Only Detected Compounds shown.
Samples analyzed for VOCs by USEPA Method 8260.
Results in microgram per liter (µg/L)
QC Code: FS = Field Sample
FD = Field Duplicate
Qualifiers:
U = Not detected at a concentration greater than the RL
J = Estimated value
D = Result was reported from a diluted analytical run

Criteria = Values from Technical and Operational Guidance Series (TOGS) 1.1.1, Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (NYSDEC, 2006).
*Criteria are New York State Groundwater Guidance Values.
Highlighted results in **BOLD** exceed associated criteria

Table 4.9: DC April 2009 Groundwater Results

	Location Name	GW-010		MW-005		MW-006		MW-007	
	Sample Date	4/2/2009		4/2/2009		4/2/2009		4/2/2009	
	Field Sample ID	DCGW01001409		DCMW00502109		DCMW00601609		DCMW00701709	
	QC Code	FS		FS		FS		FS	
Parameter	**Criteria**	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
VOCs									
1,1-Dichloroethene	5	1	U	**2.3**		1	U	1	U
Benzene	1	1	U	**2.6**		1	U	1	U
Cis-1,2-Dichloroethene	5	**8.8**		**6600**	DJ	**13**		**520**	D
Ethyl benzene	5	1	U	**3.5**		1	U	1	U
Isopropylbenzene	5	1	U	**7.4**		1	U	1	U
Tetrachloroethene	5	**20**		**51**		1	U	**410**	D
Toluene	5	1	U	**2.9**		1	U	1	U
trans-1,2-Dichloroethene	5	1	U	**9.9**		1	U	**1.6**	
Trichloroethene	5	**1.8**		**11**		**0.66**	J	**50**	
Vinyl chloride	2	1	U	**1800**	DJ	1	U	1	U
Xylene, m/p	5	2	U	**10**		2	U	2	U
Xylene, o	5	1	U	**34**		1	U	1	U
SVOCs									
Naphthalene	10	10	U	**1**	J	10	U	10	U
Pesticides									
4,4`-DDD	0.3	0.05	U	**0.26**		0.05	U	0.05	U
Metals									
Aluminum	NL	**83.1**		50	U	50	U	50	U
Barium	1,000	**84.6**		**4110**		**229**		**180**	
Calcium	NL	**71000**		**102000**		**103000**		**122000**	
Iron	300	**263**		**447**		**1060**		26.4	U
Magnesium	35,000	**10700**		**16800**		**15700**		**20100**	
Manganese	300	**37.4**		**1240**		**590**		**43.7**	
Potassium	NL	**4430**		**11300**		**3530**		**5390**	
Selenium	10	**19.9**		**7.13**	J	**7.73**	J	**9.86**	J
Sodium	20,000	**30600**		**92100**		**178000**		**82000**	
Zinc	2,000	**22.4**		**31.9**		**31**		**21.6**	

Notes:
Samples analyzed for VOCs by USEPA Method 8620, for SVOCs by USEPA Method 8270, for Pesticides by USEPA Method 8081, and for Metals by USEPA 6010B.
Only detected analytes are shown. Individual detections are presented in bold. Results are in µg/L.
Criteria = NYS Class GA drinking water standard or guidance value.
NL = not listed
QC Code - FS = Field sample
Qualifiers:
U = Not detected at a concentration greater than the reporting limit
J = Result is estimated
D = Analyte quantified in an analysis performed at a secondary dilution factor

Table 8.1: Remediation Goals

Groundwater	**Maximum Detection (µg/L)**	**Location of Maximum**	**Date of Maximim**	**Chemical-Specific SCGs**	**Remediation Goal (µg/L)**
Chemical Name				**NYS Class GA GW Standard/Guidance (µg/l)**	
1,1-Dichloroethene	8	GW-009	6/21/2005	5	5
Acetone	45	GW-007	6/21/2005	50	50
Benzene	58	GW-009	6/21/2005	1	1
Cis-1,2-Dichloroethene	20,000	GW-006	6/21/2005	5	5
Ethyl benzene	65	GW-009	6/21/2005	5	5
Isopropylbenzene	280	GW-004	6/22/2005	5	5
Tetrachloroethene	1,000	MW-02	3/23/2006	5	5
Toluene	100	GW-009	6/21/2005	5	5
Total Xylene	600	GW-009	6/21/2005	5	5
trans-1,2-Dichloroethene	22	GW-009	6/21/2005	5	5
Trichloroethene	120	GW-004	6/22/2005	5	5
Vinyl chloride	3,400	GW-9	6/21/2005	2	2

Table 9.1: Potential Remedial Technologies and Process Options

Environmental Media	General Response Action	Remedial Technology	Process Option	Applicability to		Screening Status	Comments
				Site-Limiting Characteristic	**Waste-Limiting Characteristic**		
Groundwater	No Action			Not Applicable	Not Applicable	Retained.	Retained to be carried through detailed analysis of alternatives.
	Institutional Controls	Land Use Restrictions		None.	Would provide human exposure control. Would not reduce toxicity, mobility, or volume of contaminants.	Eliminated.	Water is not currently being used for drinking, would not provide additional benefits.
	Containment	Capping	Low Permeability Cover System	None.	Would reduce leaching of soil contaminants to groundwater but not reduce migration of groundwater contaminants or reduce toxicity and volume. Contaminated vadose zone soi will be removed as part of OU-1, therefore this option provides no additional protection.	Eliminated.	
		Vertical Barriers	Slurry Wall/Sheet Piling	No ideal downgradient placement location, due to the location of buildings, utilities and roads in relation to the plume.	Would reduce off-site migration of contaminated groundwater, but would not reduce toxicity, or volume of contaminants. This alternative is more often used along with pumping for hydraulic control.	Eliminated.	
		Surface Controls	Grading/Diversion	Difficult to implement due to the location of buildings, utilities and roads in relation to the plume.	Would reduce leaching of soil contaminants to groundwater but not reduce migration of groundwater contaminants or reduce toxicity and volume. Contaminated vadose zone soi will be removed as part of OU-1, therefore this option provides no additional protection.	Eliminated.	
	Collection	Extraction	Extraction/Monitoring Wells	Proximity of buildings, utilities and roads would make implementation of this technology challenging.	None.	Retained.	Viable option for ex-situ treatment of groundwater.
		Passive Collection	Collection Trench	No ideal downgradient placement location, due to the proximity of buildings, utilities and roads in relation to the plume.	None.	Eliminated.	
	In-Situ Treatment	Biological Treatment	Enhanced Biodegradation	Proximity of buildings, utilities and roads would make this alternative challenging. Initial investigations indicate that the site had ideal conditions for this remedy.	Most often used to treat residual contamination. May require time to treat contaminant at the levels on site.	Retained.	Viable option for treatment of VOCs in saturated zone.
		Physical Treatment	Permeable Reactive Barrier	No ideal downgradient placement location, due to the proximity of buildings, utilities and roads in relation to the plume.	Trench would have to be placed outside the property line. Groundwater flow direction is variable and the barrier would have to be quite large.	Eliminated.	
			Air Sparging	Would increase potential for soil vapor and indoor air conditions in nearby residential buildings.	Would require soil vapor extraction, however, the soil woul already be remediated prior to implementation	Eliminated.	
		Thermal Treatment	Thermal Treatment	Location of buildings, utilities and roads would make this alternative challenging. Requires high electrical usage which may or may not be available.	Generally not as cost-effective for treatment of low level VOCs given the limited and relatively shallow extent of contamination.	Eliminated.	
		Chemical Treatment	Oxidation/Reduction	Proximity of buildings, utilities and roads would make implementation of this technology challenging. Would require ensuring that the selected chemicals are compatible with existing underground structures	Viable option for treatment of VOCs in groundwater. Site has high natural oxidant demand in soil which may result in high chemical quantities.	Retained.	Viable option for treatment of VOCs in saturated zone.
	On-Site Ex-situ Treatment	Physical Treatment	Air Stripping	None.	Need to size the stripper appropriately for the levels of contamination. It may require treatment of air prior to discharge.	Retained.	
			Granular Activated Carbon	May require large carbon vessels, which would require sufficient room for storage and for truck mobilization to empty/refill the vessels.	May be fouled by inorganics in the influent (high iron).	Eliminated.	
		Chemical Treatment	Oxidation/Reduction	Chemicals could be dangerous to tresspassers.	High chemical costs.	Eliminated.	
	Disposal	Discharge to POTW after treatment		Need to locate nearest storm drain and would require permitting.	Would require permitting.	Retained.	
		Discharge to Surface Water after treatment		No surface water bodies close to the Site.	Would require permitting.	Eliminated.	
		Reinjection after treatment		May be limited by local geology since soil is relatively impermeable below the contaminated groundwater area. Could also adversely impact the area hydrogeology because the groundwater table is relatively flat and groundwater moves slowly in the area.	None.	Eliminated.	

Prepared by: JDW 06/04/09
Checked by: MJS 07/29/09

Table 11.1: Cost Summary for Alternative 2 - In-Situ Enhanced Biodegradation

ITEM		**COST**
DIRECT CAPITAL COSTS		
Pre-Design Investigation	$	14,000
Full Scale In-situ Enhanced Biodegradation	$	318,000
Direct Cost Subtotal	$	332,000
INDIRECT CAPITAL COSTS		
Project Management (@ 8 Percent)	$	27,000
Remedial Design (@ 15 Percent)	$	50,000
Construction Management (@ 10 Percent)	$	33,000
Contingency (@ 15 Percent)	$	50,000
Indirect Cost Subtotal	$	160,000
TOTAL CAPITAL COSTS	**$**	**492,000**
ANNUAL OPERATION AND MAINTENANCE COSTS*		
Quarterly Monitoring (years 1-2)	$	38,000
Semi-annual Monitoring (years 2-4)	$	19,000
Annual Monitoring (years 5-30)	$	9,000
Annual Performance Reporting (years 1-30)	$	25,000
PERIODIC COSTS*		
Assume no second injection required (to be reviewed during 5/year review)	$	-
PRESENT WORTH OF ANNUAL AND PERIODIC COSTS (30 yrs)	**$**	**767,000**
TOTAL PRESENT WORTH OF ALTERNATIVE 3 (30 yrs)	**$**	**1,259,000**
TOTAL NON-DISCOUNTED COST OF ALTERNATIVE 3 (30 yrs)	**$**	**1,590,000**

NOTES:
Costs have been rounded to the nearest thousand.
* - Costs include additional 10 percent for technical support and 15 percent contingency for unforeseen project complexities, including insurance, taxes, and licensing costs.

Prepared By/Date: **JDW 7/23/09**
Checked By/Date: **RTB 7/27/09**
Modified By/Date: **JDW 11/17/09**
Checked By/Date: **RTB 11/24/09**

Table 11.2: Cost Summary for Alternative 3 - In-Situ Chemical Oxidation

ITEM		**COST**
DIRECT CAPITAL COSTS		
Pre-Design Investigation	$	18,000
Bench Scale	$	30,000
Full Scale In-situ Chemical Oxidation	$	1,200,000
Direct Cost Subtotal	$	1,248,000
INDIRECT CAPITAL COSTS		
Project Management (@ 6 Percent)	$	75,000
Remedial Design (@ 12 Percent)	$	150,000
Construction Management (@ 8 Percent)	$	100,000
Contingency (@ 15 Percent)	$	187,000
Indirect Cost Subtotal	$	512,000
TOTAL CAPITAL COSTS	**$**	**1,760,000**
ANNUAL OPERATION AND MAINTENANCE COSTS*		
Quarterly Monitoring (years 1-2)	$	38,000
Semi-annual Monitoring (years 3-4)	$	19,000
Annual Monitoring (years 5-30)	$	9,000
Annual Performance Reporting (years 1-30)	$	25,000
PERIODIC COSTS*		
Assume no second injection required (to be reviewed during 5/year review)	$	-
PRESENT WORTH OF ANNUAL AND PERIODIC COSTS (30 yrs)	**$**	**767,000**
TOTAL PRESENT WORTH OF ALTERNATIVE 4 (30 yrs)	**$**	**2,527,000**
TOTAL NON-DISCOUNTED COST OF ALTERNATIVE 4 (30 yrs)	**$**	**2,858,000**

NOTES:
Costs have been rounded to the nearest thousand.
* - Costs include additional 10 percent for technical support and 15 percent contingency for unforeseen project complexities, including insurance, taxes, and licensing costs.

Prepared By/Date: **JDW 7/23/09**
Checked By/Date: **RTB 7/27/09**
Modified By/Date: **JDW 11/17/09**
Checked By/Date: **RTB 11/24/09**

Table 11.3: Cost Summary for Alternative 4 - Combined In-Situ Chemical Oxidation and Enhanced Biodegradation

ITEM		COST
DIRECT CAPITAL COSTS		
Pre-Design Investigation	$	17,000
Bench Scale	$	15,000
Full Scale In-situ Chemical Oxidation & Enhance Biodegradation	$	400,000
Direct Cost Subtotal	$	432,000
INDIRECT CAPITAL COSTS		
Project Management (@ 8 Percent)	$	35,000
Remedial Design (@ 15 Percent)	$	65,000
Construction Management (@ 10 Percent)	$	43,000
Contingency (@ 15 Percent)	$	65,000
Indirect Cost Subtotal	$	208,000
TOTAL CAPITAL COSTS	**$**	**640,000**
ANNUAL OPERATION AND MAINTENANCE COSTS*		
Quarterly Monitoring (years 1-2)	$	38,000
Semi-annual Monitoring (years 3-4)	$	19,000
Annual Monitoring (years 5-30)	$	9,000
Annual Performance Reporting (years 1-30)	$	25,000
PERIODIC COSTS*		
Assume no second injection required (to be reviewed during 5/year review)	$	-
PRESENT WORTH OF ANNUAL AND PERIODIC COSTS (30 yrs)	**$**	**767,000**
TOTAL PRESENT WORTH OF ALTERNATIVE 4 (30 yrs)	**$**	**1,407,000**
TOTAL NON-DISCOUNTED COST OF ALTERNATIVE 4 (30 yrs)	**$**	**1,738,000**

NOTES:
Costs have been rounded to the nearest thousand.
* - Costs include additional 10 percent for technical support and 15 percent contingency for unforeseen project complexities, including insurance, taxes, and licensing costs.

Prepared By/Date: **JDW 11/17/09**
Checked By/Date: **RTB 11/24/09**

Table 11.4: Cost Summary for Alternative 5 - Groundwater Extraction and Treatment

ITEM		**COST**
DIRECT CAPITAL COSTS		
Pre-Design Investigation	$	37,000
Full Scale Pump and Treat System	$	387,000
Direct Cost Subtotal	$	424,000
INDIRECT CAPITAL COSTS		
Project Management (@ 8 Percent)	$	34,000
Remedial Design (@ 15 Percent)	$	64,000
Construction Management (@ 10 Percent)	$	42,000
Contingency (@ 15 Percent)	$	63,600
Indirect Cost Subtotal	$	203,600
TOTAL CAPITAL COSTS	**$**	**628,000**
ANNUAL OPERATION AND MAINTENANCE COSTS*		
Annual Operations and Maintenance costs (years 1-30)	$	109,000
Quarterly Monitoring (years 1-2)	$	38,000
Semi-annual Monitoring (years 3-4)	$	19,000
Annual Monitoring (years 5-30)	$	9,000
Annual Performance Reporting (years 1-30)	$	25,000
PERIODIC COSTS*		
Major System Repairs/Replacement (year 15)	$	193,527
PRESENT WORTH OF ANNUAL AND PERIODIC COSTS (30 yrs)	**$**	**3,118,000**
TOTAL PRESENT WORTH OF ALTERNATIVE 5 (30 yrs)	**$**	**3,746,000**
TOTAL NON-DISCOUNTED COST OF ALTERNATIVE 5 (30 yrs)	**$**	**5,190,000**

NOTES:
Costs have been rounded to the nearest thousand.
* - Costs include additional 10 percent for technical support and 15 percent contingency for unforeseen project complexities, including insurance, taxes, and licensing costs.

Prepared By/Date: **JDW 7/22/09**
Checked By/Date: **RTB 7/27/09**
Modified By/Date: **JDW 11/17/09**
Checked By/Date: **RTB 11/24/09**

Table 12.1: Summary of Remedial Alternative Costs

Item	Description	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
1	Capital Costs	$ -	$ 492,000	$ 1,760,000	$ 640,000	$ 628,000
2	Present Worth of Annual and Periodic Costs	$ -	$ 767,000	$ 767,000	$ 767,000	$ 3,118,000
3	Total Present Worth (Item 1 plus 2)	$ -	$ 1,259,000	$ 2,527,000	$ 1,407,000	$ 3,746,000
4	Annual Costs Years 1 and 2	$ -	$ 63,000	$ 63,000	$ 63,000	$ 172,000
5	Annual Costs Years 3 and 4	$ -	$ 44,000	$ 44,000	$ 44,000	$ 153,000
6	Annual Costs Years 5 through 30	$ -	$ 34,000	$ 34,000	$ 34,000	$ 143,000
7	Periodic Costs (see Note 1)	$ -	$ -	$ -	$ -	$ 193,527
8	Remedial Timeframe (yrs) (Note 3)	>30	30	30	30	30

Notes:
1. Periodic Costs for Alternative 5 would be incurred in Year 15.
2. Present Worth costs shown above are based upon the assumed Remedial Timeframe.
3. Annual and Periodic Costs (Item 4 - 7) presented are non-discounted costs.

1 = No Action
2 = In-Situ Enhanced Biodegradation
3 = In-Situ Chemical Oxidation
4 = Chemical Oxidation in Source Area with Enhanced Biodegradation Down gradient
5 = Groundwater Extraction and Treatment

Prepared By/Date:	JDW 7/24/09
Checked By/Date:	RTB 7/27/09
Modified By/Date:	JDW 11/17/09
Checked By/Date:	RTB 11/24/09

Table 12.2: Comparative Analysis of Remedial Alternatives for Groundwater

Remedial Alternative	Alternative 1: No Action	Alternative 2: In-Situ Enhanced Biodegradation	Alternative 3: In-Situ Chemical Oxidation/Reduction	Alternative 4: Combined In-Situ Chemical Oxidation/Reduction and Enhanced Biodegradation	Alternative 5: Pump, Treat and Discharge
Compliance with New York State SCGs	Alternative 1 would not comply with Chemical-specific SCGs.	Alternative 2 would comply with Chemical-specific SCGs by implementing in-situ treatment to reduce contaminant concentrations within the plume, thereby reducing the time necessary to meet SCGs. Location- and Action-specific SCGs would include 40 CFR Part 144 – Underground Injection Control Program.	Alternative 3 would comply with Chemical-specific SCGs by implementing in-situ treatment to reduce contaminant concentrations within the plume, thereby reducing the time necessary to meet SCGs. Location- and Action-specific SCGs associated with this alternative includes 40 CFR Part 144 – Underground Injection Control Program.	Alternative 4 would comply with Chemical-specific SCGs by implementing in-situ treatment to reduce contaminant concentrations within the plume, thereby reducing the time necessary to meet SCGs. Location- and Action-specific SCGs associated with this alternative includes 40 CFR Part 144 – Underground Injection Control Program.	Alternative 5 would comply with Chemical-specific SCGs by providing hydraulic control until the SCGs are met. Effluent will also be monitored to ensure that it meets required discharge permit requirements. Location and Action-specific SCGs associated with this alternative include permitting requirements for discharge of treated groundwater.
Overall Protection of Human Health and the Environment	Alternative 1 would not provide any additional protection of human health and the environment compared to present conditions.	Alternative 2 would protect public health and the environment by providing in-situ treatment of contaminated groundwater emanating from the site to reduce levels of total VOCs in groundwater on and downgradient of the Site.	Alternative 3 would protect public health and the environment by providing in-situ treatment of contaminated groundwater emanating from the site to reduce levels of total VOCs in groundwater on and downgradient of the Site.	Alternative 4 would protect public health and the environment by providing in-situ treatment of contaminated groundwater emanating from the site to reduce levels of total VOCs in groundwater on and downgradient of the Site.	Alternative 5 would protect public health and the environment by providing pumping and treatment of contaminated groundwater, thus reducing contaminant levels on-site and reducing off-site migration.
Short-term Impacts and Effectiveness	Alternative 1 does not include construction activities, therefore, there would be no potential short-term adverse impacts and risks of the remedy upon the community, the workers, and the environment during the construction.	Alternative 2 includes the injection of biological reagents via direct push methods, direct mixing of biological reagents into groundwater within an open excavation, as well as additional monitoring wells; therefore, there would be potential short-term adverse impacts and risks of the remedy upon site occupants. These risks would be addressed through coordination and communication with the property owner(s) and preparation and implementation of a construction health and safety plan. This alternative would decrease the level of contamination in the groundwater both on-site and off-site and would therefore reduce the migration of impacted groundwater off-site.	Alternative 3 includes the injection of chemical oxidants via direct push methods, direct mixing of chemical oxidants into groundwater within an open excavation, as well as additional monitoring wells; therefore, there would be potential short-term adverse impacts and risks of the remedy upon site occupants. These risks would be addressed through coordination and communication with the property owner(s) and preparation and implementation of a construction health and safety plan. This alternative would decrease the level of contamination quickly in the groundwater on-site and would therefore reduce the migration of impacted groundwater off-site.	Alternative 4 includes the injection of biological reagents via direct push methods, direct mixing of chemical oxidants into groundwater within an open excavation, as well as additional monitoring wells; therefore, there would be potential short-term adverse impacts and risks of the remedy upon site occupants. These risks would be addressed through coordination and communication with the property owner(s) and preparation and implementation of a construction health and safety plan. This alternative would decrease the level of contamination quickly in the groundwater on-site and would therefore reduce the migration of impacted groundwater off-site.	Alternative 5 includes institutional controls to prohibit use of on-site contaminated groundwater for drinking purposes; however, there is no current use of on-site groundwater. This alternative would include construction activities which relatively have small risks of short-term adverse impacts upon the community, workers, and the environment. This alternative would provide hydraulic control while treating contaminants on-site.
Long-term Effectiveness and Permanence	Alternative 1 would not meet the RAOs for the Site. This alternative would not provide long-term effectiveness.	Alternative 2 includes in-situ treatment of the VOC groundwater plume. Long-term effectiveness of this alternative would rely upon the effectiveness of the in-situ treatment, which contains uncertainties regarding the potential magnitude of mass reduction that could be achieved. Biological reagents are slow acting but are persistent and long lasting.	Alternative 3 includes in-situ treatment of the VOC groundwater plume. Long-term effectiveness of this alternative would rely upon the effectiveness of the in-situ treatment, which contains uncertainties regarding the potential magnitude of mass reduction that could be achieved. Chemical oxidants are fast acting but rely on direct contact with contaminated media since they do not last as long as biological reagents.	Alternative 4 includes in-situ treatment of the VOC groundwater plume. Long-term effectiveness of this alternative would rely upon the effectiveness of the in-situ treatment, which contains uncertainties regarding the potential magnitude of mass reduction that could be achieved. This alternative used the fast acting chemical oxidants in the area where the oxidants will be in direct, immediate contact with the contaminated media and uses the longer lasting biological reagents in the areas where direct contact is less likely.	Alternative 5 includes institutional controls to prohibit future use of contaminated groundwater at the Site, and a pump and treat system to treat and provide hydraulic control. Long-term effectiveness of this alternative would depend upon maintenance of the extraction wells and treatment components, and operation of the system for 30 years.
Reduction of Toxicity, Mobility, and Volume	Alternative 1 would not result in reduction of toxicity, mobility, or volume of site contaminants at the site because no treatment is taking place.	Alternative 2 includes treatment to reduce the toxicity, mobility, and volume of groundwater contamination. Enhanced biodegradation involves the enhancement of natural processes to destroy the target contaminants.	Alternative 3 would include treatment to reduce the toxicity, mobility, and volume of groundwater contamination, similar to Alternative 2. Chemical-oxidation destroys contaminants upon contact, but site-specific conditions (geology and the location of buildings) may limit the ability to achieve adequate distribution of chemical-oxidants.	Alternative 4 would include treatment to reduce the toxicity, mobility, and volume of groundwater contamination, similar to Alternatives 2 and 3. The chemical oxidant would be used in the area where direct contact is feasible and biological reagents would be used in areas where direct contact may take more time and rely on groundwater flow.	Alternative 5 reduces the toxicity, mobility and volume of groundwater contamination through ex-situ treatment within the higher impacted zone. Other areas would be expected to naturally attenuate during the time of operation of the system.

Table 12.2: Comparative Analysis of Remedial Alternatives for Groundwater

Remedial Alternative	Alternative 1: No Action	Alternative 2: In-Situ Enhanced Biodegradation	Alternative 3: In-Situ Chemical Oxidation/Reduction	Alternative 4: Combined In-Situ Chemical Oxidation/Reduction and Enhanced Biodegradation	Alternative 5: Pump, Treat and Discharge
Implementability	Although no services or materials would be required to implement Alternative 1, obtaining regulatory approval of Alternative 1 would be difficult.	The technologies used for implementation of Alternative 2 are well developed and would not be difficult to implement. Some difficulties in implementation of in-situ treatment would occur due to the location of buildings and underground utilities. In general the reagents used for in-situ enhanced biodegradation are long-lasting and travel with groundwater flow. A thorough utility survey would be conducted prior to implementation. Current site conditions are favorable for this alternative since, based upon preliminary investigations, the required micro-organisms exist within the soil, and the pH of the water is neutral.	The technologies used for implementation of Alternative 3 are well developed and would not be difficult to implement. Some difficulties in implementation of in-situ treatment would occur due to the location of buildings and underground utilities. In general the oxidants to be used are longer-lasting and travel with groundwater flow. A thorough utility survey would be conducted prior to implementation. Some chemical oxidants may not be compatible with existing underground utility structures. Preliminary investigations are not favorable for this alternative since they suggest a high permanganate natural oxidant demand (PNOD) of soil, which suggest that a large quantity of permanganate would be required to meet the soil demand and treat the groundwater. Additional testing would be conducted as part of the pre-design investigations to check the validity of the PNOD values. The results of the PNOD would not be an issue in the area where the oxidants would be added directly to the groundwater in the open excavation.	The technologies used for implementation of Alternative 4 are well developed and would not be difficult to implement. Some difficulties in implementation of in-situ treatment would occur due to the location of buildings and underground utilities. This alternative combines Alternative 2 and 3 using the longer lasting biological reagents in areas where building could impeded direct contact and uses the fast acting chemical oxidants in the area where direct contact with the contaminated groundwater is possible immediately.	The technologies used for implementation of groundwater extraction and treatment systems are not difficult to implement. One of the most difficult tasks associated with this alternative would be obtaining access agreements, contracts and permits for installation of extraction wells and underground conveyance piping on neighboring properties and around buildings. Services or materials required to implement this alternative are readily available.

Prepared by: JDW 07/24/09
Checked by: MJS 07/29/09
Revised by: JDW 11/18/09
Checked by: RTB 11/24/09

APPENDIX A

PINE AND SWALLOW REPORT

Limited Subsurface Investigation
Elmira, New York

Prepared for

MACTEC Engineering and Consulting, Inc.
511 Congress Street, P.O. Box 7050
Portland, Maine 04112-7050
Attn: Charles Staples

Prepared by

PINE & SWALLOW ENVIRONMENTAL
Environmental Field Services

867 Boston Road
Groton, MA 01450
978-448-9511

July 25, 2008
P&S Reference Number: 08148

Pine&Swallow
ENVIRONMENTAL

Vertical Profiling • Direct Push Drilling • Mobile Laboratory • Soil Vapor Surveys • High Pressure Injection

July 25, 2008

Charles Staples
MACTEC Engineering and Consulting, Inc.
511 Congress Street, P.O. Box 7050
Portland, Maine 04112-7050

RE: Elmira, New York

Dear Charles,

In accordance with the proposal dated May 7, 2008, enclosed is our report on subsurface investigations performed at Elmira, New York. This report summarizes the equipment and procedures employed by P&S for the installation of MicroWells as well as the results of on-site gas chromatographic analyses of water.

We appreciated the opportunity to work with you and thank you for engaging our services for this project. If there are any questions, please do not hesitate to call.

Sincerely yours,
Pine & Swallow Environmental

Gregory Rotondi
Field Chemist

Michael Agonis
Operations Manager/Environmental Scientist

867 Boston Road, Groton, MA 01450 Tel: 978-448-9511 Fax: 978-448-6645 www.pineandswallow.com

Pine&Swallow
ENVIRONMENTAL
Vertical Profiling • Direct Push Drilling • Mobile Laboratory • Soil Vapor Surveys • High Pressure Injection

Limited Subsurface Investigation

Elmira, New York

I. INTRODUCTION AND PROGRAM SUMMARY

On July 7, 8, 9, 10 and 11, 2008, Pine & Swallow Environmental (P&S) conducted limited subsurface investigations of the Elmira, New York site. The purpose of P&S's effort was to assist MACTEC Engineering and Consulting, Inc. in assessing groundwater conditions at the site. Details of equipment and procedures for MicroWell® installation and the methodology and results of on-site gas chromatographic (GC) analyses of groundwater samples for selected volatile organic compounds are enclosed.

Program Summary

P&S installed thirteen MicroWells. All of the wells were sequentially sampled to permit vertical profiling of groundwater quality. Fifty groundwater samples were analyzed in P&S's field laboratory for vinyl chloride, 1,1-dichloroethene, trans-1,2-dichloroethene, cis-1,2-dichloroethene, 1,1-dichloroethane, 1,1,1-trichloroethane, 1,2-dichloroethane, trichloroethene and tetrachloroethene.

All installation and sampling locations were chosen by MACTEC Engineering and Consulting, Inc. field personnel. All analyses were performed in P&S's field laboratory for compounds determined by MACTEC Engineering and Consulting, Inc.'s program.

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II. FIELD INVESTIGATION METHODS AND PROCEDURES

GROUNDWATER INVESTIGATION

MicroWell Installation Equipment and Methods

P&S's study included installation of MicroWells for groundwater sampling and water level measurements. MicroWells consist of 0.84-inch, 1.3-inch or 1.9-inch O.D. steam-cleaned steel pipe whose leading end is fitted with a drive point. Screens, manufactured from the same material, consist of a double row of longitudinal slots 0.015-inch wide on the half-inch pipe. Screens in 1.3-inch or 1.9-inch pipe consist of double rows of longitudinal slots 0.015-inch wide. In all cases, each slot is two inches long and is separated from the next slot by 1/4-inch of unslotted pipe.

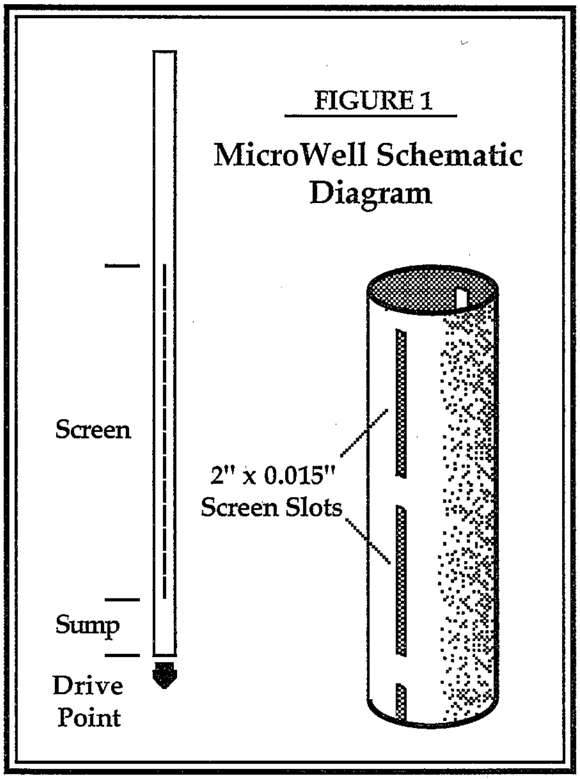


FIGURE 1
MicroWell Schematic Diagram

MicroWells are installed by a high frequency vibratory hammer mounted on a VibraDrill® all terrain drilling machine. VibraDrills are capable of driving 12-foot sections or 21-foot sections of pipe depending upon the model; to drive deeper, additional sections of riser pipe are welded or crimped on by means of an external steel collar.

Immediately after driving is completed a water level measurement is taken with a Slope Indicator water level meter. Wells are then developed with an inertial pump to remove silt and fine sand that has entered through screen slots. Pumping continues until discharge water is free of sediment wherever possible. Samples from MicroWells for VOC analysis are obtained in lab-clean 40 mL vials with septum screw caps using new polyethylene tubing dedicated to each well and sampling interval and following P&S

sampling protocols All re-usable sampling equipment is decontaminated between locations by rinsing with methanol and distilled water.

Sequential sampling is performed by driving the well screen to a predetermined depth and collecting a sample following P&S's standard sampling procedures. A section of riser pipe is then connected, the well driven to the next sampling interval and a subsequent sample taken. At each sampling level, at least three well volumes are removed from the well prior to sampling. Samples are collected in lab-clean 40 mL vials using new polyethylene tubing dedicated to each sampling level. Pump valves are decontaminated with methanol and rinsed with distilled water between samples.

MicroWell Program

A total of thirteen MicroWells, constructed of 1.32-inch steel pipe and with five-foot screens, were installed at this site by P&S's VibraDrill H641 at locations chosen by MACTEC Engineering and Consulting, Inc. field personnel. MicroWell depths ranged from 28.25' to 35' BGS. The wells were cut below grade, filled with bentonite, capped with plugs and abandoned. MicroWell completion details are noted on the table located in the Appendix.

Wells were sampled with an inertial pump according to P&S's Standard Operating Procedures. Sequential sampling was performed at all of the MicroWells.

Measuring Hydraulic Conductivity Using MicroWells

To assess hydraulic conductivity at selected wells, P&S conducted sequential permeability testing at 10 MicroWell locations. A summary table of the permeability values as well as the permeability curves for each interval is provided in the Appendix. By using VibraDrills and MicroWell technologies with pressure transducers and data processing software, three-dimensional permeabilities can be measured rapidly across a site. Pneumatic systems allow collection of data more accurately than a conventional slug test due to the absence of a mechanically induced disturbance. This is particularly important in highly transmissive media where the true aquifer response could be masked by a slug-induced disturbance. Pneumatic pressure systems also offer better control over the amount of initial displacement and in low permeable formations this rising head procedure is generally not limited by reduced recharge to the well. Disposal problems are minimized because small quantities of water are pumped from the well for development purposes only. No water is introduced to the MicroWell; therefore, additional groundwater samples may be collected for analysis.

Pneumatic permeability tests are conducted in vertical intervals using a MicroWell constructed of steel pipe. Prior to each test the well is developed with an inertial pump according to P&S' Standard Operating Procedures.

Methodology

The water level within the well is forced downward by an amount equivalent to the air pressure applied. If the new water level should drop below the top of the screen, then air will escape through the screen directly into the aquifer and the test is nullified. Prior to performing the test, the depth to static water level (SWL) is measured in the MicroWell and the distance from SWL to the top of the screen is determined. The amount of downward depression imparted by air is monitored to not exceed this distance.

A test sequence involves fitting the pneumatic testing wellhead assembly onto the well, setting the transducer to the desired depth below SWL and pressurizing the well to depress the water level (H_O). The pressure gauge on the wellhead is monitored until it stabilizes. When the pressure has stabilized the aquifer is approaching equilibration and the test is conducted. The pressure is noted and the test is started by immediately opening the ball valve at the wellhead to allow the air to escape from the well. The loss of air pressure causes an instantaneous change of head within the well. The time of recovery of the water level and the change in elevation of the water table are then recorded using a data logger and pressure transducer.

Hydraulic Conductivity Program

Sequential hydraulic conductivity testing was conducted on a total of thirteen MicroWells. The results of the testing are presented in the Appendix.

Test Results & Data Interpretation

Sequential testing is performed at intervals utilizing pneumatic hydraulic conductivity tests. Initial tests are run with one to two replicates to evaluate test consistency. Each vertical interval is tested a minimum of one time. The MicroWell is allowed to equilibrate between each interval and between each replicate test. SWL is referenced to an arbitrary datum prior to conducting each test using the pressure transducer.

Aquifer characteristics are modeled assuming an unconfined aquifer with partial penetration of the test well using Hvorslev's equation (1951):

$$K= r^2 \ln(L/R) / 2(LT_o)$$

where K is the hydraulic conductivity (in cm/sec), r is the effective radius of the well casing, L is the screen length, R is the radius of influence, and T_o is the time lag in seconds.

Hydraulic Conductivity Program

Sequential hydraulic conductivity testing was conducted on a total of thirteen MicroWells. The results of the testing are presented in the Appendix.

ON-SITE CHEMICAL ANALYSIS

P&S utilizes Hewlett Packard 5890 gas chromatographs and a Tekmar 7000/7050 Static Headspace and Autosampler to analyze soil, water and soil gas matrices for a variety of organic environmental contaminants. Gas chromatography (GC) technology physically separates the components of a contaminated matrix and the contaminants are then identified using compound-specific detectors. P&S's GC instrumentation currently employs three different detection modes. The electron capture detector (ECD) is primarily used to identify electromagnetic molecules such as chlorinated, brominated and fluorinated compounds. The photoionization detector (PID) is effective in the determination of aromatic and/or aliphatic contaminants such as benzene, toluene, ethylbenzene and xylenes (BTEX). The flame ionization detector (FID) identifies hydrocarbon-containing molecules such as polynuclear aromatic hydrocarbons and petroleum fuel constituents. Analysis is conducted in accordance with P&S's Standard Operating Procedures (SOPs).

For water and soil headspace sample matrices which are analyzed to determine BTEX/MTBE and chlorinated contaminants, field samples undergo preparation steps prior to analysis. For water samples (collected in 40 mL VOA vials), an aliquot of the water sample is removed from the closed sampling vial and transferred to a 22 ml autosampler vial in the lab. PID/ECD detector modes are utilized for compound identification. For soil matrices, an aliquot of soil of approximately 4 to 6 grams is collected in the field and immediately transferred to a 22 mL sampling vial containing organic-free, distilled reagent water with headspace in the vial.

The following are typical autosampler analytical conditions. Auto Sampler: Tekmar 7000/7050 Static Headspace and Autosampler:

Equilibrate:	60°C for 4 min
Vortex Mix:	1.0 min
Stabilize:	2.0 min
Pressurize:	14 psi for 0.3 min
Equilibration:	0.3 min.

An appropriate analytical capillary column is selected for the suite of analytes under study. Once the sample is prepared for analysis and introduced into the GCs heated inlet injection port, it is transported in its gaseous form to the analytical column. As a sample slug migrates through this column, its various components interact with the column film to become temporarily adsorbed and subsequently desorbed. Each compound in the test sample transits the column at a different rate which is temperature controlled and enhanced, hence creating a unique retention time. Each compound also elicits a unique response from the detectors. These responses are translated within the data collection system in the form of peaks which are assigned height and area values relative to analyses of analytical standards. This data is subsequently evaluated to determine concentration of the target analyte within the sample matrix.

The following are typical GC analytical conditions. GC: Hewlett Packard 5890A. Column: Restek RTX-502.2, 30-m, 0.53-µm ID, 2.0/mm film thickness fused silica capillary column.

Carrier Gas:	Helium
Flow Rate:	10-13 ml/min
Initial Column Temperature:	40°C
Initial Column Holding Time:	2 min
Ramp Rate:	10°C/min
Final Temperature:	130°C
Final Hold Time:	1 min
Approximate GC Cool Down Time:	10 min

NOTE: The typical run time under these conditions is 20 minutes.

Identification and quantification of target analytes detected in the sample are achieved by retention time comparisons to reference standards formulated with analytical grade compounds of known concentrations. In this way, unknowns detected during sample analyses can be identified and concentrations calculated.

For all analyses, blank samples from syringes, sampling equipment and reagents are analyzed periodically to ensure sample and method integrity. Daily check standards are run to verify instrument stability, calibration, sensitivity and performance. Duplicate analyses and replicate sample injections are routinely conducted to support method accuracy and analytical precision.

On-site Analysis of Groundwater Samples

Fifty groundwater samples were analyzed for vinyl chloride, 1,1-dichloroethene, trans-1,2-dichloroethene, cis-1,2-dichloroethene, 1,1-dichloroethane, 1,1,1-trichloroethane, 1,2-dichloroethane, trichloroethene and tetrachloroethene by a Hewlett Packard 5890 GC in P&S's field laboratory. Results of groundwater analyses for the compounds selected by MACTEC Engineering and Consulting, Inc. personnel at Elmira, New York are tabulated in the Appendix.

This report is submitted subject to the limitations stated in the Appendix.

APPENDIX

Limitations and Conditions

P&S Standard Abbreviations

MicroWell Completion Table

Hydraulic Conductivity Table

Analytical Results

LIMITATIONS AND CONDITIONS

1. The observations described in this report were made under the conditions stated. The conclusions presented in the report were based solely upon the services described and not on scientific tasks or procedures beyond the scope of described services or the time and budgetary constraints imposed by Client. The report has been prepared in accordance with generally accepted hydrogeological and hydrochemical practices. No other warranty, express or implied, is made.

2. Negative findings for the presence of volatile organic compounds using soil atmosphere analysis are not positive or absolute proof that disposal or discharge of chemicals has not occurred in the past at the sampled locations or anywhere else on the site. Negative findings are not positive or absolute proof that migration, seepage or any other movement of chemicals is not occurring at the sampled locations or elsewhere on the site.

3. Chemical conditions reported herein reflect conditions at the locations tested within the limitations of the methods used. Such conditions can vary rapidly from area to area. No warranty is expressed or implied that chemical conditions other than those reported do not exist within the site.

4. At those locations where volatile organic compounds were reported, chemicals other than those reported may be present. Chemical analyses have been performed for specific parameters during this assessment. However, additional chemical constituents not searched for during the current study may be present in soil and/or groundwater at the site.

5. Water level readings have been made in the wells at the times and under the conditions stated on the MicroWell logs. However, fluctuations in the level of groundwater may occur due to variation in rainfall and other factors different from those prevailing at the time measurements were made.

6. This report has been prepared for MACTEC Engineering and Consulting, Inc. solely for use in an environmental evaluation of property at Elmira, New York, Site Address.

STANDARD ABBREVIATIONS

Abbreviations which may have been used in this report and in the MicroWell logs.

mg/Kg	milligrams per kilogram
mg/L	milligrams per liter
ppb	parts per billion
ppm	parts per million
µg/g	micrograms per gram
µg/Kg	micrograms per kilogram
µg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
"	inches (in)
'	feet (ft)
cm	centimeters
m	meters
mL	milliliters
yd	yards
BGS	below ground surface
D-NAPL	dense non-aqueous phase liquid
GC	gas chromatograph
L-NAPL	light non-aqueous phase liquid
OVM	organic vapor meter
Pipe ID	internal diameter of pipe
Pipe OD	external diameter of pipe
Sample ID	sample identification number
TOC	top of casing
Well ID	well identification number
WL	water level

MicroWell Completion Table

MicroWell® Installation Log

Project Name: MACTEC/Elmira NY	Sheet 1 of 3
PSA Project Number: 08148	Start Date:07/07/08 End Date: 07/11/08
PSA Field Personnel: MC/GR	Equipment: VD H641
Screen Size: 5 feet	Pipe OD: 1.32" Pipe ID: 1.05"

Well ID	Water Level (' BGS)	Sample Interval	Pipe (feet)	Extra Tubing	Finish	Comments
GPS-1	15.4'	15.0'-20.0'	31'	140'	Abandoned	N 42° 05'55.3"/W 076° 48' 18.5"
		20.0'-25.0'				Permeability test
		25.0'-30.0'				
		30.0'-35.0'				
PGS-2	14.9'	15.0'-20.0'	49'	140'	Abandoned	N 42° 05' 54.7"/W 076° 48' 17.4"
		20.0'-25.0'				Permeability test
		25.0'-30.0'				
		30.0'-35.0'				
GPS-3	14.2'	15.0'-20.0'	31'	140'	Abandoned	N 42° 05' 54.7"/W 076° 48' 19.4"
		20.0'-25.0'				Permeability test
		25.0'-30.0'				
		30.0'-35.0'				
GPS-4	14.2'	15.0'-20.0'	31'	175'	Abandoned	N 42° 05' 34.3"/W 076° 48' 19.1"
		20.0'-25.0'				
		25.0'-30.0'				
		30.0'-35.0'				
GPS-5	14.8'	15.0'-20.0'	31'	140"	Abandoned	N 42°05' 54.2"/W 076° 48' 19.1"
		20.0'-25.0'				Permeability test

MicroWell® Installation Log

Project Name: MACTEC/Elmira NY	**Sheet 2 of 3**
PSA Project Number: 08148	**Start Date:07/07/08 End Date: 07/11/08**
PSA Field Personnel: MC/GR	**Equipment: VD H641**
Screen Size: 5 feet	**Pipe OD: 1.32” Pipe ID: 1.05”**

Well ID	Water Level (' BGS)	Sample Interval	Pipe (feet)	Extra Tubing	Finish	Comments
GS -5		25.0’-30.0’				
		30.0’-35.0’				
GPS-6	14.9’	15.0’-20.0’	31’	140’	Abandoned	N 42° 05’ 53.8”/W 076° 48’ 18.8”
		20.0’-25.0’				
		25.0’-30.0’				Permeability test
		30.0’-35.0’				
GPS-7	13.6’	15.0’-20.0’	26.5’	100’	Abandoned	N 42° 05’ 53.5”/W 076°48’ 18.6”
		20.0’-25.0’				Permeability test #8
		24.5’-29.5’				
GPS-8	17.4’	15.0’-20.0’	31’	140’	Abandoned	N 42° 05’ 53.4”/W 076° 48’ 18.2”
		20.0’-25.0’				Permeability test
		25.0’-30.0’				
		29.0’-34.0’				
GPS-9	15.1’	15.0’-20.0’	27’	140’	Abandoned	N42° 05’ 55.0”/W 076° 48’ 19.0”
		20.0’-25.0’				
		25.0’-30.0’				
		30.0’-35.0’				
GPN-1	14.1’	15.0’-20.0’	26’	100	Abandoned	N 42° 05’ 55.5”/W 076° 48’ 19.5”

MicroWell® Installation Log

Project Name: MACTEC/Elmira NY	**Sheet 3 of 3**
PSA Project Number: 08148	**Start Date:**07/07/08 **End Date:** 07/11/08
PSA Field Personnel: MC/GR	**Equipment:** VD H641
Screen Size: 5 feet	**Pipe OD:** 1.32" **Pipe ID:** 1.05"

Well ID	Water Level (' BGS)	Sample Interval	Pipe (feet)	Extra Tubing	Finish	Comments
GPN-1		20.0'-25.0'				Permeability test
		23.25'-28.25'				
GPN-2	12.5'	15.0'-20.0'	31'	140'	Abandoned	N 42° 05' 56.0"/W 076° 48' 19.7"
		20.0'-25.0'				Permeability test
		25.0'-30.0'				
		30.0'-35.0'				
GPN-3	12.9'	15.0'-20.0'	27'	100'	Abandoned	N 42° 05' 56.0"/W 076° 48' 19.8"
		20.0'-25.0'				
		24'8"-29'8"				
GPN-4	13.38'	15.0'-20.0'	37'	185'	Abandoned	N 42° 05' 56.7"/W 076° 48' 19.5"
		20.0'-25.0'				
		25.0'-30.0'				
		30.0'-35.0'				Permeability test
		35.0'-40.0'				

Mobile Laboratory Services
Groundwater Analysis
Diamond Cleaners
Elmira, New York

(ppb)ug/L

Sample ID	Comments	Depth in Feet	Vinyl Chloride	1,1-Dichloroethene	trans-1,2-Dichloroethene	cis-1,2-Dichloroethene	1,1-Dichloroethane	1,1,1-Trichloroethane	1,2- Dichloroethane	Trichloroethene	Tetrachloroethene
7/7/2008											
GPS-1A		15'-20'	U	0.5J	4.8J	13	U	U	U	2.9	E
GPS-1A	x10	15'-20'	U	U	U	U	U	U	U	U	44D
GPS-1B		20'-25	2.9	0.2J	4.9J	16	U	U	U	4.3	E
GPS-1B	X10	20'-25	U	U	U	U	U	U	U	U	88D
GPS-1C		25'-30'	2.6	0.1J	4.8J	10	U	U	U	0.9	4.4
GPS-1D		30'-35'	U	U	U	5.5	U	U	U	U	0.5
GPS-2A		15'-20'	4.3	0.3J	4.8J	6.9	U	U	U	0.9	10
GPS-2B		20'-25	2.7	0.2J	4.9J	14	U	U	U	5.2	E
GPS-2B	X10	20'-25	U	U	U	U	U	U	U	4.7D	46D
GPS-2C	*	25'-30'	U	U	U	U	U	U	U	U	0.3J
GPS-2D	*	30'-35'	U	U	U	U	U	U	U	U	0.3J
GPS-3A		15'-20'	3.9	0.3J	U	6.0	U	U	U	0.2J	4.4
GPS-3B		20'-25	U	0.2J	U	7.3	U	U	U	1.1	12
GPS-3C		25'-30'	U	0.2J	U	6.3	U	U	U	0.5	7.3
GPS-3D		30'-35'	U	0.1J	U	5.7	U	U	U	U	2.9
7/8/2008											
GPS-4A		15'-20'	4	0.4J	4.8J	7.9	U	U	U	1.6	E
GPS-4A	X10	15'-20'	U	U	U	U	U	U	U	1.1D	48D
GPS-4B		20'-25	3.3	0.3J	4.9J	11	U	U	U	0.4J	4.3
GPS-4C	*	25'-30'	U	U	U	U	U	U	U	U	0.3J
Detection limits		QC	**1.0**	**1.0**	**5.0**	**5.0**	**5.0**	**0.5**	**5.0**	**0.5**	**0.5**

Mobile Laboratory Services
Groundwater Analysis
Diamond Cleaners
Elmira, New York

(ppb)ug/L

Sample ID	Comments	Depth in Feet	Vinyl Chloride	1,1-Dichloroethene	trans-1,2-Dichloroethene	cis-1,2-Dichloroethene	1,1-Dichloroethane	1,1,1-Trichloroethane	1,2- Dichloroethane	Trichloroethene	Tetrachloroethene
GPS-4D	*	30'-35'	U	U	U	U	U	U	U	U	0.3J
GPS-5A		15'-20'	2.9	0.2J	U	7.3	U	U	U	1.0	E
GPS-5A	X10	15'-20'	U	U	U	U	U	U	U	U	39D
GPS-5B		20'-25	3.2	0.3J	5.0	16	U	U	U	0.7	9.2
GPS-2C REDO		25'-30'	U	U	U	U	U	U	U	U	0.3J
GPS-5C	*	25'-30'	U	U	U	U	U	U	U	U	0.3J
GPS-5D		30'-35'	2.9	0.3J	4.9J	18	U	U	U	2.3	E
GPS-5D	X10	30'-35'	U	U	U	U	U	U	U	2.8D	54D
GPS-6A		15'-20'	U	U	U	5.9	U	U	U	U	2.7
GPS-6B		20'-25	2.8	0.2J	4.9J	21	U	U	U	2.1	9.6
GPS-6C		25'-30'	2.5	0.2J	5.0	60	U	U	U	0.8	0.8
GPS-6D		30'-35'	2.2	0.3J	5.0	20	U	U	U	U	0.4J
7/9/2008											
GPS-7A		15'-20'	U	U	U	6.0	U	U	U	0.2J	5.4
GPS-7B		20'-25	U	U	U	7.8	U	U	U	1.2	14
GPS-7B	X10	20'-25	U	U	U	U	U	U	U	U	13D
GPS-7C		25'-30'	15	0.2J	4.9J	37	U	U	U	0.6	2.8
GPS-8A		15'-20'	U	0.5J	U	U	U	U	U	U	0.5
GPS-8B		20'-25	U	U	U	5.8	U	U	U	0.03J	2.4
GPS-8C		25'-30'	U	0.2J	U	6.7	U	U	U	0.8	8.3
GPS-8D		29'-34'	U	U	U	7.8	U	U	U	2.6	E
GPS-8D	X10	29'-34'	U	U	U	U	U	U	U	2.1D	46D
GPS-9A		15'-20'	U	U	U	5.7	U	U	U	U	2.4
Detection limits		QC	**1.0**	**1.0**	**5.0**	**5.0**	**5.0**	**0.5**	**5.0**	**0.5**	**0.5**

Mobile Laboratory Services
Groundwater Analysis
Diamond Cleaners
Elmira, New York

(ppb)ug/L

Sample ID	Comments	Depth in Feet	Vinyl Chloride	1,1-Dichloroethene	trans-1,2-Dichloroethene	cis-1,2-Dichloroethene	1,1-Dichloroethane	1,1,1-Trichloroethane	1,2- Dichloroethane	Trichloroethene	Tetrachloroethene
GPS-9B		20'-25	U	U	U	10	U	U	U	2.3	15
GPS-9B	X10	20'-25	U	U	U	U	U	U	U	2.4D	17D
GPS-9C	*	25'-30'	U	U	U	U	U	U	U	U	0.4J
GPS-9D	*	30'-35'	U	U	U	U	U	U	U	U	0.3J
GPN-1A		15'-20'	2.8	0.1J	4.9J	19	U	U	U	1.9	E
GPN-1A	X10	15'-20'	U	U	U	U	U	U	U	U	28D
GPN-1B		20'-25	U	0.3J	4.9J	35	U	U	U	5.9	E
GPN-1B	X10	20'-25	U	U	U	U	U	U	U	U	42D
GPN-1C		23.3-28.3	3.5	0.1J	4.9J	75	U	U	U	4.4	E
GPN-1C	X10	23.3-28.3	U	U	U	U	U	U	U	U	91D
7/10/2008											
9D1ML MEOH EXT	*	30'-35'	U	U	U	U	U	U	U	U	0.3J
GPN-2A		15'-20'	3.5	0.2J	5	E	U	U	U	3.3	E
GPN-2A	X10	15'-20'	U	U	U	210D	U	U	U	U	29D
GPN-2B		20'-25	27	0.5	5.3	E	U	U	U	E	E
GPN-2B	X10	20'-25	U	U	U	550D	U	U	U	27D	E
GPN-2B	X100	20'-25	U	U	U	U	U	U	U	U	160D
GPN-2C	*	25'-30'	2.7	0.5	U	20	U	U	U	0.1J	1.2
GPN-2D	*	30'-35'	U	U	U	5.9	U	U	U	U	0.3J
GPN-3A		15'-20'	U	U	U	E	U	U	U	E	E
GPN-3A	X10	15'-20'	U	U	U	270D	U	U	U	40D	E
GPN-3A	X100	15'-20'	U	U	U	U	U	U	U	U	220D
GPN-3B		20'-25	4.9	0.6	5.3	E	U	U	U	E	E
GPN-3B	X100	20'-25	U	U	U	940D	U	U	U	74D	740D
Detection limits		QC	**1.0**	**1.0**	**5.0**	**5.0**	**5.0**	**0.5**	**5.0**	**0.5**	**0.5**

Mobile Laboratory Services
Groundwater Analysis
Diamond Cleaners
Elmira, New York

(ppb)ug/L

Sample ID	Comments	Depth in Feet	Vinyl Chloride	1,1-Dichloroethene	trans-1,2-Dichloroethene	cis-1,2-Dichloroethene	1,1-Dichloroethane	1,1,1-Trichloroethane	1,2- Dichloroethane	Trichloroethene	Tetrachloroethene
GPN-3C		24.6-29.6	6.3	0.4J	5.3	E	U	U	U	E	E
GPN-3C	X10	24.6-29.6	U	U	U	420D	U	U	U	46D	E
GPN-3C	X100	24.6-29.6	U	U	U	U	U	U	U	U	170D
GPN-4A		15'-20'	4.8	0.8	5.0	90	U	U	U	3.9	E
GPN-4A	X100	15'-20'	U	U	U	U	U	U	U	U	50D
GPN-4B		20'-25	9.3	0.5	5.2	E	U	U	U	E	E
GPN-4B	X10	20'-25	U	U	U	710D	U	U	U	37D	E
GPN-4B	X100	20'-25	U	U	U	U	U	U	U	U	200D
GPN-4C		25'-30'	17	0.4J	5.2	E	U	U	U	E	E
GPN-4C	X10	25'-30'	U	U	U	230D	U	U	U	38D	54D
GPN-4C	X100	25'-30'	U	U	U	U	U	U	U	U	63D
GPN-4D		30'-35'	15	0.4J	5.2	E	U	U	U	E	E
GPN-4D	X10	30'-35'	U	U	U	260D	U	U	U	54D	86D
GPN-4D	X100	30'-35'	U	U	U	U	U	U	U	U	78D
GPN-4E		35'-40'	8.3	0.2J	5.0	E	U	U	U	E	E
GPN-4E	X10	35'-40'	U	U	U	160D	U	U	U	38D	39D
GPN-4E	X100	35'-40'	U	U	U	U	U	U	U	U	U
Detection limits		QC	**1.0**	**1.0**	**5.0**	**5.0**	**5.0**	**0.5**	**5.0**	**0.5**	**0.5**

U=Analyte not detected above sample quantitation limit.
E=Concentration of analyte exceeds the calibration range of instrument.
J=Analyte detected but less than the lowest calibration standard.
D=The value is the result of an analysis at the dilution noted.
*=Soil/Water suspension (silty sample, soils did not settle out)

APPENDIX B

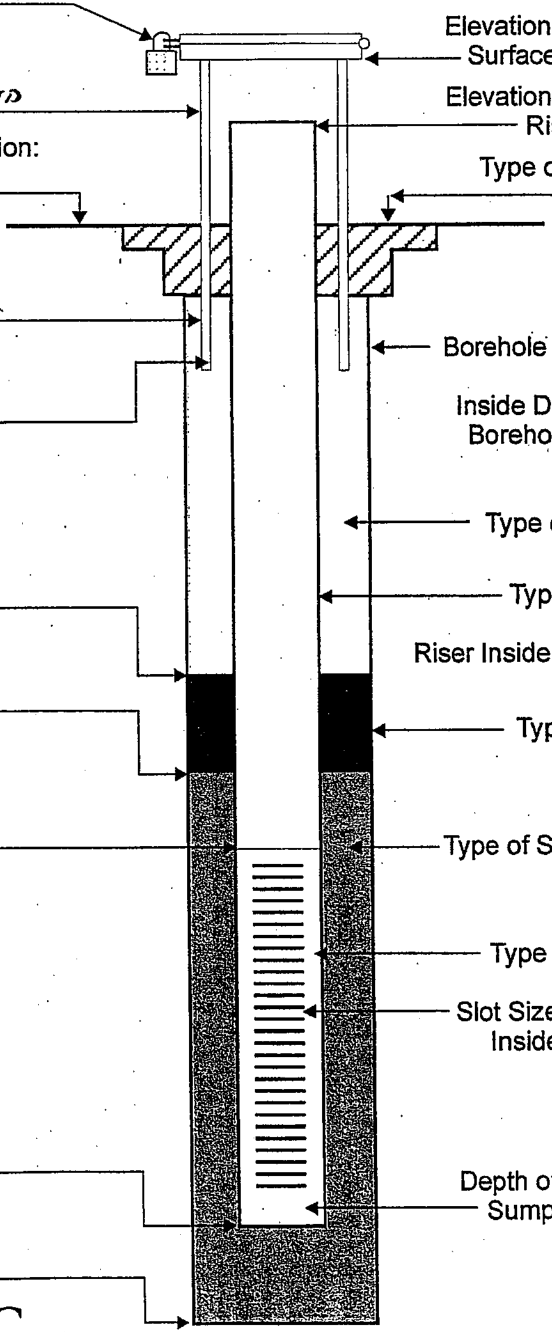
FIELD FORMS

Overburden Well Construction Diagram

Well No.: MW-6

Project No.: 3612062070		Project Name: Diamond Cleaners Site	
		Project Area:	
Contractor: Nothnagle	Driller: KEVIN BUSH	Method: Hollow Stem Auger	
Logged By: T. Longley		Date Started: 7-22-08	Completed: 7-22-08
Checked By: CRS	Date: 8/1/08	Well Development Date: 7-25-08	

Not To Scale



Lock Identification: 2342

Surface Casing Type: FLUSH-TO-GROUND

Ground Surface Elevation:

Surface Casing Diameter:

Inside Diameter of Surface Casing: 8"

Depth/Elevation of Top of Well Seal: 5.6 /

Depth/Elevation of Top of Sand: 7.0 /

Depth/Elevation of Top of Screen: 9.75 /

Depth/Elevation of Bottom of Screen: 19.75 /

Depth/Elevation of Bottom of Boring: 20.0 /

Elevation of top of Surface Casing:

Elevation of top of Riser Pipe:

Type of Surface Seal: CONCRETE

Borehole Diameter: ~9"

Inside Diameter of Borehole Casing: 4.25"

Type of Backfill: CEMENT/BENT. GROUT

Type of Riser: SCH 40 PVC

Riser Inside Diameter: 2"

Type of Seal: BENT. PURE GOLD CHIPS

Type of Sand Pack: SILICA SAND, 00 SIZE

Type of Screen: SCH 40 PVC

Slot Size x Length: 0.010" X10'

Inside Diameter of Screen: 2"

Depth of Sediment Sump with Plug: —

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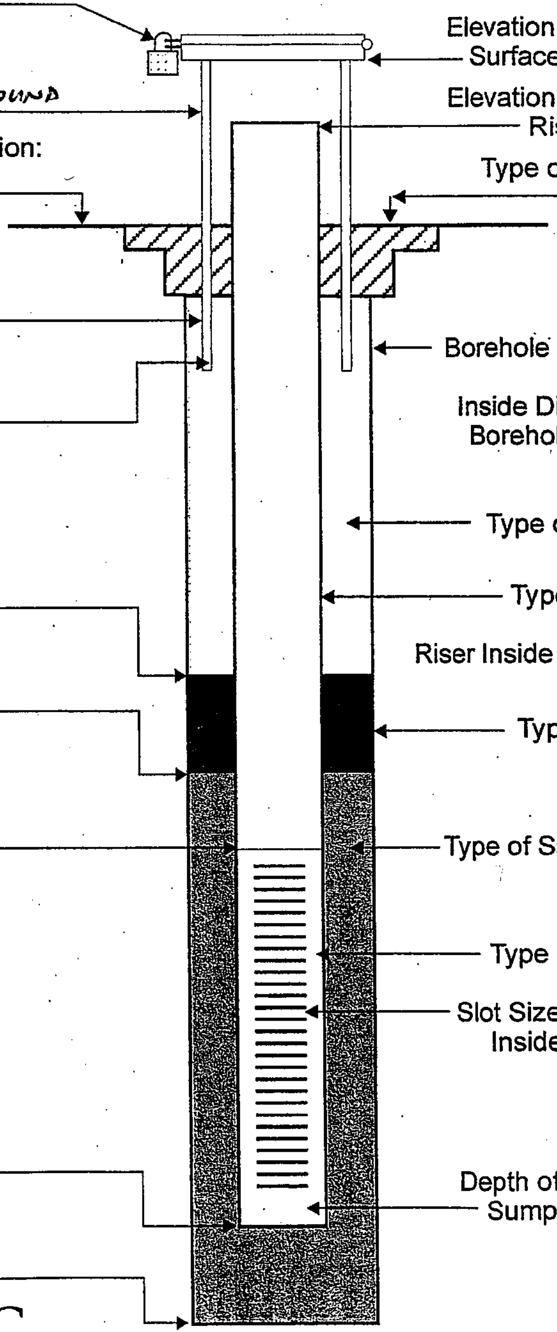
PORT2007022f.cdr

Overburden Well Construction Diagram

Well No.: MW-7

Project No.: 3612062070		Project Name: Diamond Cleaners Site	
		Project Area:	
Contractor: Nothnagle	Driller: KEVIN BUSH	Method: Hollow Stem Auger	
Logged By: T. Longley		Date Started: 7-23-08	Completed: 7-23-08
Checked By: CRS	Date: 8/1/08	Well Development Date: 7-24-08	

Not To Scale



Lock Identification: 2342

Surface Casing Type: FLUSH-TO-GROUND

Ground Surface Elevation:

Surface Casing Diameter: 8"

Inside Diameter of Surface Casing: 8"

Depth/Elevation of Top of Well Seal: 7.0 '

Depth/Elevation of Top of Sand: 9.0 '

Depth/Elevation of Top of Screen: 12.0 '

Depth/Elevation of Bottom of Screen: 22.0 '

Depth/Elevation of Bottom of Boring: 22.0 '

Elevation of top of Surface Casing:

Elevation of top of Riser Pipe:

Type of Surface Seal: CONCRETE

Borehole Diameter: ~9"

Inside Diameter of Borehole Casing: 4.25"

Type of Backfill: CEMENT/BENT. GROUT

Type of Riser: SCH 40 PVC

Riser Inside Diameter: 2"

Type of Seal: BENSEAL

Type of Sand Pack: SILICA QTZ., 00 SIZE

Type of Screen: SCH 40 PVC

Slot Size x Length: 0.010" X10'

Inside Diameter of Screen: 2"

Depth of Sediment Sump with Plug: —

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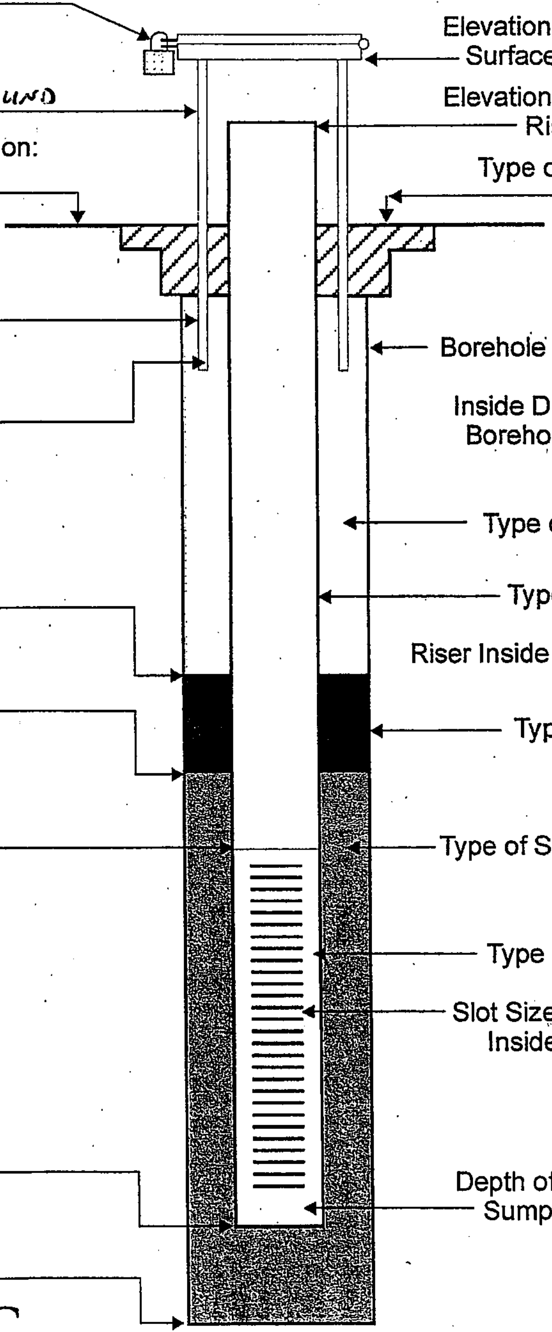
Overburden Well Construction Diagram

Well No.: MW-8

Project No.: 3612062070	Project Name: Diamond Cleaners Site
	Project Area:

Contractor: Nothnagle	Driller: KEVIN BUSH	Method: Hollow Stem Auger
Logged By: T. Longley	Date Started: 7-23-08	Completed: 7-23-08
Checked By: CRS	Date: 8/1/08	Well Development Date: 7-25-08

Not To Scale



Lock Identification: 2342

Surface Casing Type: FLUSH-TO-GROUND

Ground Surface Elevation:

Surface Casing Diameter: 8"

Inside Diameter of Surface Casing: 8"

Depth/Elevation of Top of Well Seal: 7.3 /

Depth/Elevation of Top of Sand: 9.1 /

Depth/Elevation of Top of Screen: 12.0 /

Depth/Elevation of Bottom of Screen: 22.0 /

Depth/Elevation of Bottom of Boring: 22.5 /

Elevation of top of Surface Casing:

Elevation of top of Riser Pipe:

Type of Surface Seal: CONCRETE

Borehole Diameter: ~9"

Inside Diameter of Borehole Casing: 4.25"

Type of Backfill: CEMENT/BENT. GROUT

Type of Riser: SCH 40 PVC

Riser Inside Diameter: 2"

Type of Seal: BENSEAL

Type of Sand Pack: SILICA QTZ., 00 SIZE

Type of Screen: SCH 40 PVC

Slot Size x Length: 0.010" X 10'

Inside Diameter of Screen: 2"

Depth of Sediment Sump with Plug: —

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Overburden Well Construction Diagram

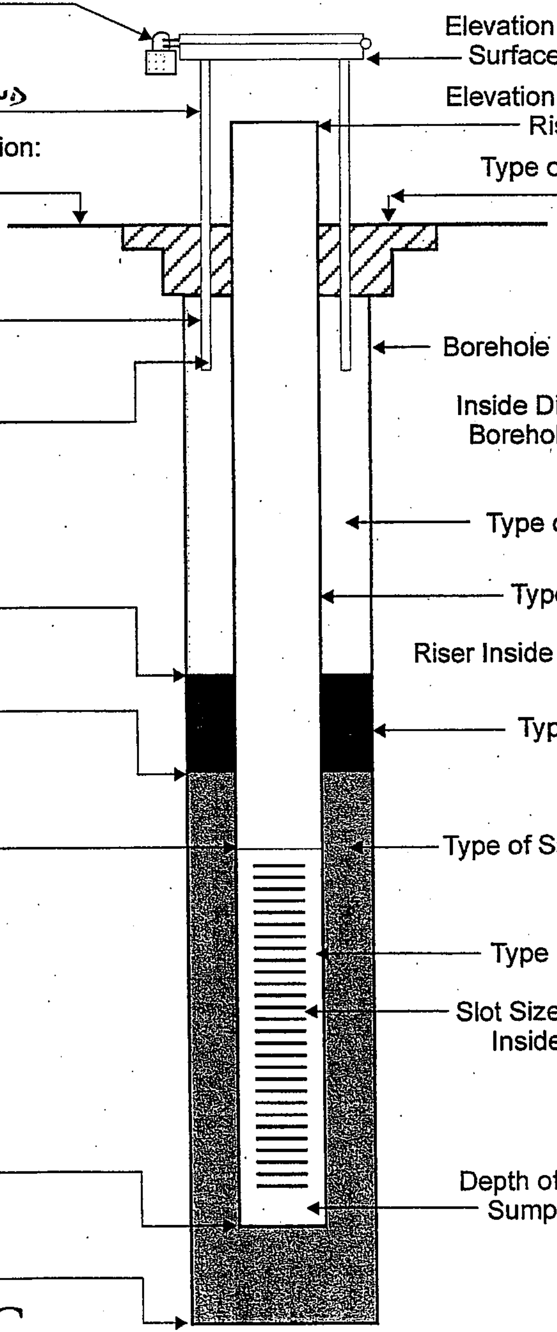
Well No.: MW-9

Project No.: 3612062070	Project Name: Diamond Cleaners Site
	Project Area:

Contractor: Nothnagle	Driller: Kevin Bush	Method: Hollow Stem Auger

Logged By: T. Longley	Date Started: 7-31-08	Completed: 7-31-08
Checked By: CRC Date: 8/1/08	Well Development Date:	

Not To Scale



Lock Identification: 2342

Surface Casing Type: FLUSH-TO-GROUND

Ground Surface Elevation:

Surface Casing Diameter: 8"

Inside Diameter of Surface Casing: 8"

Depth/Elevation of Top of Well Seal: 6.8 /

Depth/Elevation of Top of Sand: 8.6 /

Depth/Elevation of Top of Screen: 11.7 /

Depth/Elevation of Bottom of Screen: 21.7 /

Depth/Elevation of Bottom of Boring: 22.0 /

Elevation of top of Surface Casing:

Elevation of top of Riser Pipe:

Type of Surface Seal: CONCRETE

Borehole Diameter: ~9"

Inside Diameter of Borehole Casing: 4.25"

Type of Backfill: Cement/BENT. GROUT

Type of Riser: SCH 40 PVC

Riser Inside Diameter: 2"

Type of Seal: BENSEAL

Type of Sand Pack: SILICA QTZ., 00 SIZE

Type of Screen: SCH 40 PVC

Slot Size x Length: 0.010" X10'

Inside Diameter of Screen: 2"

Depth of Sediment Sump with Plug: —

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Portland, ME 04101

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Overburden Well Construction Diagram

Well No.: MW-10

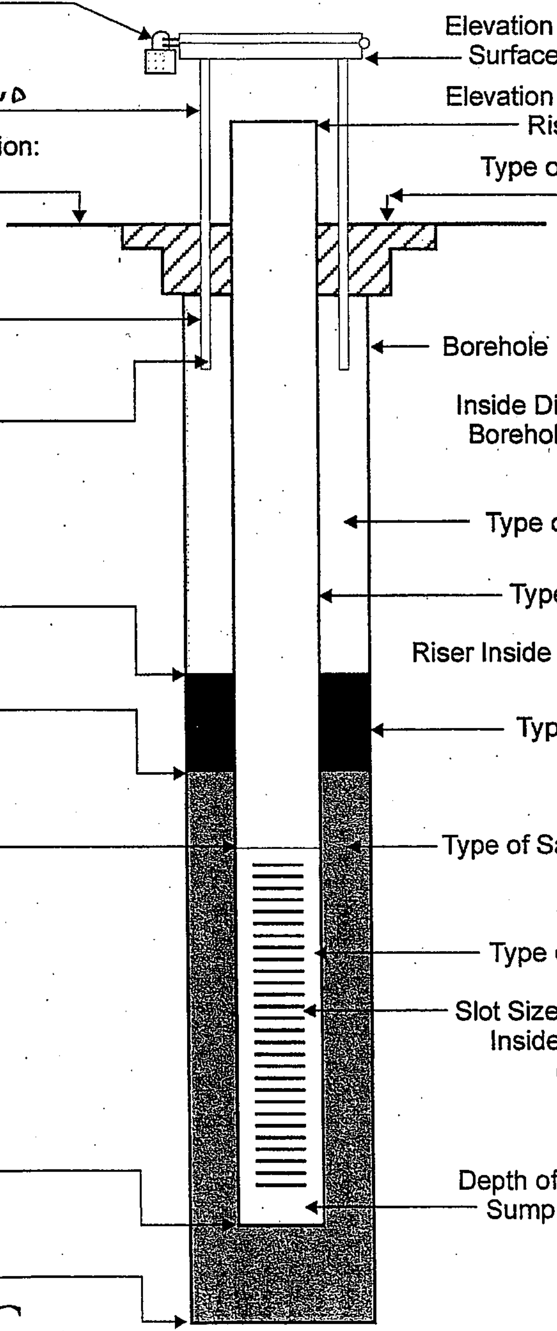
Project No.: 3612062070	Project Name: Diamond Cleaners Site
	Project Area:

Contractor: Nothnagle	Driller: KEVIN BUSH	Method: Hollow Stem Auger

Logged By: T. Longley	Date Started: 7-22-08	Completed: 7-22-08

Checked By: CRS	Date: 8/1/08	Well Development Date: 7-24-08

Not To Scale



Lock Identification: 2342

Surface Casing Type: FLUSH-TO-GROUND

Ground Surface Elevation:

Surface Casing Diameter: 8"

Inside Diameter of Surface Casing: 8"

Depth/Elevation of Top of Well Seal: 7.5 /

Depth/Elevation of Top of Sand: 9 /

Depth/Elevation of Top of Screen: 12 /

Depth/Elevation of Bottom of Screen: 22 /

Depth/Elevation of Bottom of Boring: 22 /

Elevation of top of Surface Casing:

Elevation of top of Riser Pipe:

Type of Surface Seal: CONCRETE

Borehole Diameter: ~9"

Inside Diameter of Borehole Casing: 4.25"

Type of Backfill: CEMENT/BENT. GROUT

Type of Riser: SCH 40 PVC

Riser Inside Diameter: 2"

Type of Seal: BENSEAL

Type of Sand Pack: SILICA QTZ., 00 SIZE

Type of Screen: SCH 40 PVC

Slot Size x Length: 0.010" X 10'

Inside Diameter of Screen: 2"

Depth of Sediment Sump with Plug: —

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Overburden Well Construction Diagram

Well No.: MW-11

Project No.: 3612062070

Project Name: Diamond Cleaners Site

Project Area:

Contractor: Nothnagle

Driller: KEVIN BUSH

Method: Hollow Stem Auger

Logged By: T. Longley

Date Started: 7-21-08

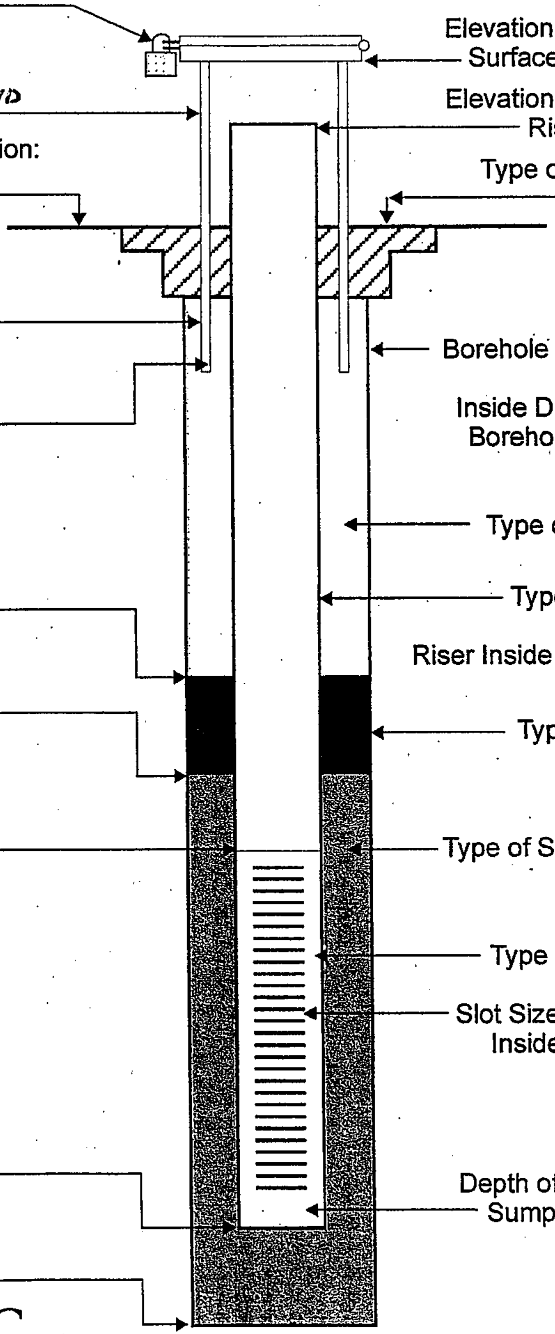
Completed: 7-21-08

Checked By: CRJ

Date: 8/1/08

Well Development Date: 7-24-08

Not To Scale



Lock Identification: 2342

Surface Casing Type: FLUSH-TO-GROUND

Ground Surface Elevation:

Surface Casing Diameter:

Inside Diameter of Surface Casing: 8"

Depth/Elevation of Top of Well Seal: 6.3 /

Depth/Elevation of Top of Sand: 9.0 /

Depth/Elevation of Top of Screen: 12.3 /

Depth/Elevation of Bottom of Screen: 22.3 /

Depth/Elevation of Bottom of Boring: 22.4 /

Elevation of top of Surface Casing:

Elevation of top of Riser Pipe:

Type of Surface Seal: CONCRETE

Borehole Diameter: ~9"

Inside Diameter of Borehole Casing: 4.25"

Type of Backfill: CEMENT/BENT. GROUT

Type of Riser: 2" SCH 40 PVC

Riser Inside Diameter: 2" I.D.

Type of Seal: BENSEAL

Type of Sand Pack: SILICA QTZ., 00 SIZE

Type of Screen: 2"X10' SCH 40 PVC

Slot Size x Length: 0.010" X10'

Inside Diameter of Screen: 2"

Depth of Sediment Sump with Plug: —

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SOIL BORING LOG

Project Diamond Cleaners Site		Boring/Well No. MW-6	Proiect No. 3612062080
Client NYSDEC	Site		Sheet No. 1 of 1
Logged By T. Longley	Ground Elevation	Start Date 7-22-08	Finish Date 7-22-08
Drilling Contractor Nothnagle	Driller's Name Kevin Bush	Rig Type BK-81	
Drilling Method HSA	Protection Level D	P.I.D. (eV) 580B	Casing Size —
Auger Size 4.25"			
Soil Drilled 20'	Rock Drilled —	Total Depth 20'	Depth to Groundwater/Date 8.20 B.T.O.R. / 7-24-08
Piez ☐	Well ☐	Boring ☐	

Depth(Feet)	Sample No. & Penetration/ Recovery (Feet)	SPT Blows/6" or Core Rec./Rqd. %	SPT-N (Blows/Ft.)	Sample Description	USCS Group Symbol	Monitoring (ppm) PI Meter Field Scan	Monitoring (ppm) PI Meter Head Space	Lab Tests ID Sample
9				DRILL w/ out Sampling to 10'; USE MACRO CORE Sampler				
10 11 12 13	S-1 No Recovery	20 Blows	—	No Recovery due to stones/gravel stuck in lead end. Pushed very easily through 4'				
14 15 16 17	S-2 15"/48"	119 Blows	—	Gray to brownish gray to olive gray SAND & SILT; gravel ~5%, SAND ~ 40%, SILT(& clay) ~ 55% TILL - dense, saturated —	ML/SM	0	0	—
18 19 20 21 22	S-3 24"/48"	?	—	Very dense resistance to sampler; Medium gray SILT; sandy & clayey; w/gravel; TILL - V. dense, non-plastic, moist	ML	0	0	—

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SOIL BORING LOG

Project Diamond Cleaners Site		Boring/Well No. MW-11	Project No. 3612062070
Client NYSDEC	Site		Sheet No. 1 of 2
Logged By T. Longley	Ground Elevation	Start Date 7-21-08	Finish Date 7-21-08
Drilling Contractor Nothnagle	Driller's Name KEVIN BUSH		Rig Type BRAINARD KILMAN 81
Drilling Method HSA	Protection Level D	P.I.D. (eV) 580B	Casing Size — / Auger Size 4.25" I.D.
Soil Drilled 22' / Rock Drilled —	Total Depth 22'	Depth to Groundwater/Date ~13.7' B.T.O.R.	Piez ☐ Well ☒ Boring ☐

Depth(Feet)	Sample No. & Penetration/ Recovery (Feet)	SPT Blows/6" or Core Rec./Rqd. %	SPT-N (Blows/Ft.)	Sample Description	USCS Group Symbol	Monitoring (ppm) PI Meter Field Scan	Monitoring (ppm) PI Meter Head Space	Lab Tests ID Sample
				DRILL W/OUT SAMPLING TO 10'				
1								
2								
3								
4								
5								
6								
7								
8								
9								
10 11	S-1 15"/24"	6 3 3 3	6	Light yellow brown, fine SAND, loose, saturated, trace-to-Little silt; very well sorted, non-plastic, stratified alluvium	SM (SP)	0.0	0.0	—
12 13	S-2 4"/24"	2 3	5					

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SOIL BORING LOG

Project Diamond Cleaners Site		Boring/Well No. MW-11	Project No. 3612052070
Client NYSDEC	Site	Sheet No. 2 of 2	
Logged By T. Longley	Ground Elevation	Start Date 7-21-08	Finish Date 7-21-08
Drilling Contractor Nothnagle	Driller's Name KEVIN BUSH	Rig Type BK-81	
Drilling Method HSA	Protection Level D	P.I.D. (eV) 580B	Casing Size —	Auger Size 4.25" ID
Soil Drilled 22'	Rock Drilled —	Total Depth 22'	Depth to Groundwater/Date ~13.7' B.T.R.	Piez ☐ Well ☒ Boring ☐

Depth(Feet)	Sample No. & Penetration/ Recovery (Feet)	SPT Blows/6" or Core Rec./Rqd. %	SPT-N (Blows/Ft.)	Sample Description	USCS Group Symbol	Monitoring (ppm) PI Meter Field Scan	Monitoring (ppm) PI Meter Head Space	Lab Tests ID Sample
13 14	S-2 4"/24"	2 2	5	yellow brown, gravelly & silty SAND; wellgraded, Loose, saturated, non-plastic; gravel is well-rounded	SW/SM	0	0	—
15 16	S-3 9"/24"	3 6 9 7	15	Brown gravelly SAND; tr. fines, wellgraded As above	SW (SP)	0	0	—
17 18	S-4 10"/24"	4 5 8 8	13	Lt. yellowish brown GRAVEL & SAND; wellgraded, med. dense, saturated, non-plastic, alluvium? gravel is rounded	GP (GM)	0	0	—
19 20	S-5 ~5"/24"	5 5 3 13	8	Gray brown GRAVEL & SILTY SAND; wellgraded, loose, saturated, non-plastic due to gravel, recovery is poor	GM	0	0	—
21 22	S-6 15"/24"	9 10 25 24	35	grayish brown, GRAVELLY SILTY SAND; well graded, dense, saturated, non-plastic, -possibly till?; GRAVEL (~50%) SAND (~40%) SILT (~10%)	GM	0	0	—
23 24 25 26				B.O.B @ 22'				

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SOIL BORING LOG

Project Diamond Cleaners Site		Boring/Well No. SOURCE BORING	Project No. 3612062070
Client NYSDEC	Site		Sheet No. 1 of 1
Logged By T. Longley	Ground Elevation	Start Date 7-23-08	Finish Date 7-23-08
Drilling Contractor Nothnagle	Driller's Name KEVIN BUSH		Rig Type BK-81
Drilling Method HSA	Protection Level D	P.I.D. (eV) 580B	Casing Size ~~4.25~~ Auger Size 4.25"
Soil Drilled 16'	Rock Drilled —	Total Depth 16'	Depth to Groundwater/Date ~11' Piez ☐ Well ☐ Boring ☒

Depth(Feet)	Sample No. & Penetration/ Recovery (Feet)	SPT Blows/6" or Core Rec./Rqd. %	SPT-N (Blows/Ft.)	Sample Description	USCS Group Symbol	Monitoring (ppm) PI Meter Field Scan	Monitoring (ppm) PI Meter Head Space	Lab Tests ID Sample
				PURPOSE OF BORING IS TO COLLECT SOURCE-AREA SOILS FOR treatability CHARACTERISTICS. DRILLED W/OUT SAMPLING to below water table, then COLLECT 2 SAMPLES				
12	S-1	2 3 8 16	11	Brown to OLIVE brown GRAVEL & SAND, Little SILT, Saturated; Loose; enough Volume for SAMPLE WAS Collected w/ Spoon	GM	—	—	Source 1
14	S-2	10 16 10 3	26	As above; very poor recovery due to Saturated gravelly conditions; collected Some soil for Sample volume off of Auger when pulled from the boring.	GM	-	-	Source 2
16				Both SAmples were sent to SIREM Laboratory in Guelph, Ontario for TOTAL OXYGEN DEMAND				

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WELL DEVELOPMENT RECORD

Project: Diamond Cleaners Site	Well Installation Date: 7-22-08		Project No. 3612062070
Client: NYSDEC	Well Development Date: 7-25-08	Logged by: T. Longley	Checked by: CRJ 8/1/08
Well/Site I.D.: MW-6	Weather: CLEAR, into 80's	Start Date: 7-24-08	Finish Date: 7-25-08
		Start Time: 08:12	Finish Time: 09:16

Well Construction Record Data:

Bottom of Screen 19.8 ft.
Sediment Sump/Plug — ft.
Screen Length 10 ft.

From Ground Surface ☐ From Top of Riser ☒

Well Diameter 2 in.

Fluids Lost during Drilling 0 gal.

Protective Casing Stick-up / ft. FLUSH

Protective Casing/Well Diff. 0.50 ft.

PID Readings: Ambient Air 0 ppm; Well Mouth 0 ppm

Well Levels:

Initial 8.41 ft.
End of Development — ft.
24 Hours after Development — ft.

Sediment:

Well Depth before Development 19.25 ft. (from top of PVC)
Well Depth after Development 19.3 ft.
Sediment Depth Removed 0.05 ft.

HT of Water Column ~11.0 ft. x ☒ 1.68* gal./ft. ☐ ______ = ~~0.05~~ 18.5 gal./vol.
*for 4" HSA Installed Wells

Equipment:

- ☒ ~~Dedicated~~ Submersible Pump
- ☐ Surge Block
- ☒ Bailer ☒ 2" ☐ ________
- ☐ Grundfos Pump 2" _____ 4" _____

Approximate Recharge Rage ~0.25 gpm

Total Gallons Removed ~15 gal.

Well Development Criteria Met:

Notes: BAILED w/ Bailer then w/ downhole pump.
Purged @ greater rate than the well will be sampled at, so considered this well developed - got good hydraulic connection w/ formation

End of Well Development Sample (1 pint) Collected? Yes ☐ No ☒

	Yes	No
Well water clear to unaided eye	☒	☐
Sediment thickness remaining in well is <1.0% of screen length	☒	☐
Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost	☐	☒
Turbidity < 5NTUs	☐	☒
10% change in field parameters	☐	☒

Water Parameter Measurements

Record at start, twice during and at the end of development (minimum): °C

Time	Volume	Total Gallons	pH	Temp.	Conductance	Turbidity	Pumping Rate
8:15	Turn on	pump & dewaters quickly;		Repeat this	4 Times		10L/min.
8:47	~~~10L~~	~10L/2.6					1.2L/min.
9:00	15.6L	~25.6/6.8	6.95	12.67	1.44	292	1.2
9:05	6L	31.6/8.3	6.97	12.69	1.67	80	1.2
9:10	6L	37.6/10	6.98	12.89	1.87	31	1.2
9:13	3L	40.6/10.7	6.99	12.99	2.18	24	1.0
9:16	3L	43.6/11.5	6.99	13.00	2.56	22	1.0

Well Developer's Signature Th. O. Lngly

- Bailed w/ 2" Bailer on 7/24/08 for Approx. 4 Gallons.
- Used downhole pump to complete development.

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WELL DEVELOPMENT RECORD

Project: Diamond Cleaners Site	Well Installation Date: 7-23-08		Project No. 3612062070
Client: NYSDEC	Well Development Date: 7-24-08	Logged by: T. Longley	Checked by: CRr 8/1/0
Well/Site I.D.: MW-7	Weather: Rainy w/ T'storms	Start Date: 7-23-08	Finish Date: 7-24-08
		Start Time: 16:16	Finish Time: 17:17

Well Construction Record Data:

Well Diameter 2 in.

Bottom of Screen	22 ft.
Sediment Sump/Plug	— ft.
Screen Length	10 ft.

From Ground Surface ☒ From Top of Riser ☐

Fluids Lost during Drilling 0 gal.

Protective Casing Stick-up — ft. FLUSH

Protective Casing/Well Diff. 0.45 ft.

PID Readings: Ambient Air 0 ppm; Well Mouth 0 ppm

Well Levels:

Initial	11.2 ft. 11.2
End of Development	– ft.
24 Hours after Development	– ft.

Sediment:

Well Depth before Development	20.85 ft. (from top of PVC)
Well Depth after Development	20.9 ft.
Sediment Depth Removed	0.05 ft.

HT of Water Column ~10.5 ft. x ☒ 1.68* gal./ft. ☐ ______ = 17.6 gal./vol.

*for 4" HSA Installed Wells

Equipment:

☒ ~~Dedicated~~ Submersible Pump

☐ Surge Block

☒ Bailer ☒ 2" ☐ ________

☐ Grundfos Pump 2" _____ 4" _____

Approximate Recharge Rage ~0.4 gpm

Total Gallons Removed 72 gal. ~4 + 68G = 72

Well Development Criteria Met:

Notes: Bailed w/ 2" Bailer on 7/23/08 for ~4 Gallons. Purged @ greater rate than at what the well will be sampled at; Consider this well developed.

End of Well Development Sample (1 pint) Collected? Yes ☐ No ☒

	Yes	No
Well water clear to unaided eye	☒	☐
Sediment thickness remaining in well is <1.0% of screen length	☒	☐
Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost	☐	☒
Turbidity < 5NTUs	☐	☒
10% change in field parameters	☐	☒

Water Parameter Measurements

Record at start, twice during and at the end of development (minimum):

16:17 until 16:37, pump @ 10 L/min for total of 200L or 53 Gallons

Time	Volume	Total Gallons	pH	Temp.	Conductance	Turbidity	Pumping Rate L/min
16:46	~14L	214L / 57g	7.13	11.95	1.49	>1000	1
16:55	11L	225L / 59g	7.20	11.86	1.29	106	1.5
17:00	7.5L	232L / 61G	7.15	11.68	1.34	48	1.5
17:05	7.5L	240L / 63G	7.14	11.67	1.16	41	1.7
17:10	8.5L	249L / 66G	7.14	11.65	1.11	34	1.7
17:17	8.L	257L / 68G	7.14	11.66	1.09	22	1.7

Well Developer's Signature

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WELL DEVELOPMENT RECORD

Project: Diamond Cleaners Site	Well Installation Date: 7-23-08		Project No. 3612062070
Client: NYSDEC	Well Development Date: 7-25-08	Logged by: T. Longley	Checked by: CRI 8/1/08
Well/Site I.D.: MW-8	Weather: Clear, into 80's	Start Date: 7-24-08	Finish Date: 7-25-08
		Start Time: 07:06	Finish Time: 08:06

Well Construction Record Data:

Bottom of Screen 22 ft.
Sediment Sump/Plug — ft.
Screen Length 10 ft.
From Ground Surface ☒ From Top of Riser ☐
Well Diameter 2 in.
Fluids Lost during Drilling 0 gal.

Protective Casing Stick-up N/A ft. FLUSH
Protective Casing/Well Diff. 0.57 ft.
PID Readings: Ambient Air 0 ppm; Well Mouth 0 ppm

Well Levels:

Initial 10.31 ft.
End of Development 10.4 ft.
24 Hours after Development — ft.
HT of Water Column 11.6 ft. x ☒ 1.68* gal./ft. ☐ ______ = 19.5 gal./vol.

Sediment:

Well Depth before Development 21.55 ft. (from top of PVC)
Well Depth after Development 21.55 ft.
Sediment Depth Removed — ft.

*for 4" HSA Installed Wells

Equipment:

- ☒ ~~Dedicated~~ Submersible Pump
- ☐ Surge Block
- ☒ Bailer ☒ 2" ☐ ________
- ☐ Grundfos Pump 2" _____ 4" _____

Approximate Recharge Rage ~0.8 gpm
Total Gallons Removed ~56 gal.

Well Development Criteria Met:

Notes: Bailed w/ Bailer then w/ downhole pump. Purged at greater rate than it will be sampled at. Considered this well developed

End of Well Development Sample (1 pint) Collected? Yes ☐ No ☒

	Yes	No
Well water clear to unaided eye	☐	☒
Sediment thickness remaining in well is <1.0% of screen length	☒	☐
Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost	☐	☒
Turbidity < 5NTUs	☐	☒
10% change in field parameters	☐	☒

Water Parameter Measurements

Record at start, twice during and at the end of development (minimum):

Time	Volume	Total Gallons	pH	Temp.	Conductance	Turbidity	Pumping Rate
07:06	Threw on pump	@ ~ 8L/min	for 14 minutes/	~112 Liters	(~29Gallons)		3L/min.
07:41	15L	~33Gal	6.95	11.05	0.999	84	3L/min.
7:45	12L	~36G	6.97	11.05	0.999	82	3L/min
7:50	15L	~40	7.11	11.05	0.999	65	↓
7:55	15L	~44	7.10	11.06	0.999	40	
8:00	15L	~48	7.07	11.04	0.999	47	
8:06	18L	~53G.	7.08	11.06	0.999	56	

Well Developer's Signature T. D. Longley

*Bailed w/ 2" Bailer on 7-24-08 then w/ pump on 7-25-08

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WELL DEVELOPMENT RECORD

Project: Diamond Cleaners Site	Well Installation Date: 7-21-08		Project No. 3612062070
Client: NYSDEC	Well Development Date: 7-24-08	Logged by: T. Longley	Checked by: CRS 9/1/09
Well/Site I.D.: MW-9	Weather: Rainy w/ T'STORMS	Start Date: 7-24-09	Finish Date: 7-24-09
		Start Time: ~10:45	Finish Time: 14:58

Well Construction Record Data:

Bottom of Screen ~21.7 ft.
Sediment Sump/Plug — ft.
Screen Length 10 ft.
From Ground Surface ☒ From Top of Riser ☐
Well Diameter ____ in.
Fluids Lost during Drilling 0 gal.

Protective Casing Stick-up — ft. FLUSH
Protective Casing/Well Diff. 0.60 ft.
PID Readings: Ambient Air 0 ppm
Well Mouth 0 ppm

Well Levels:

Initial 11.10 ft.
End of Development 11.10 ft.
24 Hours after Development — ft.

Sediment:

Well Depth before Development 20.4 ft. (from top of PVC)
Well Depth after Development — ft.
Sediment Depth Removed — ft.

HT of Water Column ~10.6 ft. x ☒ 1.68* gal./ft. ☐ ______ = ~17.8 gal./vol.
*for 4" HSA Installed Wells

Equipment:

☒ ~~Dedicated~~ Submersible Pump
☐ Surge Block
☒ Bailer ☒ 2" ☐ ________
☐ Grundfos Pump 2" _____ 4" _____

Approximate Recharge Rage ~0.4 gpm
Total Gallons Removed ~49 gal.

Well Development Criteria Met:

Notes: Bailed w/ 2" Bailer for ~4 Gallons, then used downhole pump to complete. Pumped at a rate greater than what the well will be sampled at.

End of Well Development Sample (1 pint) Collected? Yes ☐ No ☒

	Yes	No
■ Well water clear to unaided eye	☐	☒
■ Sediment thickness remaining in well is <1.0% of screen length	☒	☐
■ Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost	☐	☒
■ Turbidity < 5NTUs	☐	☒
■ 10% change in field parameters	☐	☒

Water Parameter Measurements

Record at start, twice during and at the end of development (minimum):

Time	Volume	Total Gallons	pH	Temp.	Conductance	Turbidity	Pumping Rate
14:00 Turned on pump @ ~6L/min. for 22min. = 132L (35Gallons); at 14:22 @ 1.5L/min							
14:41	~28.5L	~161L / 43	7.12	10.50	0.98	129	1.5
14:45	6L	167L/	7.12	10.50	0.99	122	1.5
14:48	4.5L	172L/	7.12	10.47	0.97	77	1.5
14:52	6L	178L/	7.12	10.54	0.93	65	1.5
14:55	4.5L	182L/	7.13	10.47	0.94	50	1.5
14:58	4.5L	187L/~49G	7.13	10.57	0.91	70	1.5

Well Developer's Signature Th D. Longley

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WELL DEVELOPMENT RECORD

Project: Diamond Cleaners Site	Well Installation Date: 7-22-08		Project No. 3612062070
Client: NYSDEC	Well Development Date: 7-24-08	Logged by: T. Longley	Checked by: CES 8/1/08
Well/Site I.D.: MW-10	Weather: Rainy w/ T'storms	Start Date: 7-24-08	Finish Date: 7-24-08
		Start Time: ~11:00	Finish Time: 16:06

Well Construction Record Data:

Well Diameter 2 in.

Bottom of Screen 22 ft.
Sediment Sump/Plug — ft.
Screen Length 10 ft.

From Ground Surface ☒ From Top of Riser ☐

Fluids Lost during Drilling 0 gal.

Protective Casing Stick-up — ft. FLUSH
Protective Casing/Well Diff. 0.55 ft.

PID Readings: Ambient Air 0 ppm
Well Mouth 0 ppm

Well Levels:

Initial 11.50 ft.
End of Development 11.17 ft.
24 Hours after Development — ft.

Sediment:

Well Depth before Development 21.48 ft. (from top of PVC)
Well Depth after Development — ft.
Sediment Depth Removed — ft.

HT of Water Column ~10.5 ft. x ☒ 1.68* gal./ft. ☐ ______ = ~17.6 gal./vol.
*for 4" HSA Installed Wells

Equipment:

☒ ~~Dedicated~~ Submersible Pump
☐ Surge Block
☒ Bailer ☒ 2" ☐ ________
☐ Grundfos Pump 2" _____ 4" _____

Approximate Recharge Rage ~0.3 gpm
Total Gallons Removed ~53 gal.

Well Development Criteria Met:

Notes: Bailed w/ 2" Bailer for ~ 4 Gallons; then used downhole pump to complete development. Pumped at higher rate than at what well will be sampled; consider well developed.

End of Well Development Sample (1 pint) Collected? Yes ☐ No ☒

	Yes	No
■ Well water clear to unaided eye	☒	☐
■ Sediment thickness remaining in well is <1.0% of screen length	☒	☐
■ Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost	☐	☒
■ Turbidity < 5NTUs	☐	☒
■ 10% change in field parameters	☐	☒

Water Parameter Measurements

Record at start, twice during and at the end of development (minimum):

Time	Volume	Total Gallons	pH	Temp.	Conductance	Turbidity	Pumping Rate L/min.
15:06 Turned on pump @ ~6L/min. for 24 min. = 144 Liters = 38 Gallons							
15:44	~14 L	162L/~42G.					1
15:50			7.21	10.22	0.911	24	1
15:53			7.20	10.24	0.853	36	1
15:57			7.20	10.22	0.899	27	1
16:01			7.20	10.21	0.911	20	1
16:06		~184L/49	7.21	10.21	0.917	12	1

Well Developer's Signature T. O. Longley

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WELL DEVELOPMENT RECORD

Project: Diamond Cleaners Site	Well Installation Date: 7-21-08		Project No. 3612062070
Client: NYSDEC	Well Development Date: 7-24-08	Logged by: T. Longley	Checked by: CRI 8/1/08
Well/Site I.D.: MW-11	Weather: Rainy w/ T'storms	Start Date: 7/24/08	Finish Date: 7/24/08
		Start Time: ~~13:05~~ JDT 07:53	Finish Time: 13:50

Well Construction Record Data:

Bottom of Screen 22.3 ft.
Sediment Sump/Plug — ft.
Screen Length 10 ft.

From Ground Surface ☒ From Top of Riser ☐

Well Diameter 2 in.

Fluids Lost during Drilling 0 gal.

Protective Casing Stick-up — ft. FLUSH

Protective Casing/Well Diff. 0.55 ft.

PID Readings: Ambient Air 0 ppm; Well Mouth 0 ppm

Well Levels:

Initial 13.75 ft.
End of Development — ft.
24 Hours after Development — ft.

Sediment:

Well Depth before Development 21.75 ft. (from top of PVC)
Well Depth after Development — ft.
Sediment Depth Removed — ft.

HT of Water Column 8.5 ft. x ☒ 1.68* gal./ft. ☐ ______ = ~14 gal./vol.
*for 4" HSA Installed Wells

Equipment:

- ☒ ~~Dedicated~~ Submersible Pump
- ☐ Surge Block
- ☒ Bailer ☒ 2" ☐ ______
- ☐ Grundfos Pump 2" ______ 4" ______

Approximate Recharge Rage ~~~1.5~~ ~~Hour~~ gpm JDT ~0.4GPm

Total Gallons Removed ~25 gal.

Well Development Criteria Met:

Notes: Pumped at higher rate than at what the well will be sampled at.

	Yes	No
■ Well water clear to unaided eye	☒	☐
■ Sediment thickness remaining in well is <1.0% of screen length	☒	☐
■ Total water removed = a minimum of 5x calculated well volume plus 5x drilling fluid lost	☐	☒
■ Turbidity < 5NTUs	☐	☒
■ 10% change in field parameters	☒	☐

End of Well Development Sample (1 pint) Collected? Yes ☐ No ☒

Water Parameter Measurements

Record at start, twice during and at the end of development (minimum):

pumped @ ~2L/min. for 16 min. = 5.8Gallons; then 17 min. @ 3L/min = 10GAL (~16GAL.) Then 1L/min. @ 13

Time	Volume	Total Gallons	pH	Temp.	Conductance	Turbidity	Pumping Rate
13:30	~~23L~~ 13L		6.62	11.74	1.34	555	1L/min.
13:40	~~33L~~ 10L		6.66	11.70	2.45	31	↓
13:44	~~37L~~ 4L		6.68	11.81	2.72	12	
13:47	~~40L~~ 3L		6.69	11.77	2.71	13	
13:50	~~43L~~ 3L	~25GAL.	6.69	11.79	2.61	12	

Well Developer's Signature Th O. Longley

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PORT2007022h.mac

LOW FLOW GROUNDWATER SAMPLING RECORD

PROJECT: Diamond Cleaners Site
SAMPLE I.D. NUMBER: DCMW00502108
SAMPLE TIME: 08:40
EXPLORATION ID: MW-5
SITE: Diamond Cleaners
DATE: 8/12/08
TIME START 07:55 END 08:40
JOB NUMBER: 3612062070-02.1
FILE TYPE:

WATER LEVEL / PUMP SETTINGS

MEASUREMENT POINT
☒ TOP OF WELL RISER
☐ TOP OF PROTECTIVE CASING
☐ OTHER

PROTECTIVE CASING STICKUP (FROM GROUND): 0.5 FT
PROTECTIVE CASING / WELL DIFFERENCE: ~~5.5~~ 0.5 FT

INITIAL DEPTH TO WATER: 11.01 FT
WELL DEPTH (TOR): 24.5 FT
PID AMBIENT AIR: 0 PPM
WELL DIAMETER: 2 IN

FINAL DEPTH TO WATER: 11.01 FT
SCREEN LENGTH: 10 FT
PID WELL MOUTH: 0 PPM

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING	✓		
LOCKED		✓	
COLLAR			✓

DRAWDOWN VOLUME (initial - final x 0.16 {2-inch} or x 0.65 {4-inch}): 0 GAL
RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME PURGED: 0.00
PRESSURE TO PUMP: N/A PSI

TOTAL VOL. PURGED (purge rate (milliliters per minute) x time duration (minutes) x 0.00026 gal/milliliter): 2.3 GAL
REFILL TIMER SETTING: NA SECONDS
DISCHARGE TIMER SETTING: N/A SECONDS

PURGE DATA

TIME	DEPTH TO WATER (ft)	PURGE RATE (ml/m)	TEMP. (deg. c)	SPECIFIC CONDUCTANCE (ms/cm)	pH (units)	DISS. O2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	PUMP INTAKE DEPTH (ft)	COMMENTS
07:55 - Pump on w/ U-22 hookup @200ml/m										
08:02	11.01	200	16.30	0.819	6.86	2.75	35.2	87	21ft	
08:07	11.01	200	16.11	0.796	6.80	2.72	21.3	84	21ft	
08:12	11.01	200	16.14	0.799	6.80	2.65	14.1	79	21ft	
08:17	11.01	200	16.18	0.807	6.81	2.49	9.4	74	21ft	
08:22	11.01	200	16.23	0.816	6.82	2.34	6.7	70	21ft	
08:27	11.01	200	16.25	0.822	6.83	2.22	5.7	67	21ft	
08:30	11.01	200	16.19	0.825	6.83	2.07	4.6	64	21ft	
08:33	11.01	200	16.19	0.828	6.83	2.00	4.2	62	21ft	
08:36	11.01	200	16.21	0.829	6.84	1.99	4.3	61	21ft	
08:40 - Sample well										

EQUIPMENT DOCUMENTATION

TYPE OF PUMP	TYPE OF TUBING	TYPE OF PUMP MATERIAL	TYPE OF BLADDER MATERIAL
☐ MARSCHALK BLADDER	☐ SILASTIC	☐ POLYVINYL CHLORIDE	☐ TEFLON
☐ SIMCO BLADDER	☒ HIGH DENSITY POLYETHYLENE	☐ STAINLESS STEEL	☐ OTHER N/A
☒ GEOPUMP	☐ OTHER	☒ OTHER N/A	

ANALYTICAL PARAMETERS

To Be Collected	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED
☒ VOC	8260B	HCL / 4 DEG. C	~~3~~ 2 X 40 mL	☒ VOC
☐ SVOC	CLP	4 DEG. C	2 X 1 L AG	☐ SVOC
☐ PEST / PCBs	CLP	4 DEG. C	2 X 1 L AG	☐ PEST / PCBs
☐ TAL INORGANICS	CLP	HNO3 to pH <2	1 x 1 L P	☐ TAL INORGANICS
☐ Other				☐

PURGE OBSERVATIONS

back in well

PURGE WATER CONTAINERIZED YES [✓ NO]
NUMBER OF GALLONS GENERATED: 3.5

Signature:

NOTES/LOCATION SKETCH

MACTEC

511 Congress Street, Portland, Maine 04101

LOW FLOW GROUNDWATER SAMPLING RECORD

PROJECT	Diamond Cleaners Site	SAMPLE I.D. NUMBER	DCMW00202108	SAMPLE TIME	10:05
EXPLORATION ID:	MW-2	SITE	Diamond Cleaners	DATE	8/14/08
TIME	START 09:15 END 10:05	JOB NUMBER	3612062070-02.1	FILE TYPE	

WATER LEVEL / PUMP SETTINGS

MEASUREMENT POINT
☒ TOP OF WELL RISER
☐ TOP OF PROTECTIVE CASING
☐ OTHER

PROTECTIVE CASING STICKUP (FROM GROUND): 0.5 FT
PROTECTIVE CASING / WELL DIFFERENCE: 0.55 FT

INITIAL DEPTH TO WATER: 11.11 FT
WELL DEPTH (TOR): 24.5 FT
PID AMBIENT AIR: 0 PPM
WELL DIAMETER: 2 IN

FINAL DEPTH TO WATER: 11.11 FT
SCREEN LENGTH: 10 FT
PID WELL MOUTH: 0 PPM

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING	✓		
LOCKED		✓	
COLLAR			✓

DRAWDOWN VOLUME: 0 GAL
(initial - final x 0.16 {2-inch} or x 0.65 {4-inch})

RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME PURGED: 0

PRESSURE TO PUMP: NA PSI

TOTAL VOL. PURGED: 3.9 GAL
(purge rate (milliliters per minute) x time duration (minutes) x 0.00026 gal/milliliter)

REFILL TIMER SETTING: NA SECONDS
DISCHARGE TIMER SETTING: NA SECONDS

PURGE DATA

TIME	DEPTH TO WATER (ft)	PURGE RATE (ml/m)	TEMP. (deg. c)	SPECIFIC CONDUCTANCE (ms/cm)	pH (units)	DISS. O2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	PUMP INTAKE DEPTH (ft)	COMMENTS
09:15	Pump on w/ hanbra @ 300 ml/min								(MAN)	
09:24	11.11	300	15.32	0.560	6.97	2.75	344	124	21.50	
09:34	11.11	300	15.08	0.564	6.89	2.42	80	126	21.50	
09:39	11.11	300	15.09	0.578	6.90	2.66	38	126	21.50	
09:44	11.11	300	15.12	0.579	6.91	2.44	27	126	21.50	
09:49	11.11	300	15.52	0.580	6.93	2.42	20	126	21.50	
09:54	11.11	300	15.50	0.583	6.95	2.43	13	126	21.50	
09:58	11.11	300	15.50	0.580	6.96	2.40	11	126	21.50	
10:03	11.11	300	15.39	0.583	6.96	2.42	10	126	21.0	
10:05	- Sample well									

EQUIPMENT DOCUMENTATION

TYPE OF PUMP	TYPE OF TUBING	TYPE OF PUMP MATERIAL	TYPE OF BLADDER MATERIAL
☐ MARSCHALK BLADDER	☑ SILASTIC	☐ POLYVINYL CHLORIDE	☐ TEFLON
☐ SIMCO BLADDER	☐ HIGH DENSITY POLYETHYLENE	☐ STAINLESS STEEL	☑ OTHER NA
☑ GEOPUMP	☐ OTHER	☑ OTHER NA	

ANALYTICAL PARAMETERS

To Be Collected

	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED
☒ VOC	8260B	HCL / 4 DEG. C	2 ~~3~~ X 40 mL	☑ VOC
☐ SVOC	CLP	4 DEG. C	2 X 1 L AG	☐ SVOC
☐ PEST / PCBs	CLP	4 DEG. C	2 X 1 L AG	☐ PEST / PCBs
☐ TAL INORGANICS	CLP	HNO3 to pH <2	1 x 1 L P	☐ TAL INORGANICS
☐ Other				☐

PURGE OBSERVATIONS Back in well

PURGE WATER CONTAINERIZED YES [✓ NO]

NUMBER OF GALLONS GENERATED 4

Signature:

NOTES/LOCATION SKETCH

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LOW FLOW GROUNDWATER SAMPLING RECORD

PROJECT	Diamond Cleaners Site	SAMPLE I.D. NUMBER	DCMW00401708	SAMPLE TIME	11:25
EXPLORATION ID:	MW-4	SITE	Diamond cleaners	DATE	8/12/08
TIME	START 10:28 END 11:25	JOB NUMBER	3612062070-02.1	FILE TYPE	

WATER LEVEL / PUMP SETTINGS

MEASUREMENT POINT
☒ TOP OF WELL RISER
☐ TOP OF PROTECTIVE CASING
☐ OTHER ______

INITIAL DEPTH TO WATER: 10.28 FT

FINAL DEPTH TO WATER: 10.28 FT

DRAWDOWN VOLUME: 0 GAL
(initial - final x 0.16 {2-inch} or x 0.65 {4-inch})

TOTAL VOL. PURGED: 327 GAL
(purge rate (milliliters per minute) x time duration (minutes) x 0.00026 gal/milliliter)

WELL DEPTH (TOR): 20.9 FT

SCREEN LENGTH: 10 FT

RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME PURGED: 0.00

PROTECTIVE CASING STICKUP (FROM GROUND): 6.5 FT

PID AMBIENT AIR: 0 PPM

PID WELL MOUTH: 0 PPM

PRESSURE TO PUMP: N/A PSI

REFILL TIMER SETTING: N/A SECONDS

PROTECTIVE CASING / WELL DIFFERENCE: 0.5 FT

WELL DIAMETER: 2 IN

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING	✓		
LOCKED			
COLLAR			

DISCHARGE TIMER SETTING: N/A SECONDS

PURGE DATA

TIME	DEPTH TO WATER (ft)	PURGE RATE (ml/m)	TEMP. (deg. c)	SPECIFIC CONDUCTANCE (ms/cm)	pH (units)	DISS. O2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	PUMP INTAKE DEPTH (ft)	COMMENTS
10:28	- Pump on w/ horiba @ 300 ml/min									
10:35	10.28	300	15.30	0.341	6.71	7.86	19	161	17	
10:39	10.28	300	15.16	0.359	6.63	7.22	82	164	17	
10:43	10.28	250	15.14	0.381	6.66	6.60	73	164	17	
10:47	10.28	250	15.63	0.370	6.79	5.90	57	161	17	
10:52	10.28	250	15.55	0.414	6.81	5.99	42	158	17	
10:57	10.28	250	15.37	0.417	6.85	6.10	37	157	17	
11:02	10.28	250	15.34	0.425	6.90	5.32	27	156	17	
11:07	10.28	250	15.34	0.430	6.92	5.56	20	155	17	
11:12	10.28	250	15.29	0.437	6.94	5.50	15	154	17	
11:17	10.28	250	15.44	0.440	6.95	5.51	13	153	17	
11:20	10.28	250	15.80	0.443	6.97	5.	13	152	17	
11:25	- Sample well w/ dup									

EQUIPMENT DOCUMENTATION

TYPE OF PUMP
☐ MARSCHALK BLADDER
☐ SIMCO BLADDER
☑ GEOPUMP

TYPE OF TUBING
☑ SILASTIC
☑ HIGH DENSITY POLYETHYLENE
☐ OTHER ______

TYPE OF PUMP MATERIAL
☐ POLYVINYL CHLORIDE
☐ STAINLESS STEEL
☑ OTHER NA

TYPE OF BLADDER MATERIAL
☐ TEFLON
☑ OTHER N/A

ANALYTICAL PARAMETERS

To Be Collected

	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED
☑ VOC	8260B	HCL / 4 DEG. C	2 X 40 mL	☒ VOC
☐ SVOC	CLP	4 DEG. C	2 X 1 L AG	☐ SVOC
☐ PEST / PCBs	CLP	4 DEG. C	2 X 1 L AG	☐ PEST / PCBs
☐ TAL INORGANICS	CLP	HNO3 to pH <2	1 x 1 L P	☐ TAL INORGANICS
☐ Other ______	______	______	______	☐

PURGE OBSERVATIONS

Back in well

PURGE WATER CONTAINERIZED YES [✓ NO]

NUMBER OF GALLONS GENERATED 3.5

Signature:

NOTES/LOCATION SKETCH

Dup: DCMW00401708D

0.86

MACTEC

511 Congress Street, Portland, Maine 04101

LOW FLOW GROUNDWATER SAMPLING RECORD

PROJECT	Diamond Cleaners Site	SAMPLE I.D. NUMBER	DCMW00801808	SAMPLE TIME	12:50
EXPLORATION ID:	MW-8	SITE	Diamond cleaners	DATE	2/12/08
TIME	START 12:14 END 12:56	JOB NUMBER	3612062070-02.1	FILE TYPE	

WATER LEVEL / PUMP SETTINGS

MEASUREMENT POINT
☒ TOP OF WELL RISER
☐ TOP OF PROTECTIVE CASING
☐ OTHER ____

INITIAL DEPTH TO WATER: 10.31 FT

FINAL DEPTH TO WATER: 10.31 FT

DRAWDOWN VOLUME: 0 GAL
(initial - final x 0.16 {2-inch} or x 0.65 {4-inch})

TOTAL VOL. PURGED: 2.34 GAL
(purge rate (milliliters per minute) x time duration (minutes) x 0.00026 gal/milliliter)

WELL DEPTH (TOR): 21.5 FT

SCREEN LENGTH: 10 FT

RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME PURGED: 0.00

PROTECTIVE CASING STICKUP (FROM GROUND): 6.5 FT

PID AMBIENT AIR: 0 PPM

PID WELL MOUTH: 0 PPM

PRESSURE TO PUMP: N/A PSI

REFILL TIMER SETTING: N/A SECONDS

PROTECTIVE CASING / WELL DIFFERENCE: 0.5 FT

WELL DIAMETER: 2 IN

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING	✓		
LOCKED			
COLLAR			

DISCHARGE TIMER SETTING: N/A SECONDS

PURGE DATA

TIME	DEPTH TO WATER (ft)	PURGE RATE (ml/m)	TEMP. (deg. c)	SPECIFIC CONDUCTANCE (ms/cm)	pH (units)	DISS. O2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	PUMP INTAKE DEPTH (ft)	COMMENTS
12:14	: Pump on w/ horiba 250 ml/mn								18ft	
12:18	10.31	250	18.08	0.815	678	259	55	135	18ft	
12:23	10.31	250	17.34	0.804	6.64	2.11	23	124	18ft	
12:25	10.31	250	17.32	0.753	6.48	2.31	16	116	18ft	
12:31	10.31	250	17.47	0.749	6.41	2.15	16	94	18	
12:34	10.31	250	17.08	0.740	6.41	206	16	83	18	
12:37	10.31	250	16.90	0.734	6.42	1.94	12	76	18	
12:40	10.31	250	16.95	0.725	6.44	1.90	12	73	18	
12:43	10.31	250	17.00	0.720	6.47	1.89	9	71	18	
12:46	10.31	250	17.25	0.715	6.49	1.83	8	73	18	
12:49	10.31	250	17.24	0.711	6.52	1.86	7	73	18	
12:50	Sample well									

EQUIPMENT DOCUMENTATION

TYPE OF PUMP	TYPE OF TUBING	TYPE OF PUMP MATERIAL	TYPE OF BLADDER MATERIAL
☐ MARSCHALK BLADDER	☐ SILASTIC	☐ POLYVINYL CHLORIDE	☐ TEFLON
☐ SIMCO BLADDER	☐ HIGH DENSITY POLYETHYLENE	☐ STAINLESS STEEL	☒ OTHER N/A
☑ GEOPUMP	☐ OTHER ____	☑ OTHER N/A	

ANALYTICAL PARAMETERS

To Be Collected

	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED
☑ VOC	8260B	HCL / 4 DEG. C	3 X 40 mL	☒ VOC
☐ SVOC	CLP	4 DEG. C	2 X 1 L AG	☐ SVOC
☐ PEST / PCBs	CLP	4 DEG. C	2 X 1 L AG	☐ PEST / PCBs
☐ TAL INORGANICS	CLP	HNO3 to pH <2	1 x 1 L P	☐ TAL INORGANICS
☐ Other ____	____	____	____	☐

PURGE OBSERVATIONS

Back in well

PURGE WATER CONTAINERIZED YES [✓ NO]

NUMBER OF GALLONS GENERATED 2.5

Signature:

NOTES/LOCATION SKETCH

MS = DCMW00801808MS
MSD DCMW00801808MSD

MACTEC

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LOW FLOW GROUNDWATER SAMPLING RECORD

PROJECT	Diamond Cleaners Site	SAMPLE I.D. NUMBER	DCMW00701708	SAMPLE TIME	13:55
EXPLORATION ID:	MW-7	SITE	Diamond Cleaners	DATE	08/12/08
TIME	START 13:11 END 14:00	JOB NUMBER	3612062070-02.1	FILE TYPE	

WATER LEVEL / PUMP SETTINGS

MEASUREMENT POINT
☑ TOP OF WELL RISER
☐ TOP OF PROTECTIVE CASING
☐ OTHER

PROTECTIVE CASING STICKUP (FROM GROUND): 0.55 FT
PROTECTIVE CASING / WELL DIFFERENCE: 0.55 FT

INITIAL DEPTH TO WATER: 11.21 FT
WELL DEPTH (TOR): 20.9 FT
PID AMBIENT AIR: 0 PPM
WELL DIAMETER: 2 IN

FINAL DEPTH TO WATER: 11.21 FT
SCREEN LENGTH: 10 FT
PID WELL MOUTH: 0 PPM

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING	✓		
LOCKED			
COLLAR			

DRAWDOWN VOLUME: 0.00 GAL
(initial - final x 0.16 {2-inch} or x 0.65 {4-inch})

RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME PURGED: 0.00

PRESSURE TO PUMP: NA PSI

TOTAL VOL. PURGED: 2.7 GAL
(purge rate (milliliters per minute) x time duration (minutes) x 0.00026 gal/milliliter)

REFILL TIMER SETTING: NA SECONDS
DISCHARGE TIMER SETTING: NA SECONDS

PURGE DATA

TIME	DEPTH TO WATER (ft)	PURGE RATE (ml/m)	TEMP. (deg. c)	SPECIFIC CONDUCTANCE (ms/cm)	pH (units)	DISS. O2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	PUMP INTAKE DEPTH (ft)	COMMENTS
13:11	Pump on w/ horiba @ 200 ml/min									
13:17	11.21	200	15.09	0.255	7.10	2.60	90	-178	17	
13:22	11.21	200	14.79	0.283	6.73	2.07	55	-163	17	
13:27	11.21	200	14.91	0.424	6.55	2.15	33	-159	17	
13:32	11.21	200	14.89	0.550	6.55	1.96	21	-155	17	
13:36	11.21	200	14.76	0.615	6.59	2.02	18	-144	17	
13:40	11.21	200	14.74	0.658	6.60	1.98	14	-150	17	
13:43	11.21	200	14.75	0.677	6.62	2.00	12	-149	17	
13:46	11.21	200	14.77	0.696	6.64	2.00	9	-147	17	
13:49	11.21	200	14.76	0.701	6.66	1.97	8	-147	17	
13:52	11.21	200	14.91	0.702	6.68	1.99	8	-144	17	
13:55	Sample well									

EQUIPMENT DOCUMENTATION

TYPE OF PUMP
☐ MARSCHALK BLADDER
☐ SIMCO BLADDER
☑ GEOPUMP

TYPE OF TUBING
☑ SILASTIC
☑ HIGH DENSITY POLYETHYLENE
☐ OTHER

TYPE OF PUMP MATERIAL
☐ POLYVINYL CHLORIDE
☐ STAINLESS STEEL
☒ OTHER NA

TYPE OF BLADDER MATERIAL
☐ TEFLON
☑ OTHER NA

ANALYTICAL PARAMETERS

To Be Collected

To Be Collected	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED
☑ VOC	8260B	HCL / 4 DEG. C	~~2~~3 X 40 mL	☒ VOC
☐ SVOC	CLP	4 DEG. C	2 X 1 L AG	☐ SVOC
☐ PEST / PCBs	CLP	4 DEG. C	2 X 1 L AG	☐ PEST / PCBs
☐ TAL INORGANICS	CLP	HNO3 to pH <2	1 x 1 L P	☐ TAL INORGANICS
☑ Other Genetract				☐

PURGE OBSERVATIONS

back in well

PURGE WATER CONTAINERIZED: YES [✓ NO]

NUMBER OF GALLONS GENERATED: 2.7

Signature:

NOTES/LOCATION SKETCH

Sample Genetract

MACTEC

511 Congress Street, Portland, Maine 04101

LOW FLOW GROUNDWATER SAMPLING RECORD

PROJECT	Diamond Cleaners Site	SAMPLE I.D. NUMBER	DCGW1001408	SAMPLE TIME	15:25
EXPLORATION ID:	GW-10	SITE	Diamond Cleaners	DATE	8/12/08
TIME	START 14:33 END 15:25	JOB NUMBER	3612062070-02.1	FILE TYPE	

WATER LEVEL / PUMP SETTINGS

MEASUREMENT POINT
☑ TOP OF WELL RISER
☐ TOP OF PROTECTIVE CASING
☐ OTHER ______

INITIAL DEPTH TO WATER: 10.63 FT
FINAL DEPTH TO WATER: 10.93 FT
DRAWDOWN VOLUME: ~~0.30~~ 0.0276 MAM GAL
(initial - final x 0.16 {2-inch} or x 0.65 {4-inch}) x0.092(1.5 inch)
TOTAL VOL. PURGED: 2.7 GAL
(purge rate (milliliters per minute) x time duration (minutes) x 0.00026 gal/milliliter)

WELL DEPTH (TOR): 17.65 FT
SCREEN LENGTH: 10 FT
RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME PURGED: ~~0.1~~ 0.010 MAM

PROTECTIVE CASING STICKUP (FROM GROUND): 0.5 FT
PID AMBIENT AIR: 0 PPM
PID WELL MOUTH: 0 PPM
PRESSURE TO PUMP: N/A PSI
REFILL TIMER SETTING: N/A SECONDS

PROTECTIVE CASING / WELL DIFFERENCE: 0.25 FT
WELL DIAMETER: 1.5 IN
DISCHARGE TIMER SETTING: NA SECONDS

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING	✓		
LOCKED			✓
COLLAR			

PURGE DATA

TIME	DEPTH TO WATER (ft)	PURGE RATE (ml/m)	TEMP. (deg. c)	SPECIFIC CONDUCTANCE (ms/cm)	pH (units)	DISS. O2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	PUMP INTAKE DEPTH (ft)	COMMENTS
14:33	- Pump on ~1 ha..by @ 200 ml/m						?		14	
14:39	10.93	200	18.20	0.423	6.97	6.48	373	88	14	
14:43	10.93	200	18.41	0.422	6.96	6.33	215	89	14	
14:46	10.97	200	18.48	0.421	6.96	6.22	125	93	14	
14:50	10.93	200	18.57	0.419	6.96	6.21	77	97	14	
14:54	10.93	200	18.37	0.420	6.96	6.22	55	98	14	
14:58	10.93	200	18.33	0.420	6.95	6.16	40	103	14	
15:03	10.93	200	17.37	0.423	6.94	6.33	26	108	14	
15:06	10.97	200	17.19	0.422	6.93	6.34	20	111	14	
15:10	10.97	200	17.03	0.422	6.92	6.32	20	113	14	
15:14	10.93	200	17.04	0.422	6.92	6.32	15	115	14	
15:17	10.93	200	17.76	0.420	6.93	6.32	15	116	14	
15:20	10.93	200	17.87	0.419	6.94	6.32	13	117	14	
15:25	- Sample well									

EQUIPMENT DOCUMENTATION

TYPE OF PUMP
☐ MARSCHALK BLADDER
☐ SIMCO BLADDER
☑ GEOPUMP

TYPE OF TUBING
☑ SILASTIC
☑ HIGH DENSITY POLYETHYLENE
☐ OTHER ______

TYPE OF PUMP MATERIAL
☐ POLYVINYL CHLORIDE
☐ STAINLESS STEEL
☑ OTHER N/A

TYPE OF BLADDER MATERIAL
☐ TEFLON
☑ OTHER NA

ANALYTICAL PARAMETERS

To Be Collected

To Be Collected	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED
☑ VOC	8260B	HCL / 4 DEG. C	~~2~~3 X 40 mL	☑ VOC
☐ SVOC	CLP	4 DEG. C	2 X 1 L AG	☐ SVOC
☐ PEST / PCBs	CLP	4 DEG. C	2 X 1 L AG	☐ PEST / PCBs
☐ TAL INORGANICS	CLP	HNO3 to pH <2	1 x 1 L P	☐ TAL INORGANICS
☐ Other ______	______	______	______	☐

PURGE OBSERVATIONS

Bail in well

PURGE WATER CONTAINERIZED: YES [✓ NO]
NUMBER OF GALLONS GENERATED: 2.0

Signature: ______

NOTES/LOCATION SKETCH

MACTEC

511 Congress Street, Portland, Maine 04101

LOW FLOW GROUNDWATER SAMPLING RECORD

PROJECT	Diamond Cleaners Site	SAMPLE I.D. NUMBER	DCGW00201508	SAMPLE TIME	16:15
EXPLORATION ID:	GW-2	SITE	Diamond Cleaners	DATE	8/12/05
TIME	START 15:45 END 16:15	JOB NUMBER	3612062070-02.1	FILE TYPE	

WATER LEVEL / PUMP SETTINGS

MEASUREMENT POINT
☒ TOP OF WELL RISER
☐ TOP OF PROTECTIVE CASING
☐ OTHER ____

PROTECTIVE CASING STICKUP (FROM GROUND): 0.3 FT
PROTECTIVE CASING / WELL DIFFERENCE: 0.45 FT

INITIAL DEPTH TO WATER: 11.68 FT
WELL DEPTH (TOR): 18.0 FT
PID AMBIENT AIR: 0 PPM
WELL DIAMETER: 1.5 IN

FINAL DEPTH TO WATER: 11.68 FT
SCREEN LENGTH: 10 FT
PID WELL MOUTH: 0 PPM

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING	✓		
LOCKED		–	–
COLLAR			–

DRAWDOWN VOLUME: 0.00 GAL
(initial - final x 0.16 {2-inch} or x 0.65 {4-inch})

RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME PURGED: 0.00

PRESSURE TO PUMP: N/A PSI

TOTAL VOL. PURGED: 1.76 GAL
(purge rate (milliliters per minute) x time duration (minutes) x 0.00026 gal/milliliter)

REFILL TIMER SETTING: NA SECONDS
DISCHARGE TIMER SETTING: ____ SECONDS

PURGE DATA

TIME	DEPTH TO WATER (ft)	PURGE RATE (ml/m)	TEMP. (deg. c)	SPECIFIC CONDUCTANCE (ms/cm)	pH (units)	DISS. O2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	PUMP INTAKE DEPTH (ft)	COMMENTS
15:45	Pump on w/ no-bra @ 225								15	
15:53	11.68	225	20.44	1.39	6.88	5.30	32	111	15	
15:57	11.68	225	20.12	1.33	6.75	4.96	15	120	15	
16:01	11.68	225	20.15	1.33	6.67	4.78	9	122	15	
16:05	11.68	225	20.07	1.32	6.65	4.73	6	120	15	
16:08	11.68	225	20.05	1.32	6.65	4.70	4	116	15	
16:11	11.68	225	20.05	1.32	6.65	4.68	3	115	15	
16:15	- Sample well									

EQUIPMENT DOCUMENTATION

TYPE OF PUMP
☐ MARSCHALK BLADDER
☐ SIMCO BLADDER
☒ GEOPUMP

TYPE OF TUBING
☒ SILASTIC
☒ HIGH DENSITY POLYETHYLENE
☐ OTHER ____

TYPE OF PUMP MATERIAL
☐ POLYVINYL CHLORIDE
☐ STAINLESS STEEL
☒ OTHER N/A

TYPE OF BLADDER MATERIAL
☐ TEFLON
☒ OTHER N/A

ANALYTICAL PARAMETERS

To Be Collected

	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED
☒ VOC	8260B	HCL / 4 DEG. C	2 X 40 mL	☒ VOC
☐ SVOC	CLP	4 DEG. C	2 X 1 L AG	☐ SVOC
☐ PEST / PCBs	CLP	4 DEG. C	2 X 1 L AG	☐ PEST / PCBs
☐ TAL INORGANICS	CLP	HNO3 to pH <2	1 x 1 L P	☐ TAL INORGANICS
☐ Other ____	____	____	____	☐

PURGE OBSERVATIONS Back in well

PURGE WATER CONTAINERIZED YES [✓ NO]

NUMBER OF GALLONS GENERATED 1.5

Signature: ____

NOTES/LOCATION SKETCH

MACTEC

511 Congress Street, Portland, Maine 04101

LOW FLOW GROUNDWATER SAMPLING RECORD

PROJECT: Diamond Cleaners Site
SAMPLE I.D. NUMBER: DCMW00601608
SAMPLE TIME: 08:55
EXPLORATION ID: MW-6
SITE: Diamond cleaners
DATE: 8/13/08
TIME: START 08:30 END 09:00
JOB NUMBER: 3612062070-02.1
FILE TYPE:

WATER LEVEL / PUMP SETTINGS

MEASUREMENT POINT
☒ TOP OF WELL RISER
☐ TOP OF PROTECTIVE CASING
☐ OTHER

PROTECTIVE CASING STICKUP (FROM GROUND): 1 FT
PROTECTIVE CASING / WELL DIFFERENCE: 0.55 FT
INITIAL DEPTH TO WATER: 8.48 FT
WELL DEPTH (TOR): 19.3 FT
PID AMBIENT AIR: 0 PPM
WELL DIAMETER: 2 IN
FINAL DEPTH TO WATER: 8.50 FT
SCREEN LENGTH: 10 FT
PID WELL MOUTH: 0 PPM
DRAWDOWN VOLUME: ~~0.02~~ 0.0032 MAM GAL
(initial - final x 0.16 {2-inch} or x 0.65 {4-inch})
RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME PURGED: 0.0018
PRESSURE TO PUMP: NA PSI
TOTAL VOL. PURGED: 1.76 GAL
(purge rate (milliliters per minute) x time duration (minutes) x 0.00026 gal/milliliter)
REFILL TIMER SETTING: NA SECONDS
DISCHARGE TIMER SETTING: NA SECONDS

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING	✓		
LOCKED			
COLLAR			

PURGE DATA

TIME	DEPTH TO WATER (ft)	PURGE RATE (ml/m)	TEMP. (deg. c)	SPECIFIC CONDUCTANCE (ms/cm)	pH (units)	DISS. O2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	PUMP INTAKE DEPTH (ft)	COMMENTS
08:30	Pump on w/ hon-ba @ 225 ml/m								16 ft	
08:40	8.50	225	16.61	1.88	7.70	2.42	10	-54	16 ft	
08:45	8.50	225	16.58	1.90	7.69	2.03	6	-77	16	
08:48	8.50	225	16.55	1.90	7.68	1.87	6	-82	16	
08:51	8.50	225	16.52	1.91	7.68	1.83	5	-85	16	
08:54	8.50	225	16.51	1.91	7.68	1.79	4	-88	16	
08:55	Sample well									

EQUIPMENT DOCUMENTATION

TYPE OF PUMP
☐ MARSCHALK BLADDER
☐ SIMCO BLADDER
☒ GEOPUMP

TYPE OF TUBING
☒ SILASTIC
☒ HIGH DENSITY POLYETHYLENE
☐ OTHER

TYPE OF PUMP MATERIAL
☐ POLYVINYL CHLORIDE
☐ STAINLESS STEEL
☑ OTHER NA

TYPE OF BLADDER MATERIAL
☐ TEFLON
☑ OTHER NA

ANALYTICAL PARAMETERS

To Be Collected	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED
☒ VOC	8260B	HCL / 4 DEG. C	~~3~~ 2 X 40 mL	☑ VOC
☐ SVOC	CLP	4 DEG. C	2 X 1 L AG	☐ SVOC
☐ PEST / PCBs	CLP	4 DEG. C	2 X 1 L AG	☐ PEST / PCBs
☐ TAL INORGANICS	CLP	HNO3 to pH <2	1 x 1 L P	☐ TAL INORGANICS
☐ Other				☐

PURGE OBSERVATIONS Back in well

PURGE WATER CONTAINERIZED: YES [✓ NO]
NUMBER OF GALLONS GENERATED: ~1.0

Signature:

NOTES/LOCATION SKETCH

MACTEC

511 Congress Street, Portland, Maine 04101

LOW FLOW GROUNDWATER SAMPLING RECORD

PROJECT: Diamond Cleaners Site
SAMPLE I.D. NUMBER: DC MW001 02008
SAMPLE TIME: 08:10
EXPLORATION ID: MW-1
SITE: Diamond cleaners
DATE: 8/13/08
TIME START: 07:35 END: 08:15
JOB NUMBER: 3612062070-02.1
FILE TYPE:

WATER LEVEL / PUMP SETTINGS

MEASUREMENT POINT
☒ TOP OF WELL RISER
☐ TOP OF PROTECTIVE CASING
☐ OTHER ________

INITIAL DEPTH TO WATER: 11.06 FT
FINAL DEPTH TO WATER: 11.07 FT
DRAWDOWN VOLUME: Max 0.0032 ~~0.02~~ GAL
(initial - final x 0.16 {2-inch} or x 0.65 {4-inch})
TOTAL VOL. PURGED: 2.08 GAL
(purge rate (milliliters per minute) x time duration (minutes) x 0.00026 gal/milliliter)

WELL DEPTH (TOR): 23.3 FT
SCREEN LENGTH: 16 FT
RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME PURGED: 0.001

PROTECTIVE CASING STICKUP (FROM GROUND): 0.5 FT
PID AMBIENT AIR: 0 PPM
PID WELL MOUTH: 0 PPM
PRESSURE TO PUMP: N/A PSI
REFILL TIMER SETTING: NA SECONDS

PROTECTIVE CASING / WELL DIFFERENCE: 0.5 FT
WELL DIAMETER: 2 IN
DISCHARGE TIMER SETTING: NA SECONDS

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING	✓		
LOCKED			✓
COLLAR			✓

PURGE DATA

TIME	DEPTH TO WATER (ft)	PURGE RATE (ml/m)	TEMP. (deg. c)	SPECIFIC CONDUCTANCE (ms/cm)	pH (units)	DISS. O2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	PUMP INTAKE DEPTH (ft)	COMMENTS
07:35	- Pump on w/ horiba @ 200 ml/min								20ft	
07:40	11:08	200	15.53	1.02	7.25	4.41	70	257	20	
07:45	11.08	206	15.34	1.03	7.32	3.97	45	246	20	
07:50	11.08	200	15.32	1.06	7.37	3.50	21	237	20	
07:55	11.08	200	15.30	1.07	7.41	3.24	12	228	20	
08:00	11.08	200	15.33	1.08	7.44	3.01	6	222	20	
08:03	11.08	200	15.34	1.09	7.46	2.95	6	219	20	
08:06	11.08	200	15.38	1.10	7.48	2.97	5	216	20	
08:10	- Sample well									

EQUIPMENT DOCUMENTATION

TYPE OF PUMP
☐ MARSCHALK BLADDER
☐ SIMCO BLADDER
☒ GEOPUMP

TYPE OF TUBING
☒ SILASTIC
☒ HIGH DENSITY POLYETHYLENE
☐ OTHER ________

TYPE OF PUMP MATERIAL
☐ POLYVINYL CHLORIDE
☐ STAINLESS STEEL
☒ OTHER NA

TYPE OF BLADDER MATERIAL
☐ TEFLON
☒ OTHER NA

ANALYTICAL PARAMETERS

To Be Collected	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED
☒ VOC	8260B	HCL / 4 DEG. C	2 8 X 40 mL	☒ VOC
☐ SVOC	CLP	4 DEG. C	2 X 1 L AG	☐ SVOC
☐ PEST / PCBs	CLP	4 DEG. C	2 X 1 L AG	☐ PEST / PCBs
☐ TAL INORGANICS	CLP	HNO3 to pH <2	1 x 1 L P	☐ TAL INORGANICS
☐ Other ________	________	________	________	☐

PURGE OBSERVATIONS

Back in well

PURGE WATER CONTAINERIZED YES [✓ NO]
NUMBER OF GALLONS GENERATED 1.5

Signature:

NOTES/LOCATION SKETCH

MACTEC

511 Congress Street, Portland, Maine 04101

LOW FLOW GROUNDWATER SAMPLING RECORD

PROJECT: Diamond Cleaners Site
SAMPLE I.D. NUMBER: DCGW0140130?
SAMPLE TIME: 11:45
EXPLORATION ID: GW-14
SITE: Diamond cleaners
DATE: 8/13/08
TIME START: 10:11 END:
JOB NUMBER: 3612062070-02.1
FILE TYPE:

WATER LEVEL / PUMP SETTINGS

MEASUREMENT POINT
☒ TOP OF WELL RISER
☐ TOP OF PROTECTIVE CASING
☐ OTHER

PROTECTIVE CASING STICKUP (FROM GROUND): 0.3 FT
PROTECTIVE CASING / WELL DIFFERENCE: 0.45 FT
INITIAL DEPTH TO WATER: 9.83 FT
WELL DEPTH (TOR): 14.65 FT
PID AMBIENT AIR: 0 PPM
WELL DIAMETER: 1.5 IN
FINAL DEPTH TO WATER: 12.48 FT
SCREEN LENGTH: 10 FT
PID WELL MOUTH: 0 PPM

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING	✓		
LOCKED			
COLLAR			

DRAWDOWN VOLUME: 0.2438 MAM ~~2.65~~ GAL
(initial - final x 0.16 {2-inch} or x 0.65 {4-inch}) x 0.092 (1.5-inch)
RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME PURGED: ~~1.09~~ 0.099 MAM
PRESSURE TO PUMP: NA PSI
TOTAL VOL. PURGED: 2.44 GAL
(purge rate (milliliters per minute) x time duration (minutes) x 0.00026 gal/milliliter)
REFILL TIMER SETTING: NA SECONDS
DISCHARGE TIMER SETTING: NA SECONDS

PURGE DATA

TIME	DEPTH TO WATER (ft)	PURGE RATE (ml/m)	TEMP. (deg. c)	SPECIFIC CONDUCTANCE (ms/cm)	pH (units)	DISS. O2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	PUMP INTAKE ~~DEPTH (ft)~~	COMMENTS
10:11 Pump on @ 100 ml/min									MAM	Ver
10:13	11.3	100	23.17	0.96	7.07	5.35	<1000	66	11 ft 13.0	
10:16	12.0	100	22.62	0.96	6.88	3.26	404	71	11 13.0	MAM
10:19	12.2	100	22.19	0.99	6.81	2.89	313	75	11 13	
10:22	12.2	100	21.93	1.01	6.75	2.62	293	79	11 13	
10:25	12.2	100	21.65	1.07	6.71	2.82	345	84	11 13	
10:30	12.2	100	21.65	1.06	6.70	2.71	355	85	11 13	
10:35	12.23	100	21.91	1.06	6.70	2.45	224	82	11 13	
10:40	12.31	100	21.78	1.06	6.71	2.43	204	80	13	
10:45	12.40	100	21.81	1.07	6.75	2.53	128	88	13	
10:50	12.48	100	21.88	1.07	6.79	2.33	95	88	13	
10:55	12.48	100	21.71	1.08	6.81	2.48	99	89	13	
11:00	12.48	100	21.70	1.09	6.82	2.46	76	85	13	
11:05	12.48	100	21.76	1.09	6.83	2.37	48	83	13	
11:10	12.48	100	21.73	1.09	6.82	2.34	30	78	13	
11:15	12.48	100	21.83	1.09	6.82	2.30	27	76	13	
11:20	12.48	100	21.73	1.09	6.84	2.23	24	84	13	
11:25	12.48	100	21.49	1.09	6.85	2.22	20	85	13	

EQUIPMENT DOCUMENTATION

TYPE OF PUMP
☐ MARSCHALK BLADDER
☐ SIMCO BLADDER
☑ GEOPUMP

TYPE OF TUBING
☑ SILASTIC
☑ HIGH DENSITY POLYETHYLENE
☐ OTHER

TYPE OF PUMP MATERIAL
☐ POLYVINYL CHLORIDE
☐ STAINLESS STEEL
☑ OTHER NA

TYPE OF BLADDER MATERIAL
☐ TEFLON
☑ OTHER NA

ANALYTICAL PARAMETERS

To Be Collected

	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED
☑ VOC	8260B	HCL / 4 DEG. C	~~2~~3 X 40 mL	☑ VOC
☐ SVOC	CLP	4 DEG. C	2 X 1 L AG	☐ SVOC
☐ PEST / PCBs	CLP	4 DEG. C	2 X 1 L AG	☐ PEST / PCBs
☐ TAL INORGANICS	CLP	HNO3 to pH <2	1 x 1 L P	☐ TAL INORGANICS
☐ Other				☐

PURGE OBSERVATIONS

Back in well

PURGE WATER CONTAINERIZED: YES [✓ NO]
NUMBER OF GALLONS GENERATED: 2.5

Signature:

NOTES/LOCATION SKETCH

Very turbid, Silty, Dropped water level until stabilize

Pg 1 of 2

MACTEC

511 Congress Street, Portland, Maine 04101

LOW FLOW GROUNDWATER SAMPLING RECORD

PROJECT	Diamond Cleaners Site	SAMPLE I.D. NUMBER	DCGW01401308	SAMPLE TIME	11:45
EXPLORATION ID:	GW-14	SITE	Diamond Cleaners	DATE	8/13/08
TIME	START 10:11 END 11:45	JOB NUMBER	3612062070-02.1	FILE TYPE	

WATER LEVEL / PUMP SETTINGS

MEASUREMENT POINT
☒ TOP OF WELL RISER
☐ TOP OF PROTECTIVE CASING
☐ OTHER ______

INITIAL DEPTH TO WATER: 9.83 FT

FINAL DEPTH TO WATER: 12.48 FT

DRAWDOWN VOLUME: ~~2.65~~ 0.2438 MAA GAL
(initial - final x 0.16 {2-inch} or x 0.65 {4-inch}) x 0.092 1.5 inch

TOTAL VOL. PURGED: 2.41 GAL
(purge rate (milliliters per minute) x time duration (minutes) x 0.00026 gal/milliliter)

WELL DEPTH (TOR): 14.65 FT

SCREEN LENGTH: 10 FT

RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME PURGED: ~~1.09~~ 0.099 MAA

PROTECTIVE CASING STICKUP (FROM GROUND): 0.3 FT

PID AMBIENT AIR: 0 PPM

PID WELL MOUTH: 0 PPM

PRESSURE TO PUMP: NA PSI

REFILL TIMER SETTING: NA SECONDS

PROTECTIVE CASING / WELL DIFFERENCE: 6.45 FT

WELL DIAMETER: 1.5 IN

WELL INTEGRITY:	YES	NO	N/A
CAP	Y		
CASING	Y		
LOCKED			
COLLAR			

DISCHARGE TIMER SETTING: NA SECONDS

PURGE DATA *continue from Page 1

TIME	DEPTH TO WATER (ft)	PURGE RATE (ml/m)	TEMP. (deg. c)	SPECIFIC CONDUCTANCE (ms/cm)	pH (units)	DISS. O2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	PUMP INTAKE DEPTH (ft)	COMMENTS
11:30	12.48	100	22.12	1.09	6.85	2.15	16	82	13	
11:35	12.48	100	22.10	1.09	6.84	2.12	11	78	13	
11:38	12.48	100	22.13	1.09	6.84	2.11	8	75	13	
11:41	12.48	100	22.13	1.09	6.84	2.10	8	74	13	
11:45	-Sample well									

EQUIPMENT DOCUMENTATION

TYPE OF PUMP	TYPE OF TUBING	TYPE OF PUMP MATERIAL	TYPE OF BLADDER MATERIAL
☐ MARSCHALK BLADDER	☒ SILASTIC	☐ POLYVINYL CHLORIDE	☐ TEFLON
☐ SIMCO BLADDER	☒ HIGH DENSITY POLYETHYLENE	☐ STAINLESS STEEL	☒ OTHER NA
☒ GEOPUMP	☐ OTHER ______	☑ OTHER NA	

ANALYTICAL PARAMETERS

To Be Collected	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED
☑ VOC	8260B	HCL / 4 DEG. C	2 X 40 mL	☒ VOC
☐ SVOC	CLP	4 DEG. C	2 X 1 L AG	☐ SVOC
☐ PEST / PCBs	CLP	4 DEG. C	2 X 1 L AG	☐ PEST / PCBs
☐ TAL INORGANICS	CLP	HNO3 to pH <2	1 x 1 L P	☐ TAL INORGANICS
☐ Other ______	______	______	______	☐

PURGE OBSERVATIONS

Bach, Anvil

PURGE WATER CONTAINERIZED YES [✓ NO]

NUMBER OF GALLONS GENERATED 2.5

Signature:

NOTES/LOCATION SKETCH

Pg 2 of 2

MACTEC

1 Congress Street, Portland, Maine 04101

LOW FLOW GROUNDWATER SAMPLING RECORD

PROJECT: Diamond Cleaners Site
SAMPLE I.D. NUMBER: DCMW00302008
SAMPLE TIME: 13:00
EXPLORATION ID: MW-3
SITE: Diamond Cleaners
DATE: 8/13/08
TIME START 12:33 END 13:04
JOB NUMBER: 3612062070-02.1
FILE TYPE:

WATER LEVEL / PUMP SETTINGS

MEASUREMENT POINT
☒ TOP OF WELL RISER
☐ TOP OF PROTECTIVE CASING
☐ OTHER

PROTECTIVE CASING STICKUP (FROM GROUND): 0.55 FT
PROTECTIVE CASING / WELL DIFFERENCE: 0.55 FT

INITIAL DEPTH TO WATER: 10.55 FT
WELL DEPTH (TOR): 23.8 FT
PID AMBIENT AIR: 0 PPM
WELL DIAMETER: 2 IN

FINAL DEPTH TO WATER: 10.55 FT
SCREEN LENGTH: 10 FT
PID WELL MOUTH: 0 PPM

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING	✓		
LOCKED			✓
COLLAR			✓

DRAWDOWN VOLUME: 0.0 GAL
(initial - final x 0.16 {2-inch} or x 0.65 {4-inch})
RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME PURGED: 0.00
PRESSURE TO PUMP: NA PSI

TOTAL VOL. PURGED: 1.6 GAL
(purge rate (milliliters per minute) x time duration (minutes) x 0.00026 gal/milliliter)
REFILL TIMER SETTING: NA SECONDS
DISCHARGE TIMER SETTING: NA SECONDS

PURGE DATA

TIME	DEPTH TO WATER (ft)	PURGE RATE (ml/m)	TEMP. (deg. c)	SPECIFIC CONDUCTANCE (ms/cm)	pH (units)	DISS. O2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	PUMP INTAKE DEPTH (ft)	COMMENTS
12:33	Pump on w/ hor. bra @ 200 ml/m								20	
12:38	10.55	200	17.91	1.09	7.54	2.82	27	103	20	
12:43	10.55	200	16.39	1.04	7.21	2.18	14	118	20	
12:48	10.55	200	16.30	1.03	7.04	2.07	11	126	20	
12:51	10.55	200	16.18	1.02	6.97	2.18	7	129	20	
12:54	10.55	200	16.09	1.02	6.95	2.05	5	130	20	
12:57	10.55	200	16.10	1.02	6.95	2.15	<1	130	20	
13:00 - Sample well										

EQUIPMENT DOCUMENTATION

TYPE OF PUMP	TYPE OF TUBING	TYPE OF PUMP MATERIAL	TYPE OF BLADDER MATERIAL
☐ MARSCHALK BLADDER	☒ SILASTIC	☐ POLYVINYL CHLORIDE	☐ TEFLON
☐ SIMCO BLADDER	☒ HIGH DENSITY POLYETHYLENE	☐ STAINLESS STEEL	☑ OTHER NA
☒ GEOPUMP	☐ OTHER	☒ OTHER NA	

ANALYTICAL PARAMETERS

To Be Collected	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED
☒ VOC	8260B	HCL / 4 DEG. C	2 ~~3~~ X 40 mL	☒ VOC
☐ SVOC	CLP	4 DEG. C	2 X 1 L AG	☐ SVOC
☐ PEST / PCBs	CLP	4 DEG. C	2 X 1 L AG	☐ PEST / PCBs
☐ TAL INORGANICS	CLP	HNO3 to pH <2	1 x 1 L P	☐ TAL INORGANICS
☐ Other				☐

RGE OBSERVATIONS Back in well

GE WATER TAINERIZED YES [✓ NO]
NUMBER OF GALLONS GENERATED: 1.5

ınature:

NOTES/LOCATION SKETCH

MACTEC

ongress Street, Portland, Maine 04101

LOW FLOW GROUNDWATER SAMPLING RECORD

PROJECT: Diamond Cleaners Site
SAMPLE I.D. NUMBER: DCMW01001808
SAMPLE TIME: 13:45
EXPLORATION ID: MW-10
SITE: Diamond cleaners
DATE: 8/10/08
TIME START 13:22 END 13:56
JOB NUMBER: 3612062070-02.1
FILE TYPE:

WATER LEVEL / PUMP SETTINGS

MEASUREMENT POINT
☒ TOP OF WELL RISER
☐ TOP OF PROTECTIVE CASING
☐ OTHER

PROTECTIVE CASING STICKUP (FROM GROUND): 0.55 FT
PROTECTIVE CASING / WELL DIFFERENCE: 0.55 FT
INITIAL DEPTH TO WATER: 11.60 FT
WELL DEPTH (TOR): 21.5 FT
PID AMBIENT AIR: 0 PPM
WELL DIAMETER: 2 IN
FINAL DEPTH TO WATER: 11.65 FT
SCREEN LENGTH: 10 FT
PID WELL MOUTH: 0 PPM
DRAWDOWN VOLUME (initial - final x 0.16 {2-inch} or x 0.65 {4-inch}): ~~0.05~~ 0.008 MAM GAL
RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME PURGED: ~~0.03~~ MAM 0.005
PRESSURE TO PUMP: NA PSI
TOTAL VOL. PURGED (purge rate (milliliters per minute) x time duration (minutes) x 0.00026 gal/milliliter): 1.46 GAL
REFILL TIMER SETTING: NA SECONDS
DISCHARGE TIMER SETTING: NA SECONDS

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING	✓		
LOCKED			✓
COLLAR			✓

PURGE DATA

TIME	DEPTH TO WATER (ft)	PURGE RATE (ml/m)	TEMP. (deg. c)	SPECIFIC CONDUCTANCE (ms/cm)	pH (units)	DISS. O2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	PUMP INTAKE DEPTH (ft)	COMMENTS
13:22	Pump on w/ hon. bin @ 200ml/mn								18 ft	
13:27	11.65	200	17.64	0.813	7.76	5.67	17	114	18	
13:32	11.65	200	16.98	0.798	7.58	5.42	12	121	18	
13:37	11.65	200	16.83	0.793	7.51	5.42	7	125	18	
13:40	11.65	200	16.87	0.793	7.52	5.42	6	125	18	
13:43	11.65	200	17.03	0.792	7.52	5.41	4	126	18	
13:45	Sample well									

EQUIPMENT DOCUMENTATION

TYPE OF PUMP
☐ MARSCHALK BLADDER
☐ SIMCO BLADDER
☑ GEOPUMP

TYPE OF TUBING
☒ SILASTIC
☑ HIGH DENSITY POLYETHYLENE
☐ OTHER

TYPE OF PUMP MATERIAL
☐ POLYVINYL CHLORIDE
☐ STAINLESS STEEL
☒ OTHER NA

TYPE OF BLADDER MATERIAL
☐ TEFLON
☑ OTHER NA

ANALYTICAL PARAMETERS

To Be Collected

	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED
☑ VOC	8260B	HCL / 4 DEG. C	2 X 40 mL	☒ VOC
☐ SVOC	CLP	4 DEG. C	2 X 1 L AG	☐ SVOC
☐ PEST / PCBs	CLP	4 DEG. C	2 X 1 L AG	☐ PEST / PCBs
☐ TAL INORGANICS	CLP	HNO3 to pH <2	1 x 1 L P	☐ TAL INORGANICS
☐ Other				☐

PURGE OBSERVATIONS

Back in well

PURGE WATER CONTAINERIZED YES [✓ NO]
NUMBER OF GALLONS GENERATED 1.0

NOTES/LOCATION SKETCH

Signature:

MACTEC

511 Congress Street, Portland, Maine 04101

LOW FLOW GROUNDWATER SAMPLING RECORD

PROJECT	Diamond Cleaners Site	SAMPLE I.D. NUMBER	ATG-W0040150Y	SAMPLE TIME	11:30
EXPLORATION ID:	GW-4	SITE	Associated textile	DATE	8/13/08
TIME	START 14:15 END 14:55	JOB NUMBER	3612062070-02.1	FILE TYPE	

WATER LEVEL / PUMP SETTINGS

MEASUREMENT POINT
☒ TOP OF WELL RISER
☐ TOP OF PROTECTIVE CASING
☐ OTHER ______

INITIAL DEPTH TO WATER: 12.37 FT
FINAL DEPTH TO WATER: 12.43 FT
DRAWDOWN VOLUME: ~~0.01~~ 0.00368 GAL
(initial - final x 0.16 {2-inch} or x 0.65 {4-inch}) x0.092(1.5inch)
TOTAL VOL. PURGED: 1.82 GAL
(purge rate (milliliters per minute) x time duration (minutes) x 0.00026 gal/milliliter)

WELL DEPTH (TOR): 18.4 FT
SCREEN LENGTH: 16 FT
RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME PURGED: 0.002

PROTECTIVE CASING STICKUP (FROM GROUND): 0.3 FT
PID AMBIENT AIR: 0 PPM
PID WELL MOUTH: 0 PPM
PRESSURE TO PUMP: NA PSI
REFILL TIMER SETTING: NA SECONDS

PROTECTIVE CASING / WELL DIFFERENCE: 0.45 FT
WELL DIAMETER: 1.5 IN

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING			
LOCKED			
COLLAR			

DISCHARGE TIMER SETTING: NA SECONDS

PURGE DATA

TIME	DEPTH TO WATER (ft)	PURGE RATE (ml/m)	TEMP. (deg. c)	SPECIFIC CONDUCTANCE (ms/cm)	pH (units)	DISS. O2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	PUMP INTAKE DEPTH (ft)	COMMENTS
14:15	Pump on w/ hon. bra @ 200 ml/m								15 ft	
14:20	12:43	200	17.37	1.06	7.32	4.53	59	120	15	
14:25	12:43	200	17.11	1.06	7.28	4.50	22	134	15	
14.30	12.43	200	16.91	1.06	7.19	4.43	17	141	15	
14:35	12.43	200	16.92	1.05	7.16	4.43	15	144	15	
14.40	12.43	200	16.75	1.06	7.17	4.42	9	145	15	
14:43	12.43	200	16.82	1.02	7.19	4.41	6	145	15	
14:46	12.43	200	16.76	1.03	7.22	4.41	4	145	15	
14.50	Sample well									

EQUIPMENT DOCUMENTATION

TYPE OF PUMP
☐ MARSCHALK BLADDER
☐ SIMCO BLADDER
☑ GEOPUMP

TYPE OF TUBING
☑ SILASTIC
☑ HIGH DENSITY POLYETHYLENE
☐ OTHER ______

TYPE OF PUMP MATERIAL
☐ POLYVINYL CHLORIDE
☐ STAINLESS STEEL
☑ OTHER NA

TYPE OF BLADDER MATERIAL
☐ TEFLON
☑ OTHER NA

ANALYTICAL PARAMETERS

To Be Collected	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED
☑ VOC	8260B	HCL / 4 DEG. C	~~2~~ 3 X 40 mL	☑ VOC
☐ SVOC	CLP	4 DEG. C	2 X 1 L AG	☐ SVOC
☐ PEST / PCBs	CLP	4 DEG. C	2 X 1 L AG	☐ PEST / PCBs
☐ TAL INORGANICS	CLP	HNO3 to pH <2	1 x 1 L P	☐ TAL INORGANICS
☐ Other ______				☐

PURGE OBSERVATIONS

Back in well

PURGE WATER CONTAINERIZED: YES [✓ NO]
NUMBER OF GALLONS GENERATED: 1.5

Signature:

NOTES/LOCATION SKETCH

MACTEC

511 Congress Street, Portland, Maine 04101

LOW FLOW GROUNDWATER SAMPLING RECORD

PROJECT: Diamond Cleaners Site
SAMPLE I.D. NUMBER: DCMW00901708
SAMPLE TIME: 15:50
EXPLORATION ID: MW-9
SITE: Diamond Cleaners
DATE: 8/13/08
TIME: START 15:05 END 15:50
JOB NUMBER: 3612062070-02.1
FILE TYPE:

WATER LEVEL / PUMP SETTINGS

MEASUREMENT POINT
☑ TOP OF WELL RISER
☐ TOP OF PROTECTIVE CASING
☐ OTHER

INITIAL DEPTH TO WATER: 11.10 FT
FINAL DEPTH TO WATER: 11.10 FT
DRAWDOWN VOLUME: 0.0 GAL
(initial - final x 0.16 {2-inch} or x 0.65 {4-inch})
TOTAL VOL. PURGED: 2.73 GAL
(purge rate (milliliters per minute) x time duration (minutes) x 0.00026 gal/milliliter)

WELL DEPTH (TOR): 26.8 FT
SCREEN LENGTH: 10 FT
RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME PURGED: 0.00

PROTECTIVE CASING STICKUP (FROM GROUND): 0.55 FT
PID AMBIENT AIR: 0 PPM
PID WELL MOUTH: 0 PPM
PRESSURE TO PUMP: NA PSI
REFILL TIMER SETTING: NA SECONDS

PROTECTIVE CASING / WELL DIFFERENCE: 0.55 FT
WELL DIAMETER: 2 IN
DISCHARGE TIMER SETTING: NA SECONDS

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING	✓		
LOCKED			
COLLAR			

PURGE DATA

TIME	DEPTH TO WATER (ft)	PURGE RATE (ml/m)	TEMP. (deg. c)	SPECIFIC CONDUCTANCE (ms/cm)	pH (units)	DISS. O2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	PUMP INTAKE DEPTH (ft)	COMMENTS
15:05	Pump on w/ horiba @ 300 ml/mn								17 ft	
15:10	11.10	300	15.93	0.581	7.22	5.84	42	138	17	
15:15	11.10	300	15.66	0.743	7.37	4.47	60	139	17	
15:20	11.10	250	15.77	0.829	7.45	2.97	120	137	17	
15:25	11.10	250	15.89	0.817	7.38	3.28	48	137	17	
15:30	11.10	250	15.87	0.878	7.54	2.44	34	132	17	
15:35	11.10	250	15.88	0.896	7.56	2.10	19	129	17	
15:40	11.10	250	15.97	0.909	7.58	1.96	11	127	17	
15:43	11.10	250	15.91	0.916	7.60	1.91	10	125	17	
15:46	11.10	250	15.93	0.920	7.60	1.89	8	125	17	
15:49	11.10	250	15.93	0.925	7.61	1.84	7	124	17	
15:50	Sample well									

EQUIPMENT DOCUMENTATION

TYPE OF PUMP
☐ MARSCHALK BLADDER
☐ SIMCO BLADDER
☑ GEOPUMP

TYPE OF TUBING
☑ SILASTIC
☑ HIGH DENSITY POLYETHYLENE
☐ OTHER

TYPE OF PUMP MATERIAL
☐ POLYVINYL CHLORIDE
☐ STAINLESS STEEL
☑ OTHER NA

TYPE OF BLADDER MATERIAL
☐ TEFLON
☒ OTHER NA

ANALYTICAL PARAMETERS

To Be Collected	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED
☒ VOC	8260B	HCL / 4 DEG. C	2 X 40 mL	☑ VOC
☐ SVOC	CLP	4 DEG. C	2 X 1 L AG	☐ SVOC
☐ PEST / PCBs	CLP	4 DEG. C	2 X 1 L AG	☐ PEST / PCBs
☐ TAL INORGANICS	CLP	HNO3 to pH <2	1 x 1 L P	☐ TAL INORGANICS
☐ Other				☐

PURGE OBSERVATIONS Back in well

PURGE WATER CONTAINERIZED YES [✓ NO]
NUMBER OF GALLONS GENERATED 2.5

Signature:

NOTES/LOCATION SKETCH

0.78
1.95

MACTEC

511 Congress Street, Portland, Maine 04101

LOW FLOW GROUNDWATER SAMPLING RECORD

PROJECT: Diamond Cleaners Site
SAMPLE I.D. NUMBER: DCGW01301508
SAMPLE TIME: 07:25
EXPLORATION ID: GW-13
SITE: Diamond Cleaners
DATE: 8/13/08
TIME: START 09:35 8/13/08 END 07:25 8/14/08
JOB NUMBER: 3612062070-02.1
FILE TYPE:

WATER LEVEL / PUMP SETTINGS

MEASUREMENT POINT
☑ TOP OF WELL RISER
☐ TOP OF PROTECTIVE CASING
☐ OTHER ______

PROTECTIVE CASING STICKUP (FROM GROUND): 0.3 FT
PROTECTIVE CASING / WELL DIFFERENCE: 0.45 FT
INITIAL DEPTH TO WATER: 10.04 FT
WELL DEPTH (TOR): 19.8 FT
PID AMBIENT AIR: 0 PPM
WELL DIAMETER: 1.5 IN
FINAL DEPTH TO WATER: 13.56 FT
SCREEN LENGTH: 10 FT
PID WELL MOUTH: 0 PPM

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING	✓		
LOCKED			✓
COLLAR			✓

DRAWDOWN VOLUME: Sample recharged GAL
(initial - final x 0.16 {2-inch} or x 0.65 {4-inch})
RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME PURGED: ——
PRESSURE TO PUMP: 0 NA PSI
TOTAL VOL. PURGED: —— GAL
(purge rate (milliliters per minute) x time duration (minutes) x 0.00026 gal/milliliter)
REFILL TIMER SETTING: NA SECONDS
DISCHARGE TIMER SETTING: NA SECONDS

PURGE DATA

TIME	DEPTH TO WATER (ft)	PURGE RATE (ml/m)	TEMP. (deg. c)	SPECIFIC CONDUCTANCE (ms/cm)	pH (units)	DISS. O2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	PUMP INTAKE DEPTH (ft)	COMMENTS
09:35 pump on w/ horiba @ 220 ml/min										
09:40	12.20	220	18.60	1.34	7.62	3.72	~<1000	-11	15ft	
09:42 - well went dry, Very turbid H2O will sample recharge										
										MAM
8/14/08										
07:20 - Pump on w horiba 100 ml/m										
07:22	13.56	100	17.81	1.19	7.14	4.81	<1000	-14	15ft	
07:25 - Sample recharge										

EQUIPMENT DOCUMENTATION

TYPE OF PUMP
☐ MARSCHALK BLADDER
☐ SIMCO BLADDER
☒ GEOPUMP

TYPE OF TUBING
☑ SILASTIC
☑ HIGH DENSITY POLYETHYLENE
☐ OTHER ______

TYPE OF PUMP MATERIAL
☐ POLYVINYL CHLORIDE
☐ STAINLESS STEEL
☑ OTHER NA

TYPE OF BLADDER MATERIAL
☐ TEFLON
☑ OTHER NA

ANALYTICAL PARAMETERS

To Be Collected	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED
☑ VOC	8260B	HCL / 4 DEG. C	2 X 40 mL	☒ VOC
☑ SVOC	CLP	4 DEG. C	2 X 1 L AG	☐ SVOC
☐ PEST / PCBs	CLP	4 DEG. C	2 X 1 L AG	☐ PEST / PCBs
☐ TAL INORGANICS	CLP	HNO3 to pH <2	1 x 1 L P	☐ TAL INORGANICS
☐ Other ______				☐

PURGE OBSERVATIONS

Back in well

PURGE WATER CONTAINERIZED: YES [✓ NO]
NUMBER OF GALLONS GENERATED: ______

Signature:

NOTES/LOCATION SKETCH

Sample recharge on 8/14/08

MACTEC

ongress Street, Portland, Maine 04101

LOW FLOW GROUNDWATER SAMPLING RECORD

PROJECT: Diamond Cleaners Site
SAMPLE I.D. NUMBER: ATMW0801508
SAMPLE TIME: 08:25
EXPLORATION ID: MW-8
SITE: Associated Textile
DATE: 8/14/08
TIME: START 07:55 END 08:25
JOB NUMBER: 3612062070-02.1
FILE TYPE:

WATER LEVEL / PUMP SETTINGS

MEASUREMENT POINT
☒ TOP OF WELL RISER
☐ TOP OF PROTECTIVE CASING
☐ OTHER

PROTECTIVE CASING STICKUP (FROM GROUND): 1 FT
PROTECTIVE CASING / WELL DIFFERENCE: 0.005 FT
INITIAL DEPTH TO WATER: 13.59 FT
WELL DEPTH (TOR): 18.95 FT
PID AMBIENT AIR: 0 PPM
WELL DIAMETER: 4 IN
FINAL DEPTH TO WATER: 13.59 FT
SCREEN LENGTH: Unknown FT
PID WELL MOUTH: 0 PPM
DRAWDOWN VOLUME: ~~0.03~~ 0.0145 GAL
(initial - final x 0.16 {2-inch} or x 0.65 {4-inch})
RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME PURGED: 0.0096
PRESSURE TO PUMP: NA PSI
TOTAL VOL. PURGED: 1.5 GAL
(purge rate (milliliters per minute) x time duration (minutes) x 0.00026 gal/milliliter)
REFILL TIMER SETTING: NA SECONDS
DISCHARGE TIMER SETTING: NA SECONDS

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING	✓		
LOCKED			✓
COLLAR			

PURGE DATA

TIME	DEPTH TO WATER (ft)	PURGE RATE (ml/m)	TEMP. (deg. c)	SPECIFIC CONDUCTANCE (ms/cm)	pH (units)	DISS. O2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	PUMP INTAKE DEPTH (ft)	COMMENTS
07:55 - Pump on w/ bladder @ 200ml/m									15ft	
08:00	13.59	200	14.82	1.15	7.14	2.99	14	114	15	
08:05	13.59	200	14.39	1.15	7.12	2.60	13	120	15	
08:08	13.59	200	14.31	1.16	7.10	2.59	11	124	15	
08:11	13.59	200	14.26	1.16	7.11	2.41	9	125	15	
08:14	13.59	200	14.23	1.17	7.13	2.25	8	125	15	
08:17	13.59	200	14.16	1.17	7.15	2.22	7	125	15	
08:20	13.59	260	14.11	1.17	7.12	2.20	6	124	15	
08:25 - Sample well										

EQUIPMENT DOCUMENTATION

TYPE OF PUMP
☐ MARSCHALK BLADDER
☐ SIMCO BLADDER
☑ GEOPUMP

TYPE OF TUBING
☑ SILASTIC
☑ HIGH DENSITY POLYETHYLENE
☐ OTHER

TYPE OF PUMP MATERIAL
☐ POLYVINYL CHLORIDE
☐ STAINLESS STEEL
☑ OTHER NA

TYPE OF BLADDER MATERIAL
☐ TEFLON
☑ OTHER NA

ANALYTICAL PARAMETERS

To Be Collected	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED
☑ VOC	8260B	HCL / 4 DEG. C	~~3~~ 2 X 40 mL	☑ VOC
☐ SVOC	CLP	4 DEG. C	2 X 1 L AG	☐ SVOC
☐ PEST / PCBs	CLP	4 DEG. C	2 X 1 L AG	☐ PEST / PCBs
☐ TAL INORGANICS	CLP	HNO3 to pH <2	1 x 1 L P	☐ TAL INORGANICS
☐ Other				☐

PURGE OBSERVATIONS

Back in well

PURGE WATER CONTAINERIZED: YES [✓ NO]
NUMBER OF GALLONS GENERATED: 0.5

NOTES/LOCATION SKETCH

Signature:

MACTEC

Congress Street, Portland, Maine 04101

LOW FLOW GROUNDWATER SAMPLING RECORD

PROJECT: Diamond Cleaners Site
SAMPLE I.D. NUMBER: DCMW01101908
SAMPLE TIME: 09:40
EXPLORATION ID: MW-11
SITE: Diamond cleaners
DATE: 8/14/08
TIME: START 09:20 END 09:40
JOB NUMBER: 3612062070-02.1
FILE TYPE:

WATER LEVEL / PUMP SETTINGS

MEASUREMENT POINT
☒ TOP OF WELL RISER
☐ TOP OF PROTECTIVE CASING
☐ OTHER

PROTECTIVE CASING STICKUP (FROM GROUND): 0.55 FT
PROTECTIVE CASING / WELL DIFFERENCE: 0.55 FT
INITIAL DEPTH TO WATER: 14.01 FT
WELL DEPTH (TOR): 21.77 FT
PID AMBIENT AIR: 0 PPM
WELL DIAMETER: 2 IN
FINAL DEPTH TO WATER: 14.01 FT
SCREEN LENGTH: 10 FT
PID WELL MOUTH: 0 PPM
DRAWDOWN VOLUME: 0.0 GAL
(initial - final x 0.16 {2-inch} or x 0.65 {4-inch})
RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME PURGED: 0.0
PRESSURE TO PUMP: NA PSI
TOTAL VOL. PURGED: 1.04 GAL
(purge rate (milliliters per minute) x time duration (minutes) x 0.00026 gal/milliliter)
REFILL TIMER SETTING: NA SECONDS
DISCHARGE TIMER SETTING: NA SECONDS

WELL INTEGRITY: YES NO N/A
CAP
CASING
LOCKED
COLLAR

PURGE DATA

TIME	DEPTH TO WATER (ft)	PURGE RATE (ml/m)	TEMP. (deg. c)	SPECIFIC CONDUCTANCE (ms/cm)	pH (units)	DISS. O2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	PUMP INTAKE DEPTH (ft)	COMMENTS
09:20	- Pump on w/ horiba			@ 200 ml/min					19	
09:25	14.01	200	17.80	0.989	6.81	2.95	4	165	19	
09:30	14.01	200	17.54	0.994	6.77	3.07	3	165	19	
09:35	14.01	200	17.54	0.993	6.74	3.10	3	167	19	
09:38	14.01	200	17.49	0.992	6.80	3.09	3	167	19	
09:40	Sample well									

EQUIPMENT DOCUMENTATION

TYPE OF PUMP
☐ MARSCHALK BLADDER
☐ SIMCO BLADDER
☒ GEOPUMP

TYPE OF TUBING
☒ SILASTIC
☒ HIGH DENSITY POLYETHYLENE
☐ OTHER

TYPE OF PUMP MATERIAL
☐ POLYVINYL CHLORIDE
☐ STAINLESS STEEL
☒ OTHER NA

TYPE OF BLADDER MATERIAL
☐ TEFLON
☒ OTHER NA

ANALYTICAL PARAMETERS
To Be Collected

	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED
☒ VOC	8260B	HCL / 4 DEG. C	2 X 40 mL	☒ VOC
☐ SVOC	CLP	4 DEG. C	2 X 1 L AG	☐ SVOC
☐ PEST / PCBs	CLP	4 DEG. C	2 X 1 L AG	☐ PEST / PCBs
☐ TAL INORGANICS	CLP	HNO3 to pH <2	1 x 1 L P	☐ TAL INORGANICS
☐ Other				☐

RGE OBSERVATIONS Back in well

3E WATER AINERIZED YES [✓ NO]
NUMBER OF GALLONS GENERATED: 0.5

ature:

NOTES/LOCATION SKETCH

MACTEC

ress Street, Portland, Maine 04101

LOW FLOW GROUNDWATER SAMPLING RECORD

PROJECT: Diamond Cleaners Site
SAMPLE I.D. NUMBER: ATMW0090815 0?
SAMPLE TIME: 09:00
EXPLORATION ID: MW-9
SITE: Associated Textile
DATE: 8/14/08
TIME START 08:35 END 09:00
JOB NUMBER: 3612062070-02.1
FILE TYPE:

WATER LEVEL / PUMP SETTINGS

MEASUREMENT POINT
☒ TOP OF WELL RISER
☐ TOP OF PROTECTIVE CASING
☐ OTHER

PROTECTIVE CASING STICKUP (FROM GROUND): 0.7 FT
PROTECTIVE CASING / WELL DIFFERENCE: 0.3 FT
INITIAL DEPTH TO WATER: 14.01 FT
WELL DEPTH (TOR): 19.4 FT
PID AMBIENT AIR: 0 PPM
WELL DIAMETER: 2 IN
FINAL DEPTH TO WATER: 14.01 FT
SCREEN LENGTH: NA FT
PID WELL MOUTH: 0 PPM
DRAWDOWN VOLUME: 0.0 GAL
(initial - final x 0.16 {2-inch} or x 0.65 {4-inch})
RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME PURGED: 0.0
PRESSURE TO PUMP: NA PSI
TOTAL VOL. PURGED: 1.3 GAL
(purge rate (milliliters per minute) x time duration (minutes) x 0.00026 gal/milliliter)
REFILL TIMER SETTING: NA SECONDS
DISCHARGE TIMER SETTING: NA SECONDS

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING	✓		
LOCKED			✓
COLLAR			✓

PURGE DATA

TIME	DEPTH TO WATER (ft)	PURGE RATE (ml/m)	TEMP. (deg. c)	SPECIFIC CONDUCTANCE (ms/cm)	pH (units)	DISS. O2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	PUMP INTAKE DEPTH (ft)	COMMENTS
08:35	- Pump	on w/	hon.bru	e 200 ml/min					15 ft	
08:40	14.01	200	15.85	6.462	7.07	7.94	23	147	15 ft	
08:45	14.01	200	15.90	6.470	7.07	7.93	18	152	15 ft	
08:50	14.01	200	15.86	6.482	7.09	7.94	12	155	15 ft	
08:53	14.01	200	15.88	0.488	7.11	7.90	9	156	15 ft	
08:56	14.01	200	15.91	0.490	7.11	7.92	9	158	15 ft	
08:59	14.01	200	15.92	0.491	7.13	7.90	9	160	15 ft	
09:00	Sample	Well								

EQUIPMENT DOCUMENTATION

TYPE OF PUMP
☐ MARSCHALK BLADDER
☐ SIMCO BLADDER
☒ GEOPUMP

TYPE OF TUBING
☒ SILASTIC
☒ HIGH DENSITY POLYETHYLENE
☐ OTHER

TYPE OF PUMP MATERIAL
☐ POLYVINYL CHLORIDE
☐ STAINLESS STEEL
☑ OTHER NA

TYPE OF BLADDER MATERIAL
☐ TEFLON
☑ OTHER NA

ANALYTICAL PARAMETERS

To Be Collected	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED
☑ VOC	8260B	HCL / 4 DEG. C	~~2~~ 3 X 40 mL	☒ VOC
☐ SVOC	CLP	4 DEG. C	2 X 1 L AG	☐ SVOC
☐ PEST / PCBs	CLP	4 DEG. C	2 X 1 L AG	☐ PEST / PCBs
☐ TAL INORGANICS	CLP	HNO3 to pH <2	1 x 1 L P	☐ TAL INORGANICS
☐ Other				☐

PURGE OBSERVATIONS

Backinwell

PURGE WATER CONTAINERIZED YES [✓ NO]
NUMBER OF GALLONS GENERATED 0.5

Signature:

NOTES/LOCATION SKETCH

MACTEC

511 Congress Street, Portland, Maine 04101

LOW FLOW GROUNDWATER SAMPLING RECORD

PROJECT	Diamond Cleaners Site	SAMPLE I.D. NUMBER	DCMW00502109	SAMPLE TIME	15:17
EXPLORATION ID:	MW-5	SITE	Diamond	DATE	4-2-09
TIME	START 14:25 END 15:45	JOB NUMBER	3612062070-02.1	FILE TYPE	

WATER LEVEL / PUMP SETTINGS

MEASUREMENT POINT
☒ TOP OF WELL RISER
☐ TOP OF PROTECTIVE CASING
☐ OTHER ____________

INITIAL DEPTH TO WATER: 11.19 FT
FINAL DEPTH TO WATER: 11.35 FT
DRAWDOWN VOLUME: 0.03 GAL
(initial - final x 0.16 {2-inch} or x 0.65 {4-inch})
TOTAL VOL. PURGED: 2.73 GAL
(purge rate (milliliters per minute) x time duration (minutes) x 0.00026 gal/milliliter)

WELL DEPTH (TOR): 24.5 FT
SCREEN LENGTH: 10 FT
RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME PURGED: 0.01

PROTECTIVE CASING STICKUP (FROM GROUND): flush FT
PID AMBIENT AIR: NA PPM
PID WELL MOUTH: NA PPM
PRESSURE TO PUMP: — PSI
REFILL TIMER SETTING: — SECONDS

PROTECTIVE CASING / WELL DIFFERENCE: NA FT
WELL DIAMETER: 2 IN
DISCHARGE TIMER SETTING: — SECONDS

WELL INTEGRITY:	YES	NO	N/A
CAP	✓	___	___
CASING	✓	___	___
LOCKED	✓	___	___
COLLAR	✓	___	___

PURGE DATA

TIME	DEPTH TO WATER (ft)	PURGE RATE (ml/m)	TEMP. (deg. c)	SPECIFIC CONDUCTANCE (ms/cm)	pH (units)	DISS. O2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	PUMP INTAKE DEPTH (ft)	COMMENTS
14:35	Start	purge							21	
14:42	11.37	250	11.0	0.98	7.4	<0.01	4.9	-168	|	
14:48	11.35	|	11.0	1.09	7.4	<0.01	4.2	-170	|	
14:53	11.35	|	11.0	1.16	7.4	<0.01	3.7	-171	|	
14:58	11.35	|	11.0	1.22	7.4	<0.01	2.0	-172	|	
15:03	11.35	|	11.1	1.25	7.4	<0.01	2.0	-173	|	
15:09	11.35	|	11.2	1.29	7.4	<0.01	2.1	-174	|	
15:14	11.35	↓	11.1	1.31	7.4	<0.01	1.7	-174	|	
15:17	sample.								↓	

EQUIPMENT DOCUMENTATION

TYPE OF PUMP	TYPE OF TUBING	TYPE OF PUMP MATERIAL	TYPE OF BLADDER MATERIAL
☐ MARSCHALK BLADDER	☐ SILASTIC	☐ POLYVINYL CHLORIDE	☐ TEFLON
☐ SIMCO BLADDER	☒ HIGH DENSITY POLYETHYLENE	☐ STAINLESS STEEL	☐ OTHER ____________
☒ GEOPUMP	☐ OTHER ____________	☐ OTHER ____________	

ANALYTICAL PARAMETERS
To Be Collected

	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED
☒ VOC	8260B	HCL / 4 DEG. C	3 X 40 mL	☑ VOC
☒ SVOC	CLP 8270	4 DEG. C	2 X 1 L AG	☑ SVOC
☒ PEST / ~~PCBs~~	CLP 8081	4 DEG. C	2 X 1 L AG	☑ PEST / PCBs
☒ TAL INORGANICS	CLP 6010B	HNO3 to pH <2	1 x 1 L P	☑ TAL INORGANICS unfiltered
☐ Other				☐

PURGE OBSERVATIONS back in well

PURGE WATER CONTAINERIZED YES [✓ NO]
NUMBER OF GALLONS GENERATED 2.7

Signature: Laura Smith

Checked by CES 4/30/09

NOTES/LOCATION SKETCH

MACTEC

511 Congress Street, Portland, Maine 04101

LOW FLOW GROUNDWATER SAMPLING RECORD

PROJECT: Diamond Cleaners Site
SAMPLE I.D. NUMBER: DCMW006011609
SAMPLE TIME: 11:00
EXPLORATION ID: MW-6
SITE: DC.
DATE: 4-2-09
TIME: START 10:00 END 11:25
JOB NUMBER: 3612062070-02.1
FILE TYPE:

WATER LEVEL / PUMP SETTINGS

MEASUREMENT POINT
☒ TOP OF WELL RISER
☐ TOP OF PROTECTIVE CASING
☐ OTHER

PROTECTIVE CASING STICKUP (FROM GROUND): flush FT
PROTECTIVE CASING / WELL DIFFERENCE: NA FT

INITIAL DEPTH TO WATER: 9.37 FT
WELL DEPTH (TOR): 19.3 FT
PID AMBIENT AIR: NA PPM
WELL DIAMETER: 2 IN

FINAL DEPTH TO WATER: 9.59 FT
SCREEN LENGTH: 10 FT
PID WELL MOUTH: NA PPM

WELL INTEGRITY:	YES	NO	N/A
CAP	✓		
CASING	✓		
LOCKED	✓		
COLLAR	✓		

DRAWDOWN VOLUME: 0.04 GAL
(initial - final x 0.16 {2-inch} or x 0.65 {4-inch})

RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME PURGED: 0.02

PRESSURE TO PUMP: — PSI

TOTAL VOL. PURGED: 2.56 GAL
(purge rate (milliliters per minute) x time duration (minutes) x 0.00026 gal/milliliter)

REFILL TIMER SETTING: — SECONDS
DISCHARGE TIMER SETTING: — SECONDS

PURGE DATA

TIME	DEPTH TO WATER (ft)	PURGE RATE (ml/m)	TEMP. (deg. c)	SPECIFIC CONDUCTANCE (ms/cm)	pH (units)	DISS. O2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	PUMP INTAKE DEPTH (ft)	COMMENTS
10:12	start	purge							16	
10:15	9.57	'300'							16	
10:18	9.57	250	10.7	1.88	7.0	<0.01	16.9	-33	16	
10:23	9.58	|	10.8	1.89	7.1	<0.01	5.5	-60	|	
10:29	9.59	|	10.8	1.89	7.2	<0.01	4.7	-88	|	
10:35		↓							|	pump stopped; switched battery
10:39	9.54	200	10.8	1.88	7.3	<0.01	3.4	-100	|	
10:44	9.56	|	10.9	1.88	7.4	<0.01	3.4	-109	|	
10:50	9.56	|	10.9	1.88	7.4	0.1	2.1	-114	|	
10:54	9.57	↓	11.0	1.88	7.4	0.1	2.6	-117	↓	
11:00	sample									

EQUIPMENT DOCUMENTATION

TYPE OF PUMP
☐ MARSCHALK BLADDER
☐ SIMCO BLADDER
☒ GEOPUMP

TYPE OF TUBING
☐ SILASTIC
☒ HIGH DENSITY POLYETHYLENE
☐ OTHER

TYPE OF PUMP MATERIAL
☐ POLYVINYL CHLORIDE
☐ STAINLESS STEEL
☐ OTHER

TYPE OF BLADDER MATERIAL
☐ TEFLON
☐ OTHER

ANALYTICAL PARAMETERS
To Be Collected

	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED
☒ VOC	8260B	HCL / 4 DEG. C	3 X 40 mL	☑ VOC
☒ SVOC	CLP 8270	4 DEG. C	2 X 1 L AG	☑ SVOC
☒ PEST / ~~PCBs~~	CLP 8081	4 DEG. C	2 X 1 L AG	☑ PEST / ~~PCBs~~
☒ TAL INORGANICS	CLP 6010 B	HNO3 to pH <2	1 x 1 L P	☑ TAL INORGANICS unfiltered
☐ Other				☐

PURGE OBSERVATIONS

PURGE WATER CONTAINERIZED: YES [✓ NO] Back in well
NUMBER OF GALLONS GENERATED: 2.5

Signature: Laura Smith
Checked by CRS 4/30/09

NOTES/LOCATION SKETCH

MACTEC

511 Congress Street, Portland, Maine 04101

LOW FLOW GROUNDWATER SAMPLING RECORD

PROJECT: Diamond Cleaners Site
SAMPLE I.D. NUMBER: DCMW00701709
SAMPLE TIME: 13:55
EXPLORATION ID: MW-7
SITE: DC
DATE: 4-2-09
TIME START 13:10 END 14:20
JOB NUMBER: 3612062070-02.1
FILE TYPE:

WATER LEVEL / PUMP SETTINGS

MEASUREMENT POINT
☒ TOP OF WELL RISER
☐ TOP OF PROTECTIVE CASING
☐ OTHER ____

PROTECTIVE CASING STICKUP (FROM GROUND): flush FT
PROTECTIVE CASING / WELL DIFFERENCE: NA FT

INITIAL DEPTH TO WATER: 12.08 FT
WELL DEPTH (TOR): 20.9 FT
PID AMBIENT AIR: NA PPM
WELL DIAMETER: 2 IN

FINAL DEPTH TO WATER: 12.10 FT
SCREEN LENGTH: 10 FT
PID WELL MOUTH: NA PPM

DRAWDOWN VOLUME: 0.003 GAL
(initial - final x 0.16 {2-inch} or x 0.65 {4-inch})
RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME PURGED: 0.001
PRESSURE TO PUMP: — PSI

WELL INTEGRITY:	YES	NO	N/A
CAP	✓	___	___
CASING	✓	___	___
LOCKED	✓	___	___
COLLAR	✓	___	___

TOTAL VOL. PURGED: 2.04 GAL
(purge rate (milliliters per minute) x time duration (minutes) x 0.00026 gal/milliliter)
REFILL TIMER SETTING: — SECONDS
DISCHARGE TIMER SETTING: — SECONDS

PURGE DATA

TIME	DEPTH TO WATER (ft)	PURGE RATE (ml/m)	TEMP. (deg. c)	SPECIFIC CONDUCTANCE (ms/cm)	pH (units)	DISS. O2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	PUMP INTAKE DEPTH (ft)	COMMENTS
13:22	Start	purge							17	
13:29	12.09	250	12.4	1.36	7.4	<0.01	<3.2	98	17	
13:34	12.10	|	12.5	1.37	7.4	<0.01	2.4	89	|	
13:39	12.10	↓	12.3	1.37	7.4	<0.01	2.8	83	|	
13:44	12.10	225	12.4	1.37	7.3	<0.01	2.6	81	|	
13:49	12.10	|	12.4	1.41	7.4	<0.01	1.7	77	|	
13:54	12.10	↓	12.3	1.45	7.4	<0.01	2.0	76	|	
13:55	Sam	ple							↓	

EQUIPMENT DOCUMENTATION

TYPE OF PUMP	TYPE OF TUBING	TYPE OF PUMP MATERIAL	TYPE OF BLADDER MATERIAL
☐ MARSCHALK BLADDER	☐ SILASTIC	☐ POLYVINYL CHLORIDE	☐ TEFLON
☐ SIMCO BLADDER	☒ HIGH DENSITY POLYETHYLENE	☐ STAINLESS STEEL	☐ OTHER ____
☒ GEOPUMP	☐ OTHER ____	☐ OTHER ____	

ANALYTICAL PARAMETERS

To Be Collected	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED
☒ VOC	8260B	HCL / 4 DEG. C	3 X 40 mL	☑ VOC
☒ SVOC	CLP 8270	4 DEG. C	2 X 1 L AG	☑ SVOC
☒ PEST / ~~PCBs~~	CLP 8081	4 DEG. C	2 X 1 L AG	☑ PEST / PCBs
☒ TAL INORGANICS	CLP 6010B	HNO3 to pH <2	1 x 1 L P	☑ TAL INORGANICS unfiltered
☐ Other				☐

PURGE OBSERVATIONS

back in well
PURGE WATER CONTAINERIZED YES [✓ NO]
NUMBER OF GALLONS GENERATED 2

Signature: Laura Smith
Checked by CEI 4/30/09

NOTES/LOCATION SKETCH

MACTEC
511 Congress Street, Portland, Maine 04101

revised 3/27/2009

LOW FLOW GROUNDWATER SAMPLING RECORD

PROJECT: Diamond Cleaners Site
SAMPLE I.D. NUMBER: DCGW01001409
SAMPLE TIME: 12:30
EXPLORATION ID: GW-10
SITE: DC
DATE: 4-2-09
TIME START: 11:30 END: 12:45
JOB NUMBER: 3612062070-02.1
FILE TYPE:

WATER LEVEL / PUMP SETTINGS

MEASUREMENT POINT
☒ TOP OF WELL RISER
☐ TOP OF PROTECTIVE CASING
☐ OTHER

PROTECTIVE CASING STICKUP (FROM GROUND): flush FT
PROTECTIVE CASING / WELL DIFFERENCE: NA FT
INITIAL DEPTH TO WATER: 11.89 FT
WELL DEPTH (TOR): 17.65 FT
PID AMBIENT AIR: NA PPM
WELL DIAMETER: 1 IN
FINAL DEPTH TO WATER: 11.99 FT
SCREEN LENGTH: 10 FT
PID WELL MOUTH: NA PPM

WELL INTEGRITY:

	YES	NO	N/A
CAP		✓	
CASING	✓		
LOCKED		✓	
COLLAR	✓		

DRAWDOWN VOLUME: 0.004 GAL
(initial - final x 0.16 {2-inch} or x 0.65 {4-inch})
RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME PURGED: 0.001
PRESSURE TO PUMP: — PSI
TOTAL VOL. PURGED: 2.86 GAL
(purge rate (milliliters per minute) x time duration (minutes) x 0.00026 gal/milliliter)
REFILL TIMER SETTING: — SECONDS
DISCHARGE TIMER SETTING: — SECONDS

PURGE DATA

TIME	DEPTH TO WATER (ft)	PURGE RATE (ml/m)	TEMP. (deg. c)	SPECIFIC CONDUCTANCE (ms/cm)	pH (units)	DISS. O2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	PUMP INTAKE DEPTH (ft)	COMMENTS
11:35	start purge									
11:42	11.97	200	10.2	0.65	7.5	2.2	114	22	14	
11:48	11.99	|	10.3	0.64	7.6	3.9	62.4	29	|	
11:53	11.99	|	10.3	0.65	7.6	3.9	47.8	34	|	
11:58	11.99	|	10.3	0.65	7.6	3.4	21.8	42	|	
12:03	11.99	|	10.3	0.64	7.6	3.3	13.6	46	|	
12:08	11.99	|	10.4	0.64	7.6	3.5	10.4	49	|	
12:13	11.99	|	10.3	0.64	7.6	4.4	5.6	52	|	
12:18	11.99	|	10.3	0.64	7.6	4.1	4.5	55	|	
12:23	11.99	↓	10.4	0.64	7.6	4.6	2.7	58	↓	
12:30	sample									

EQUIPMENT DOCUMENTATION

TYPE OF PUMP
☐ MARSCHALK BLADDER
☐ SIMCO BLADDER
☒ GEOPUMP

TYPE OF TUBING
☐ SILASTIC
☒ HIGH DENSITY POLYETHYLENE
☐ OTHER

TYPE OF PUMP MATERIAL
☐ POLYVINYL CHLORIDE
☐ STAINLESS STEEL
☐ OTHER

TYPE OF BLADDER MATERIAL
☐ TEFLON
☐ OTHER

ANALYTICAL PARAMETERS

To Be Collected	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED
☒ VOC	8260B	HCL / 4 DEG. C	3 X 40 mL	☑ VOC
☒ SVOC	CLP 8270	4 DEG. C	2 X 1 L AG	☑ SVOC
☒ PEST / ~~PCBs~~	CLP 8081	4 DEG. C	2 X 1 L AG	☑ PEST / PCBs
☒ TAL INORGANICS	CLP 6010B	HNO3 to pH <2	1 x 1 L P	☑ TAL INORGANICS unfiltered
☐ Other				☐

PURGE OBSERVATIONS

PURGE WATER CONTAINERIZED: YES [✓ NO] Back in well
NUMBER OF GALLONS GENERATED: 2.86

Signature: Laura Smith

Checked by CAS 4/21/09

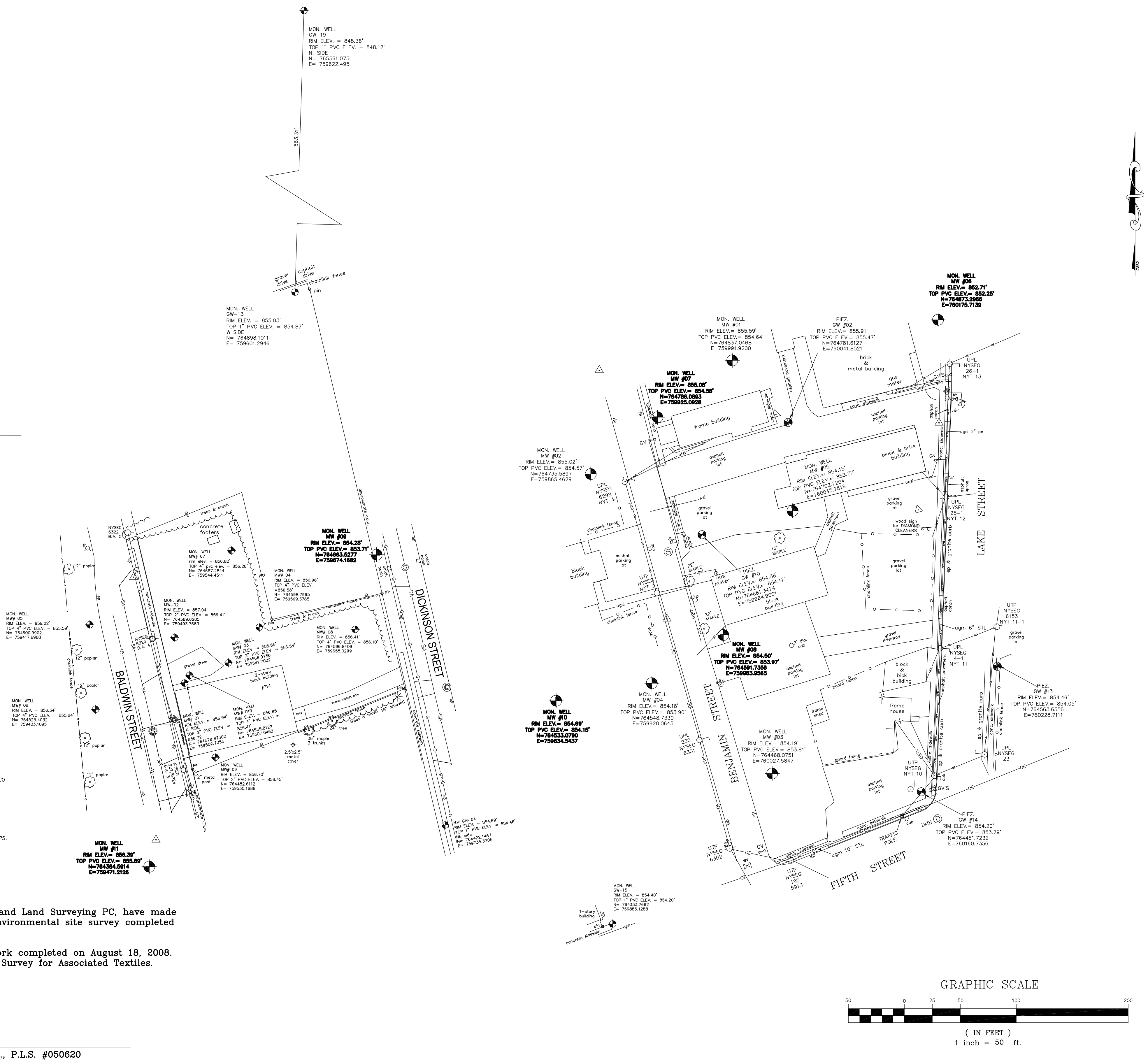
NOTES/LOCATION SKETCH

MACTEC
511 Congress Street, Portland, Maine 04101

revised 3/27/2009

APPENDIX C

SITE SURVEY



LEGEND

	UTP NYSEG 6302	UTILITY POLE
WV		WATER VALVE
		WATER SEVICE VALVE
	GV	GAS VALVE
	UPL NYSEG 6298 NYT 4	UTILITY POLE WITH LIGHT
△		SURVEY CONTROL POINT
□	cab	DRAINAGE CATCH BASIN
Ⓓ	DMH	DRAINAGE MANHOLE
—SA—		SEWER LINE
——		GAS MAIN
	MON. WELL MW #04 RIM ELEV.= 854.18' TOP PVC ELEV.= 853.90' N=764634.7515 E=760549.2186	MONITORING WELL

SURVEY NOTES:

1.) THE VERTICAL ELEVATIONS LISTED HEREON ARE REFERENCED TO NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988.

2.) THE HORIZONTAL COORDINATES ARE REFERENCED TO THE NEW YORK STATE PLANE COORDINATES SYSTEM, CENTRAL ZONE. THEY ARE BASED ON THE NAD 1983 COORDINATE DATUM.

3.) ALL ELEVATIONS ON MONITORING WELL PVC WAS TAKEN ON THE NORTH SIDE UNLESS OTHERWISE SPECIFIED.

4.) PROPERTY LINES ARE APPROXIMATE FROM TAX MAPS.

Certification:

We, Joseph C. Lu Engineering and Land Surveying PC, have made this map from notes of an environmental site survey completed on January 26, 2006.

Added new wells from field work completed on August 18, 2008. Merge the Environmental Site Survey for Associated Textiles.

Clifford James Rigerman, N.Y.S., P.L.S. #050620

J:\PROJECTS\36400 MACTEC\36402 DIAMOND ELMIRA\CADD\Diamond and Associated.DWG

08/19/08 Added MW-06-MW-11 & Associated Cleaners data. CR

DATE	REVISIONS	BY
03/07	added cert. & signature line	CR
12/11/06	Adjusted coordinates on wells and piez pnts, adn updated the mapping.	CR
4/17/06	Adjusted coordinates on wells and piez pnts.	CR
4/13/06	Adjusted coordinates and rotated the drawing.	CR
1/27/06	ADDED MON. WELL DATA	CR
7/13/05	ADDED N&E'S TO PIEZ PT.S	CR

DRAWING ALTERATION

WARNING: It is a violation of the New York State Education Law, Article 145, Section 7209, Special Provision 2, for any person unless he is acting under the direction of a Licensed Professional Engineer or Land Surveyor to alter an item in any way. If an item bearing the seal of an engineer or land surveyor is altered, the altering engineer or land surveyor shall affix to the item his seal and notation "altered by" followed by his signature and date of such alteration, and a specific description of the alteration.

BY: ____________

DATE: ____________

LU ENGINEERS
Civil and Environmental

JOSEPH C. LU ENGINEERING
LAND SURVEYING, P.C.
2230 Penfield Road
Penfield, New York 14526
(585) 377-1450
FAX: (585) 377-1266

PROJECT:

DIAMOND CLEANERS
ELMIRA, NY

CLIENT:

MACTEC ENGINEERING, INC.
511 CONGRESS STREET
PORTLAND, ME 04101

DRAWING TITLE:

ENVIRONMENTAL MAP

DESIGNED BY:	SCALE: 1"=50'
DRAWN BY: CR	DATE: 07-01-05
CHECKED BY: CR, CP	PROJECT No. 36402
SHEET 1 OF 1	DRAWING No. 1

APPENDIX D

CALCULATIONS AND NATURAL ATTENUATION SCREENING FORMS

PROJECT Diamond Cleaners - NYSDEC.	COMP. BY RAL	JOB NO. 3612052028/02.4.3
	CHK. BY CRS	DATE 9/28/06

10/1/06 1 of 2

Do site data suggest the possible presence of NAPL ?

<u>Soils</u>

CIS-1,2-DCE 6300 ppb (13-15') in saturated zone
PCE 540,000 ppb (4-4') unsaturated zone

use C_{sat} equation to express equilibrium concs.

$$C_{sat} = \frac{S}{\rho_b}(K_d\rho_b + \theta_w + H'\theta_a)$$

K_{oc}, H', S = chemical specific
Use USEPA defaults for $f_{oc}, \rho_b, \theta_w, \theta_a$

$$f_{oc} = 0.006$$
$$\rho_b = 1.5$$
$$\left.\begin{array}{l}\theta_w = 0.15 \\ \theta_a = 0.28\end{array}\right\} \text{unsaturated}$$

for cis-1,2-DCE $S = 3500$ mg/L, $K_{oc} = 49\ \frac{ml}{g}$
since saturated, use $\theta_w = 0.43$ and drop last term in C_{sat}

$$C_{sat} = \frac{3500}{1.5}(\overset{0.441}{(0.006)(1.5)(49)} + 0.43)$$
$$= 2032 \text{ mg/Kg} \gg 6.3 \text{ mg/Kg} \therefore \text{no NAPL cis-1,2-DCE}$$

for PCE $S = 150$ mg/L, $K_{oc} = 364$ ml/g, $H' = 0.754$

$$C_{sat} = \frac{150}{1.5}((0.006)(364)(1.5) + 0.15 + (0.754)(0.28))$$
$$= 363.7 \text{ mg/Kg}$$

$$540 \text{ mg/Kg} > 363.7 \text{ mg/Kg}$$

∴ presence of DNAPL PCE likely

MACTEC

PROJECT	COMP. BY	JOB NO.
Diamond Cleaners - NYSDEC	RAL	3612052028/02.01.3
	CHK. BY	DATE 9/28/06

2 of 2

Groundwater

Use rule of thumb - does concentration exceed 1% of water solubility of compound?

cis-1,2-DCE 20 mg/L $< 0.01(3500$ mg/L$) = 35$ mg/L

$\therefore$ NAPL cis-1,2-DCE not likely

PCE 1.7 mg/L $> 0.01(150$ mg/L$) = 1.5$ mg/L

$\therefore$ NAPL PCE may be present

Soil vapor

PCE @ 2,000,000 ppbv = 2 ppt (parts per thousand)

$\therefore$ in one m^3 (=1000L) would have 2L PCE vapor

or $\frac{2}{22.4}(165.83g) = 14.8 g/m^3 = 14{,}800{,}000 \mu g/m^3$

with $H' = 0.754$

$\therefore C_w = 19{,}628{,}647 \mu g/m^3$ (water)

$C_w = 19.63$ mg/L $> 0.01(150) = 1.5$ mg/L

$\therefore$ Likely presence of PCE NAPL in unsaturated soil

Note that these estimates depend on default or assumed parameter values and should be considered to be only approximate.

Also, this analysis cannot be performed for the cPAHs as they may be present in an alternate form in soils than as a NAPL at the concentrations indicated. A more helpful analysis might be for TPH which could indicate the potential for residual or possibly mobile petroleum product phase.

MW-09

Natural Attenuation Screening Protocol

The following is taken from the USEPA protocol (USEPA, 1998) The results of this scoring process have no regulatory significance

Interpretation	Score
Inadequate evidence for anaerobic biodegradation* of chlorinated organics	0 to 5
Limited evidence for anaerobic biodegradation* of chlorinated organics	6 to 14
Adequate evidence for anaerobic biodegradation* of chlorinated organics	15 to 20
Strong evidence for anaerobic biodegradation* of chlorinated organics	>20

* reductive dechlorination

Score: 7

Scroll to End of Table

Analysis	Concentration in Most Contam. Zone	Interpretation	Yes	No	Points Awarded
Oxygen*	<0.5 mg/L	Tolerated, suppresses the reductive pathway at higher concentrations	●	○	3
	> 5mg/L	Not tolerated; however, VC may be oxidized aerobically	○	●	0
Nitrate*	<1 mg/L	At higher concentrations may compete with reductive pathway	○	●	0
Iron II*	>1 mg/L	Reductive pathway possible; VC may be oxidized under Fe(III)-reducing conditions	○	○	
Sulfate*	<20 mg/L	At higher concentrations may compete with reductive pathway	○	●	0
Sulfide*	>1 mg/L	Reductive pathway possible	○	●	0
Methane*	>0.5 mg/L	Ultimate reductive daughter product, VC Accumulates	○	●	0
Oxidation Reduction Potential* (ORP)	<50 millivolts (mV)	Reductive pathway possible	○	●	0
	<-100mV	Reductive pathway likely	○	●	0
pH*	5 < pH < 9	Optimal range for reductive pathway	●	○	0
TOC	>20 mg/L	Carbon and energy source; drives dechlorination; can be natural or anthropogenic	○	●	0
Temperature*	>20°C	At T >20°C biochemical process is accelerated	○	●	0
Carbon Dioxide	>2x background	Ultimate oxidative daughter product	○	●	0
Alkalinity	>2x background	Results from interaction of carbon dioxide with aquifer minerals	○	●	0
Chloride*	>2x background	Daughter product of organic chlorine	○	●	0
Hydrogen	>1 nM	Reductive pathway possible, VC may accumulate	○	○	
Volatile Fatty Acids	>0.1 mg/L	Intermediates resulting from biodegradation of aromatic compounds; carbon and energy source	○	○	
BTEX*	>0.1 mg/L	Carbon and energy source; drives dechlorination	○	●	0
PCE*		Material released	●	○	0
TCE*		Daughter product of PCE $^{a/}$	●	○	2
DCE*		Daughter product of TCE. If cis is greater than 80% of total DCE it is likely a daughter product of TCE$^{a/}$; 1,1-DCE can be a chem. reaction product of TCA	●	○	2
VC*		Daughter product of DCE$^{a/}$	○	●	0
1,1,1-Trichloroethane*		Material released	○	●	0
DCA		Daughter product of TCA under reducing conditions	○	●	0
Carbon Tetrachloride		Material released	○	●	0
Chloroethane*		Daughter product of DCA or VC under reducing conditions	○	●	0
Ethene/Ethane	>0.01 mg/L	Daughter product of VC/ethene	○	●	0
	>0.1 mg/L	Daughter product of VC/ethene	○	●	0
Chloroform		Daughter product of Carbon Tetrachloride	○	●	0
Dichloromethane		Daughter product of Chloroform	○	●	0

* required analysis.

a/ Points awarded only if it can be shown that the compound is a daughter product (i.e., not a constituent of the source NAPL).

SCORE Reset

End of Form

MW-002

Natural Attenuation Screening Protocol

The following is taken from the USEPA protocol (USEPA, 1998). The results of this scoring process have no regulatory significance.

Interpretation	Score
Inadequate evidence for anaerobic biodegradation* of chlorinated organics	0 to 5
Limited evidence for anaerobic biodegradation* of chlorinated organics	6 to 14
Adequate evidence for anaerobic biodegradation* of chlorinated organics	15 to 20
Strong evidence for anaerobic biodegradation* of chlorinated organics	>20

* reductive dechlorination

Score: 9

Scroll to End of Table

Analysis	Concentration in Most Contam. Zone	Interpretation	Yes	No	Points Awarded
Oxygen*	<0.5 mg/L	Tolerated, suppresses the reductive pathway at higher concentrations	●	○	3
	> 5mg/L	Not tolerated; however, VC may be oxidized aerobically	○	●	0
Nitrate*	<1 mg/L	At higher concentrations may compete with reductive pathway	○	●	0
Iron II*	>1 mg/L	Reductive pathway possible; VC may be oxidized under Fe(III)-reducing conditions	○	●	0
Sulfate*	<20 mg/L	At higher concentrations may compete with reductive pathway	○	●	0
Sulfide*	>1 mg/L	Reductive pathway possible	○	●	0
Methane*	>0.5 mg/L	Ultimate reductive daughter product, VC Accumulates	○	●	0
Oxidation Reduction Potential* (ORP)	<50 millivolts (mV)	Reductive pathway possible	○	●	0
	<-100mV	Reductive pathway likely	○	●	0
pH*	5 < pH < 9	Optimal range for reductive pathway	●	○	0
TOC	>20 mg/L	Carbon and energy source; drives dechlorination; can be natural or anthropogenic	○	●	0
Temperature*	>20°C	At T >20°C biochemical process is accelerated	○	●	0
Carbon Dioxide	>2x background	Ultimate oxidative daughter product	○	●	0
Alkalinity	>2x background	Results from interaction of carbon dioxide with aquifer minerals	○	●	0
Chloride*	>2x background	Daughter product of organic chlorine	○	●	0
Hydrogen	>1 nM	Reductive pathway possible, VC may accumulate	○	○	
Volatile Fatty Acids	>0.1 mg/L	Intermediates resulting from biodegradation of aromatic compounds; carbon and energy source	○	○	
BTEX*	>0.1 mg/L	Carbon and energy source; drives dechlorination	○	●	0
PCE*		Material released	●	○	0
TCE*		Daughter product of PCE [a/]	●	○	2
DCE*		Daughter product of TCE. If cis is greater than 80% of total DCE it is likely a daughter product of TCE[a/]; 1,1-DCE can be a chem. reaction product of TCA	●	○	2
VC*		Daughter product of DCE[a/]	●	○	2
1,1,1-Trichloroethane*		Material released	○	●	0
DCA		Daughter product of TCA under reducing conditions	○	●	0
Carbon Tetrachloride		Material released	○	●	0
Chloroethane*		Daughter product of DCA or VC under reducing conditions	○	●	0
Ethene/Ethane	>0.01 mg/L	Daughter product of VC/ethene	○	●	0
	>0.1 mg/L	Daughter product of VC/ethene	○	●	0
Chloroform		Daughter product of Carbon Tetrachloride	○	●	0
Dichloromethane		Daughter product of Chloroform	○	●	0

* required analysis.

a/ Points awarded only if it can be shown that the compound is a daughter product (i.e., not a constituent of the source NAPL).

SCORE Reset

End of Form

MW-003

Natural Attenuation Screening Protocol

The following is taken from the USEPA protocol (USEPA, 1998) The results of this scoring process have no regulatory significance.

Interpretation	Score
Inadequate evidence for anaerobic biodegradation* of chlorinated organics	0 to 5
Limited evidence for anaerobic biodegradation* of chlorinated organics	6 to 14
Adequate evidence for anaerobic biodegradation* of chlorinated organics	15 to 20
Strong evidence for anaerobic biodegradation* of chlorinated organics	>20

* reductive dechlorination

Score: 7

Scroll to End of Table

Analysis	Concentration in Most Contam. Zone	Interpretation	Yes	No	Points Awarded
Oxygen*	<0.5 mg/L	Tolerated, suppresses the reductive pathway at higher concentrations	●	○	3
	> 5mg/L	Not tolerated; however, VC may be oxidized aerobically	○	●	0
Nitrate*	<1 mg/L	At higher concentrations may compete with reductive pathway	○	●	0
Iron II*	>1 mg/L	Reductive pathway possible; VC may be oxidized under Fe(III)-reducing conditions	○	●	0
Sulfate*	<20 mg/L	At higher concentrations may compete with reductive pathway	○	●	0
Sulfide*	>1 mg/L	Reductive pathway possible	○	●	0
Methane*	>0.5 mg/L	Ultimate reductive daughter product, VC Accumulates	○	●	0
Oxidation Reduction Potential* (ORP)	<50 millivolts (mV)	Reductive pathway possible	○	●	0
	<-100mV	Reductive pathway likely	○	●	0
pH*	5 < pH < 9	Optimal range for reductive pathway	●	○	0
TOC	>20 mg/L	Carbon and energy source; drives dechlorination; can be natural or anthropogenic	○	●	0
Temperature*	>20°C	At T >20°C biochemical process is accelerated	○	●	0
Carbon Dioxide	>2x background	Ultimate oxidative daughter product	○	●	0
Alkalinity	>2x background	Results from interaction of carbon dioxide with aquifer minerals	○	●	0
Chloride*	>2x background	Daughter product of organic chlorine	○	●	0
Hydrogen	>1 nM	Reductive pathway possible, VC may accumulate	○	○	
Volatile Fatty Acids	>0.1 mg/L	Intermediates resulting from biodegradation of aromatic compounds; carbon and energy source	○	○	
BTEX*	>0.1 mg/L	Carbon and energy source; drives dechlorination	○	●	0
PCE*		Material released	●	○	0
TCE*		Daughter product of PCE $^{a/}$	●	○	2
DCE*		Daughter product of TCE. If cis is greater than 80% of total DCE it is likely a daughter product of TCE$^{a/}$; 1,1-DCE can be a chem. reaction product of TCA	●	○	2
VC*		Daughter product of DCE$^{a/}$	○	●	0
1,1,1-Trichloroethane*		Material released	○	●	0
DCA		Daughter product of TCA under reducing conditions	○	●	0
Carbon Tetrachloride		Material released	○	●	0
Chloroethane*		Daughter product of DCA or VC under reducing conditions	○	●	0
Ethene/Ethane	>0.01 mg/L	Daughter product of VC/ethene	○	●	0
	>0.1 mg/L	Daughter product of VC/ethene	○	●	0
Chloroform		Daughter product of Carbon Tetrachloride	○	●	0
Dichloromethane		Daughter product of Chloroform	○	●	0

* required analysis.

a/ Points awarded only if it can be shown that the compound is a daughter product (i.e., not a constituent of the source NAPL).

SCORE Reset

End of Form

MW-004

Natural Attenuation Screening Protocol

The following is taken from the USEPA protocol (USEPA, 1998) The results of this scoring process have no regulatory significance.

Interpretation	Score
Inadequate evidence for anaerobic biodegradation* of chlorinated organics	0 to 5
Limited evidence for anaerobic biodegradation* of chlorinated organics	6 to 14
Adequate evidence for anaerobic biodegradation* of chlorinated organics	15 to 20
Strong evidence for anaerobic biodegradation* of chlorinated organics	>20

* reductive dechlorination

Score: 17

Scroll to End of Table

Analysis	Concentration in Most Contam. Zone	Interpretation	Yes	No	Points Awarded
Oxygen*	<0.5 mg/L	Tolerated, suppresses the reductive pathway at higher concentrations	●	○	3
	> 5mg/L	Not tolerated; however, VC may be oxidized aerobically	○	●	0
Nitrate*	<1 mg/L	At higher concentrations may compete with reductive pathway	○	●	0
Iron II*	>1 mg/L	Reductive pathway possible; VC may be oxidized under Fe(III)-reducing conditions	○	●	0
Sulfate*	<20 mg/L	At higher concentrations may compete with reductive pathway	○	●	0
Sulfide*	>1 mg/L	Reductive pathway possible	○	●	0
Methane*	>0.5 mg/L	Ultimate reductive daughter product, VC Accumulates	●	○	3
Oxidation Reduction Potential* (ORP)	<50 millivolts (mV)	Reductive pathway possible	●	○	1
	<-100mV	Reductive pathway likely	●	○	2
pH*	5 < pH < 9	Optimal range for reductive pathway	●	○	0
TOC	>20 mg/L	Carbon and energy source; drives dechlorination; can be natural or anthropogenic	○	●	0
Temperature*	>20^{o}C	At T >20^{o}C biochemical process is accelerated	○	●	0
Carbon Dioxide	>2x background	Ultimate oxidative daughter product	○	●	0
Alkalinity	>2x background	Results from interaction of carbon dioxide with aquifer minerals	○	●	0
Chloride*	>2x background	Daughter product of organic chlorine	○	●	0
Hydrogen	>1 nM	Reductive pathway possible, VC may accumulate	○	○	
Volatile Fatty Acids	>0.1 mg/L	Intermediates resulting from biodegradation of aromatic compounds; carbon and energy source	○	○	
BTEX*	>0.1 mg/L	Carbon and energy source; drives dechlorination	●	○	2
PCE*		Material released	●	○	0
TCE*		Daughter product of PCE $^{a/}$	●	○	2
DCE*		Daughter product of TCE. If cis is greater than 80% of total DCE it is likely a daughter product of TCE$^{a/}$; 1,1-DCE can be a chem. reaction product of TCA	●	○	2
VC*		Daughter product of DCE$^{a/}$	○	●	0
1,1,1-Trichloroethane*		Material released	○	●	0
DCA		Daughter product of TCA under reducing conditions	○	●	0
Carbon Tetrachloride		Material released	○	●	0
Chloroethane*		Daughter product of DCA or VC under reducing conditions	○	●	0
Ethene/Ethane	>0.01 mg/L	Daughter product of VC/ethene	○	●	0
	>0.1 mg/L	Daughter product of VC/ethene	○	●	0
Chloroform		Daughter product of Carbon Tetrachloride	●	○	2
Dichloromethane		Daughter product of Chloroform	○	●	0

* required analysis.

a/ Points awarded only if it can be shown that the compound is a daughter product (i.e., not a constituent of the source NAPL).

SCORE Reset

End of Form

MW-005

Natural Attenuation Screening Protocol

The following is taken from the USEPA protocol (USEPA, 1998). The results of this scoring process have no regulatory significance.

Interpretation	Score
Inadequate evidence for anaerobic biodegradation* of chlorinated organics	0 to 5
Limited evidence for anaerobic biodegradation* of chlorinated organics	6 to 14
Adequate evidence for anaerobic biodegradation* of chlorinated organics	15 to 20
Strong evidence for anaerobic biodegradation* of chlorinated organics	>20

* reductive dechlorination

Score: 14

Scroll to End of Table

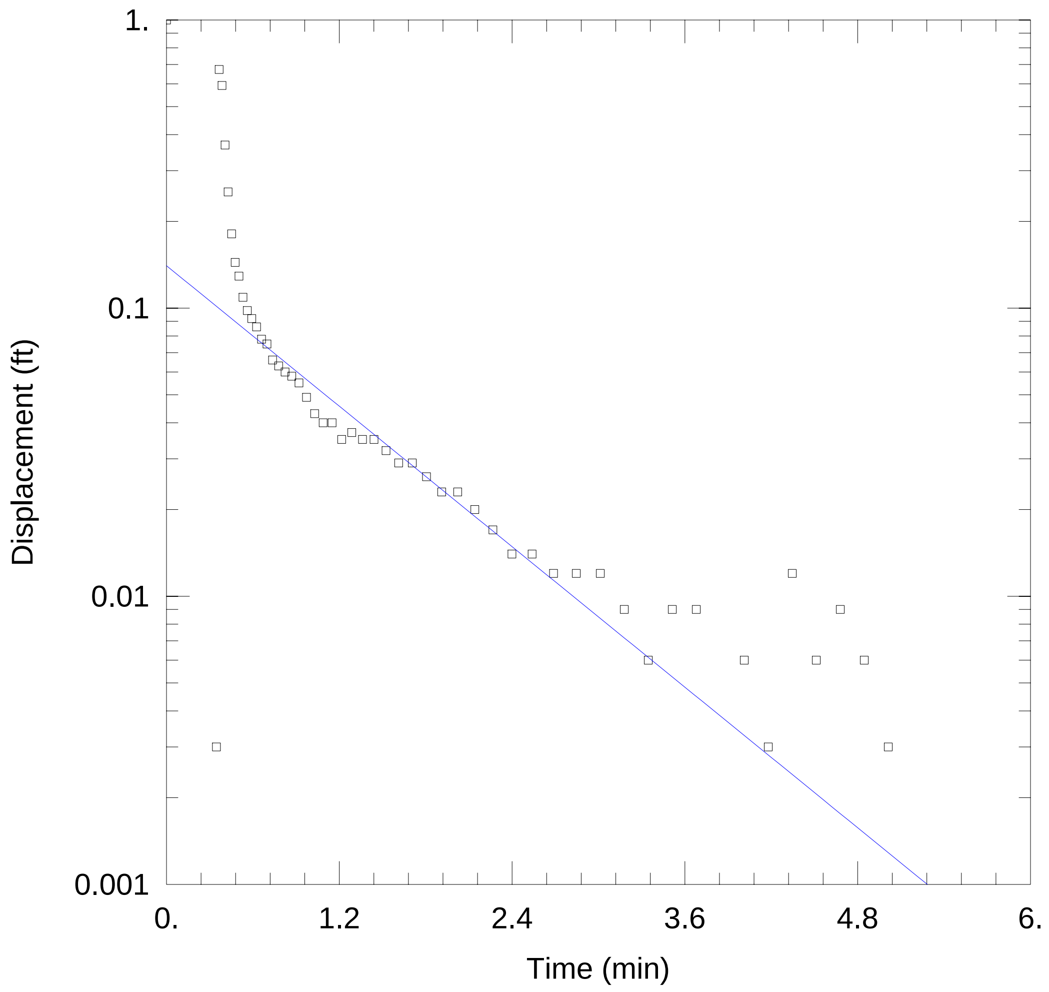
Analysis	Concentration in Most Contam. Zone	Interpretation	Yes	No	Points Awarded
Oxygen*	<0.5 mg/L	Tolerated, suppresses the reductive pathway at higher concentrations	●	○	3
	> 5mg/L	Not tolerated; however, VC may be oxidized aerobically	○	●	0
Nitrate*	<1 mg/L	At higher concentrations may compete with reductive pathway	○	●	0
Iron II*	>1 mg/L	Reductive pathway possible; VC may be oxidized under Fe(III)-reducing conditions	○	●	0
Sulfate*	<20 mg/L	At higher concentrations may compete with reductive pathway	○	●	0
Sulfide*	>1 mg/L	Reductive pathway possible	○	●	0
Methane*	>0.5 mg/L	Ultimate reductive daughter product, VC Accumulates	●	○	3
Oxidation Reduction Potential* (ORP)	<50 millivolts (mV)	Reductive pathway possible	●	○	1
	<-100mV	Reductive pathway likely	○	●	0
pH*	5 < pH < 9	Optimal range for reductive pathway	●	○	0
TOC	>20 mg/L	Carbon and energy source; drives dechlorination; can be natural or anthropogenic	○	●	0
Temperature*	>20°C	At T >20°C biochemical process is accelerated	○	●	0
Carbon Dioxide	>2x background	Ultimate oxidative daughter product	●	○	1
Alkalinity	>2x background	Results from interaction of carbon dioxide with aquifer minerals	○	●	0
Chloride*	>2x background	Daughter product of organic chlorine	○	●	0
Hydrogen	>1 nM	Reductive pathway possible, VC may accumulate	○	●	0
Volatile Fatty Acids	>0.1 mg/L	Intermediates resulting from biodegradation of aromatic compounds; carbon and energy source	○	●	0
BTEX*	>0.1 mg/L	Carbon and energy source; drives dechlorination	○	●	0
PCE*		Material released	●	○	0
TCE*		Daughter product of PCE a/	●	○	2
DCE*		Daughter product of TCE. If cis is greater than 80% of total DCE it is likely a daughter product of TCE a/; 1,1-DCE can be a chem. reaction product of TCA	●	○	2
VC*		Daughter product of DCE a/	●	○	2
1,1,1-Trichloroethane*		Material released	○	●	0
DCA		Daughter product of TCA under reducing conditions	○	●	0
Carbon Tetrachloride		Material released	○	●	0
Chloroethane*		Daughter product of DCA or VC under reducing conditions	○	●	0
Ethene/Ethane	>0.01 mg/L	Daughter product of VC/ethene	○	●	0
	>0.1 mg/L	Daughter product of VC/ethene	○	●	0
Chloroform		Daughter product of Carbon Tetrachloride	○	●	0
Dichloromethane		Daughter product of Chloroform	○	●	0

* required analysis.

a/ Points awarded only if it can be shown that the compound is a daughter product (i.e., not a constituent of the source NAPL).

SCORE Reset

End of Form



MW-3-RISING 1

Data Set: P:\...\MW_3.aqt
Date: 11/19/07
Time: 12:51:58

PROJECT INFORMATION

Company: MACTEC
Client: NYSDEC
Location: ATRS-DC
Test Well: MW-3-1
Test Date: 8/29/07

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

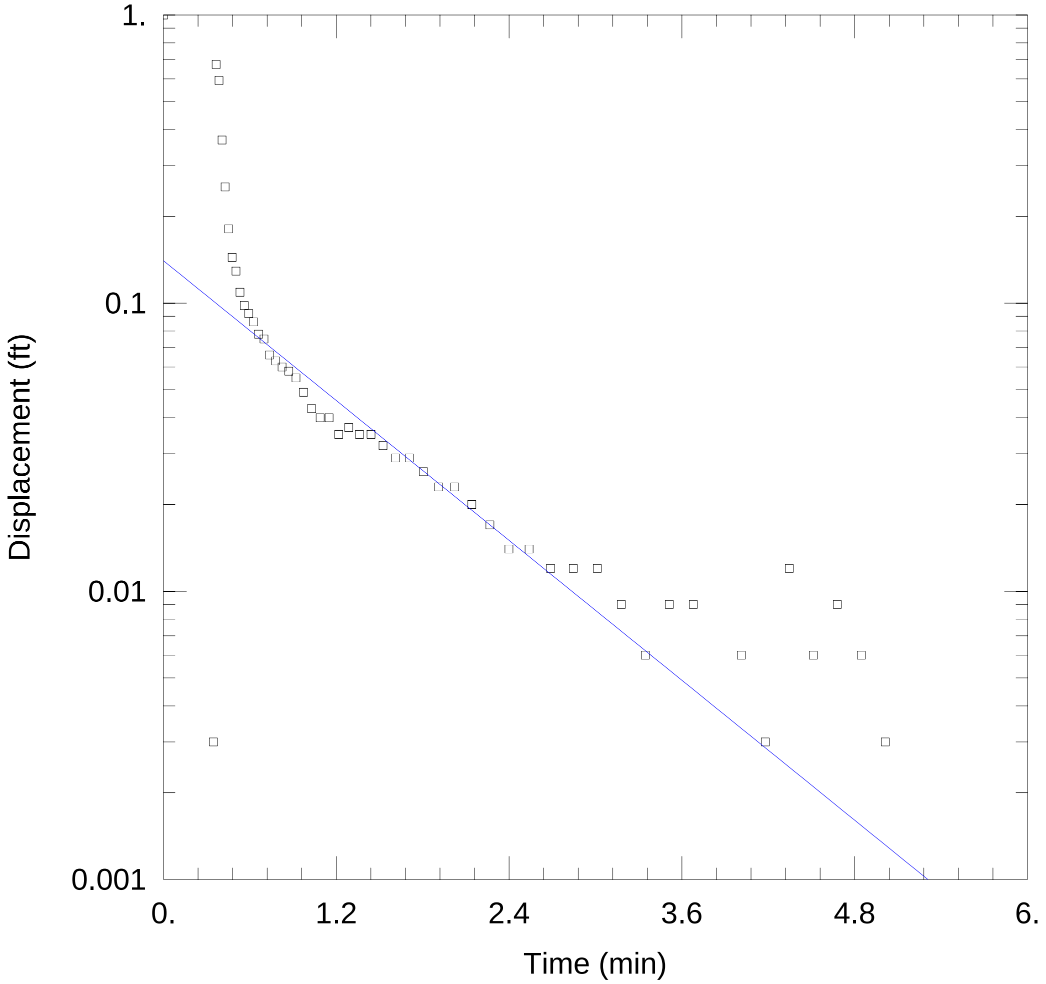
WELL DATA (MW-3)

Initial Displacement: 1. ft
Total Well Penetration Depth: 3.77 ft
Casing Radius: 0.083 ft
Static Water Column Height: 3.77 ft
Screen Length: 10. ft
Wellbore Radius: 0.166 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.001349 ft/min
y0 = 0.1403 ft



MW-3-RISING 1

Data Set: P:\...\MW_3.aqt

Date: 11/19/07 Time: 12:49:26

PROJECT INFORMATION

Company: MACTEC
Client: NYSDEC
Location: ATRS-DC
Test Well: MW-3-1
Test Date: 8/29/07

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

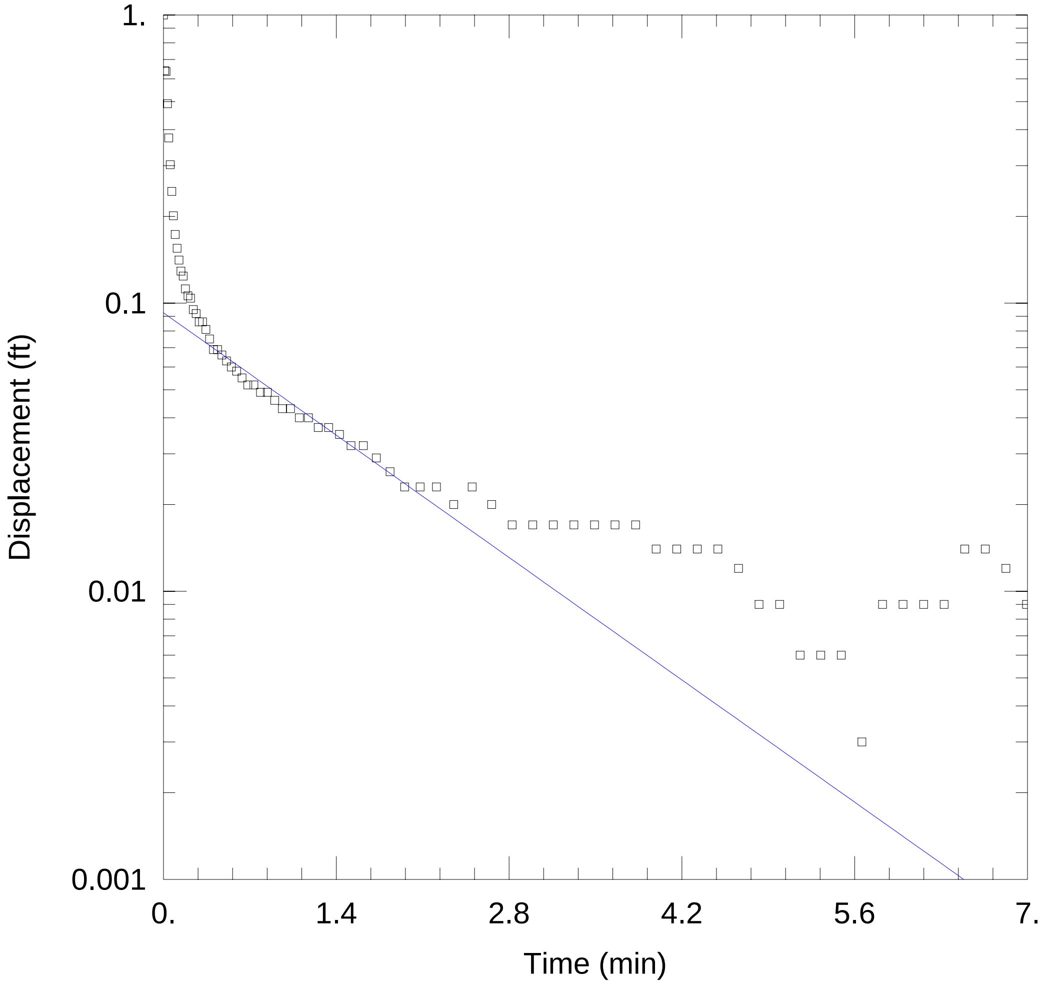
WELL DATA (MW-3)

Initial Displacement: 1. ft
Total Well Penetration Depth: 3.77 ft
Casing Radius: 0.083 ft
Static Water Column Height: 3.77 ft
Screen Length: 10. ft
Wellbore Radius: 0.166 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev

K = 0.002498 ft/min
y0 = 0.1403 ft



MW-3-RISING 2

Data Set: P:\...\MW_3.aqt

Date: 11/19/07 Time: 12:55:03

PROJECT INFORMATION

Company: MACTEC
Client: NYSDEC
Location: ATRS-DC
Test Well: MW-3-2
Test Date: 8/29/07

AQUIFER DATA

Saturated Thickness: 30. ft Anisotropy Ratio (Kz/Kr): 1.

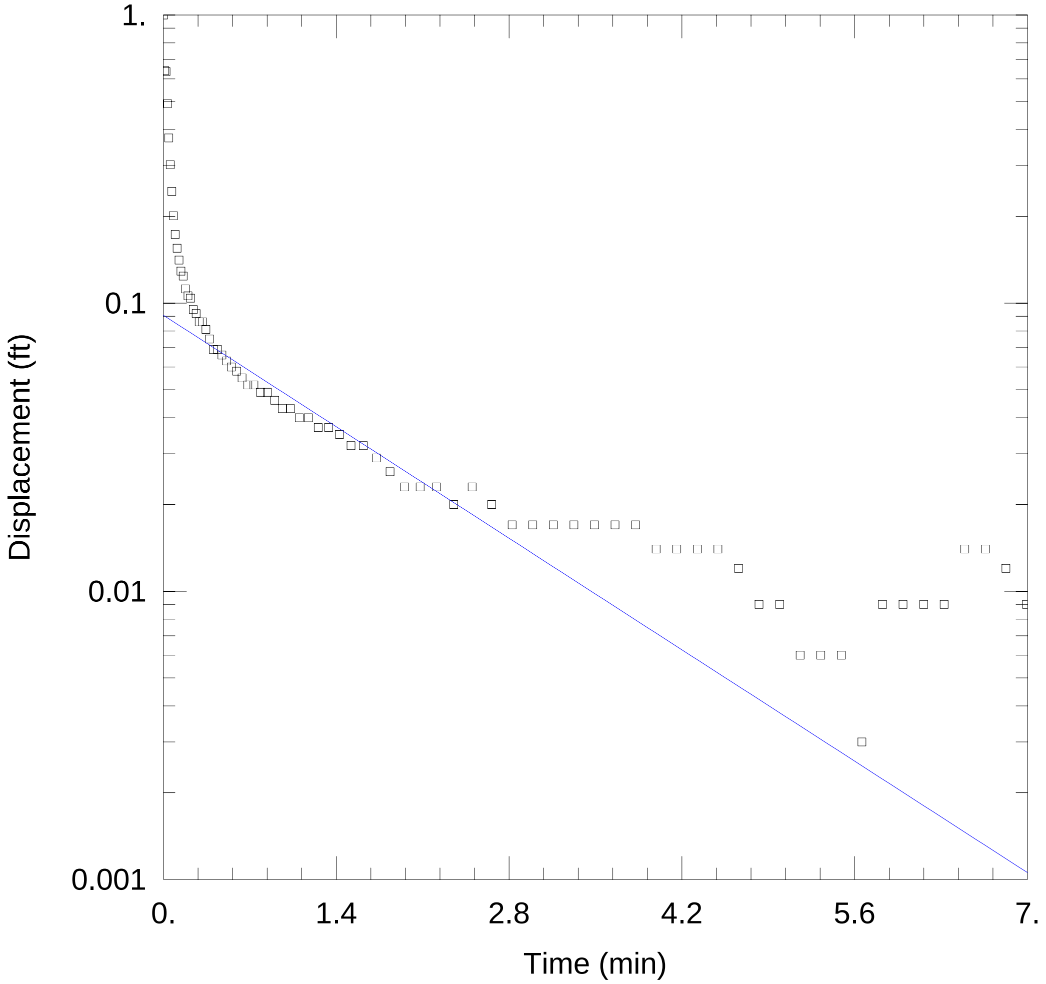
WELL DATA (MW-3)

Initial Displacement: 1. ft
Total Well Penetration Depth: 3.77 ft
Casing Radius: 0.083 ft
Static Water Column Height: 3.77 ft
Screen Length: 10. ft
Wellbore Radius: 0.166 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.001007 ft/min y0 = 0.09251 ft



MW-3-RISING 2

Data Set: P:\...\MW_3.aqt
Date: 11/19/07
Time: 12:56:07

PROJECT INFORMATION

Company: MACTEC
Client: NYSDEC
Location: ATRS-DC
Test Well: MW-3-2
Test Date: 8/29/07

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

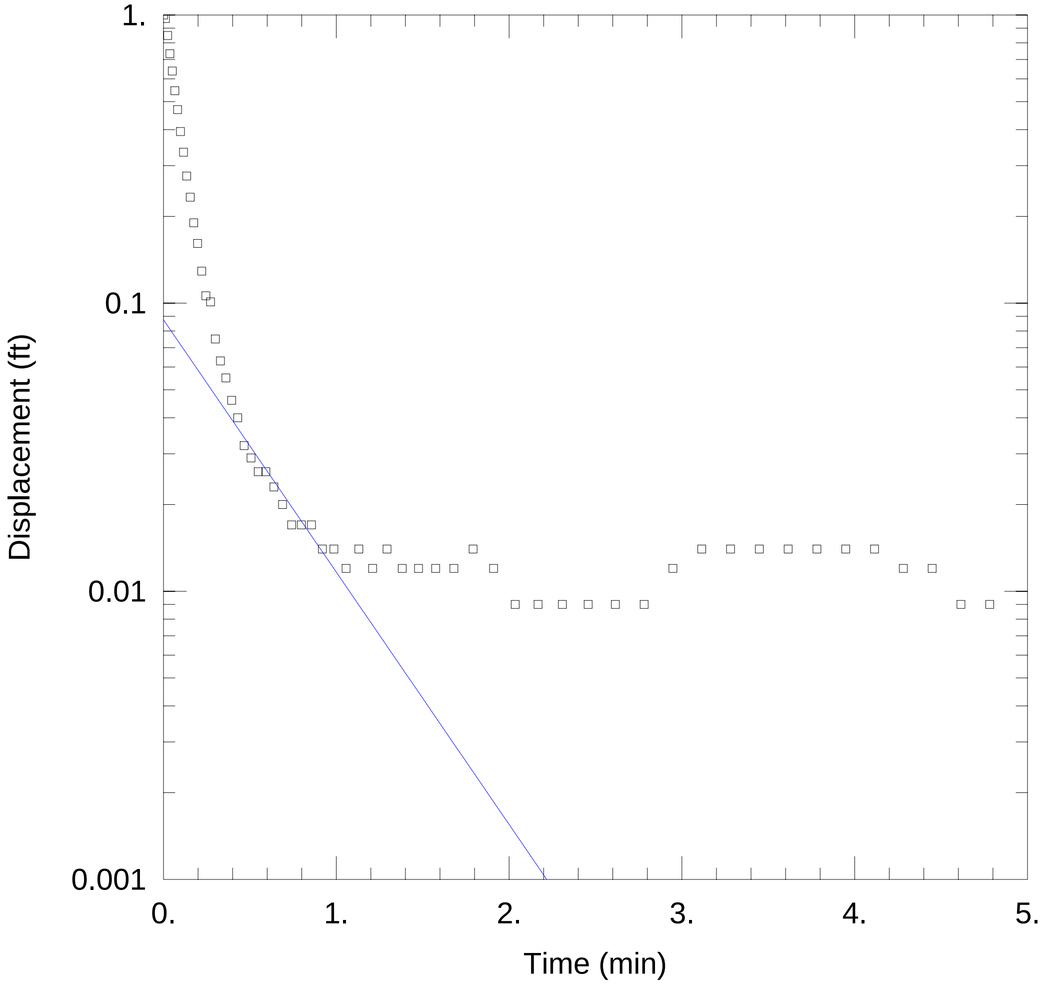
WELL DATA (MW-3)

Initial Displacement: 1. ft
Total Well Penetration Depth: 3.77 ft
Casing Radius: 0.083 ft
Static Water Column Height: 3.77 ft
Screen Length: 10. ft
Wellbore Radius: 0.166 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev

K = 0.001707 ft/min
y0 = 0.09069 ft



MW-9-RISING 1

Data Set: P:\...\MW_9.aqt
Date: 11/19/07 Time: 13:01:53

PROJECT INFORMATION

Company: MACTEC
Client: NYSDEC
Location: ATRS-DC
Test Well: MW-9-1
Test Date: 8/29/07

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

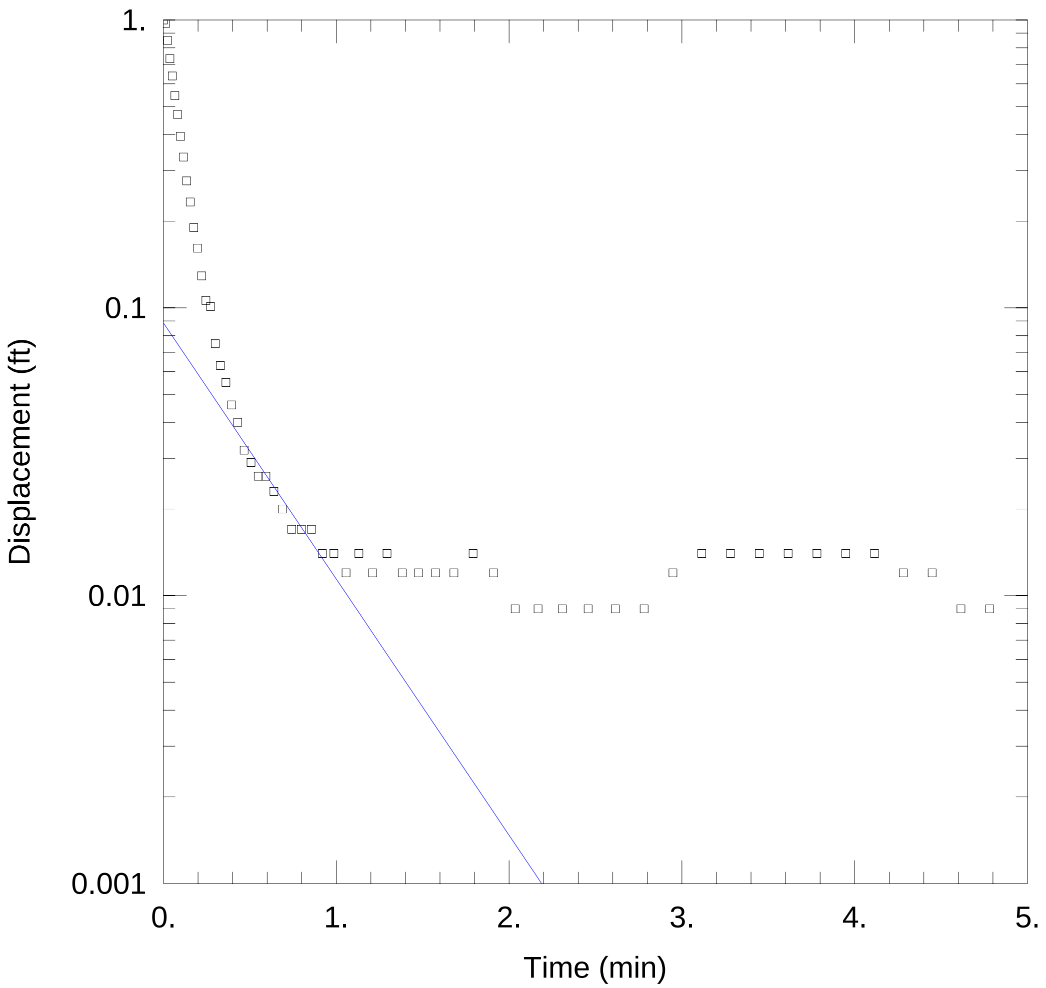
WELL DATA (MW-9)

Initial Displacement: 1. ft
Total Well Penetration Depth: 4.73 ft
Casing Radius: 0.083 ft
Static Water Column Height: 4.73 ft
Screen Length: 10. ft
Wellbore Radius: 0.166 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.003071 ft/min
y0 = 0.08749 ft



MW-9-RISING 1

Data Set: P:\...\MW_9.aqt
Date: 11/19/07 Time: 13:01:08

PROJECT INFORMATION

Company: MACTEC
Client: NYSDEC
Location: ATRS-DC
Test Well: MW-9-1
Test Date: 8/29/07

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

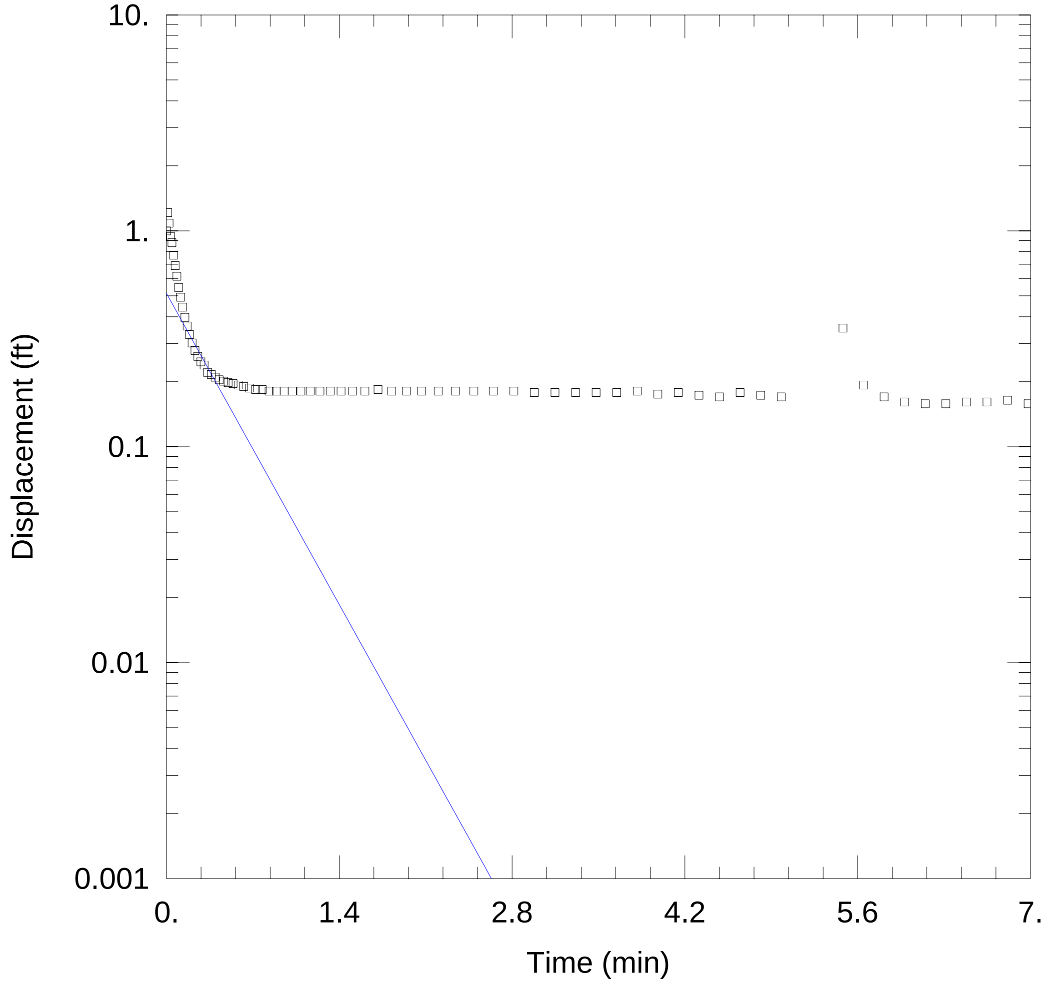
WELL DATA (MW-9)

Initial Displacement: 1. ft
Total Well Penetration Depth: 4.73 ft
Casing Radius: 0.083 ft
Static Water Column Height: 4.73 ft
Screen Length: 10. ft
Wellbore Radius: 0.166 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev

K = 0.005495 ft/min
y0 = 0.08851 ft



MW-9-RISING 2

Data Set: P:\...\MW_9.aqt
Date: 11/19/07 Time: 13:06:41

PROJECT INFORMATION

Company: MACTEC
Client: NYSDEC
Location: ATRS-DC
Test Well: MW-9-2
Test Date: 8/29/07

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

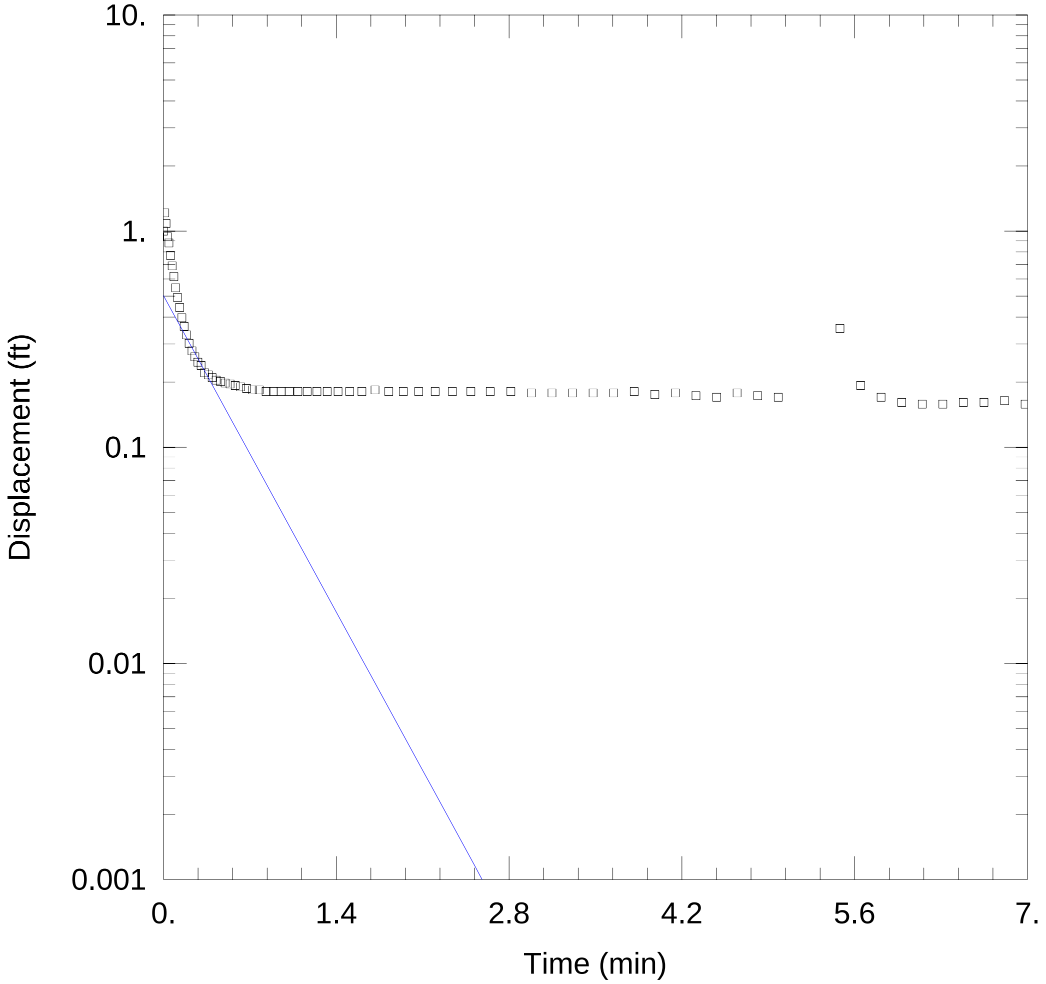
WELL DATA (MW-9)

Initial Displacement: 1. ft
Total Well Penetration Depth: 4.73 ft
Casing Radius: 0.083 ft
Static Water Column Height: 4.73 ft
Screen Length: 10. ft
Wellbore Radius: 0.166 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.003611 ft/min
y0 = 0.513 ft



MW-9-RISING 2

Data Set: P:\...\MW_9.aqt
Date: 11/19/07 Time: 13:09:15

PROJECT INFORMATION

Company: MACTEC
Client: NYSDEC
Location: ATRS-DC
Test Well: MW-9-2
Test Date: 8/29/07

AQUIFER DATA

Saturated Thickness: 30. ft Anisotropy Ratio (Kz/Kr): 1.

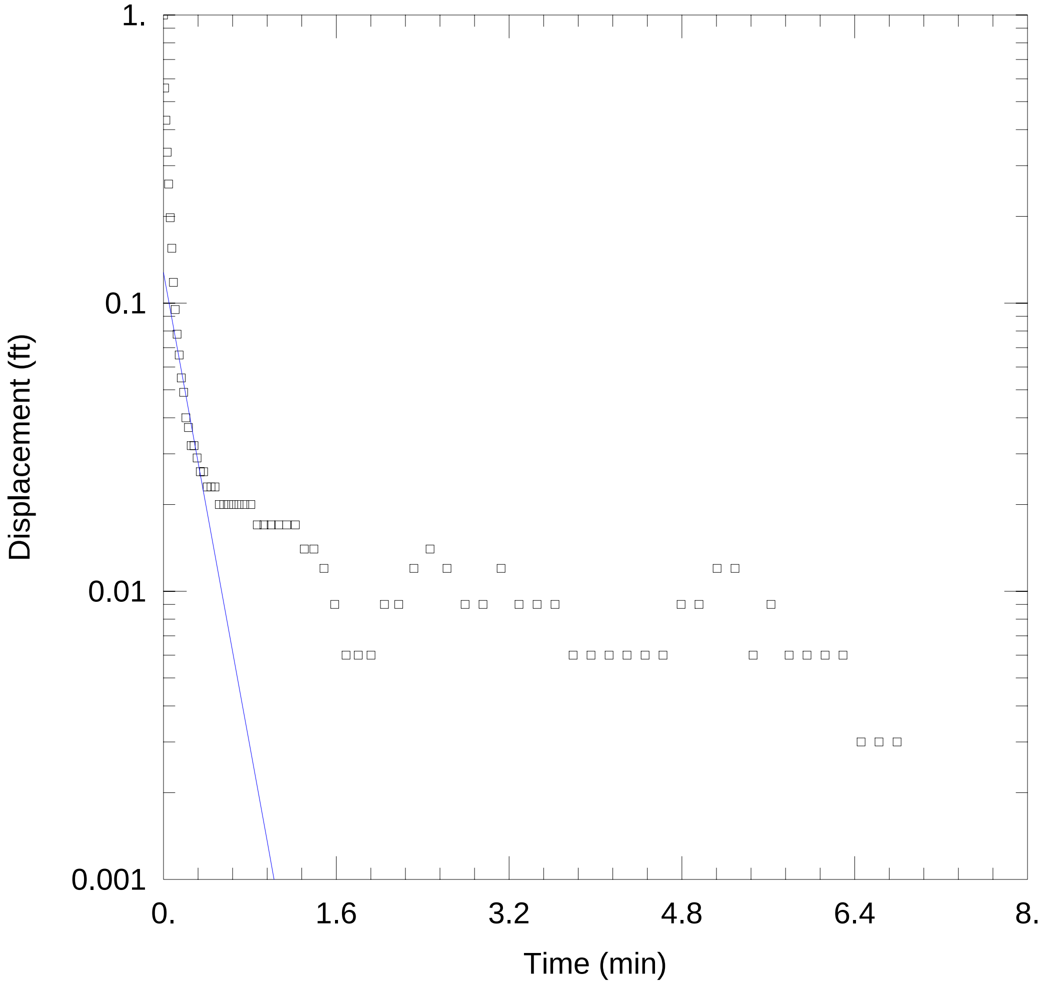
WELL DATA (MW-9)

Initial Displacement: 1. ft
Total Well Penetration Depth: 4.73 ft
Casing Radius: 0.083 ft
Static Water Column Height: 4.73 ft
Screen Length: 10. ft
Wellbore Radius: 0.166 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 0.006462 ft/min y0 = 0.5028 ft



DCMW-3-RISING 1

Data Set: P:\...\DCMW_3.aqt

Date: 11/19/07 Time: 12:31:05

PROJECT INFORMATION

Company: MACTEC
Client: NYSDEC
Location: ATRS-DC
Test Well: DCMW-3-1
Test Date: 8/29/07

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

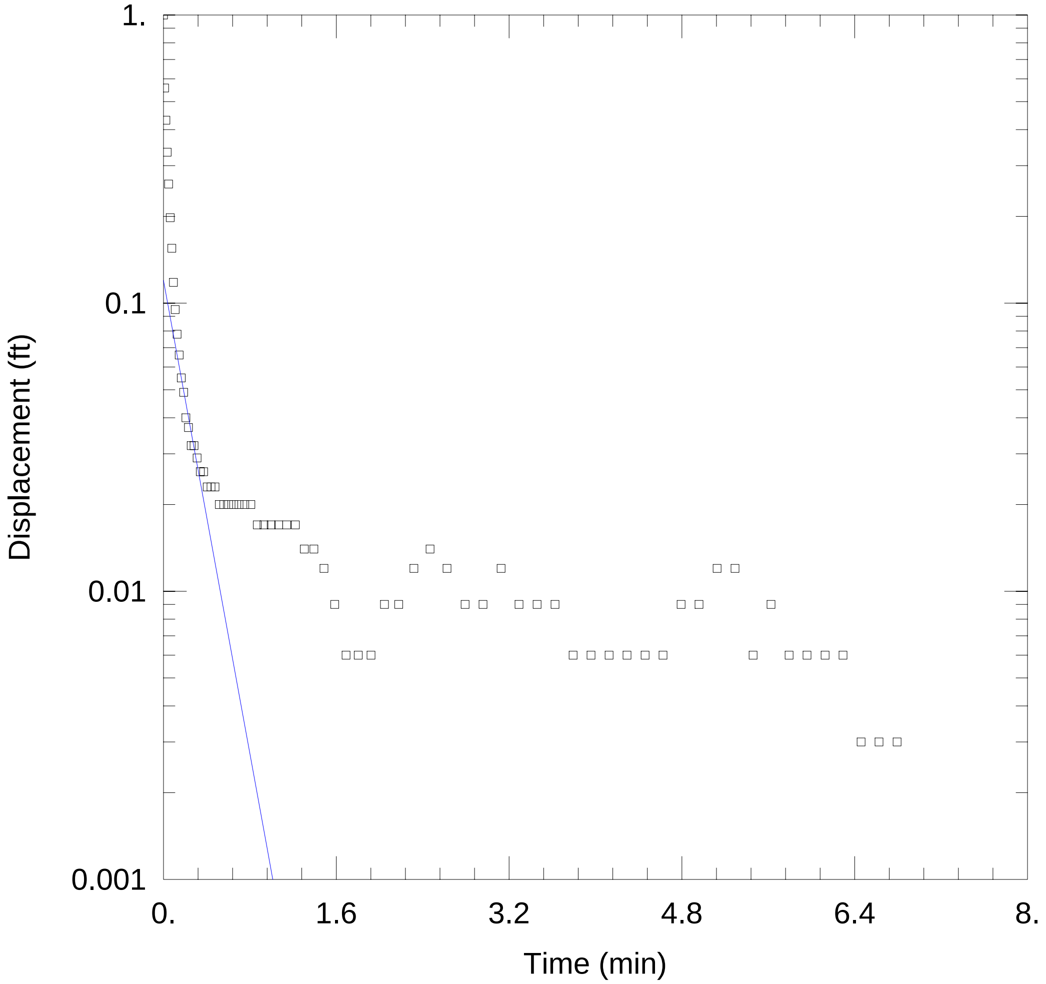
WELL DATA (DCMW-3)

Initial Displacement: 1. ft
Static Water Column Height: 12.28 ft
Total Well Penetration Depth: 12.28 ft
Screen Length: 10. ft
Casing Radius: 0.083 ft
Wellbore Radius: 0.166 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.008756 ft/min
y0 = 0.1275 ft



DCMW-3-RISING 1

Data Set: P:\...\DCMW_3.aqt
Date: 11/19/07 Time: 12:28:26

PROJECT INFORMATION

Company: MACTEC
Client: NYSDEC
Location: ATRS-DC
Test Well: DCMW-3-1
Test Date: 8/29/07

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

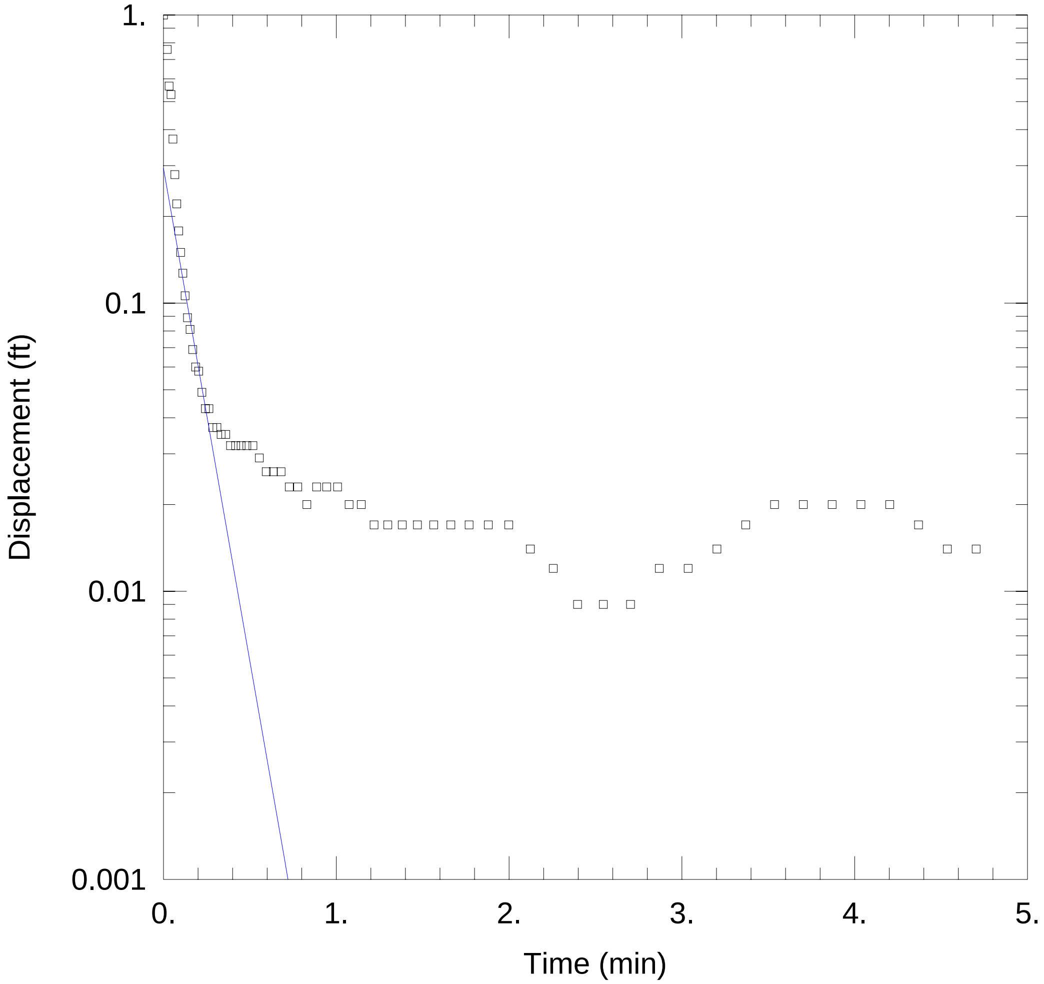
WELL DATA (DCMW-3)

Initial Displacement: 1. ft
Total Well Penetration Depth: 12.28 ft
Casing Radius: 0.083 ft
Static Water Column Height: 12.28 ft
Screen Length: 10. ft
Wellbore Radius: 0.166 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev

K = 0.01268 ft/min
y0 = 0.1198 ft



DCMW-3-RISING 2

Data Set: P:\...\DCMW_3.aqt
Date: 11/19/07 Time: 12:34:57

PROJECT INFORMATION

Company: MACTEC
Client: NYSDEC
Location: ATRS-DC
Test Well: DCMW-3-2
Test Date: 8/29/07

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

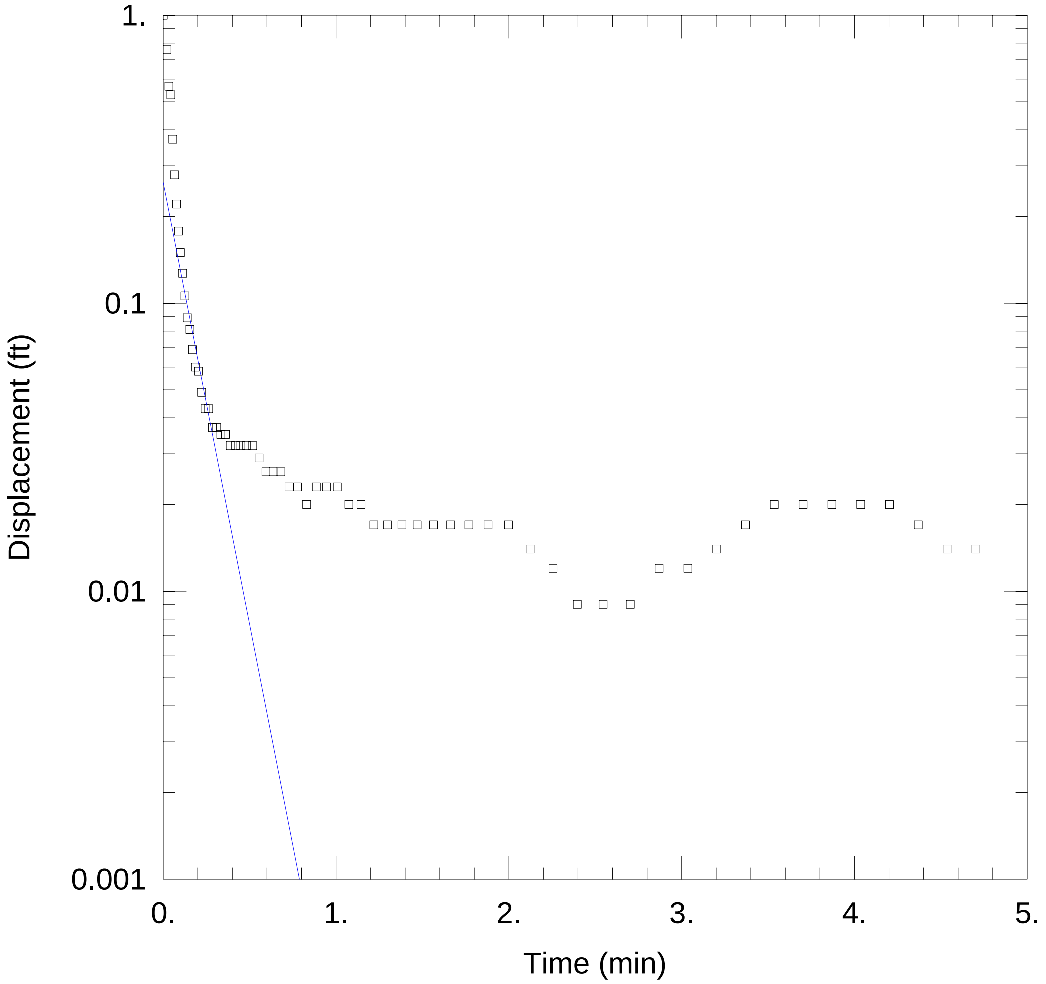
WELL DATA (DCMW-3)

Initial Displacement: 1. ft
Total Well Penetration Depth: 12.28 ft
Casing Radius: 0.083 ft
Static Water Column Height: 12.28 ft
Screen Length: 10. ft
Wellbore Radius: 0.166 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.01458 ft/min
y0 = 0.2934 ft



DCMW-3-RISING 2

Data Set: P:\...\DCMW_3.aqt

Date: 11/19/07 Time: 13:24:54

PROJECT INFORMATION

Company: MACTEC
Client: NYSDEC
Location: ATRS-DC
Test Well: DCMW-3-2
Test Date: 8/29/07

AQUIFER DATA

Saturated Thickness: 30. ft Anisotropy Ratio (Kz/Kr): 1.

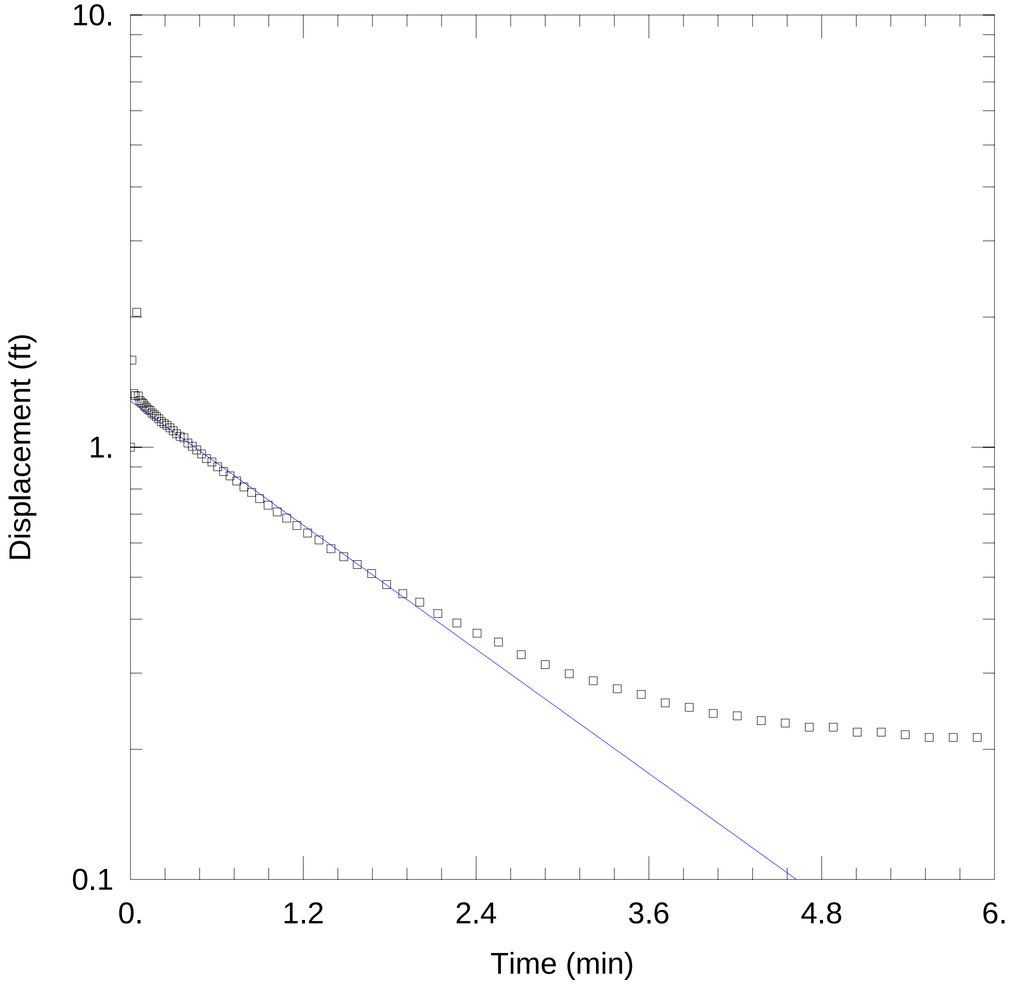
WELL DATA (DCMW-3)

Initial Displacement: 1. ft
Total Well Penetration Depth: 12.28 ft
Casing Radius: 0.083 ft
Static Water Column Height: 12.28 ft
Screen Length: 10. ft
Wellbore Radius: 0.166 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 0.01896 ft/min y0 = 0.2622 ft



DCMW-4-RISING 1

Data Set: P:\...\DCMW_4.aqt
Date: 11/19/07 | Time: 11:48:54

PROJECT INFORMATION

Company: MACTEC
Client: NYSDEC
Location: ATRS-DC
Test Well: DCMW-4-1
Test Date: 8/29/07

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

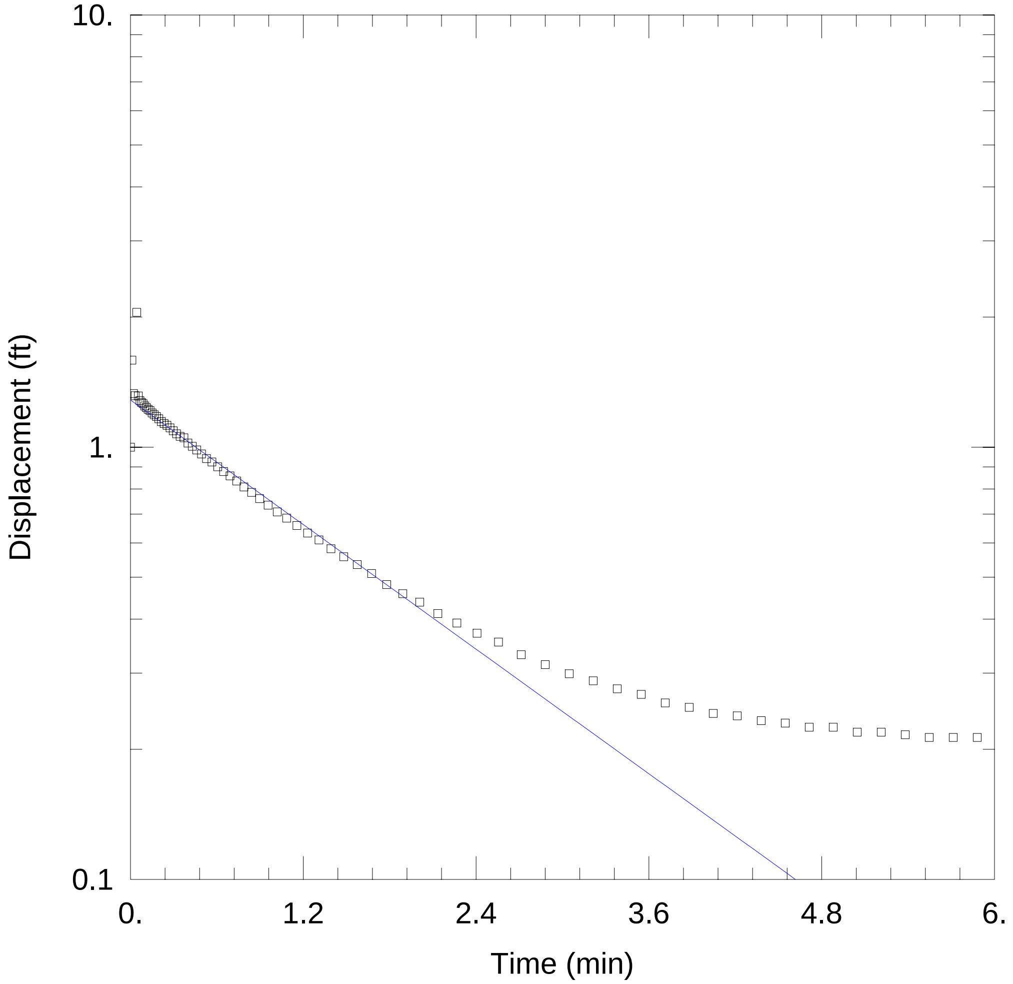
WELL DATA (DCMW-4)

Initial Displacement: 1. ft
Total Well Penetration Depth: 2.78 ft
Casing Radius: 0.083 ft
Static Water Column Height: 2.78 ft
Screen Length: 10. ft
Wellbore Radius: 0.166 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.0007326 ft/min
y0 = 1.278 ft



DCMW-4-RISING 1

Data Set: P:\...\DCMW_4.aqt
Date: 11/19/07 Time: 11:50:33

PROJECT INFORMATION

Company: MACTEC
Client: NYSDEC
Location: ATRS-DC
Test Well: DCMW-4-1
Test Date: 8/29/07

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

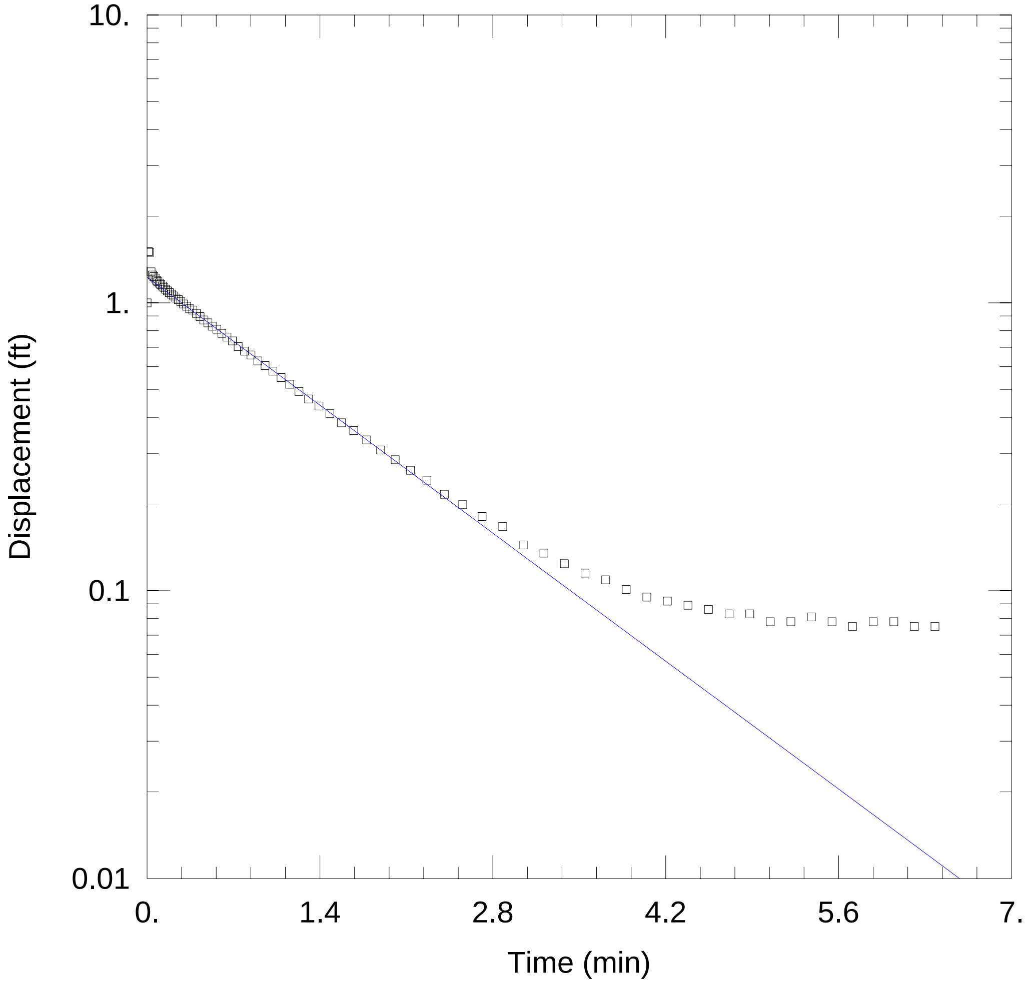
WELL DATA (DCMW-4)

Initial Displacement: 1. ft
Total Well Penetration Depth: 2.78 ft
Casing Radius: 0.083 ft
Static Water Column Height: 2.78 ft
Screen Length: 10. ft
Wellbore Radius: 0.166 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev

K = 0.001483 ft/min
y0 = 1.285 ft



DCMW-4-RISING 2

Data Set: P:\...\DCMW_4.aqt
Date: 11/19/07 | Time: 11:29:31

PROJECT INFORMATION

Company: MACTEC
Client: NYSDEC
Location: ATRS-DC
Test Well: DCMW-4-2
Test Date: 8/29/07

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

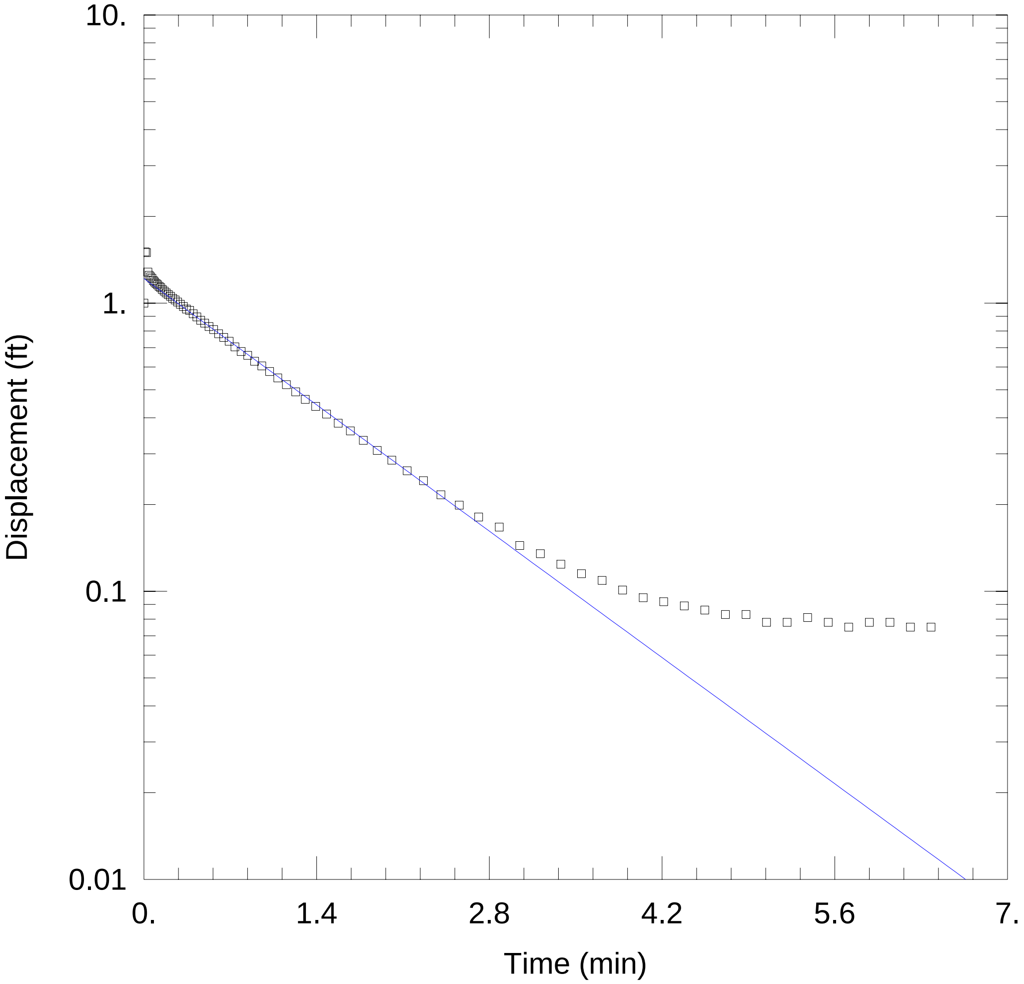
WELL DATA (DCMW-4)

Initial Displacement: 1. ft
Total Well Penetration Depth: 2.78 ft
Casing Radius: 0.083 ft
Static Water Column Height: 2.78 ft
Screen Length: 10. ft
Wellbore Radius: 0.166 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.0009719 ft/min
y0 = 1.227 ft



DCMW-4-RISING 2

Data Set: P:\...\DCMW_4.aqt
Date: 11/19/07 | Time: 11:37:22

PROJECT INFORMATION

Company: MACTEC
Client: NYSDEC
Location: ATRS-DC
Test Well: DCMW-4-2
Test Date: 8/29/07

AQUIFER DATA

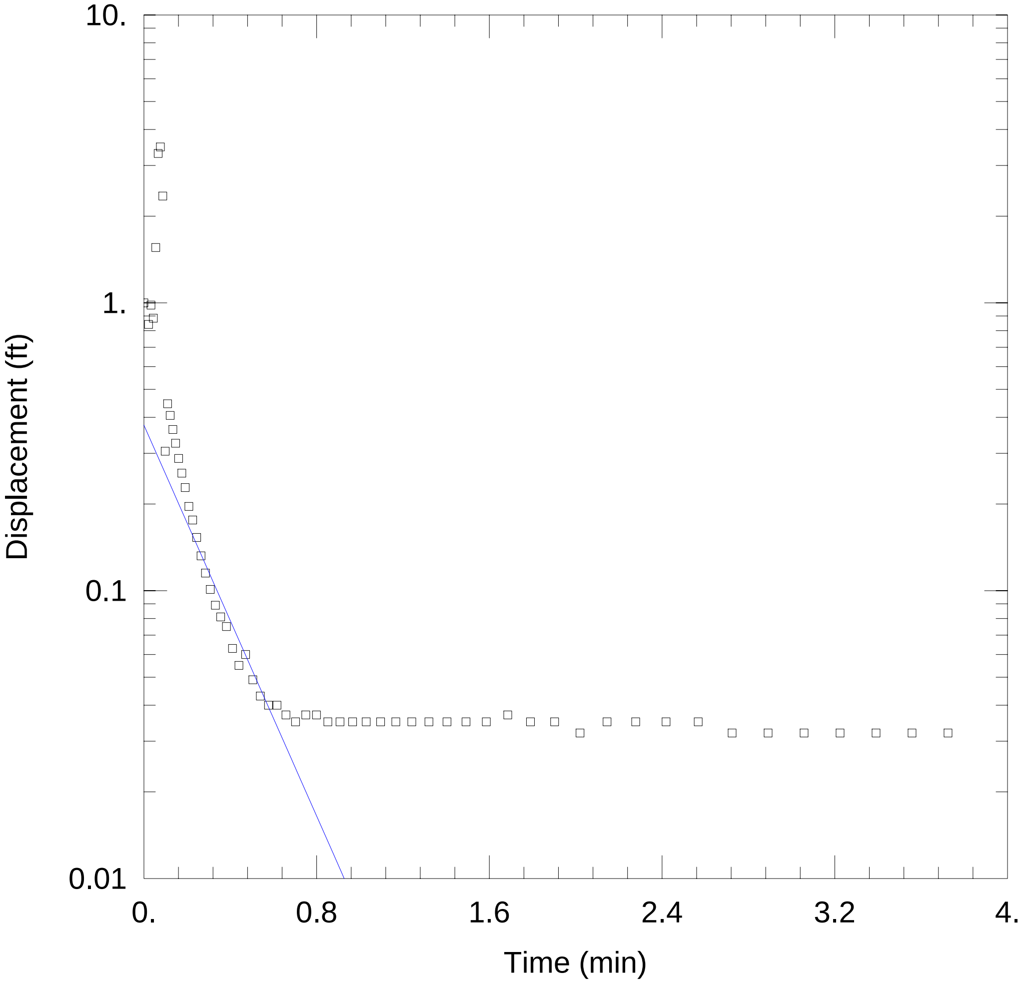
Saturated Thickness: 30. ft	Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DCMW-4)

Initial Displacement: 1. ft	Static Water Column Height: 2.78 ft
Total Well Penetration Depth: 2.78 ft	Screen Length: 10. ft
Casing Radius: 0.083 ft	Wellbore Radius: 0.166 ft
	Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined	Solution Method: Hvorslev
K = 0.001934 ft/min	y0 = 1.216 ft



DCMW-5-RISING 1

Data Set: P:\...\DCMW_5.aqt

Date: 11/19/07 Time: 12:04:29

PROJECT INFORMATION

Company: MACTEC
Client: NYSDEC
Location: ATRS-DC
Test Well: DCMW-5-1
Test Date: 8/29/07

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

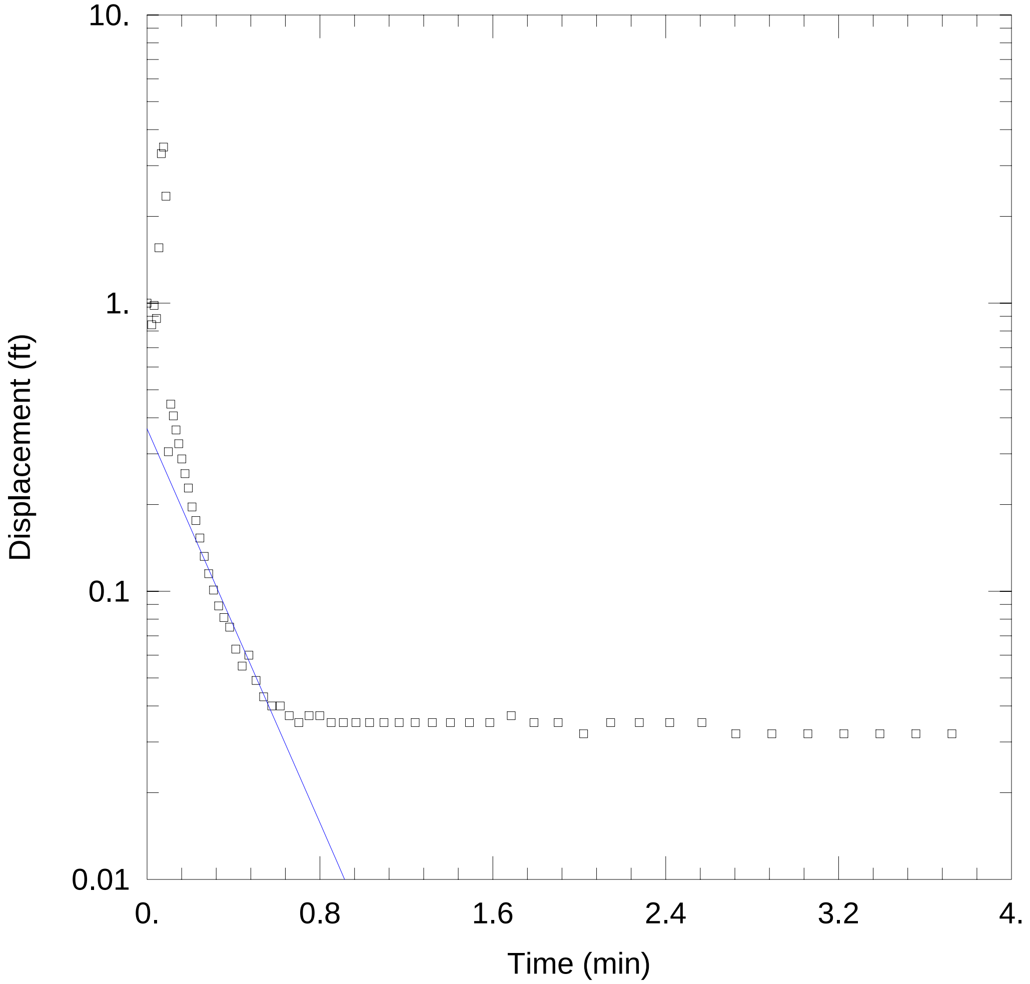
WELL DATA (DCMW-5)

Initial Displacement: 1. ft
Total Well Penetration Depth: 10.89 ft
Casing Radius: 0.083 ft
Static Water Column Height: 10.89 ft
Screen Length: 10. ft
Wellbore Radius: 0.166 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.007072 ft/min
y0 = 0.3757 ft



DCMW-5-RISING 1

Data Set: P:\...\DCMW_4.aqt
Date: 11/19/07
Time: 11:56:53

PROJECT INFORMATION

Company: MACTEC
Client: NYSDEC
Location: ATRS-DC
Test Well: DCMW-5-1
Test Date: 8/29/07

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

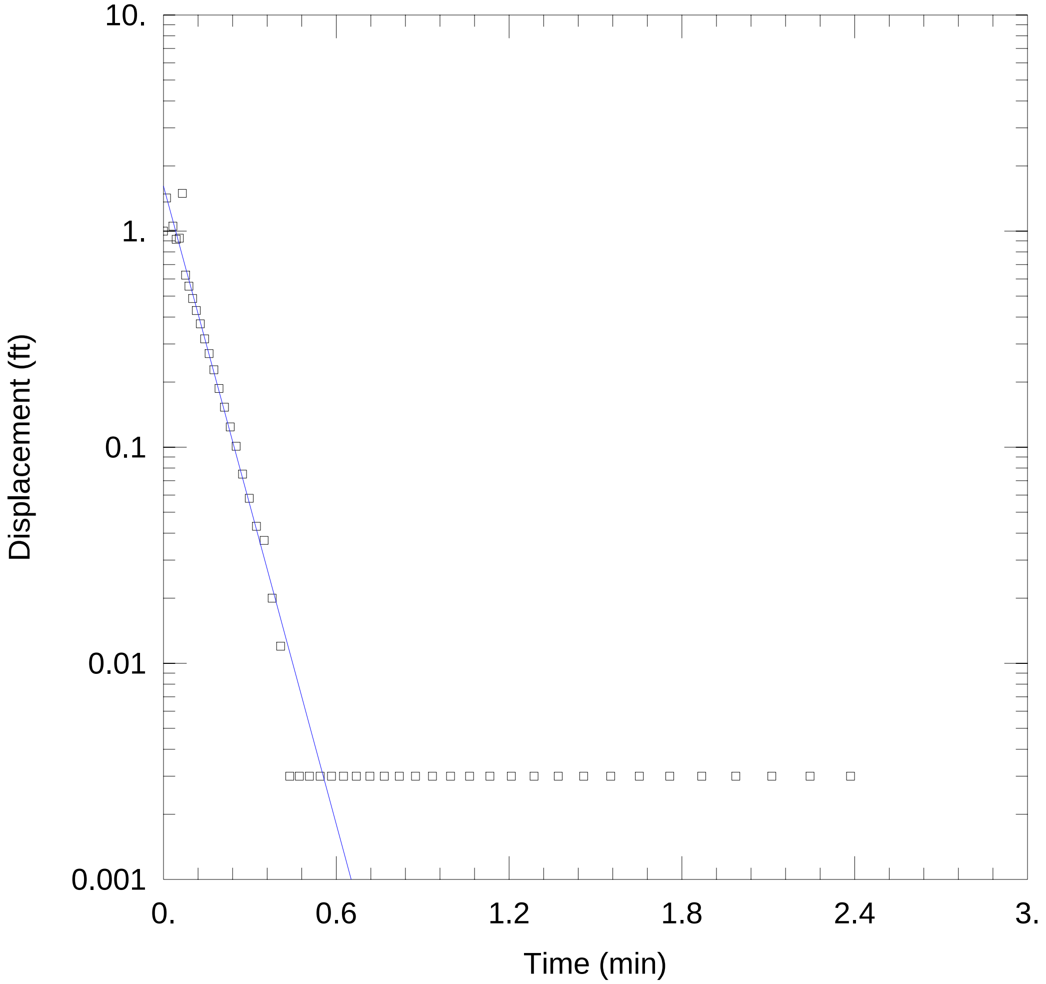
WELL DATA (DCMW-5)

Initial Displacement: 1. ft
Total Well Penetration Depth: 10.89 ft
Casing Radius: 0.083 ft
Static Water Column Height: 10.89 ft
Screen Length: 10. ft
Wellbore Radius: 0.166 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev

K = 0.01056 ft/min
y0 = 0.366 ft



DCMW-5-RISING 2

Data Set: P:\...\DCMW_5.aqt

Date: 11/19/07 Time: 12:10:10

PROJECT INFORMATION

Company: MACTEC
Client: NYSDEC
Location: ATRS-DC
Test Well: DCMW-5-2
Test Date: 8/29/07

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

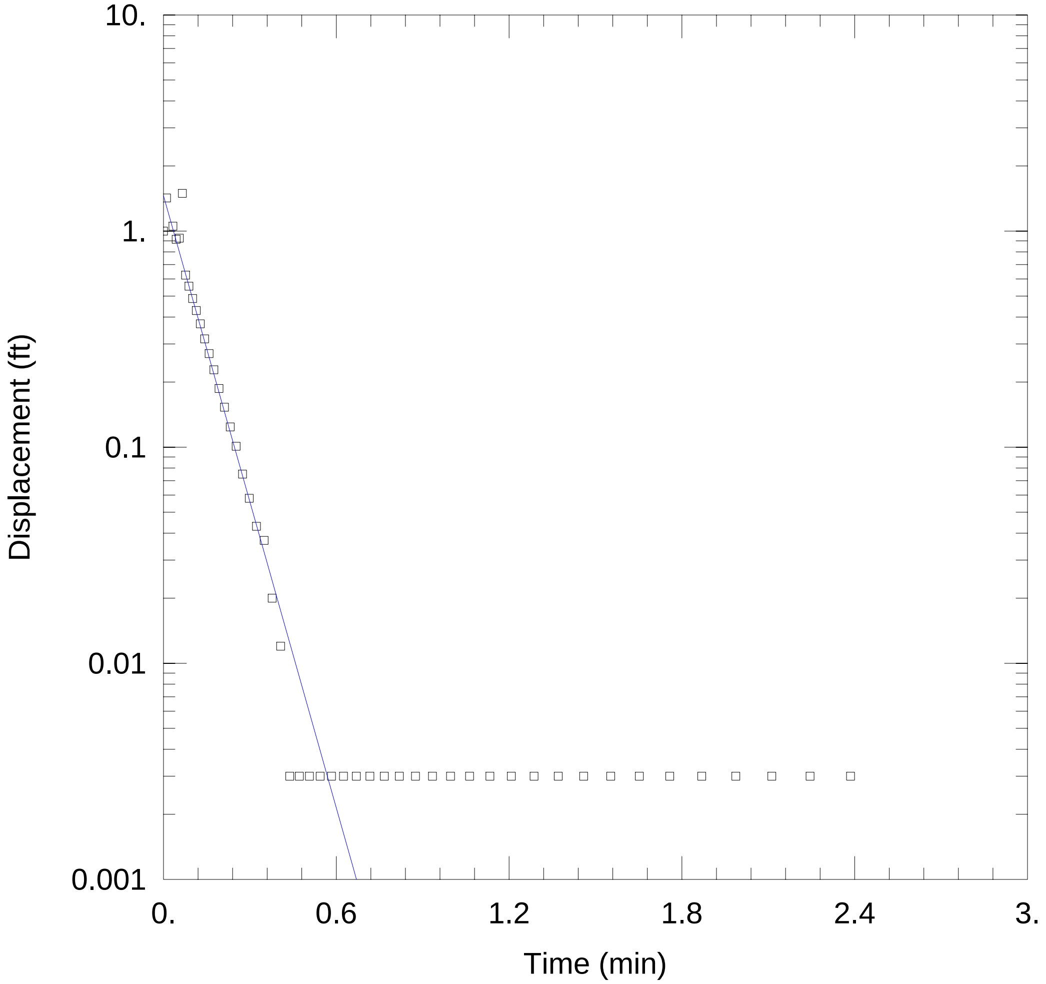
WELL DATA (DCMW-5)

Initial Displacement: 1. ft
Total Well Penetration Depth: 10.89 ft
Casing Radius: 0.083 ft
Static Water Column Height: 10.89 ft
Screen Length: 10. ft
Wellbore Radius: 0.166 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.02051 ft/min
y0 = 1.613 ft



DCMW-5-RISING 2

Data Set: P:\...\DCMW_5.aqt
Date: 11/19/07
Time: 12:12:37

PROJECT INFORMATION

Company: MACTEC
Client: NYSDEC
Location: ATRS-DC
Test Well: DCMW-5-2
Test Date: 8/29/07

AQUIFER DATA

Saturated Thickness: 30. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (DCMW-5)

Initial Displacement: 1. ft
Total Well Penetration Depth: 10.89 ft
Casing Radius: 0.083 ft
Static Water Column Height: 10.89 ft
Screen Length: 10. ft
Wellbore Radius: 0.166 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Hvorslev

K = 0.02916 ft/min
y0 = 1.456 ft

APPENDIX E

DATA USABILITY SUMMARY REPORTS

DATA USABILITY SUMMARY REPORT
DIAMOND CLEANERS SITE
AUGUST 2008 GROUNDWATER SAMPLING EVENT
ROUND 4
ELMIRA, NEW YORK

1.0 Introduction:

Groundwater samples were collected at the Diamond Cleaners Site in Elmira, New York in August 2008 and submitted for off-site laboratory analyses. Samples were analyzed by Chemtech Laboratory in Mountainside, NJ. A listing of samples included in this investigation is presented in Table 1. A summary of the analytical results is presented in Tables 2. Groundwater samples were analyzed for volatile organic compounds (VOCs) by USEPA Method SW-846 8260B.

Deliverables for the off-site laboratory analyses included a Category B deliverable as defined in the New York State Department of Environmental Conservation (NYSDEC) Analytical Services Protocols (NYSDEC, 2005).

A project chemist review was completed based on NYSDEC Division of Environmental Remediation guidance for Data Usability Summary Reports (NYSDEC, 2002). Laboratory QC limits were used during the data evaluation unless noted otherwise. The project chemist review included evaluations of sample collection, data package completeness, holding times, QC data (blanks, instrument calibrations, duplicates, surrogate recovery, and spike recovery), data transcription, electronic data reporting, calculations, and data qualification. With the exception of the items discussed below, results are interpreted to be usable as reported by the laboratory. The following laboratory or data validation qualifiers are used in the final data presentation.

U = target analyte is not detected at the reported detection limit
J = concentration is estimated
UJ = target analyte is not detected at the reported detection limit and is estimated
D = result is reported from a dilution analysis

Results are interpreted to be usable as reported by the laboratory unless discussed in the following sections.

2.0 Groundwater Samples

2.1 Volatile Organic Compounds

Continuing Calibration

The continuing calibration analyzed on August 22, 2008 had a percent difference greater than the control limit of 25 for tetrachloroethene (26). The following table presents the associated samples that were qualified estimated (J/UJ) for tetrachloroethene:

field_sample_id	qc_code	lab_sample_id	param_name	final_result (µg/L)	final_qualifier
DCGW00201508	FS	Z4127-10DL	Tetrachloroethene	280	DJ
DCGW01301508	FS	Z4127-18	Tetrachloroethene	0.68	UJ
DCMW00401708D	FD	Z4127-04DL	Tetrachloroethene	1600	DJ
DCMW00401708	FS	Z4127-03DL	Tetrachloroethene	1300	DJ
DCMW00502108	FS	Z4127-01DL	Tetrachloroethene	590	DJ
DCMW01001808	FS	Z4127-15DL	Tetrachloroethene	370	DJ

The continuing calibration analyzed on August 21, 2008 had a percent difference greater than the control limit of 25 for acetone (29). The following table presents the associated samples with reporting limits that were qualified estimated (UJ) for acetone:

field_sample_id	qc_code	lab_sample_id	param_name	final_result (µg/L)	final_qualifier
DCGW00201508	FS	Z4127-10	Acetone	2.7	UJ
DCGW01001408	FS	Z4127-09	Acetone	2.7	UJ
DCGW01401308	FS	Z4127-13	Acetone	2.7	UJ
DCMW00102008	FS	Z4127-11	Acetone	2.7	UJ
DCMW00302008	FS	Z4127-14	Acetone	2.7	UJ
ATGW00401508	FS	Z4127-16	Acetone	2.7	UJ
ATMW00801508	FS	Z4127-19	Acetone	2.7	UJ
ATMW00901508	FS	Z4127-20	Acetone	2.7	UJ
DCMW00601608	FS	Z4127-12	Acetone	2.7	UJ
DCMW00701708	FS	Z4127-08	Acetone	2.7	UJ
DCMW00901708	FS	Z4127-17	Acetone	2.7	UJ
DCMW01001808	FS	Z4127-15	Acetone	2.7	UJ
DCMW01101908	FS	Z4127-21	Acetone	2.7	UJ

Matrix Spike/Matrix Spike Duplicate

A matrix spike and matrix spike duplicate analysis was performed on sample DCMW00801808 (lab ID: Z4127-05). Numerous analytes had percent recoveries above the laboratory upper control limit; however, there were no positive detections reported in the un-spike sample and no qualifiers were added. Acetone (142%) was recovered above the control limit of 136. Acetone was reported at 5.8 µg/L in sample DCMW00801808 and was qualified estimated (J). The relative percent difference (RPD) between the matrix spike and matrix spike duplicate percent recovery was above the lab control limit of 20 for methyl tertbutyl ether (32). Methyl tertbutyl ether was qualified estimated in sample DCMW00801808.

Dilution Analysis

A sub-set of samples in the following table were analyzed at a dilution due to high concentrations of one or more of the following target compounds: tetrachloroethene, cis-1,2-dichloroethene, and vinyl chloride. The un-diluted and dilution analyses were combined in the final data set to report one analytical result for each analyte reported by method 8260B.

field_sample_id	qc_code	lab_sample_id
DCGW00201508	FS	Z4127-10
DCMW00202108	FS	Z4127-02
DCMW00401708D	FD	Z4127-04
DCMW00401708	FS	Z4127-03
DCMW00502108	FS	Z4127-01
ATMW00901508	FS	Z4127-20
DCMW00701708	FS	Z4127-08
DCMW00801808	FS	Z4127-05
DCMW00901708	FS	Z4127-17
DCMW01001808	FS	Z4127-15

Tentatively Identified Compounds

Tentatively identified compounds (TICs) were reported by the laboratory. TICs reported in samples are presented in Table 3. Only samples that had TICs reported are included on Table 3. If a sample is not listed, no TICs were reported.

TABLE 1
SUMMARY OF SAMPLES

SDG	Field Sample ID	Lab Sample ID	Collection Date	Analysis Method	Parameter	Type
Z4127	DCMW00502108	Z4127-01	8/12/2008	SW8260	VOC	FS
Z4127	DCMW00202108	Z4127-02	8/12/2008	SW8260	VOC	FS
Z4127	DCMW00401708	Z4127-03	8/12/2008	SW8260	VOC	FS
Z4127	DCMW00401708D	Z4127-04	8/12/2008	SW8260	VOC	FD
Z4127	DCMW00801808	Z4127-05	8/12/2008	SW8260	VOC	FS
Z4127	DCMW00701708	Z4127-08	8/12/2008	SW8260	VOC	FS
Z4127	DCGW01001408	Z4127-09	8/12/2008	SW8260	VOC	FS
Z4127	DCGW00201508	Z4127-10	8/12/2008	SW8260	VOC	FS
Z4127	DCMW00102008	Z4127-11	8/13/2008	SW8260	VOC	FS
Z4127	DCMW00601608	Z4127-12	8/13/2008	SW8260	VOC	FS
Z4127	DCGW01401308	Z4127-13	8/13/2008	SW8260	VOC	FS
Z4127	DCMW00302008	Z4127-14	8/13/2008	SW8260	VOC	FS
Z4127	DCMW01001808	Z4127-15	8/13/2008	SW8260	VOC	FS
Z4127	ATGW00401508	Z4127-16	8/13/2008	SW8260	VOC	FS
Z4127	DCMW00901708	Z4127-17	8/13/2008	SW8260	VOC	FS
Z4127	DCGW01301508	Z4127-18	8/14/2008	SW8260	VOC	FS
Z4127	ATMW00801508	Z4127-19	8/14/2008	SW8260	VOC	FS
Z4127	ATMW00901508	Z4127-20	8/14/2008	SW8260	VOC	FS
Z4127	DCMW01101908	Z4127-21	8/14/2008	SW8260	VOC	FS
Z4127	TRIPBLANK	Z4127-22	8/14/2008	SW8260	VOC	TB

Notes: FS = Field Sample TB = Trip Blank FD = Field Duplicate

TABLE 3
Summary of Tentatively Identified Compounds

Field Sample ID	Lab Sample ID	CAS No.	Chemical Name	Result (µg/L)	Lab Qualifier
DCMW00701708	Z4127-08	TIC000108-67-8	Benzene, 1,3,5-trimethyl-	42	JN
DCMW00701708	Z4127-08	TIC000526-73-8	Benzene, 1,2,3-trimethyl-	66	JN
DCMW00701708	Z4127-08	TIC000611-14-3	Benzene, 1-ethyl-2-methyl-	28	JN
DCMW00701708	Z4127-08	TIC000620-14-4	Benzene, 1-ethyl-3-methyl-	38	JN
DCGW01301508	Z4127-18	TIC000488-23-3	Benzene, 1,2,3,4-tetramethyl-	7.2	JN
DCGW01301508	Z4127-18	TIC000565-59-3	Pentane, 2,3-dimethyl-	6.6	JN
DCGW01301508	Z4127-18	TIC000589-90-2	Cyclohexane, 1,4-dimethyl-	5.4	JN
DCGW01301508	Z4127-18	TIC003290-53-7	Benzene, (2-methyl-2-propenyl)-	5.2	JN
DCGW01301508	Z4127-18	TIC013632-94-5	Benzene, 1,4-diethyl-2-methyl-	7	JN

Notes:

JN = Presumptive evidence of the presence of the material at an estimated quantity.

Reference:

New York State Department of Environmental Conservation (NYSDEC), 2005. "Analytical Services Protocols"; July 2005.

New York State Department of Environmental Conservation (NYSDEC), 2002. "Technical Guidance for Site Investigation and Remediation-Appendix 2B"; Draft DER-10; Division of Environmental Remediation; December 2002.

Data Validator: Tige Cunningham

Signature Date October 7, 2008

Reviewed by: Quality Assurance Officer: Chris Ricardi, NRCC-EAC

Chris Ricardi

Signature Date: October 14, 2008

DATA USABILITY SUMMARY REPORT
AUGUST 2008 GROUNDWATER SAMPLING EVENT ROUND 4
Table 2

	Lab Sample Delivery Group		Z4127		Z4127		Z4127		Z4127		Z4127	
		Loc Name	ATGW-004		ATMW-008		ATMW-009		GW-002		GW-010	
	Field Sample Date		8/13/2008		8/14/2008		8/14/2008		8/12/2008		8/12/2008	
	Field Sample Id		ATGW00401508		ATMW00801508		ATMW00901508		DCGW00201508		DCGW01001408	
		Media	GW		GW		GW		GW		GW	
		Qc Code	FS		FS		FS		FS		FS	
Analysis	**Param Name**	**Units**	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
SW8260	1,1,1-Trichloroethane	ug/L	21		5		0.46	U	0.46	U	0.46	U
SW8260	1,1,2,2-Tetrachloroethane	ug/L	0.49	U	0.49	U	0.49	U	0.49	U	0.49	U
SW8260	1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/L	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U
SW8260	1,1,2-Trichloroethane	ug/L	0.52	U	0.52	U	0.52	U	0.52	U	0.52	U
SW8260	1,1-Dichloroethane	ug/L	3.5		1.9		0.55	U	0.55	U	0.55	U
SW8260	1,1-Dichloroethene	ug/L	1.4		0.55	U	0.55	U	0.55	U	0.55	U
SW8260	1,2,4-Trichlorobenzene	ug/L	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U
SW8260	1,2-Dibromo-3-chloropropane	ug/L	0.45	U	0.45	U	0.45	U	0.45	U	0.45	U
SW8260	1,2-Dibromoethane	ug/L	0.56	U	0.56	U	0.56	U	0.56	U	0.56	U
SW8260	1,2-Dichlorobenzene	ug/L	0.48	U	0.48	U	0.48	U	0.48	U	0.48	U
SW8260	1,2-Dichloroethane	ug/L	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U
SW8260	1,2-Dichloropropane	ug/L	0.56	U	0.56	U	0.56	U	0.56	U	0.56	U
SW8260	1,3-Dichlorobenzene	ug/L	0.45	U	0.45	U	0.45	U	0.45	U	0.45	U
SW8260	1,4-Dichlorobenzene	ug/L	0.43	U	0.43	U	0.43	U	0.43	U	0.43	U
SW8260	2-Butanone	ug/L	4.6	U	4.6	U	4.6	U	4.6	U	4.6	U
SW8260	2-Hexanone	ug/L	2.9	U	2.9	U	2.9	U	2.9	U	2.9	U
SW8260	4-Methyl-2-pentanone	ug/L	2.7	U	2.7	U	2.7	U	2.7	U	2.7	U
SW8260	Acetic acid, methyl ester	ug/L	0.92	U	0.92	U	0.92	U	0.92	U	0.92	U
SW8260	Acetone	ug/L	2.7	UJ	2.7	UJ	2.7	UJ	2.7	UJ	2.7	UJ
SW8260	Benzene	ug/L	1.1		0.52	U	0.52	U	0.52	U	0.52	U
SW8260	Bromodichloromethane	ug/L	0.59	U	0.59	U	0.59	U	0.59	U	0.59	U
SW8260	Bromoform	ug/L	0.42	U	0.42	U	0.42	U	0.42	U	0.42	U
SW8260	Bromomethane	ug/L	0.63	U	0.63	U	0.63	U	0.63	U	0.63	U
SW8260	Carbon disulfide	ug/L	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U
SW8260	Carbon tetrachloride	ug/L	0.49	U	0.49	U	0.49	U	0.49	U	0.49	U
SW8260	Chlorobenzene	ug/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
SW8260	Chlorodibromomethane	ug/L	0.45	U	0.45	U	0.45	U	0.45	U	0.45	U
SW8260	Chloroethane	ug/L	0.49	U	0.49	U	0.49	U	0.49	U	0.49	U
SW8260	Chloroform	ug/L	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U

DATA USABILITY SUMMARY REPORT
AUGUST 2008 GROUNDWATER SAMPLING EVENT ROUND 4
Table 2

	Lab Sample Delivery Group		Z4127		Z4127		Z4127		Z4127		Z4127	
	Loc Name		ATGW-004		ATMW-008		ATMW-009		GW-002		GW-010	
	Field Sample Date		8/13/2008		8/14/2008		8/14/2008		8/12/2008		8/12/2008	
	Field Sample Id		ATGW00401508		ATMW00801508		ATMW00901508		DCGW00201508		DCGW01001408	
		Media	GW		GW		GW		GW		GW	
		Qc Code	FS		FS		FS		FS		FS	
Analysis	**Param Name**	**Units**	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
SW8260	Chloromethane	ug/L	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U
SW8260	Cis-1,2-Dichloroethene	ug/L	37		8.5		290	D	20		0.85	J
SW8260	cis-1,3-Dichloropropene	ug/L	0.54	U	0.54	U	0.54	U	0.54	U	0.54	U
SW8260	Cyclohexane	ug/L	0.37	U	0.37	U	0.37	U	0.37	U	0.37	U
SW8260	Dichlorodifluoromethane	ug/L	0.43	U	0.43	U	0.43	U	0.43	U	0.43	U
SW8260	Ethyl benzene	ug/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
SW8260	Isopropylbenzene	ug/L	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U
SW8260	Methyl cyclohexane	ug/L	0.43	U	0.43	U	0.43	U	0.43	U	0.43	U
SW8260	Methyl Tertbutyl Ether	ug/L	4.2		20		0.5	U	0.5	U	0.5	U
SW8260	Methylene chloride	ug/L	0.52	U	0.52	U	0.52	U	0.52	U	0.52	U
SW8260	o-Xylene	ug/L	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U
SW8260	Styrene	ug/L	0.48	U	0.48	U	0.48	U	0.48	U	0.48	U
SW8260	Tetrachloroethene	ug/L	9.2		3.1		4.9		280	DJ	15	
SW8260	Toluene	ug/L	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U
SW8260	trans-1,2-Dichloroethene	ug/L	0.57	U	0.57	U	0.57	U	0.57	U	0.57	U
SW8260	trans-1,3-Dichloropropene	ug/L	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U
SW8260	Trichloroethene	ug/L	14		9.1		26		21		0.56	U
SW8260	Trichlorofluoromethane	ug/L	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
SW8260	Vinyl chloride	ug/L	4.5		1	J	0.46	U	0.46	U	0.46	U
SW8260	Xylene, m/p	ug/L	0.97	U	0.97	U	0.97	U	0.97	U	0.97	U

Created by: BJS 10/15/08
Checked by: TLC 10/15/08

		Lab Sample Delivery Group	Z4127		Z4127		Z4127		Z4127		Z4127	
		Loc Name	GW-013		GW-014		MW-001		MW-002		MW-003	
		Field Sample Date	8/14/2008		8/13/2008		8/13/2008		8/12/2008		8/13/2008	
		Field Sample Id	DCGW01301508		DCGW01401308		DCMW00102008		DCMW00202108		DCMW00302008	
		Media	GW		GW		GW		GW		GW	
		Qc Code	FS		FS		FS		FS		FS	
Analysis	**Param Name**	**Units**	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
SW8260	1,1,1-Trichloroethane	ug/L	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U
SW8260	1,1,2,2-Tetrachloroethane	ug/L	0.49	U	0.49	U	0.49	U	0.49	U	0.49	U
SW8260	1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/L	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U
SW8260	1,1,2-Trichloroethane	ug/L	0.52	U	0.52	U	0.52	U	0.52	U	0.52	U
SW8260	1,1-Dichloroethane	ug/L	0.55	U	0.55	U	0.55	U	0.55	U	0.55	U
SW8260	1,1-Dichloroethene	ug/L	0.55	U	0.55	U	0.55	U	0.55	U	0.55	U
SW8260	1,2,4-Trichlorobenzene	ug/L	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U
SW8260	1,2-Dibromo-3-chloropropane	ug/L	0.45	U	0.45	U	0.45	U	0.45	U	0.45	U
SW8260	1,2-Dibromoethane	ug/L	0.56	U	0.56	U	0.56	U	0.56	U	0.56	U
SW8260	1,2-Dichlorobenzene	ug/L	0.48	U	0.48	U	0.48	U	0.48	U	0.48	U
SW8260	1,2-Dichloroethane	ug/L	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U
SW8260	1,2-Dichloropropane	ug/L	0.56	U	0.56	U	0.56	U	0.56	U	0.56	U
SW8260	1,3-Dichlorobenzene	ug/L	0.45	U	0.45	U	0.45	U	0.45	U	0.45	U
SW8260	1,4-Dichlorobenzene	ug/L	0.43	U	0.43	U	0.43	U	0.43	U	0.43	U
SW8260	2-Butanone	ug/L	4.6	U	4.6	U	4.6	U	4.6	U	4.6	U
SW8260	2-Hexanone	ug/L	2.9	U	2.9	U	2.9	U	2.9	U	2.9	U
SW8260	4-Methyl-2-pentanone	ug/L	2.7	U	2.7	U	2.7	U	2.7	U	2.7	U
SW8260	Acetic acid, methyl ester	ug/L	0.92	U	0.92	U	0.92	U	0.92	U	0.92	U
SW8260	Acetone	ug/L	5.4		2.7	UJ	2.7	UJ	2.7	U	2.7	UJ
SW8260	Benzene	ug/L	0.52	U	0.52	U	0.52	U	0.52	U	0.52	U
SW8260	Bromodichloromethane	ug/L	0.59	U	0.59	U	0.59	U	0.59	U	0.59	U
SW8260	Bromoform	ug/L	0.42	U	0.42	U	0.42	U	0.42	U	0.42	U
SW8260	Bromomethane	ug/L	0.63	U	0.63	U	0.63	U	0.63	U	0.63	U
SW8260	Carbon disulfide	ug/L	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U
SW8260	Carbon tetrachloride	ug/L	0.49	U	0.49	U	0.49	U	0.49	U	0.49	U
SW8260	Chlorobenzene	ug/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
SW8260	Chlorodibromomethane	ug/L	0.45	U	0.45	U	0.45	U	0.45	U	0.45	U
SW8260	Chloroethane	ug/L	0.49	U	0.49	U	0.49	U	0.49	U	0.49	U
SW8260	Chloroform	ug/L	0.46	U	0.46	U	0.46	U	0.46	U	0.69	J

	Lab Sample Delivery Group		Z4127		Z4127		Z4127		Z4127		Z4127	
		Loc Name	GW-013		GW-014		MW-001		MW-002		MW-003	
		Field Sample Date	8/14/2008		8/13/2008		8/13/2008		8/12/2008		8/13/2008	
		Field Sample Id	DCGW01301508		DCGW01401308		DCMW00102008		DCMW00202108		DCMW00302008	
		Media	GW		GW		GW		GW		GW	
		Qc Code	FS		FS		FS		FS		FS	
Analysis	**Param Name**	**Units**	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
SW8260	Chloromethane	ug/L	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U
SW8260	Cis-1,2-Dichloroethene	ug/L	0.53	U	0.53	U	4.8		48		31	
SW8260	cis-1,3-Dichloropropene	ug/L	0.54	U	0.54	U	0.54	U	0.54	U	0.54	U
SW8260	Cyclohexane	ug/L	0.37	U	0.37	U	0.37	U	0.37	U	0.37	U
SW8260	Dichlorodifluoromethane	ug/L	0.43	U	0.43	U	0.43	U	0.43	U	0.43	U
SW8260	Ethyl benzene	ug/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
SW8260	Isopropylbenzene	ug/L	0.8	J	0.44	U	0.44	U	0.44	U	0.44	U
SW8260	Methyl cyclohexane	ug/L	0.43	U	0.43	U	0.43	U	0.43	U	0.43	U
SW8260	Methyl Tertbutyl Ether	ug/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
SW8260	Methylene chloride	ug/L	0.52	U	0.52	U	0.52	U	0.52	U	0.52	U
SW8260	o-Xylene	ug/L	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U
SW8260	Styrene	ug/L	0.48	U	0.48	U	0.48	U	0.48	U	0.48	U
SW8260	Tetrachloroethene	ug/L	0.68	UJ	1.8		17		100	D	66	
SW8260	Toluene	ug/L	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U
SW8260	trans-1,2-Dichloroethene	ug/L	0.57	U	0.57	U	0.57	U	0.57	U	0.57	U
SW8260	trans-1,3-Dichloropropene	ug/L	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U
SW8260	Trichloroethene	ug/L	0.56	U	0.56	U	6.3		14		8.6	
SW8260	Trichlorofluoromethane	ug/L	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
SW8260	Vinyl chloride	ug/L	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U
SW8260	Xylene, m/p	ug/L	0.97	U	0.97	U	0.97	U	0.97	U	0.97	U

DATA USABILITY SUMMARY REPORT
AUGUST 2008 GROUNDWATER SAMPLING EVENT ROUND 4
Table 2

	Lab Sample Delivery Group		Z4127		Z4127		Z4127		Z4127		Z4127	
	Loc Name		MW-004		MW-004		MW-005		MW-006		MW-007	
	Field Sample Date		8/12/2008		8/12/2008		8/12/2008		8/13/2008		8/12/2008	
	Field Sample Id		DCMW00401708		DCMW00401708D		DCMW00502108		DCMW00601608		DCMW00701708	
		Media	GW		GW		GW		GW		GW	
		Qc Code	FS		FD		FS		FS		FS	
Analysis	**Param Name**	**Units**	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
SW8260	1,1,1-Trichloroethane	ug/L	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U
SW8260	1,1,2,2-Tetrachloroethane	ug/L	0.49	U	0.49	U	0.49	U	0.49	U	0.49	U
SW8260	1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/L	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U
SW8260	1,1,2-Trichloroethane	ug/L	0.52	U	0.52	U	0.52	U	0.52	U	0.52	U
SW8260	1,1-Dichloroethane	ug/L	0.55	U	0.55	U	0.55	U	0.55	U	0.55	U
SW8260	1,1-Dichloroethene	ug/L	0.55	U	0.55	U	0.55	U	0.55	U	0.55	U
SW8260	1,2,4-Trichlorobenzene	ug/L	0.41	U	0.41	U	0.41	U	0.41	U	1.2	
SW8260	1,2-Dibromo-3-chloropropane	ug/L	0.45	U	0.45	U	0.45	U	0.45	U	0.45	U
SW8260	1,2-Dibromoethane	ug/L	0.56	U	0.56	U	0.56	U	0.56	U	0.56	U
SW8260	1,2-Dichlorobenzene	ug/L	0.48	U	0.48	U	0.48	U	0.48	U	0.48	U
SW8260	1,2-Dichloroethane	ug/L	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U
SW8260	1,2-Dichloropropane	ug/L	0.56	U	0.56	U	0.56	U	0.56	U	0.56	U
SW8260	1,3-Dichlorobenzene	ug/L	0.45	U	0.45	U	0.45	U	0.45	U	0.45	U
SW8260	1,4-Dichlorobenzene	ug/L	0.43	U	0.43	U	0.43	U	0.43	U	0.43	U
SW8260	2-Butanone	ug/L	4.6	U	4.6	U	4.6	U	4.6	U	4.6	U
SW8260	2-Hexanone	ug/L	2.9	U	2.9	U	2.9	U	2.9	U	2.9	U
SW8260	4-Methyl-2-pentanone	ug/L	2.7	U	2.7	U	2.7	U	2.7	U	2.7	U
SW8260	Acetic acid, methyl ester	ug/L	0.92	U	0.92	U	0.92	U	0.92	U	0.92	U
SW8260	Acetone	ug/L	2.7	U	2.7	U	2.7	U	2.7	UJ	2.7	UJ
SW8260	Benzene	ug/L	0.52	U	0.52	U	0.52	U	0.52	U	0.96	J
SW8260	Bromodichloromethane	ug/L	0.59	U	0.59	U	0.59	U	0.59	U	0.59	U
SW8260	Bromoform	ug/L	0.42	U	0.42	U	0.42	U	0.42	U	0.42	U
SW8260	Bromomethane	ug/L	0.63	U	0.63	U	0.63	U	0.63	U	0.63	U
SW8260	Carbon disulfide	ug/L	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U
SW8260	Carbon tetrachloride	ug/L	0.49	U	0.49	U	0.49	U	0.49	U	0.49	U
SW8260	Chlorobenzene	ug/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
SW8260	Chlorodibromomethane	ug/L	0.45	U	0.45	U	0.45	U	0.45	U	0.45	U
SW8260	Chloroethane	ug/L	0.49	U	0.49	U	0.49	U	0.49	U	0.49	U
SW8260	Chloroform	ug/L	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U

	Lab Sample Delivery Group		Z4127		Z4127		Z4127		Z4127		Z4127	
		Loc Name	MW-004		MW-004		MW-005		MW-006		MW-007	
	Field Sample Date		8/12/2008		8/12/2008		8/12/2008		8/13/2008		8/12/2008	
	Field Sample Id		DCMW00401708		DCMW00401708D		DCMW00502108		DCMW00601608		DCMW00701708	
		Media	GW		GW		GW		GW		GW	
		Qc Code	FS		FD		FS		FS		FS	
Analysis	**Param Name**	**Units**	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
SW8260	Chloromethane	ug/L	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U
SW8260	Cis-1,2-Dichloroethene	ug/L	17		17		600	D	18		960	D
SW8260	cis-1,3-Dichloropropene	ug/L	0.54	U	0.54	U	0.54	U	0.54	U	0.54	U
SW8260	Cyclohexane	ug/L	0.37	U	0.37	U	0.37	U	0.37	U	0.37	U
SW8260	Dichlorodifluoromethane	ug/L	0.43	U	0.43	U	0.43	U	0.43	U	0.43	U
SW8260	Ethyl benzene	ug/L	0.5	U	0.5	U	0.5	U	0.5	U	2.1	
SW8260	Isopropylbenzene	ug/L	0.44	U	0.44	U	0.44	U	0.44	U	3.3	
SW8260	Methyl cyclohexane	ug/L	0.43	U	0.43	U	0.43	U	0.43	U	0.43	U
SW8260	Methyl Tertbutyl Ether	ug/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
SW8260	Methylene chloride	ug/L	0.52	U	0.52	U	0.52	U	0.52	U	0.52	U
SW8260	o-Xylene	ug/L	0.51	U	0.51	U	0.51	U	0.51	U	15	
SW8260	Styrene	ug/L	0.48	U	0.48	U	0.48	U	0.48	U	0.48	U
SW8260	Tetrachloroethene	ug/L	1300	DJ	1600	DJ	590	DJ	0.72	J	230	D
SW8260	Toluene	ug/L	0.51	U	0.51	U	0.51	U	0.51	U	2.2	
SW8260	trans-1,2-Dichloroethene	ug/L	0.57	U	0.57	U	1.6		0.57	U	3.2	
SW8260	trans-1,3-Dichloropropene	ug/L	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U
SW8260	Trichloroethene	ug/L	11		11		71		0.56	U	13	
SW8260	Trichlorofluoromethane	ug/L	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
SW8260	Vinyl chloride	ug/L	0.46	U	0.46	U	10		0.46	U	230	D
SW8260	Xylene, m/p	ug/L	0.97	U	0.97	U	0.97	U	0.97	U	7.5	

Table 2

	Lab Sample Delivery Group		Z4127		Z4127		Z4127		Z4127		Z4127	
	Loc Name		MW-008		MW-009		MW-010		MW-011		QC	
	Field Sample Date		8/12/2008		8/13/2008		8/13/2008		8/14/2008		8/14/2008	
	Field Sample Id		DCMW00801808		DCMW00901708		DCMW01001808		DCMW01101908		TRIPBLANK	
		Media	GW		GW		GW		GW		GW	
		Qc Code	FS		FS		FS		FS		TB	
Analysis	**Param Name**	**Units**	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
SW8260	1,1,1-Trichloroethane	ug/L	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U
SW8260	1,1,2,2-Tetrachloroethane	ug/L	0.49	U	0.49	U	0.49	U	0.49	U	0.49	U
SW8260	1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/L	0.35	U	0.35	U	0.35	U	0.35	U	0.35	U
SW8260	1,1,2-Trichloroethane	ug/L	0.52	U	0.52	U	0.52	U	0.52	U	0.52	U
SW8260	1,1-Dichloroethane	ug/L	0.55	U	0.55	U	0.55	U	0.55	U	0.55	U
SW8260	1,1-Dichloroethene	ug/L	0.55	U	0.55	U	0.55	U	0.55	U	0.55	U
SW8260	1,2,4-Trichlorobenzene	ug/L	0.41	U	0.41	U	0.41	U	0.41	U	0.41	U
SW8260	1,2-Dibromo-3-chloropropane	ug/L	0.45	U	0.45	U	0.45	U	0.45	U	0.45	U
SW8260	1,2-Dibromoethane	ug/L	0.56	U	0.56	U	0.56	U	0.56	U	0.56	U
SW8260	1,2-Dichlorobenzene	ug/L	0.48	U	0.48	U	0.48	U	0.48	U	0.48	U
SW8260	1,2-Dichloroethane	ug/L	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U
SW8260	1,2-Dichloropropane	ug/L	0.56	U	0.56	U	0.56	U	0.56	U	0.56	U
SW8260	1,3-Dichlorobenzene	ug/L	0.45	U	0.45	U	0.45	U	0.45	U	0.45	U
SW8260	1,4-Dichlorobenzene	ug/L	0.43	U	0.43	U	0.43	U	0.43	U	0.43	U
SW8260	2-Butanone	ug/L	4.6	U	4.6	U	4.6	U	4.6	U	4.6	U
SW8260	2-Hexanone	ug/L	2.9	U	2.9	U	2.9	U	2.9	U	2.9	U
SW8260	4-Methyl-2-pentanone	ug/L	2.7	U	2.7	U	2.7	U	2.7	U	2.7	U
SW8260	Acetic acid, methyl ester	ug/L	0.92	U	0.92	U	0.92	U	0.92	U	0.92	U
SW8260	Acetone	ug/L	5.8	J	2.7	UJ	2.7	UJ	2.7	UJ	2.7	U
SW8260	Benzene	ug/L	0.52	U	0.52	U	0.52	U	0.52	U	0.52	U
SW8260	Bromodichloromethane	ug/L	0.59	U	0.59	U	0.59	U	0.59	U	0.59	U
SW8260	Bromoform	ug/L	0.42	U	0.42	U	0.42	U	0.42	U	0.42	U
SW8260	Bromomethane	ug/L	0.63	U	0.63	U	0.63	U	0.63	U	0.63	U
SW8260	Carbon disulfide	ug/L	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U
SW8260	Carbon tetrachloride	ug/L	0.49	U	0.49	U	0.49	U	0.49	U	0.49	U
SW8260	Chlorobenzene	ug/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
SW8260	Chlorodibromomethane	ug/L	0.45	U	0.45	U	0.45	U	0.45	U	0.45	U
SW8260	Chloroethane	ug/L	0.49	U	0.49	U	0.49	U	0.49	U	0.49	U
SW8260	Chloroform	ug/L	0.46	U	0.46	U	0.46	U	0.46	U	0.46	U

		Lab Sample Delivery Group	Z4127		Z4127		Z4127		Z4127		Z4127	
		Loc Name	MW-008		MW-009		MW-010		MW-011		QC	
		Field Sample Date	8/12/2008		8/13/2008		8/13/2008		8/14/2008		8/14/2008	
		Field Sample Id	DCMW00801808		DCMW00901708		DCMW01001808		DCMW01101908		TRIPBLANK	
		Media	GW		GW		GW		GW		GW	
		Qc Code	FS		FS		FS		FS		TB	
Analysis	**Param Name**	**Units**	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
SW8260	Chloromethane	ug/L	0.38	U	0.38	U	0.38	U	0.38	U	0.38	U
SW8260	Cis-1,2-Dichloroethene	ug/L	62		55	D	8.5		0.58	J	0.53	U
SW8260	cis-1,3-Dichloropropene	ug/L	0.54	U	0.54	U	0.54	U	0.54	U	0.54	U
SW8260	Cyclohexane	ug/L	0.37	U	0.37	U	0.37	U	0.37	U	0.37	U
SW8260	Dichlorodifluoromethane	ug/L	0.43	U	0.43	U	0.43	U	0.43	U	0.43	U
SW8260	Ethyl benzene	ug/L	0.5	U	0.5	U	0.5	U	0.5	U	0.5	U
SW8260	Isopropylbenzene	ug/L	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U
SW8260	Methyl cyclohexane	ug/L	0.43	U	0.43	U	0.43	U	0.43	U	0.43	U
SW8260	Methyl Tertbutyl Ether	ug/L	0.5	UJ	0.5	U	0.5	U	0.5	U	0.5	U
SW8260	Methylene chloride	ug/L	0.52	U	0.52	U	0.52	U	0.52	U	0.52	U
SW8260	o-Xylene	ug/L	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U
SW8260	Styrene	ug/L	0.48	U	0.48	U	0.48	U	0.48	U	0.48	U
SW8260	Tetrachloroethene	ug/L	140	D	41		370	DJ	0.68	U	0.68	U
SW8260	Toluene	ug/L	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U
SW8260	trans-1,2-Dichloroethene	ug/L	0.57	U	0.57	U	0.57	U	0.57	U	0.57	U
SW8260	trans-1,3-Dichloropropene	ug/L	0.44	U	0.44	U	0.44	U	0.44	U	0.44	U
SW8260	Trichloroethene	ug/L	11		13		3.5		1.4		0.56	U
SW8260	Trichlorofluoromethane	ug/L	0.4	U	0.4	U	0.4	U	0.4	U	0.4	U
SW8260	Vinyl chloride	ug/L	1.4		0.46	U	0.46	U	0.46	U	0.46	U
SW8260	Xylene, m/p	ug/L	0.97	U	0.97	U	0.97	U	0.97	U	0.97	U

Created by: BJS 10/15/08
Checked by: TLC 10/15/08

Field Sample ID	Lab Sample ID	CAS No.	Chemical Name	Result (µg/L)	Lab Qualifier
DCMW00701708	Z4127-08	TIC000108-67-8	Benzene, 1,3,5-trimethyl-	42	JN
DCMW00701708	Z4127-08	TIC000526-73-8	Benzene, 1,2,3-trimethyl-	66	JN
DCMW00701708	Z4127-08	TIC000611-14-3	Benzene, 1-ethyl-2-methyl-	28	JN
DCMW00701708	Z4127-08	TIC000620-14-4	Benzene, 1-ethyl-3-methyl-	38	JN
DCGW01301508	Z4127-18	TIC000488-23-3	Benzene, 1,2,3,4-tetramethyl-	7.2	JN
DCGW01301508	Z4127-18	TIC000565-59-3	Pentane, 2,3-dimethyl-	6.6	JN
DCGW01301508	Z4127-18	TIC000589-90-2	Cyclohexane, 1,4-dimethyl-	5.4	JN
DCGW01301508	Z4127-18	TIC003290-53-7	Benzene, (2-methyl-2-propenyl)-	5.2	JN
DCGW01301508	Z4127-18	TIC013632-94-5	Benzene, 1,4-diethyl-2-methyl-	7	JN

DATA USABILITY SUMMARY REPORT
2009 GROUNDWATER SAMPLING
OU2 REMEDIAL INVESTIGATION
DIAMOND CLEANERS SITE
ELMIRA, NEW YORK

1.0 INTRODUCTION

Groundwater samples were collected at the Diamond Cleaners Site (Site) in Elmira, New York on April 2, 2009 and submitted for off-site laboratory analyses. Samples were analyzed by Chemtech Laboratory located in Mountainside, New Jersey. Results were reported in Sample Delivery Group (SDG): A2166. A listing of samples included in this Data Usability Summary Report is presented in Table 1. A summary of the analytical results is presented in Table 2. A summary of tentatively identified compounds (TICs) is presented in Table 3. Samples were analyzed for one or more of the following methods:

- Volatile Organic Compounds (VOCs) by USEPA Method 8260B
- Semi Volatile Organic Compounds (SVOCs) by USEPA Method 8270C
- Pesticides by USEPA Method 8081
- Dissolved Metals by USEPA Method 6010B
- Dissolved Mercury by USEPA Method 7470

Deliverables for the off-site laboratory analyses included a Category B deliverable as defined in the New York State Department of Environmental Conservation (NYSDEC) Analytical Services Protocols (NYSDEC, 2005).

A project chemist review was completed based on NYSDEC Division of Environmental Remediation guidance for Data Usability Summary Reports (NYSDEC, 2002). Laboratory QC limits were used during the data evaluation unless noted otherwise. The project chemist review included evaluations of sample collection, data package completeness, holding times, QC data (blanks, instrument calibrations, duplicates, surrogate recovery, and spike recovery), data transcription, electronic data reporting, calculations, and data qualification.

The following laboratory or data validation qualifiers are used in the final data presentation.

U = target analyte is not detected at the reported detection limit
J = concentration is estimated
UJ = target analyte is not detected at the reported detection limit and is estimated
D = result is reported from a diluted analysis
B (metals) = concentration is between the MDL and reporting limit

Results are interpreted to be usable as reported by the laboratory unless discussed in the following sections.

2.0 VOLATILE ORGANIC COMPOUNDS (VOCS)

VOC – Internal Standard Areas

Sample DCWM00502109 (dilution analysis) had internal standard area counts below the lower control limit. The two results reported from this analytical run were cis-1,2-dichloroethe (6600 µg/l) and vinyl chloride (1800 µg/l) and were qualified estimated (J).

Internal Standard Areas				
	Pentafluorobenzene	1,4-difluorobenzene	Chlorobenzene-d5	1,4-dichlorobenzene-d4
12 Hour Std	537169	817498	777051	369197
Upper limit	1074338	1634996	1554102	738394
Lower limit	268585	408749	388526	184599
DCMW00502109DL	**166862**	**255549**	**258481**	**124003**

VOC - Initial and Continuing Calibration Standards

SDG A2166

The continuing calibration analyzed on April 9, 2009 had a percent difference greater than the control limit of 20 for 1,1,1-trichloroethane (-28), 1,1-dichloroethane (-23), 2-butanone (-20.4), and methyl tert-butyl ether (-22). There were no detections for these analytes and results were qualified estimated (UJ) in the following samples: DCMW00502109 and DCGW01001409.

The continuing calibration analyzed on April 10, 2009 had a percent difference greater than the control limit of 20 for dichlorofluoromethane (-22), trichlorofluoromethane (-21), and 1,1-dichloroethane (-26). There were no detections for these analytes and results were qualified estimated (UJ) in the following samples: DCMW00601609 and DCGW00701709.

VOC – Sample Reporting

SDG A2166

The following samples were re-analyzed at a dilution due to elevated concentrations of target compounds. Sample results reported in the final data set are a combination of the two analytical runs.

Field Sample ID	Dilution Factor
DCMW00502109	1X, 50X
DCMW00701709	1X, 10X

3.0 SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCS)

SVOC – Method Blanks

SDG A2166

The method blank (Lab ID: PB4057B) that was extracted and analyzed with the four groundwater samples in SDG A2166 had detections of the following TICs: 2-methoxy-2-methyl- butane (9.5

µg/L) and 4-hydroxy-4-methyl-2-pentanone (5.6 µg/L). These compounds were detected at similar concentrations in the four samples and were subsequently removed from the final data set.

SVOC – Lab Control Samples

SDG A2166

The lab control spike and spike duplicate associated with samples in SDG A2166 had a low percent recovery for caprolactam (18 and 19). Caprolactam was not detected and qualified estimated (UJ) in all samples in SDG A2166.

4.0 PESTICIDES

PEST - Initial and Continuing Calibration Standards

The percent difference (%D) for 4,4'-DDT (22) was above the control limit of 20 in the continuing calibration analyzed with samples in SDG A2166. 4,4'-DDT was qualified estimated (UJ) in all sample in SDG A2166.

5.0 METALS

Metals - Blanks

SDG A2166

Blank contamination was observed in calibration, preparation, and method blanks associated with samples in SDG A2166. A 5X action level was established and analytes reported below the action level were qualified non-detect (U). The following table presents the highest concentration of a specific metal that was detected in a blank (prep, method, continuing calibration):

Analyte	Blank Concentration (µg/L)	5X Action Level (µg/L)	Samples Qualified non-detect (U)
Iron	8.8	44	DCMW00701709
Lead	3.9	19.5	DCMW00502109, DCMW00601609, DCGW01001409, DCMW00701709
Cadmium	0.7	3.5	None
Barium	6.6	33	None
Calcium	46.9	234.5	None
Manganese	2.4	12	None
Potassium	65.7	328.5	None
Sodium	122	610	None
Thallium	2.6	13	None

Reference:

New York State Department of Environmental Conservation (NYSDEC), 2005. "Analytical Services Protocols"; July 2005.

New York State Department of Environmental Conservation (NYSDEC), 2002. "Technical Guidance for Site Investigation and Remediation-Appendix 2B"; Draft DER-10; Division of Environmental Remediation; December 2002.

Data Validator: Tige Cunningham

Date: 5/15/09

Reviewed by Chris Ricardi, NRCC-EAC
Quality Assurance Officer

Date: 5/18/09

Table 1 – DUSR Sample Listing

					Class	VOCs	SVOCs	Pesticides	Metals	Metals
					Analysis Method	SW8260	SW8270	SW8081	SW6010	SW7470
					Fraction	T	T	T	D	D
SDG	**Media**	**Location**	**Sample ID**	**Sample Date**	**Qc Code**					
A2166	GW	GW-010	DCGW01001409	4/2/2009	FS	X	X	X	X	X
A2166	GW	MW-005	DCMW00502109	4/2/2009	FS	X	X	X	X	X
A2166	GW	MW-006	DCMW00601609	4/2/2009	FS	X	X	X	X	X
A2166	GW	MW-007	DCMW00701709	4/2/2009	FS	X	X	X	X	X
A2166	BW	QC	TRIPBLANK	4/2/2009	TB	X				

Table 3 - SVOC and VOC - Tentatively Identified compounds

Tentatively identified compounds (TICs) were reported by the laboratory. TICs reported in samples are presented in Table 3. Only samples that had TICs reported are included on Table 3. If a sample is not listed, no TICs were reported.

Table 3 - Tentatively Identified Compounds in VOC and SVOC Samples

sample_name	sample_date	lab_sample_id	Method	Cas No.	chemical_name	concentration (µg/L)	Qualifier
DCMW00502109	4/2/2009	A2166-01	SW8260	000526-73-8	Benzene, 1,2,3-trimethyl-	57	JN
DCMW00502109	4/2/2009	A2166-01	SW8260	000095-63-6	Benzene, 1,2,4-trimethyl-	28	JN
DCMW00502109	4/2/2009	A2166-01	SW8260	000108-67-8	Benzene, 1,3,5-trimethyl-	50	JN
DCMW00502109	4/2/2009	A2166-01	SW8260	000611-14-3	Benzene, 1-ethyl-2-methyl-	23	JN
DCMW00502109	4/2/2009	A2166-01	SW8270	4551-51-3	1H-Indene, octahydro-, cis-	2.7	J
DCMW00502109	4/2/2009	A2166-01	SW8270	10/5/6966	3,4-Dimethylbenzyl alcohol	4.2	J
DCMW00502109	4/2/2009	A2166-01	SW8270	527-53-7	Benzene, 1,2,3,5-tetramethyl-	3.6	J
DCMW00502109	4/2/2009	A2166-01	SW8270	95-93-2	Benzene, 1,2,4,5-tetramethyl-	3.4	J
DCMW00502109	4/2/2009	A2166-01	SW8270	135-01-3	Benzene, 1,2-diethyl-	4.3	J
DCMW00502109	4/2/2009	A2166-01	SW8270	108-67-8	Benzene, 1,3,5-trimethyl-	82	J
DCMW00502109	4/2/2009	A2166-01	SW8270	141-93-5	Benzene, 1,3-diethyl-	9	J
DCMW00502109	4/2/2009	A2166-01	SW8270	933-98-2	Benzene, 1-ethyl-2,3-dimethyl-	5.7	J
DCMW00502109	4/2/2009	A2166-01	SW8270	622-96-8	Benzene, 1-ethyl-4-methyl-	9.2	J
DCMW00502109	4/2/2009	A2166-01	SW8270	1074-55-1	Benzene, 1-methyl-4-propyl-	10	J
DCMW00502109	4/2/2009	A2166-01	SW8270	1758-88-9	Benzene, 2-ethyl-1,4-dimethyl-	4.5	J
DCMW00502109	4/2/2009	A2166-01	SW8270	619-04-5	Benzoic acid, 3,4-dimethyl-	2.6	J
DCMW00502109	4/2/2009	A2166-01	SW8270	6783-92-2	Cyclohexane, 1,1,2,3-tetramethyl-	4.9	J
DCMW00502109	4/2/2009	A2166-01	SW8270	119-64-2	Naphthalene, 1,2,3,4-tetrahydro-	2.9	J
DCMW00502109	4/2/2009	A2166-01	SW8270	UNKNOWN at 3.44 min	unknown3.44	3.5	J
DCMW00502109	4/2/2009	A2166-01	SW8270	UNKNOWN at 5.32 min	unknown5.32	6.7	J

TABLE 2 - RESULTS SUMMARY
DATA USABILITY SUMMARY REPORT - SDG A2166
DIAMOND CLEANERS SITE
ELMIRA, NEW YORK

	Lab Sample Delivery Group		A2166		A2166		A2166		A2166		A2166	
	Lab Sample Id		A2166-01		A2166-01DL		A2166-02		A2166-03		A2166-04	
	Loc Name		MW-005		MW-005		MW-006		GW-010		MW-007	
	Field Sample Id		DCMW00502109		DCMW00502109		DCMW00601609		DCGW01001409		DCMW00701709	
	Field Sample Date		4/2/2009		4/2/2009		4/2/2009		4/2/2009		4/2/2009	
		Qc Code	FS		FS		FS		FS		FS	
Analysis Methoc	**Param Name**	**Units**	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
SW8260	1,1,1-Trichloroethane	ug/l	1	UJ			1	U	1	UJ	1	U
SW8260	1,1,2,2-Tetrachloroethane	ug/l	1	U			1	U	1	U	1	U
SW8260	1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/l	1	U			1	U	1	U	1	U
SW8260	1,1,2-Trichloroethane	ug/l	1	U			1	U	1	U	1	U
SW8260	1,1-Dichloroethane	ug/l	1	UJ			1	UJ	1	UJ	1	UJ
SW8260	1,1-Dichloroethene	ug/l	2.3				1	U	1	U	1	U
SW8260	1,2,4-Trichlorobenzene	ug/l	1	U			1	U	1	U	1	U
SW8260	1,2-Dibromo-3-chloropropane	ug/l	1	U			1	U	1	U	1	U
SW8260	1,2-Dibromoethane	ug/l	1	U			1	U	1	U	1	U
SW8260	1,2-Dichlorobenzene	ug/l	1	U			1	U	1	U	1	U
SW8260	1,2-Dichloroethane	ug/l	1	U			1	U	1	U	1	U
SW8260	1,2-Dichloropropane	ug/l	1	U			1	U	1	U	1	U
SW8260	1,3-Dichlorobenzene	ug/l	1	U			1	U	1	U	1	U
SW8260	1,4-Dichlorobenzene	ug/l	1	U			1	U	1	U	1	U
SW8260	2-Butanone	ug/l	5	UJ			5	U	5	UJ	5	U
SW8260	2-Hexanone	ug/l	5	U			5	U	5	U	5	U
SW8260	4-Methyl-2-pentanone	ug/l	5	U			5	U	5	U	5	U
SW8260	Acetic acid, methyl ester	ug/l	1	U			1	U	1	U	1	U
SW8260	Acetone	ug/l	5	U			5	U	5	U	5	U
SW8260	Benzene	ug/l	2.6				1	U	1	U	1	U
SW8260	Bromodichloromethane	ug/l	1	U			1	U	1	U	1	U
SW8260	Bromoform	ug/l	1	U			1	U	1	U	1	U
SW8260	Bromomethane	ug/l	1	U			1	U	1	U	1	U
SW8260	Carbon disulfide	ug/l	1	U			1	U	1	U	1	U
SW8260	Carbon tetrachloride	ug/l	1	U			1	U	1	U	1	U
SW8260	Chlorobenzene	ug/l	1	U			1	U	1	U	1	U
SW8260	Chlorodibromomethane	ug/l	1	U			1	U	1	U	1	U
SW8260	Chloroethane	ug/l	1	U			1	U	1	U	1	U
SW8260	Chloroform	ug/l	1	U			1	U	1	U	1	U
SW8260	Chloromethane	ug/l	1	U			1	U	1	U	1	U
SW8260	Cis-1,2-Dichloroethene	ug/l			6600	DJ	13		8.8			
SW8260	cis-1,3-Dichloropropene	ug/l	1	U			1	U	1	U	1	U
SW8260	Cyclohexane	ug/l	1	U			1	U	1	U	1	U
SW8260	Dichlorodifluoromethane	ug/l	1	U			1	UJ	1	U	1	UJ
SW8260	Ethyl benzene	ug/l	3.5				1	U	1	U	1	U
SW8260	Isopropylbenzene	ug/l	7.4				1	U	1	U	1	U
SW8260	Methyl cyclohexane	ug/l	1	U			1	U	1	U	1	U
SW8260	Methyl Tertbutyl Ether	ug/l	1	UJ			1	U	1	UJ	1	U
SW8260	Methylene chloride	ug/l	1	U			1	U	1	U	1	U
SW8260	Styrene	ug/l	1	U			1	U	1	U	1	U
SW8260	Tetrachloroethene	ug/l	51				1	U	20			
SW8260	Toluene	ug/l	2.9				1	U	1	U	1	U
SW8260	trans-1,2-Dichloroethene	ug/l	9.9				1	U	1	U	1.6	
SW8260	trans-1,3-Dichloropropene	ug/l	1	U			1	U	1	U	1	U
SW8260	Trichloroethene	ug/l	11				0.66	J	1.8		50	
SW8260	Trichlorofluoromethane	ug/l	1	U			1	UJ	1	U	1	UJ
SW8260	Vinyl chloride	ug/l			1800	DJ	1	U	1	U	1	U
SW8260	Xylene, m/p	ug/l	10				2	U	2	U	2	U
SW8260	Xylene, o	ug/l	34				1	U	1	U	1	U
SW8270	2,4,5-Trichlorophenol	ug/l										
SW8270	2,4,6-Trichlorophenol	ug/l										
SW8270	2,4-Dichlorophenol	ug/l										
SW8270	2,4-Dimethylphenol	ug/l										
SW8270	2,4-Dinitrophenol	ug/l										
SW8270	2,4-Dinitrotoluene	ug/l										
SW8270	2,6-Dinitrotoluene	ug/l										
SW8270	2-Chloronaphthalene	ug/l										
SW8270	2-Chlorophenol	ug/l										
SW8270	2-Methylnaphthalene	ug/l										
SW8270	2-Methylphenol	ug/l										
SW8270	2-Nitroaniline	ug/l										
SW8270	2-Nitrophenol	ug/l										
SW8270	3,3`-Dichlorobenzidine	ug/l										
SW8270	3-Nitroaniline	ug/l										
SW8270	4,6-Dinitro-2-methylphenol	ug/l										
SW8270	4-Bromophenyl phenyl ether	ug/l										

TABLE 2 - RESULTS SUMMARY
DATA USABILITY SUMMARY REPORT - SDG A2166
DIAMOND CLEANERS SITE
ELMIRA, NEW YORK

		Lab Sample Delivery Group	A2166		A2166		A2166		A2166		A2166	
		Lab Sample Id	A2166-01		A2166-01DL		A2166-02		A2166-03		A2166-04	
		Loc Name	MW-005		MW-005		MW-006		GW-010		MW-007	
		Field Sample Id	DCMW00502109		DCMW00502109		DCMW00601609		DCGW01001409		DCMW00701709	
		Field Sample Date	4/2/2009		4/2/2009		4/2/2009		4/2/2009		4/2/2009	
		Qc Code	FS		FS		FS		FS		FS	
Analysis Metho	**Param Name**	**Units**	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
SW8270	4-Chloro-3-methylphenol	ug/l										
SW8270	4-Chloroaniline	ug/l										
SW8270	4-Chlorophenyl phenyl ether	ug/l										
SW8270	4-Nitroaniline	ug/l										
SW8270	4-Nitrophenol	ug/l										
SW8270	Acenaphthene	ug/l										
SW8270	Acenaphthylene	ug/l										
SW8270	Acetophenone	ug/l										
SW8270	Anthracene	ug/l										
SW8270	Atrazine	ug/l										
SW8270	Benzaldehyde	ug/l										
SW8270	Benzo(a)anthracene	ug/l										
SW8270	Benzo(a)pyrene	ug/l										
SW8270	Benzo(b)fluoranthene	ug/l										
SW8270	Benzo(ghi)perylene	ug/l										
SW8270	Benzo(k)fluoranthene	ug/l										
SW8270	Biphenyl	ug/l										
SW8270	Bis(2-Chloroethoxy)methane	ug/l										
SW8270	Bis(2-Chloroethyl)ether	ug/l										
SW8270	Bis(2-Chloroisopropyl)ether	ug/l										
SW8270	Bis(2-Ethylhexyl)phthalate	ug/l										
SW8270	Butylbenzylphthalate	ug/l										
SW8270	Caprolactum	ug/l										
SW8270	Carbazole	ug/l										
SW8270	Chrysene	ug/l										
SW8270	Di-n-butylphthalate	ug/l										
SW8270	Di-n-octylphthalate	ug/l										
SW8270	Dibenz(a,h)anthracene	ug/l										
SW8270	Dibenzofuran	ug/l										
SW8270	Diethylphthalate	ug/l										
SW8270	Dimethylphthalate	ug/l										
SW8270	Fluoranthene	ug/l										
SW8270	Fluorene	ug/l										
SW8270	Hexachlorobenzene	ug/l										
SW8270	Hexachlorobutadiene	ug/l										
SW8270	Hexachlorocyclopentadiene	ug/l										
SW8270	Hexachloroethane	ug/l										
SW8270	Indeno(1,2,3-cd)pyrene	ug/l										
SW8270	Isophorone	ug/l										
SW8270	m+p-Methylphenol	ug/l										
SW8270	N-Nitrosodi-n-propylamine	ug/l										
SW8270	N-Nitrosodiphenylamine	ug/l										
SW8270	Naphthalene	ug/l										
SW8270	Nitrobenzene	ug/l										
SW8270	Pentachlorophenol	ug/l										
SW8270	Phenanthrene	ug/l										
SW8270	Phenol	ug/l										
SW8270	Pyrene	ug/l										
SW6010	Aluminum	ug/l	50	U			50	U	83.1		50	U
SW6010	Antimony	ug/l	25	U			25	U	25	U	25	U
SW6010	Arsenic	ug/l	10	U			10	U	10	U	10	U
SW6010	Barium	ug/l	4,110				229		85		180	
SW6010	Beryllium	ug/l	3	U			3	U	3	U	3	U
SW6010	Cadmium	ug/l	3	U			3	U	3	U	3	U
SW6010	Calcium	ug/l	102,000				103,000		71,000		122,000	
SW6010	Chromium	ug/l	5	U			5	U	5	U	5	U
SW6010	Cobalt	ug/l	15	U			15	U	15	U	15	U
SW6010	Copper	ug/l	10	U			10	U	10	U	10	U
SW6010	Iron	ug/l	447				1060		263		26.4	U
SW6010	Lead	ug/l	3.27	U			3.02	U	4.22	U	4.35	U
SW6010	Magnesium	ug/l	16,800				15,700		10,700		20,100	
SW6010	Manganese	ug/l	1,240				590		37		44	
SW6010	Nickel	ug/l	20	U			20	U	20	U	20	U
SW6010	Potassium	ug/l	11,300				3,530		4,430		5,390	
SW6010	Selenium	ug/l	7.13	J			7.73	J	19.9		9.86	J
SW6010	Silver	ug/l	5	U			5	U	5	U	5	U

produced by: BJS 5/15/09
checked by: TLC 5/18/09

TABLE 2 - RESULTS SUMMARY
DATA USABILITY SUMMARY REPORT - SDG A2166
DIAMOND CLEANERS SITE
ELMIRA, NEW YORK

	Lab Sample Delivery Group		A2166		A2166		A2166		A2166		A2166	
	Lab Sample Id		A2166-01		A2166-01DL		A2166-02		A2166-03		A2166-04	
		Loc Name	MW-005		MW-005		MW-006		GW-010		MW-007	
	Field Sample Id		DCMW00502109		DCMW00502109		DCMW00601609		DCGW01001409		DCMW00701709	
	Field Sample Date		4/2/2009		4/2/2009		4/2/2009		4/2/2009		4/2/2009	
		Qc Code	FS		FS		FS		FS		FS	
Analysis Method	**Param Name**	**Units**	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
SW6010	Sodium	ug/l	92,100				178,000		30,600		82,000	
SW6010	Thallium	ug/l	20	U			20	U	20	U	20	U
SW6010	Vanadium	ug/l	20	U			20	U	20	U	20	U
SW6010	Zinc	ug/l	31.9				31		22.4		21.6	
SW7470	Mercury	ug/l	0.2	U			0.2	U	0.2	U	0.2	U
SW8081	4,4`-DDD	ug/l	0.26				0.05	U	0.05	U	0.05	U
SW8081	4,4`-DDE	ug/l	0.05	U			0.05	U	0.05	U	0.05	U
SW8081	4,4`-DDT	ug/l	0.05	UJ			0.05	UJ	0.05	UJ	0.05	UJ
SW8081	Aldrin	ug/l	0.05	U			0.05	U	0.05	U	0.05	U
SW8081	Alpha-BHC	ug/l	0.05	U			0.05	U	0.05	U	0.05	U
SW8081	Alpha-Chlordane	ug/l	0.05	U			0.05	U	0.05	U	0.05	U
SW8081	Beta-BHC	ug/l	0.05	U			0.05	U	0.05	U	0.05	U
SW8081	Delta-BHC	ug/l	0.05	U			0.05	U	0.05	U	0.05	U
SW8081	Dieldrin	ug/l	0.05	U			0.05	U	0.05	U	0.05	U
SW8081	Endosulfan I	ug/l	0.05	U			0.05	U	0.05	U	0.05	U
SW8081	Endosulfan II	ug/l	0.05	U			0.05	U	0.05	U	0.05	U
SW8081	Endosulfan sulfate	ug/l	0.05	U			0.05	U	0.05	U	0.05	U
SW8081	Endrin	ug/l	0.05	U			0.05	U	0.05	U	0.05	U
SW8081	Endrin aldehyde	ug/l	0.05	U			0.05	U	0.05	U	0.05	U
SW8081	Endrin ketone	ug/l	0.05	U			0.05	U	0.05	U	0.05	U
SW8081	Gamma-BHC/Lindane	ug/l	0.05	U			0.05	U	0.05	U	0.05	U
SW8081	Gamma-Chlordane	ug/l	0.05	U			0.05	U	0.05	U	0.05	U
SW8081	Heptachlor	ug/l	0.05	U			0.05	U	0.05	U	0.05	U
SW8081	Heptachlor epoxide	ug/l	0.05	U			0.05	U	0.05	U	0.05	U
SW8081	Methoxychlor	ug/l	0.05	U			0.05	U	0.05	U	0.05	U
SW8081	Toxaphene	ug/l	0.5	U			0.5	U	0.5	U	0.5	U
Notes:												
ug/l = microgram per liter												
Qualifier: U = not detected, J = estimated value,												
D = result from a dilution analysis												
QC Code: FS = Field Sample, FD = Field Duplicate												
TB = Trip Blank												
Metals results are dissolved fraction												

TABLE 2 - RESULTS SUMMARY
DATA USABILITY SUMMARY REPORT - SDG A2166
DIAMOND CLEANERS SITE
ELMIRA, NEW YORK

	Lab Sample Delivery Group		A2166		A2166		A2166		A2166		A2166	
	Lab Sample Id		A2166-04DL		A2166-05		A2166-01		A2166-02		A2166-03	
	Loc Name		MW-007		QC		MW-005		MW-006		GW-010	
	Field Sample Id		DCMW00701709		TRIPBLANK		DCMW00502109		DCMW00601609		DCGW01001409	
	Field Sample Date		4/2/2009		4/2/2009		4/2/2009		4/2/2009		4/2/2009	
		Qc Code	FS		TB		FS		FS		FS	
Analysis Method	**Param Name**	**Units**	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
SW8260	1,1,1-Trichloroethane	ug/l			1	U						
SW8260	1,1,2,2-Tetrachloroethane	ug/l			1	U						
SW8260	1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/l			1	U						
SW8260	1,1,2-Trichloroethane	ug/l			1	U						
SW8260	1,1-Dichloroethane	ug/l			1	U						
SW8260	1,1-Dichloroethene	ug/l			1	U						
SW8260	1,2,4-Trichlorobenzene	ug/l			1	U						
SW8260	1,2-Dibromo-3-chloropropane	ug/l			1	U						
SW8260	1,2-Dibromoethane	ug/l			1	U						
SW8260	1,2-Dichlorobenzene	ug/l			1	U						
SW8260	1,2-Dichloroethane	ug/l			1	U						
SW8260	1,2-Dichloropropane	ug/l			1	U						
SW8260	1,3-Dichlorobenzene	ug/l			1	U						
SW8260	1,4-Dichlorobenzene	ug/l			1	U						
SW8260	2-Butanone	ug/l			5	U						
SW8260	2-Hexanone	ug/l			5	U						
SW8260	4-Methyl-2-pentanone	ug/l			5	U						
SW8260	Acetic acid, methyl ester	ug/l			1	U						
SW8260	Acetone	ug/l			5	U						
SW8260	Benzene	ug/l			1	U						
SW8260	Bromodichloromethane	ug/l			1	U						
SW8260	Bromoform	ug/l			1	U						
SW8260	Bromomethane	ug/l			1	U						
SW8260	Carbon disulfide	ug/l			1	U						
SW8260	Carbon tetrachloride	ug/l			1	U						
SW8260	Chlorobenzene	ug/l			1	U						
SW8260	Chlorodibromomethane	ug/l			1	U						
SW8260	Chloroethane	ug/l			1	U						
SW8260	Chloroform	ug/l			1	U						
SW8260	Chloromethane	ug/l			1	U						
SW8260	Cis-1,2-Dichloroethene	ug/l	520	D	1	U						
SW8260	cis-1,3-Dichloropropene	ug/l			1	U						
SW8260	Cyclohexane	ug/l			1	U						
SW8260	Dichlorodifluoromethane	ug/l			1	U						
SW8260	Ethyl benzene	ug/l			1	U						
SW8260	Isopropylbenzene	ug/l			1	U						
SW8260	Methyl cyclohexane	ug/l			1	U						
SW8260	Methyl Tertbutyl Ether	ug/l			1	U						
SW8260	Methylene chloride	ug/l			1	U						
SW8260	Styrene	ug/l			1	U						
SW8260	Tetrachloroethene	ug/l	410	D	1	U						
SW8260	Toluene	ug/l			1	U						
SW8260	trans-1,2-Dichloroethene	ug/l			1	U						
SW8260	trans-1,3-Dichloropropene	ug/l			1	U						
SW8260	Trichloroethene	ug/l			1	U						
SW8260	Trichlorofluoromethane	ug/l			1	U						
SW8260	Vinyl chloride	ug/l			1	U						
SW8260	Xylene, m/p	ug/l			2	U						
SW8260	Xylene, o	ug/l			1	U						
SW8270	2,4,5-Trichlorophenol	ug/l					10	U	10	U	10	U
SW8270	2,4,6-Trichlorophenol	ug/l					10	U	10	U	10	U
SW8270	2,4-Dichlorophenol	ug/l					10	U	10	U	10	U
SW8270	2,4-Dimethylphenol	ug/l					10	U	10	U	10	U
SW8270	2,4-Dinitrophenol	ug/l					10	U	10	U	10	U
SW8270	2,4-Dinitrotoluene	ug/l					10	U	10	U	10	U
SW8270	2,6-Dinitrotoluene	ug/l					10	U	10	U	10	U
SW8270	2-Chloronaphthalene	ug/l					10	U	10	U	10	U
SW8270	2-Chlorophenol	ug/l					10	U	10	U	10	U
SW8270	2-Methylnaphthalene	ug/l					10	U	10	U	10	U
SW8270	2-Methylphenol	ug/l					10	U	10	U	10	U
SW8270	2-Nitroaniline	ug/l					10	U	10	U	10	U
SW8270	2-Nitrophenol	ug/l					10	U	10	U	10	U
SW8270	3,3`-Dichlorobenzidine	ug/l					10	U	10	U	10	U
SW8270	3-Nitroaniline	ug/l					10	U	10	U	10	U
SW8270	4,6-Dinitro-2-methylphenol	ug/l					10	U	10	U	10	U
SW8270	4-Bromophenyl phenyl ether	ug/l					10	U	10	U	10	U

produced by: BJS 5/15/09
checked by: TLC 5/18/09

TABLE 2 - RESULTS SUMMARY
DATA USABILITY SUMMARY REPORT - SDG A2166
DIAMOND CLEANERS SITE
ELMIRA, NEW YORK

		Lab Sample Delivery Group	A2166		A2166		A2166		A2166		A2166	
		Lab Sample Id	A2166-04DL		A2166-05		A2166-01		A2166-02		A2166-03	
		Loc Name	MW-007		QC		MW-005		MW-006		GW-010	
		Field Sample Id	DCMW00701709		TRIPBLANK		DCMW00502109		DCMW00601609		DCGW01001409	
		Field Sample Date	4/2/2009		4/2/2009		4/2/2009		4/2/2009		4/2/2009	
		Qc Code	FS		TB		FS		FS		FS	
Analysis Method	**Param Name**	**Units**	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
SW8270	4-Chloro-3-methylphenol	ug/l					10	U	10	U	10	U
SW8270	4-Chloroaniline	ug/l					10	U	10	U	10	U
SW8270	4-Chlorophenyl phenyl ether	ug/l					10	U	10	U	10	U
SW8270	4-Nitroaniline	ug/l					10	U	10	U	10	U
SW8270	4-Nitrophenol	ug/l					30	U	30	U	30	U
SW8270	Acenaphthene	ug/l					10	U	10	U	10	U
SW8270	Acenaphthylene	ug/l					10	U	10	U	10	U
SW8270	Acetophenone	ug/l					10	U	10	U	10	U
SW8270	Anthracene	ug/l					10	U	10	U	10	U
SW8270	Atrazine	ug/l					10	U	10	U	10	U
SW8270	Benzaldehyde	ug/l					10	U	10	U	10	U
SW8270	Benzo(a)anthracene	ug/l					10	U	10	U	10	U
SW8270	Benzo(a)pyrene	ug/l					10	U	10	U	10	U
SW8270	Benzo(b)fluoranthene	ug/l					10	U	10	U	10	U
SW8270	Benzo(ghi)perylene	ug/l					10	U	10	U	10	U
SW8270	Benzo(k)fluoranthene	ug/l					10	U	10	U	10	U
SW8270	Biphenyl	ug/l					10	U	10	U	10	U
SW8270	Bis(2-Chloroethoxy)methane	ug/l					10	U	10	U	10	U
SW8270	Bis(2-Chloroethyl)ether	ug/l					10	U	10	U	10	U
SW8270	Bis(2-Chloroisopropyl)ether	ug/l					10	U	10	U	10	U
SW8270	Bis(2-Ethylhexyl)phthalate	ug/l					10	U	10	U	10	U
SW8270	Butylbenzylphthalate	ug/l					10	U	10	U	10	U
SW8270	Caprolactum	ug/l					30	UJ	30	UJ	30	UJ
SW8270	Carbazole	ug/l					10	U	10	U	10	U
SW8270	Chrysene	ug/l					10	U	10	U	10	U
SW8270	Di-n-butylphthalate	ug/l					20	U	20	U	20	U
SW8270	Di-n-octylphthalate	ug/l					10	U	10	U	10	U
SW8270	Dibenz(a,h)anthracene	ug/l					10	U	10	U	10	U
SW8270	Dibenzofuran	ug/l					10	U	10	U	10	U
SW8270	Diethylphthalate	ug/l					10	U	10	U	10	U
SW8270	Dimethylphthalate	ug/l					10	U	10	U	10	U
SW8270	Fluoranthene	ug/l					10	U	10	U	10	U
SW8270	Fluorene	ug/l					10	U	10	U	10	U
SW8270	Hexachlorobenzene	ug/l					10	U	10	U	10	U
SW8270	Hexachlorobutadiene	ug/l					10	U	10	U	10	U
SW8270	Hexachlorocyclopentadiene	ug/l					10	U	10	U	10	U
SW8270	Hexachloroethane	ug/l					10	U	10	U	10	U
SW8270	Indeno(1,2,3-cd)pyrene	ug/l					10	U	10	U	10	U
SW8270	Isophorone	ug/l					10	U	10	U	10	U
SW8270	m+p-Methylphenol	ug/l					10	U	10	U	10	U
SW8270	N-Nitrosodi-n-propylamine	ug/l					10	U	10	U	10	U
SW8270	N-Nitrosodiphenylamine	ug/l					10	U	10	U	10	U
SW8270	Naphthalene	ug/l					1	J	10	U	10	U
SW8270	Nitrobenzene	ug/l					10	U	10	U	10	U
SW8270	Pentachlorophenol	ug/l					10	U	10	U	10	U
SW8270	Phenanthrene	ug/l					10	U	10	U	10	U
SW8270	Phenol	ug/l					10	U	10	U	10	U
SW8270	Pyrene	ug/l					10	U	10	U	10	U
SW6010	Aluminum	ug/l										
SW6010	Antimony	ug/l										
SW6010	Arsenic	ug/l										
SW6010	Barium	ug/l										
SW6010	Beryllium	ug/l										
SW6010	Cadmium	ug/l										
SW6010	Calcium	ug/l										
SW6010	Chromium	ug/l										
SW6010	Cobalt	ug/l										
SW6010	Copper	ug/l										
SW6010	Iron	ug/l										
SW6010	Lead	ug/l										
SW6010	Magnesium	ug/l										
SW6010	Manganese	ug/l										
SW6010	Nickel	ug/l										
SW6010	Potassium	ug/l										
SW6010	Selenium	ug/l										
SW6010	Silver	ug/l										

produced by: BJS 5/15/09
checked by: TLC 5/18/09

TABLE 2 - RESULTS SUMMARY
DATA USABILITY SUMMARY REPORT - SDG A2166
DIAMOND CLEANERS SITE
ELMIRA, NEW YORK

	Lab Sample Delivery Group		A2166		A2166		A2166		A2166		A2166	
	Lab Sample Id		A2166-04DL		A2166-05		A2166-01		A2166-02		A2166-03	
		Loc Name	MW-007		QC		MW-005		MW-006		GW-010	
	Field Sample Id		DCMW00701709		TRIPBLANK		DCMW00502109		DCMW00601609		DCGW01001409	
	Field Sample Date		4/2/2009		4/2/2009		4/2/2009		4/2/2009		4/2/2009	
		Qc Code	FS		TB		FS		FS		FS	
Analysis Method	**Param Name**	**Units**	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
SW6010	Sodium	ug/l										
SW6010	Thallium	ug/l										
SW6010	Vanadium	ug/l										
SW6010	Zinc	ug/l										
SW7470	Mercury	ug/l										
SW8081	4,4`-DDD	ug/l										
SW8081	4,4`-DDE	ug/l										
SW8081	4,4`-DDT	ug/l										
SW8081	Aldrin	ug/l										
SW8081	Alpha-BHC	ug/l										
SW8081	Alpha-Chlordane	ug/l										
SW8081	Beta-BHC	ug/l										
SW8081	Delta-BHC	ug/l										
SW8081	Dieldrin	ug/l										
SW8081	Endosulfan I	ug/l										
SW8081	Endosulfan II	ug/l										
SW8081	Endosulfan sulfate	ug/l										
SW8081	Endrin	ug/l										
SW8081	Endrin aldehyde	ug/l										
SW8081	Endrin ketone	ug/l										
SW8081	Gamma-BHC/Lindane	ug/l										
SW8081	Gamma-Chlordane	ug/l										
SW8081	Heptachlor	ug/l										
SW8081	Heptachlor epoxide	ug/l										
SW8081	Methoxychlor	ug/l										
SW8081	Toxaphene	ug/l										
Notes:												
ug/l = microgram per liter												
Qualifier: U = not detected, J = estimated value,												
D = result from a dilution analysis												
QC Code: FS = Field Sample, FD = Field Duplicate												
TB = Trip Blank												
Metals results are dissolved fraction												

TABLE 2 - RESULTS SUMMARY
DATA USABILITY SUMMARY REPORT - SDG A2166
DIAMOND CLEANERS SITE
ELMIRA, NEW YORK

		Lab Sample Delivery Group	A2166	
		Lab Sample Id	A2166-04	
		Loc Name	MW-007	
		Field Sample Id	DCMW00701709	
		Field Sample Date	4/2/2009	
		Qc Code	FS	
Analysis Methoc	**Param Name**	**Units**	Result	Qualifier
SW8260	1,1,1-Trichloroethane	ug/l		
SW8260	1,1,2,2-Tetrachloroethane	ug/l		
SW8260	1,1,2-Trichloro-1,2,2-Trifluoroethane	ug/l		
SW8260	1,1,2-Trichloroethane	ug/l		
SW8260	1,1-Dichloroethane	ug/l		
SW8260	1,1-Dichloroethene	ug/l	`````	
SW8260	1,2,4-Trichlorobenzene	ug/l		
SW8260	1,2-Dibromo-3-chloropropane	ug/l		
SW8260	1,2-Dibromoethane	ug/l		
SW8260	1,2-Dichlorobenzene	ug/l		
SW8260	1,2-Dichloroethane	ug/l		
SW8260	1,2-Dichloropropane	ug/l		
SW8260	1,3-Dichlorobenzene	ug/l		
SW8260	1,4-Dichlorobenzene	ug/l		
SW8260	2-Butanone	ug/l		
SW8260	2-Hexanone	ug/l		
SW8260	4-Methyl-2-pentanone	ug/l		
SW8260	Acetic acid, methyl ester	ug/l		
SW8260	Acetone	ug/l		
SW8260	Benzene	ug/l		
SW8260	Bromodichloromethane	ug/l		
SW8260	Bromoform	ug/l		
SW8260	Bromomethane	ug/l		
SW8260	Carbon disulfide	ug/l		
SW8260	Carbon tetrachloride	ug/l		
SW8260	Chlorobenzene	ug/l		
SW8260	Chlorodibromomethane	ug/l		
SW8260	Chloroethane	ug/l		
SW8260	Chloroform	ug/l		
SW8260	Chloromethane	ug/l		
SW8260	Cis-1,2-Dichloroethene	ug/l		
SW8260	cis-1,3-Dichloropropene	ug/l		
SW8260	Cyclohexane	ug/l		
SW8260	Dichlorodifluoromethane	ug/l		
SW8260	Ethyl benzene	ug/l		
SW8260	Isopropylbenzene	ug/l		
SW8260	Methyl cyclohexane	ug/l		
SW8260	Methyl Tertbutyl Ether	ug/l		
SW8260	Methylene chloride	ug/l		
SW8260	Styrene	ug/l		
SW8260	Tetrachloroethene	ug/l		
SW8260	Toluene	ug/l		
SW8260	trans-1,2-Dichloroethene	ug/l		
SW8260	trans-1,3-Dichloropropene	ug/l		
SW8260	Trichloroethene	ug/l		
SW8260	Trichlorofluoromethane	ug/l		
SW8260	Vinyl chloride	ug/l		
SW8260	Xylene, m/p	ug/l		
SW8260	Xylene, o	ug/l		
SW8270	2,4,5-Trichlorophenol	ug/l	10	U
SW8270	2,4,6-Trichlorophenol	ug/l	10	U
SW8270	2,4-Dichlorophenol	ug/l	10	U
SW8270	2,4-Dimethylphenol	ug/l	10	U
SW8270	2,4-Dinitrophenol	ug/l	10	U
SW8270	2,4-Dinitrotoluene	ug/l	10	U
SW8270	2,6-Dinitrotoluene	ug/l	10	U
SW8270	2-Chloronaphthalene	ug/l	10	U
SW8270	2-Chlorophenol	ug/l	10	U
SW8270	2-Methylnaphthalene	ug/l	10	U
SW8270	2-Methylphenol	ug/l	10	U
SW8270	2-Nitroaniline	ug/l	10	U
SW8270	2-Nitrophenol	ug/l	10	U
SW8270	3,3`-Dichlorobenzidine	ug/l	10	U
SW8270	3-Nitroaniline	ug/l	10	U
SW8270	4,6-Dinitro-2-methylphenol	ug/l	10	U
SW8270	4-Bromophenyl phenyl ether	ug/l	10	U

TABLE 2 - RESULTS SUMMARY
DATA USABILITY SUMMARY REPORT - SDG A2166
DIAMOND CLEANERS SITE
ELMIRA, NEW YORK

		Lab Sample Delivery Group	A2166	
		Lab Sample Id	A2166-04	
		Loc Name	MW-007	
		Field Sample Id	DCMW00701709	
		Field Sample Date	4/2/2009	
		Qc Code	FS	
Analysis Method	**Param Name**	**Units**	Result	Qualifier
SW8270	4-Chloro-3-methylphenol	ug/l	10	U
SW8270	4-Chloroaniline	ug/l	10	U
SW8270	4-Chlorophenyl phenyl ether	ug/l	10	U
SW8270	4-Nitroaniline	ug/l	10	U
SW8270	4-Nitrophenol	ug/l	30	U
SW8270	Acenaphthene	ug/l	10	U
SW8270	Acenaphthylene	ug/l	10	U
SW8270	Acetophenone	ug/l	10	U
SW8270	Anthracene	ug/l	10	U
SW8270	Atrazine	ug/l	10	U
SW8270	Benzaldehyde	ug/l	10	U
SW8270	Benzo(a)anthracene	ug/l	10	U
SW8270	Benzo(a)pyrene	ug/l	10	U
SW8270	Benzo(b)fluoranthene	ug/l	10	U
SW8270	Benzo(ghi)perylene	ug/l	10	U
SW8270	Benzo(k)fluoranthene	ug/l	10	U
SW8270	Biphenyl	ug/l	10	U
SW8270	Bis(2-Chloroethoxy)methane	ug/l	10	U
SW8270	Bis(2-Chloroethyl)ether	ug/l	10	U
SW8270	Bis(2-Chloroisopropyl)ether	ug/l	10	U
SW8270	Bis(2-Ethylhexyl)phthalate	ug/l	10	U
SW8270	Butylbenzylphthalate	ug/l	10	U
SW8270	Caprolactum	ug/l	30	UJ
SW8270	Carbazole	ug/l	10	U
SW8270	Chrysene	ug/l	10	U
SW8270	Di-n-butylphthalate	ug/l	20	U
SW8270	Di-n-octylphthalate	ug/l	10	U
SW8270	Dibenz(a,h)anthracene	ug/l	10	U
SW8270	Dibenzofuran	ug/l	10	U
SW8270	Diethylphthalate	ug/l	10	U
SW8270	Dimethylphthalate	ug/l	10	U
SW8270	Fluoranthene	ug/l	10	U
SW8270	Fluorene	ug/l	10	U
SW8270	Hexachlorobenzene	ug/l	10	U
SW8270	Hexachlorobutadiene	ug/l	10	U
SW8270	Hexachlorocyclopentadiene	ug/l	10	U
SW8270	Hexachloroethane	ug/l	10	U
SW8270	Indeno(1,2,3-cd)pyrene	ug/l	10	U
SW8270	Isophorone	ug/l	10	U
SW8270	m+p-Methylphenol	ug/l	10	U
SW8270	N-Nitrosodi-n-propylamine	ug/l	10	U
SW8270	N-Nitrosodiphenylamine	ug/l	10	U
SW8270	Naphthalene	ug/l	10	U
SW8270	Nitrobenzene	ug/l	10	U
SW8270	Pentachlorophenol	ug/l	10	U
SW8270	Phenanthrene	ug/l	10	U
SW8270	Phenol	ug/l	10	U
SW8270	Pyrene	ug/l	10	U
SW6010	Aluminum	ug/l		
SW6010	Antimony	ug/l		
SW6010	Arsenic	ug/l		
SW6010	Barium	ug/l		
SW6010	Beryllium	ug/l		
SW6010	Cadmium	ug/l		
SW6010	Calcium	ug/l		
SW6010	Chromium	ug/l		
SW6010	Cobalt	ug/l		
SW6010	Copper	ug/l		
SW6010	Iron	ug/l		
SW6010	Lead	ug/l		
SW6010	Magnesium	ug/l		
SW6010	Manganese	ug/l		
SW6010	Nickel	ug/l		
SW6010	Potassium	ug/l		
SW6010	Selenium	ug/l		
SW6010	Silver	ug/l		

produced by: BJS 5/15/09
checked by: TLC 5/18/09

TABLE 2 - RESULTS SUMMARY
DATA USABILITY SUMMARY REPORT - SDG A2166
DIAMOND CLEANERS SITE
ELMIRA, NEW YORK

		Lab Sample Delivery Group	A2166	
		Lab Sample Id	A2166-04	
		Loc Name	MW-007	
		Field Sample Id	DCMW00701709	
		Field Sample Date	4/2/2009	
		Qc Code	FS	
Analysis Methoc	**Param Name**	**Units**	Result	Qualifier
SW6010	Sodium	ug/l		
SW6010	Thallium	ug/l		
SW6010	Vanadium	ug/l		
SW6010	Zinc	ug/l		
SW7470	Mercury	ug/l		
SW8081	4,4`-DDD	ug/l		
SW8081	4,4`-DDE	ug/l		
SW8081	4,4`-DDT	ug/l		
SW8081	Aldrin	ug/l		
SW8081	Alpha-BHC	ug/l		
SW8081	Alpha-Chlordane	ug/l		
SW8081	Beta-BHC	ug/l		
SW8081	Delta-BHC	ug/l		
SW8081	Dieldrin	ug/l		
SW8081	Endosulfan I	ug/l		
SW8081	Endosulfan II	ug/l		
SW8081	Endosulfan sulfate	ug/l		
SW8081	Endrin	ug/l		
SW8081	Endrin aldehyde	ug/l		
SW8081	Endrin ketone	ug/l		
SW8081	Gamma-BHC/Lindane	ug/l		
SW8081	Gamma-Chlordane	ug/l		
SW8081	Heptachlor	ug/l		
SW8081	Heptachlor epoxide	ug/l		
SW8081	Methoxychlor	ug/l		
SW8081	Toxaphene	ug/l		

Notes:
ug/l = microgram per liter
Qualifier: U = not detected, J = estimated value,
D = result from a dilution analysis
QC Code: FS = Field Sample, FD = Field Duplicate
TB = Trip Blank
Metals results are dissolved fraction

Table 3 - Tentativley Identified Compounds in VOC and SVOC Samples

sample_name	sample_date	lab_sample_id	Method	Cas No.	chemical_name	concentration (ug/L)	Qualifier
DCMW00502109	4/2/2009	A2166-01	SW8260	000526-73-8	Benzene, 1,2,3-trimethyl-	57	JN
DCMW00502109	4/2/2009	A2166-01	SW8260	000095-63-6	Benzene, 1,2,4-trimethyl-	28	JN
DCMW00502109	4/2/2009	A2166-01	SW8260	000108-67-8	Benzene, 1,3,5-trimethyl-	50	JN
DCMW00502109	4/2/2009	A2166-01	SW8260	000611-14-3	Benzene, 1-ethyl-2-methyl-	23	JN
DCMW00502109	4/2/2009	A2166-01	SW8270	4551-51-3	1H-Indene, octahydro-, cis-	2.7	J
DCMW00502109	4/2/2009	A2166-01	SW8270	10/5/6966	3,4-Dimethylbenzyl alcohol	4.2	J
DCMW00502109	4/2/2009	A2166-01	SW8270	527-53-7	Benzene, 1,2,3,5-tetramethyl-	3.6	J
DCMW00502109	4/2/2009	A2166-01	SW8270	95-93-2	Benzene, 1,2,4,5-tetramethyl-	3.4	J
DCMW00502109	4/2/2009	A2166-01	SW8270	135-01-3	Benzene, 1,2-diethyl-	4.3	J
DCMW00502109	4/2/2009	A2166-01	SW8270	108-67-8	Benzene, 1,3,5-trimethyl-	82	J
DCMW00502109	4/2/2009	A2166-01	SW8270	141-93-5	Benzene, 1,3-diethyl-	9	J
DCMW00502109	4/2/2009	A2166-01	SW8270	933-98-2	Benzene, 1-ethyl-2,3-dimethyl-	5.7	J
DCMW00502109	4/2/2009	A2166-01	SW8270	622-96-8	Benzene, 1-ethyl-4-methyl-	9.2	J
DCMW00502109	4/2/2009	A2166-01	SW8270	1074-55-1	Benzene, 1-methyl-4-propyl-	10	J
DCMW00502109	4/2/2009	A2166-01	SW8270	1758-88-9	Benzene, 2-ethyl-1,4-dimethyl-	4.5	J
DCMW00502109	4/2/2009	A2166-01	SW8270	619-04-5	Benzoic acid, 3,4-dimethyl-	2.6	J
DCMW00502109	4/2/2009	A2166-01	SW8270	6783-92-2	Cyclohexane, 1,1,2,3-tetramethyl-	4.9	J
DCMW00502109	4/2/2009	A2166-01	SW8270	119-64-2	Naphthalene, 1,2,3,4-tetrahydro-	2.9	J
DCMW00502109	4/2/2009	A2166-01	SW8270	UNKNOWN at 3.44 min	unknown3.44	3.5	J
DCMW00502109	4/2/2009	A2166-01	SW8270	UNKNOWN at 5.32 min	unknown5.32	6.7	J

APPENDIX F

OXIDANT DEMAND AND DEHALOCOCCOIDES RESULTS

CRS 6/1/09

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Natural Oxidant Demand Test (Permanganate) Certificate of Analysis

Customer MACTEC E&S

Project: Diamond Cleaners

Customer Reference #: 3612062070 / 02.1

Site Sampling Date: 23 July 2008

SiREM Reference #: S-1364/TL0168

Report Issued: 14 August 2008

Data Files: S-1364-NOD

Test Results Summary:

Customer Sample ID	SiREM ID	MnO_4 NOD (g/kg)	$KMnO_4$ NOD (g/kg)	$NaMnO_4$ NOD (g/kg)	Comments
NA	Reagent Control	0.00	0.00	0.00	Normal
Source-1 12-14ft	08-0909	11.71	15.56	13.98	--
Source-2 14-16ft	08-0910	7.66	10.17	9.14	--

Notes:

-NOD-Natural oxidant demand
-NOD based on 14 day incubation and reported as grams of specified oxidant per kilogram of sediment.
-MnO_4- permanganate
-$KMnO_4$- potassium permanganate
-$NaMnO_4$- sodium permanganate
-$NaMnO_4$ and KMnO4 values are calculated from the MnO_4 NOD and the relative molecular weights of the compounds
-Reagent Control-Sodium permanganate solution without added sediment (i.e., negative control).
-NA-not applicable

Analyst: Rita Schofield
Rita Schofield
Laboratory Technician

Reviewed by: Philip Dennis
Philip Dennis, M.A.Sc.
Technology Manager

Case Narrative

Two sediment samples were received from MACTEC E&S on 28 July 2008. The samples arrived in good condition at a temperature of 24.4 °C and were stored at 4°C upon arrival. Oxidant demand testing commenced on 29 July 2008. All controls and test procedures were normal.

Detailed Test Parameters:

Lab ID	Client ID
Sample 08-0909	Source-1 (12-14ft)

Initial Concentration (g/L)	14.90
Volume of Solution (mL)	89.85
Ave Mass soil (g)	50.32

Incubation Time (days)	Concentration of MnO_4 (g/L)					Remaining MnO_4 (g)	Consumed MnO_4(g)	Oxidant Demand (g/kg)
	Rep.1	Rep. 2	Rep. 3	Average	SD			
2	11.85	11.50	11.95	11.8	0.24	1.06	0.28	5.59
7	9.55	9.05	10.10	9.6	0.53	0.86	0.48	9.52
14	8.44	7.59	8.99	8.3	0.71	0.75	0.59	11.71

Lab ID	Client ID
Sample 08-0910	Source-2 (14-16ft)

Initial Concentration (g/L)	14.90
Volume of Solution (mL)	91.42
Ave Mass soil (g)	50.55

Incubation Time (days)	Concentration of MnO_4 (g/L)					Remaining MnO_4 (g)	Consumed MnO_4(g)	Oxidant Demand (g/kg)
	Rep.1	Rep. 2	Rep. 3	Average	SD			
2	12.40	12.50	12.35	12.4	0.08	1.14	0.23	4.49
7	11.41	11.26	11.21	11.3	0.10	1.03	0.33	6.52
14	10.85	10.60	10.55	10.7	0.16	0.98	0.39	7.66

Lab ID	Client ID
Sample Reagent Control	N/A

Initial Concentration (g/L)	14.90
Volume of Solution (mL)	115.08
Ave Mass soil (g)	0.00

Incubation Time (days)	Concentration of MnO_4 (g/L)						
	Rep.1	Rep. 2	Average	SD	Mass of MnO_4 Remaining (g)	Mass of MnO_4 Consumed (g)	*Equivalent Oxidant Demand (g/kg)
0	14.92	14.87	14.90	0.04	1.71	0.00	0.00
14	14.90	14.97	14.94	0.05	1.72	0.00	0.00

Notes:

-Avg.-Average
-*Equivalent Oxidant Demand (g/kg): due to the fact that no sediment is added to Reagent Control, this value assumes 50 g of sediment added to express reagent oxidant demand in g/kg.
-g- grams
-g/kg-grams per kilogram
-SD-Standard deviation
-Rep- Replicate

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Lab # S-1364

Page 1 of 1

Project Name: DIAMOND CLEANERS
Project #: 3612062070/02.1
Project Manager: CHARLES STAPLES
Email Address: CRSTAPLES@MACTEC.COM
Company: MACTEC E&C
Address: 511 CONGRESS ST. P.O. BOX 7050, PORTLAND, ME 04112 USA
Phone #: (207) 775-5401
Fax #: (207) 772-4762
Sampler's Signature:
Sampler's Printed Name: Thomas D. Longley

Analysis

Client Sample ID	Lab ID	Sampling Date	Sampling Time	Matrix	# of Containers	TOTAL OXYGEN DEMAND	Other Information
Preservative							
SOURCE-1		7/23/08	14:22	SOIL	1	1	~1-L GLASS CONTAINER
SOURCE-2		7/23/08	14:26	SOIL	1	1	~1-L GLASS CONTAINER
							(SOURCE-1 IS 12'-14')
							(SOURCE-2 IS 14'-16')

Preservative Key
0. None
1. HCL
2. Other
3. Other
4. Other
5. Other
6. Other

Sample Receipt
Cooler Condition: good
Cooler Temperature: 24.4°C
Custody Seals: Yes ☐ No ☒

Invoice Information
P.O. #
Bill To:
Quotation #

For Lab Use Only

	Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature						
Printed Name	Thomas D. Longley	Kirsten Marden				
Firm	MACTEC E&C	SiREM				
Date/Time	7/24/08 18:00	7/28/08 2:30				

Distribution: White - Return to Originator: Yellow - Lab Copy: Pink - Retained by Client

TO FEDEX

Jeff Roberts

In the absence of an executed agreement, submission of samples to SiREM implies consent for performance of analyses specified on this Chain-of-Custody form and agreement with the terms and conditions of the SiREM Laboratory Services Agreement. The entity submitting samples shall be responsible for payment in full for said analyses.

REVIEWED
By crstaples at 12:49 pm, 6/2/09

CRS 6/2/09

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Certificate of Analysis: Quantitative Gene-Trac *Dehalococcoides* Assay

Customer: John Peterson, Mactec Engineering

Project: Diamond Cleaners

Customer Reference: 3612062070

SiREM Reference: S-1378

Report Issued: 2-Sept-08

Data Files: DHC-UP-0491
QPCR-0381

Table 1: Test Results

Customer Sample ID	SiREM Sample ID	Sample Collection Date	Sample Matrix	Percent Dhc [A]	*Dehalococcoides* Enumeration [B]
DCMWOOS02108	DHC-4253	12-Aug-08	Groundwater	NA(1)	ND(2)
DCMWOO701708	DHC-4254	12-Aug-08	Groundwater	0.007-0.02%	8 x 10^4/liter

Notes:

[A] Percent *Dehalococcoides* (Dhc) in microbial population. This value is calculated by dividing the number of Dhc 16S ribosomal ribonucleic acid (rRNA) gene copies by the total number of bacteria as estimated by the mass of DNA extracted from the sample. Range represents normal variation in Dhc enumeration.

[B] Based on quantification of Dhc 16S rRNA gene copies. Dhc are generally reported to contain one 16S rRNA gene copy per cell; therefore, this number is often interpreted to represent the number of Dhc cells present in the sample.

NA = not applicable
ND = not detected

[1] Not applicable as *Dehalococcoides* not detected.
[2] Not detected. The sample specific quantitation limit is 4 x 10^3/liter.

Analyst: J. Wilkinson
Jennifer Wilkinson
Biotechnology Technologist

Approved: Ximena Druar
Ximena Druar, B.Sc.
Molecular Biology Coordinator

Table 2: Detailed Test Parameters, Gene-Trac Test Reference S-1378

Customer Sample ID	DCMWOOS02108	DCMWOO701708
SiREM Sample ID	DHC-4253	DHC-4254
Date Received	13-Aug-08	13-Aug-08
Sample Temperature	10.2 °C	10.2 °C
Volume Used for DNA Extraction	500 mL	400 mL
DNA Extraction Date	21-Aug-08	21-Aug-08
DNA Concentration in Sample (extractable)	1241 ng/L	2566 ng/L
Extracted DNA Quality Test (universal PCR primers)	Passed	Passed
Secondary DNA Purification	NR	NR
qPCR Date Analyzed	29-Aug-08	29-Aug-08
Laboratory Controls (see Table 3)	Passed	Passed
Comments	- -	- -

Notes:

Refer to Table 3 for detailed results of controls.
NR = not required
ND = not detected
°C = degrees Celsius

PCR = polymerase chain reaction
qPCR = quantitative PCR
Dhc = *Dehalococcoides*

ng/L = nanograms per liter
mL = milliliters
DNA = Deoxyribonucleic acid

Table 3: Experimental Control Results, Gene-Trac Test Reference S-1378

Laboratory Control	Analysis Date	Control Description	Spiked Dhc 16S rRNA Gene Copies per Liter	Recovered Dhc 16S rRNA Gene Copies per Liter	Comments
Positive Control Low Concentration	29-Aug-08	qPCR with KB1 genomic DNA (CSLD-0025)	1.7×10^6	1.3×10^6	Normal[1]
Positive Control High Concentration	29-Aug-08	qPCR with KB1 genomic DNA (CSHD-0025)	1.7×10^8	1.6×10^8	Normal[1]
DNA Extraction Blank	29-Aug-08	DNA extraction sterile water (DB-0817)	0	ND	Normal
Negative Control	29-Aug-08	Tris Reagent Blank	0	ND	Normal

Notes:

[1] Within defined limits of +/- 50%

Dhc = *Dehalococcoides*

DNA = Deoxyribonucleic acid

ND = not detected

qPCR = quantitative PCR

16S rRNA = 16S ribosomal ribonucleic acid

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№ 1671

Lab # S-1378

Page 1 of 1

Project Name: Diamond Cleaners Site
Project #: 3612062070
Project Manager: John Peterson
Email Address:
Company: Mactec Engineering
Address: 511 Congress St. Portland, Maine 04101
Phone #:
Fax #:
Sampler's Signature:
Sampler's Printed Name: Mark K Maggiore

Analysis

Preservative: 0

Client Sample ID	Lab ID	Sampling Date	Sampling Time	Matrix	# of Containers	Gene-Trac Method #3	Other Information
DCMW00502108		8/12/08	08:40	Water	1	X	
DCMW00701708		8/12/08	13:55	water	1	X	

Preservative Key
0. None
1. HCL
2. Other
3. Other
4. Other
5. Other
6. Other

Sample Receipt

Cooler Condition: Good

Cooler Temperature: 10.2°C

Custody Seals: Yes ☐ No ☒

Invoice Information

P.O. #
Bill To:
Quotation #

For Lab Use Only

	Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature						
Printed Name	Mark K. Maggiore	D. Nespoli				
Firm	Mactec	SiREM				
Date/Time	8/12/08 17:30	AUG 13 '08. 1pm.				

Distribution: White - Return to Originator: Yellow - Lab Copy: Pink - Retained by Client

In the absence of an executed agreement, submission of samples to SiREM implies consent for performance of analyses specified on this Chain-of-Custody form and agreement with the terms and conditions of the SiREM Laboratory Services Agreement. The entity submitting samples shall be responsible for payment in full for said analyses.

Interpretation of Quantitative Gene-Trac *Dehalococcoides* Test Results

1) Background:

Dehalococcoides group organisms (*Dhc*) are the only known microorganisms capable of complete dechlorination of chloroethenes (i.e., tetrachloroethene, trichloroethene, *cis*-dichloroethene, vinyl chloride to non-toxic ethene. The detection of the *Dhc* 16S ribosomal ribonucleic acid (rRNA) gene has been correlated with the complete biological dechlorination of chlorinated ethenes to ethene at contaminated sites (Hendrickson et. al., 2002, *Applied and Environmental Microbiology*, 68: 485-495). The Quantitative Gene-Trac *Dehalococcoides* test is a quantitative polymerase chain reaction (PCR) test used to determine the concentration of the *Dhc* 16S rRNA gene in soil and groundwater samples.

2) Interpretation of Test Results:

The Quantitative Gene-Trac test reports two types of results, *"Dehalococcoides* 16S rRNA Gene Copies" is a raw value whereas **"**% *Dehalococcoides* in Microbial Population*"* is the raw value expressed as percentage of total microbial population.
A detailed explanation of the two types of results is provided below.

a) *Dehalococcoides* 16S rRNA Gene Copies

This value is the direct number of *Dhc* 16S rRNA gene copies detected in the sample. Results may be reported either per liter (for groundwater) or per gram (for soil). This number is generally interpreted as equivalent to the number of viable *Dhc* present in the sample when certain reasonable assumptions are made, including that the DNA quantified belongs to viable *Dhc* (i.e., not from dead *Dhc*) and that each *Dhc* cell contains only one 16S rRNA gene. Guidelines for relating this value to observable dechlorination impacts for groundwater samples are provided below.

- **Values of 10^3 gene copies per liter or lower,** indicate the sample contains low concentrations of *Dhc* organisms which may indicate that site conditions are sub-optimal for high rates of dechlorination. Increases in *Dhc* concentrations at the site may be possible if conditions are modified (e.g., electron donor addition).

- **Values of 10^4-10^6 gene copies per liter,** indicates the sample contains moderate concentrations of *Dhc* which may, or may not, be associated with observable dechlorination impacts (i.e., ethene).

- **Values at or above 10^7 gene copies per liter,** indicate the samples contains high concentrations of *Dhc* which is often associated with high rates of dechlorination and the production of ethene. Test results exceeding 10^9 gene copies/liter are rarely observed.

b) % *Dehalococcoides* in Microbial Population (% *Dhc*)

This value presents the percentage of *Dhc* (% *Dhc*) relative to other microorganisms in the sample based on the formulas below. % *Dhc* is a measure of the predominance of *Dhc and,* in general, the higher this percentage the better.

$$\% \ Dhc = \frac{Number \ Dhc}{Number \ Dhc + Number \ other \ Bacteria}$$

Where:

$$Number \ other \ Bacteria = \frac{Total \ DNA \ in \ sample \ (ng) - DNA \ attributed \ to \ Dhc \ (ng)}{4.0 \ x \ 10^{-6} \ ng \ DNA \ per \ bacterial \ cell}$$

The number of non-*Dhc* bacteria is estimated by assuming each non-*Dhc* bacterium contains 4.0 x 10^{-6} nanograms (ng) of DNA (Paul and Clark. 1996. *Soil Microbiology and Biochemistry*). Because the total mass of DNA in a sample is determined (by fluorometry) the total number of bacteria present can be estimated. For perspective, the % *Dhc* can range from very low fractions of percentages, in samples that have low numbers of *Dhc* and high numbers of other bacteria (incompletely colonized by *Dhc*), to greater than 50% in *Dhc* enriched cultures such as KB-1™ (fully colonized by *Dhc*).

In addition to determining the predominance of *Dhc*, this value is also used for interpretation of *Dhc* counts from different sampling locations or the same location over time, because it is normalized to total bacteria. In particular, the % *Dhc* value can be used to correct *Dhc* counts where samples are biased low due to non-representative sampling of biomass (bacteria). Example 1 below illustrates a scenario where the % *Dhc* value improves the interpretation of data where one sampling event was biased.

Example 1, use of % Dhc Value to interpret raw data

Example 1 presents results from monitoring well MW-1 sampled in April, May and June. Based on the raw *Dhc* counts alone (*Dehalococcoides* 16S rRNA Gene Copies) it might be assumed that the number of *Dhc* decreased 10-fold between April and May; however, based on the percentage of *Dhc* it is clear that the proportion of *Dhc* actually increased from April to May and that the low count is probably a case of sampling variability (biased low). The higher raw count and the higher percentage of *Dhc* in June confirms the trend of increasing *Dhc* concentrations over time.

Sample	***Dehalococcoides* 16S rRNA Gene Copies**	**% *Dhc***	**Interpretation Based on % *Dhc***
MW-1–April	1.0 x 10^5/Liter	0.1%	*Dhc* is a low proportion of total microbial population
MW-1–May	1.0 x 10^4/Liter	1%	*Dhc* predominance increased 10-fold from April, low count from low biomass sampled, non-biased sample would be [(1.0/0.1) x 1.0 x10^5] = 10^6 /Liter
MW-1 June	1.0 x 10^7/Liter	10%	*Dhc* predominance moderate and has increased 100-fold from April

3) Explanation of Notes

Quantitation limit: The quantitation limit of Gene-Trac test is 2,150 *Dhc* 16S rRNA gene copies per liter. Note, the specific quantitation limit for each test varies depending on the volume of sample used in the DNA extraction process. For example, if only a ½ liter of water was used the quantitation limit would increase two-fold to 4300 gene copies per liter. The specific quantitation limit is provided only where *Dhc* is not detected.

Value is an estimated quantity between the quantitation limit and detection limit: This is applicable in situations where *Dhc* DNA is detected above the detection limit, but below the quantitation limit, of the standard curve. In such cases an estimated value is provided which is based on extrapolation of the standard curve.

Sample inhibited testing: Each Quantitative Gene-Trac test includes a quantification of the amount of DNA extracted from the sample and a second test to determine if the extracted DNA is suitable for *Dhc* testing (PCR with a universal Bacteria primer). If a sample is determined to contain DNA and PCR with universal primers is negative, it suggests that the extracted DNA inhibited the PCR. Inhibition may be caused by compounds present in the original groundwater sample (e.g., humic acids). Where inhibition occurs there is an increased likelihood of false negatives since *Dhc* DNA, if present, may not be detected.

DNA not extracted from the sample: If DNA is not detected in the sample then "DNA not extracted from the sample" is reported. This is commonly due to samples that contain little or no biomass (bacteria). In some cases sampling may not capture bacteria (e.g., when attached bacteria are not dislodged from the aquifer matrix).

4) Converting Standard Gene-Trac to *Dhc* 16S rRNA Gene Copies/Liter

Quantitative Gene-Trac provides quantitative results in *Dhc* 16S rRNA Gene Copies/Liter, whereas standard Gene-Trac provides semi-quantitative results using a plus scale. Based on parallel analysis of standard versus Quantitative Gene-Trac estimates of the number of *Dhc* gene copies for each + score in the standard test were determined. Note, the conversion factors do not apply in all cases and are meant to be used as a rule of thumb for relating standard Gene-Trac results to Quantitative-Gene-Trac.

Estimated 16S rRNA Gene Copies/Liter for Standard Gene-Trac Intensity Scores

Standard Gene-Trac Intensity Score	Approximate Range of 16S rRNA Gene Copies/Liter
+	10^3-10^5
++	10^4-10^6
+++	10^5-10^7
++++	10^6-10^8

SiREM
Site Recovery & Management

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130 Research Lane, Suite 2
Guelph, Ontario N1G 5G3
Phone (519) 822-2265
Fax (519) 822-3151

Certificate of Analysis: Gene-Trac-VC, Vinyl Chloride Reductase (*vcrA*) Assay

Customer: Chuck Staples, Mactec Engineering

Project: Diamond Cleaners

Customer Reference: 3612062070

SiREM Reference: S-1378

Report Issued: 11-Nov-09

Data Files: VC-QPCR-0236
VC-QPCR-Check-gel-0259
DB-VC-QPCR-0040

Table 1: Test Results

Customer Sample ID	SiREM Sample ID	Sample Collection Date	Sample Matrix	Percent *vcrA* [A]	Vinyl Chloride Reductase (*vcrA*) Gene Copies
DCMWOO701708	VCR-1543	12-Aug-08	Groundwater	0.001-0.004%	2 x 10^4/liter(1)

Notes:

[A] Percentage of bacteria in the microbial population that harbor the *vcrA* gene. This value is calculated by dividing the measured number of cells haboring the vinyl chloride reductase A (*vcrA*) gene by the total number of bacteria in the sample estimated using the mass of DNA extracted from the sample. Range represents normal variation in enumeration of *vcrA*.

[1] Correction factor applied to correct for non-specific PCR amplification products.

Analyst: Julie Pring
Julie Pring
Biotechnology Technologist

Approved: Philip
Philip Dennis, M.A.Sc.
Technology Manager

Table 2: Detailed Test Parameters, Gene-Trac Test Reference S-1378

Customer Sample ID	DCMWOO701708
SiREM Sample ID	VCR-1543
Date Received	13-Aug-08
Sample Temperature	10.2 ºC
Volume Used for DNA Extraction	400 mL
Filtration Date	20-Aug-08
DNA Extraction Date	21-Aug-08
DNA Concentration in Sample (extractable)	3208 ng/L
PCR Amplifiable DNA	Detected
qPCR Date Analyzed	6-Nov-09
Laboratory Controls (see Table 3)	Passed
Comments	Gene-Trac VC test performed on frozen archived DNA sample.

Notes:

Refer to Table 3 for detailed results of controls.
ND = not detected
ng/L = nanograms per liter

PCR = polymerase chain reaction
qPCR = quantitative PCR
vcrA = vinyl chloride reductase

DNA = Deoxyribonucleic acid
°C = degrees Celsius
mL = milliliters

Table 3: Experimental Control Results, Gene-Trac Test Reference S-1378

Laboratory Control	Analysis Date	Control Description	Spiked *vcrA* reductase Gene Copies per Liter	Recovered *vcrA* reductase Gene Copies per Liter	Comments
Positive Control Low Concentration	6-Nov-09	qPCR with KB-1 genomic DNA (CSLV-0104)	1.1×10^{6}	1.2×10^{6}	- -
Positive Control High Concentration	6-Nov-09	qPCR with KB-1 genomic DNA (CSHV-0104)	1.6×10^{8}	1.4×10^{8}	- -
Negative Control	6-Nov-09	Tris Reagent Blank (TBV-0075)	0	Inconclusive	See Note 1
DNA Extraction Blank	5-Nov-09	DNA extraction sterile water (DB-0817)	0	ND	- -

Notes:

ND = not detected

qPCR = quantitative PCR

Dhc = *Dehalococcoides*

DNA = Deoxyribonucleic acid

16S rRNA = 16S ribosomal ribonucleic acid

vcrA = vinyl chloride reductase

[1] Inconclusive results may indicate extremely low concentrations of *vcrA* DNA.

SiREM
Site Recovery & Management

Chain-of-Custody Form

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www.siremlab.com

№ 1671
Lab # S-1378
Page 1 of 1

Project Name Diamond Cleaners Site	Project # 3612062070
Project Manager John Peterson	
Email Address	
Company Mactec Engineering	
Address 511 Congress St. Portland, Maine 04101	
Phone #	Fax #
Sampler's Signature Mark Maggiore	Sampler's Printed Name Mark Maggiore

Analysis

Client Sample ID	Lab ID	Sampling Date	Sampling Time	Matrix	# of Containers	Gene-Trac Method #3											Other Information
Preservative						0											
DCMW00502108		8/12/08	08:40	Water	1	X											
DCMW00701708		8/12/08	13:55	Water	1	X											

Preservative Key
0. None
1. HCL
2. Other
3. Other
4. Other
5. Other
6. Other

Sample Receipt

Cooler Condition: Good

Cooler Temperature: 10.2°C

Custody Seals: Yes ☐ No ☒

Invoice Information

P.O. #

Bill To:

Quotation #

For Lab Use Only

	Relinquished By:	Received By:	Relinquished By:	Received By:	Relinquished By:	Received By:
Signature	Mark Maggiore	D. Nespoli				
Printed Name	Mark Maggiore	D. Nespoli				
Firm	MacTec	SiREM				
Date/Time	8/12/08 17:30	AUG 13 '08. 1pm.				

Distribution: White - Return to Originator: Yellow - Lab Copy: Pink - Retained by Client

In the absence of an executed agreement, submission of samples to SiREM implies consent for performance of analyses specified on this Chain-of-Custody form and agreement with the terms and conditions of the SiREM Laboratory Services Agreement. The entity submitting samples shall be responsible for payment in full for said analyses.

APPENDIX G

DESCRIPTIONS OF VARIOUS IN-SITU ENHANCED BIODEGRADATION AND CHEMICAL OXIDATION REAGENTS

APPENDIX G – IN-SITU ENHANCED BIODEGRADATION REAGENTS

The information presented for enhanced biodegradation reagents presented in this Appendix are based upon MACTEC discussions and/or internet searches associated with the vendors referenced. The following paragraphs are intended only to provide examples of several commercially available enhanced biodegradation reagents, and not to preclude other reagents or to promote these products. Furthermore, MACTEC does not attest to the accuracy of the information presented.

Chitin ('kI-t&n). Chitin is a polysaccharide found in the outer skeleton (exoskeleton) of insects, crabs, shrimps, and lobsters and in the internal structures of other invertebrates (http://www.euchis.org/). JRW Bioremediation, LLC, Lenexa, Kansas has formulated a product called ChitoRem™, a food-grade biopolymer derived from chitin that has been treated with caustic and ground to various particle sizes. According to JRW Bioremediation, LLC, ChitoRem™ is a natural source of volatile fatty acids, which serve as electron donors for up to several years, facilitating bioremediation of chlorinated solvents and reduction of metals (www.jrwbioremediation.com). Additionally, nitrogen is naturally present in the polymer to facilitate biological growth. Potential applications of this product include permeable reactive barriers (PRBs) and hydraulic fracturing into source areas.

Hydrogen Release Compound™. Hydrogen Release Compound (HRC)™, a product of Regenesis, Inc., San Clemente, CA, is a polylactate ester that is specifically designed to slowly release lactic acid when contacted with water that is metabolized by subsurface microbes that indirectly produce hydrogen (www.regenesis.com/products/hrc/). Hydrogen is a key ingredient in an anaerobic contaminant degrading process known as reductive dechlorination. Reductive dechlorination is the mechanism by which chlorinated compounds are biodegraded. HRC™ is currently available in four formulations, HRC® (a viscous, slow release formulation), HRC-X™ (a more viscous, longer lasting formulation), HRC Advanced™ (a less viscous, more mobile formulation), and HRC Primer® (a less viscous, shorter lived, formulation used to prime an aquifer for implementation of the other formulations).

EHC™. Adventus Americas (Adventus) markets EHC™, a product which consists of a solid phase controlled release carbon source combined with micro-scale ZVI (http://www.adventusgroup.com/products/ehc.shtml). EHC™ causes destruction of contaminants through two primary mechanisms: (i) chemical reduction; and (ii) enhanced biological degradation. Together the two components provide powerful reducing conditions (i.e., eH < -550 millivolts), lower than otherwise independently applied conventional enhanced biodegradation products or granular ZVI can achieve. The organic component of EHC™ consists of a fibrous organic material that is nutrient rich, hydrophilic, and has high surface area that supports bacterial growth in the groundwater environment. As the bacteria grow on the organic particles, they ferment the carbon source and release a variety of volatile fatty acids (acetic, propionic, and butyric) and hydrogen which diffuse from the site of fermentation into the groundwater plume where they serve as electron donors for other microbes including dehalogenators. The ZVI is micro-scale (5 to 10 microns) which, due to its small diameter, provides a substantially more reactive surface than granular ZVI and stimulates direct chemical dechlorination through the decrease in the redox potential of the groundwater via corrosion of the iron and oxygen uptake. The combined biological and chemical reduction promotes an extremely reduced environment that can dechlorinate otherwise persistent chlorinated compounds.

EHC™ is reportedly completely non-hazardous and safe to handle. It is delivered as a dry powder in 50-lb bags or 2,000 lb super-sacks. It is mixed with water on site into slurry containing 30 to 40 percent solids. A mixing tank with paddle-mixer is recommended, although other methods used have ranged from a sophisticated in-line automated system to manual mixing using a hand-held drill with mixing attachment. The slurry is then transferred to a feed tank connected to the injection pump capable of injecting at least 5 gpm at 300 lb per square inch pressure.

APPENDIX G – IN-SITU CHEMICAL OXIDATION REAGENTS

The information presented for chemical oxidation reagents presented in this Appendix are based upon MACTEC discussions and/or internet searches associated with the vendors referenced. The following paragraphs are intended only to provide examples of several commercially available chemical oxidation reagents, and not to preclude other reagents or to promote these products. Furthermore, MACTEC does not attest to the accuracy of the information presented.

Permanganate. Chemical oxidation using permanganate typically involves injecting aqueous potassium permanganate (KMnO4) or sodium permanganate (NaMnO4) solution into the contaminant zone. Groundwater can also be extracted, dosed with KMnO4, and then reinjected at an upgradient location. This creates a treatment cell, allowing flushing of several pore volumes of solution through the contaminated zone until the contaminants have been oxidized. The physical flushing action aids in distribution of the oxidant through the treatment zone.

Permanganate has proven successful at dechlorination of ethene-based chlorinated solvents. Tests typically have shown greater than 90 percent removal rates with proper dosing and retention times. However, permanganate is far less successful in treating ethane-based chlorinated solvents such as 1,1,1-TCA. Permanganate is relatively stable and persistent in the subsurface, and as a result, migrates by diffusive processes. Manganese dioxide (MnO_2), one of the chief byproducts of permanganate application, may need to be controlled because it may cause clogging of the wells, aquifer, or treatment system (if recirculation system is used).

Typical application of MnO_4^- involves direct injection of permanganate. Other applications include use of an extraction/re-injection recirculation-type system. Previous studies have shown that a pilot test is required to optimize the application of MnO_4^- .

Hydrogen Peroxide. Injection of hydrogen peroxide (H_2O_2) is usually accompanied by injection of ferrous ion (Fe2+). The H_2O_2 reacts with ferrous ion (Fe2+) to produce the hydroxyl free radical (OH•), a powerful oxidizer. Known as Fenton's reagent, the hydroxyl radical progressively oxidizes organic compounds to produce carbon dioxide and water. Several vendors offer commercial versions of this technology. Typically, injection of ferrous sulfate is followed by injection of H_2O_2 or a reagent blend. The ensuing reaction is highly exothermic. Dosage is dependent on contaminant mass, and distribution of the injected chemical solution can be difficult to control.

No waste is generated from the treatment process, and no material is brought to the surface. End products of this process are carbon dioxide, water, and chloride ions. Fenton's reagent generally reacts more with soil materials, typically requiring the injection of greater quantities of oxidant than for the permanganate chemical oxidation technology.

One of the most experienced vendors is Geo-Cleanse International, Inc. (GCI) (Kenilworth, New Jersey). GCI markets a H_2O_2 and ferric iron catalyst product which is injected into the ground, typically using injectors which have components to stimulate circulation of groundwater to promote rapid mixing and dispersion. The ferric iron is injected first in order to optimize the pH, to between 4 and 6. This is followed by injecting a mixture of ferric iron and H_2O_2. When the H_2O_2 is injected into the subsurface it will generate heat, primarily due to the formation of oxygen as the H_2O_2 breaks down. The entire process requires pH control.

In-Situ Oxidative Technologies, Inc. (ISOTEC) has developed a modified Fenton's Reagent to overcome what they feel are the shortcomings of typical Fenton's reagent applications, namely the use of strong acids and high reagent concentrations under pressure, and potential incomplete treatment, explosive reactions, organic vapor generation, and contaminant migration. ISOTEC's modified Fenton's Reagent process allows reagents to work at neutral pH conditions and to be effectively distributed within the aquifer, destroying contaminants in saturated soil and groundwater without generating organic vapors or high temperatures (http://www.insituoxidation.com/pages/833738/index.htm). The reported radius of influence of the modified Fenton's product is 10 to 12 feet.

Ozone. Injection (or sparging) of ozone gas into the aquifer can oxidize contaminants directly or produce hydroxyl radicals. Like peroxide, the ozone reacts with soil materials, requiring the use of more oxidant material than required for contaminant destruction alone.

Ozone is a highly reactive gas that is typically generated on-site. Ozone is an extremely powerful oxidant because it non-selectively oxidizes compounds dissolved in groundwater. However, because of its reactivity, ozone may dissipate rapidly in natural water either by reacting with natural constituents or by spontaneous decomposition. Similar to permanganate, ozone application has successfully dechlorinated solvents in several bench- and pilot-scale tests. The tests typically have shown greater than 90 percent removal rates with proper dosing. The sparging treats the contaminated soil and groundwater through a combination of stripping and chemical oxidation (via a hydroxyl radical). The byproducts of ozone application on chlorinated solvents are carbon dioxide and hydrochloric acid. Because ozone is a gas, preferential pathways in the soil may limit the completeness of treatment.

Ozone must be produced on-site and delivered through sparge points. Vapor capture is not normally necessary. Ozone treatment may require significantly more time than the other chemical oxidants. Power requirements to manufacture ozone are relatively low. The ozone application may require pH control.

RegenOx™. RegenOx™ is a solid alkaline oxidant [Product of Regenesis, Inc. of San Clemente, CA] that employs a sodium percarbonate complex with a multi-part catalytic formula (www.Regenesis.com). Benefits of this product are rapid and sustained oxidation, applicability to a broad range of contaminants, enhancement of subsequent bioremediation, and safe and easy application. Regenesis claims RegenOx™ is effective in treatment of both ethane- and ethene-based chlorinated solvents. RegenOx™ lasts 30 days in the subsurface, and is marketed as a safer alternative to the traditional peroxide/Fenton's reagent and permanganate chemical oxidation technologies.

Activated Persulfate. Persulfate, the newest form of oxidant being used in practice, is a strong oxidant capable of degrading many environmental contaminants which, when catalyzed with various reactants to form the sulfate radical, becomes an even more powerful oxidant (USEPA, 2006). Catalysis can be achieved at elevated temperatures (35 to 40 ˚C), with ferrous iron (Fe(II)), by photo (UV) activation, with base (i.e., elevated pH), or with H_2O_2.

Sodium persulfate is the most common and feasible form of persulfate used. Sodium persulfate costs approximately $1.20/lb. The solubility is high (73 g/100 g H2O @ 25 ˚C) and the density of a 20 g/L solution (1.0104 g/mL) at 25 ˚C is greater than water. Therefore, the density-driven transport of a high concentration solution would occur in the subsurface. Persulfate is more stable in the subsurface as compared to H_2O_2 and ozone, and can persist in the subsurface for weeks, suggesting that the NOD for persulfate is low. The persulfate anion is not significantly involved in sorption reactions. These characteristics make persulfate an attractive oxidant because it persists in the subsurface, can be injected at high concentrations, can be transported in porous media, and will undergo density-driven and diffusive transport into low-permeability materials.

Persulfate is an emerging technology and, in general, the peer-reviewed literature is limited, and there are few reports of bench- and field-scale studies. The lack of information pertaining to the fundamental chemistry and applications in subsurface systems suggests there is also a limited infrastructure of knowledge and experience upon which to design successful remediation systems. This limitation/disadvantage will diminish with time based on ongoing fundamental and applied research.

Persulfate is less stable than permanganate and will not persist as long in subsurface systems. Catalysts are required in the persulfate reaction to produce the more powerful sulfate radical. There are potential difficulties in achieving the optimal mix of reagents in the subsurface due to the lack of naturally occurring catalyst, and due to the difference in transport behavior of these reagents upon injection. Sodium persulfate costs approximately $2.70/kg, which is more than permanganate and H_2O_2. This cost of oxidant may be offset by the lack of oxidant demand by non-target aquifer materials.

References.

United States Environmental Protection Agency (USEPA), 2006. Engineering Issue Paper: In-Situ Chemical Oxidation (EPA 600-R-06-072). August 2006.

APPENDIX H

CALCULATIONS AND CORRESPONDENCES REGARDING QUANTITIES OF HRC^{TM} AND PERMANGANATE

HRC Design Software for Plume Area/Grid Treatment

US Version 3.1

Regenesis Technical Support: USA (949) 366-8000, www.regenesis.com

Site Name: Diamond Cleaners - Remaining Treatment Area
Location: Elmira, New York
Consultant: MACTEC

Site Conceptual Model/Extent of Plume Requiring Remediation

Width of plume (intersecting gw flow direction)	70	ft			
Length of plume (parallel to gw flow direction)	120	ft	=	8,400	sq. ft.
Depth to contaminated zone	10	ft			
Thickness of contaminated saturated zone	25	ft			
Nominal aquifer soil (gravel, sand, silty sand, silt, clay)	silty sand				
Total porosity	0.2		Eff. porosity:	0.2	
Hydraulic conductivity	4.3	ft/day	=	1.5E-03	cm/sec
Hydraulic gradient	0.001	ft/ft			
Seepage velocity	7.8	ft/yr	=	0.022	ft/day,
Treatment Zone Pore Volume	42,000	ft^3	=	314,202	gallons

Dissolved Phase Electron Donor Demand	Contaminant Conc (mg/L)	Mass (lb)	Stoich. (wt/wt) contam/H_2
Tetrachloroethene (PCE)	1.70	4.5	20.7
Trichloroethene (TCE)	0.02	0.1	21.9
cis-1,2-dichloroethene (DCE)	20.00	52.4	24.2
Vinyl Chloride (VC)	0.28	0.7	31.2
Carbon tetrachloride	0.00	0.0	19.2
Chloroform	0.00	0.0	19.9
1,1,1-Trichloroethane (TCA)	0.08	0.2	22.2
1,1-Dichlorochloroethane (DCA)	0.03	0.1	24.7
Hexavalent Chromium	0.00	0.0	17.3
1,1-Dichloroethene (1,1-DCE) (use stoich for 1,1-DCA)	0.01	0.0	24.7
User added, also add stoichiometric demand	0.00	0.0	0.0

Sorbed Phase Electron Donor Demand

Soil bulk density	1.76	g/cm^3	=	110	lb/cf
Fraction of organic carbon: foc	0.01	range: 0.0001 to 0.01			

(Values are estimated using Soil Conc=foc*Koc*Cgw) (Adjust Koc as nec. to provide realistic estimates)	Koc (L/kg)	Contaminant Conc (mg/kg)	Mass (lb)	Stoich. (wt/wt) contam/H_2
Tetrachloroethene (PCE)	263	4.47	103.2	20.7
Trichloroethene (TCE)	107	0.03	0.6	21.9
cis-1,2-dichloroethene (DCE)	80	16.00	369.2	24.2
Vinyl Chloride (VC)	2.5	0.01	0.2	31.2
Carbon tetrachloride	110	0.00	0.0	19.2
Chloroform	34	0.00	0.0	19.9
1,1,1-Trichloroethane (TCA)	183	0.14	3.3	22.2
1,1-Dichlorochloroethane (DCA)	183	0.05	1.1	24.7
1,1-Dichloroethene (1,1-DCE) (use stoich for 1,1-DCA)	65	0.01	0.1	24.7
User added, also add stoichiometric demand	0	0.00	0.0	0.0

Competing Electron Acceptors	Electron Acceptor Conc (mg/L)	Mass (lb)	Stoich. (wt/wt) elec acceptor/H_2
Oxygen	2.00	5	8.0
Nitrate	2.20	6	12.4
Est. Mn reduction demand (potential amt of Mn2+ formed)	1.00	3	27.5
Est. Fe reduction demand (potential amt of Fe2+ formed)	0.40	1	55.9
Estimated sulfate reduction demand	100.00	262	12.0

Microbial Demand Factor	3	Recommend 1-4x
Safety Factor	2	Recommend 1-4x

Injection Point Spacing and Dose:

Injection spacing within rows (ft)	15.0	# points per row:	5
Injection spacing between rows (ft)	10.0	# of rows:	12
Advective travel time bet. rows (days)	465	Total # of points:	60
		Minimum req. HRC dose per foot (lb/ft)	6.9

Project Summary			
Number of HRC delivery points (adjust as nec. for site)			60
HRC Dose in lb/foot (adjust as nec. for site)			6.9
Corresponding amount of HRC per point (lb)			172
Number of 30 lb HRC Buckets per injection point			5.7
Total Number of 30 lb Buckets			344
Total Amt of HRC (lb)			10,320
HRC Cost		$	6.00
Total Material Cost		**$**	**61,920**
Shipping and Tax Estimates in US Dollars			
Sales Tax	rate: 0%	$	-
Total Matl. Cost		$	61,920
Shipping of HRC (call for amount)		$	-
Total Regenesis Material Cost		**$**	**61,920**

List Price has been adjusted

HRC Design Software for Excavation Applications

US Version 3.1

Regenesis Technical Support: USA (949) 366-8000, www.regenesis.com

Site Name: Diamond Cleaners - Source Zone
Location: Elmira, New York
Consultant: MACTEC

Site Conceptual Model/Extent of Plume Requiring Remediation

Planned Excavation:	Width of planned excavation	55	ft			
	Length of planned excavation	70	ft	=	3,850	sq. ft.
	Thickness of saturated zone to be excavated	20	ft		77,000	cu. ft.
GW Plume:	Width of plume area containing contaminant	65	ft			
	Length of plume area containing contaminant	80	ft	=	5,200	sq. ft.
	Thickness of contaminated saturated zone	20	ft		104,000	cu. ft.
	Total porosity	0.2				
Treatment Zone Pore Volume		20,800	ft^3	=	155,605	gallons

Dissolved Phase Electron Donor Demand

	Contaminant		Stoich. (wt/wt)
	Conc. (mg/L)	Mass (lb)	contam/H_2
Tetrachloroethene (PCE)	1.70	2.2	20.7
Trichloroethene (TCE)	0.02	0.0	21.9
cis-1,2-dichloroethene (DCE)	20.00	25.9	24.2
Vinyl Chloride (VC)	0.28	0.4	31.2
Carbon tetrachloride	0.00	0.0	19.2
Chloroform	0.00	0.0	19.9
1,1,1-Trichloroethane (TCA)	0.08	0.1	22.2
1,1-Dichlorochloroethane (DCA)	0.03	0.0	24.7
Hexavalent Chromium	0.00	0.0	17.3
User added, also add stoichiometric demand	0.01	0.0	0.0
User added, also add stoichiometric demand	0.00	0.0	0.0

Sorbed Phase Electron Donor Demand

Soil bulk density	1.76	g/cm^3	=	110	lb/cf
Fraction of organic carbon: foc	0.01	range: 0.0001 to 0.01			

(Values are estimated using Soil Conc=foc*Koc*Cgw)	Koc	Contaminant		Stoich. (wt/wt)
(Adjust Koc as nec. to provide realistic estimates)	(L/kg)	Conc. (mg/kg)	Mass (lb)	contam/H_2
Tetrachloroethene (PCE)	263	4.47	13.3	20.7
Trichloroethene (TCE)	107	0.02	0.1	21.9
cis-1,2-dichloroethene (DCE)	80	16.00	47.5	24.2
Vinyl Chloride (VC)	2.5	0.01	0.0	31.2
Carbon tetrachloride	110	0.00	0.0	19.2
Chloroform	34	0.00	0.0	19.9
1,1,1-Trichloroethane (TCA)	183	0.15	0.4	22.2
1,1-Dichlorochloroethane (DCA)	184	0.06	0.2	24.7
User added, also add stoichiometric demand	65	0.01	0.0	0.0
User added, also add stoichiometric demand	0	0.00	0.0	0.0

Competing Electron Acceptors:

	Electron Acceptor		Stoich. (wt/wt)
	Conc (mg/L)	Mass (lb)	elec acceptor/H_2
Oxygen	2.00	2.6	8.0
Nitrate	2.20	2.9	12.4
Est. Mn reduction demand (potential amt of Mn2+ formed)	1.00	1.3	27.5
Est. Fe reduction demand (potential amt of Fe2+ formed)	0.40	0.5	55.9
Estimated sulfate reduction demand	100.00	129.7	12.0

Microbial Demand Factor	3	Recommend 1-4x
Additional Demand Factor	3	Recommend 1-4x

Project Summary			
Approx HRC Dose (lb)			3,608
Total Number of 30 lb Buckets			121
Total Amt of HRC (lb)			3,630
Volume of HRC (gal)			335
% of excav. backfill pore space (assume 30% backfill porosity)			0.2%
HRC Cost		$	6.00
Total Material Cost		**$**	**21,780**
Shipping and Tax Estimates in US Dollars			
Sales tax	rate: 5%	$	1,089
Total Matl. Cost		$	22,869
Shipping of HRC (call for amount)		$	-
Total Regenesis Material Cost		**$**	**22,869**

Other Project Cost Estimates		
Design	$	-
Permitting and reporting	$	-
Excavation contractors	$	-
Construction management	$	-
Laboratory costs	$	-
Groundwater monitoring	$	-
Other	$	-
Other	$	-
Other	$	-
Other	$	-
Other	$	-
Total Project Cost	**$**	**22,869**

CARUS®

CARUS REMEDIATION TECHNOLOGIES

In Situ Chemical Oxidation (ISCO) *In Situ* Bioremediation (BIO) *In Situ* Biogeochemical Stabilization (ISBS)

RemOx® S and L ISCO Reagents Estimation Spreadsheet

Input data into boxes with blue font.

Proj/Area: Diamond Cleaners - Source Area. NOD=12.5.

	Estimates	Units
Treatment Area Volume		
Length	**60**	ft
Width	**55**	ft
Area	3300	sq ft
Thickness	**20**	ft
Total Volume	2444	cu yd
Soil Characteristics/Analysis		
Porosity	**30**	%
Total Plume Pore Volume	148114	gal
Avg Contaminant Conc	**100**	ppm
Mass of Contaminant	123.61	lb
PNOD	**12.5**	g/kg
Effective PNOD	**100**	%
Effective PNOD Calculated	12.5	
PNOD Oxidant Demand	90750	lb
Avg Stoichiometric Demand	**2.4**	lb/lb
Contaminant Oxidant Demand	296.66	lb
Theoretical Oxidant Demand	91046.66	lb
Confidence Factor	**1**	
Calculated Oxidant Demand	91046.65676	
Injection Volumes for RemOx S		
RemOx S Injection Concentration	**2.5%**	%
Total Volume of Injection Fluid	436,413	gal
Pore Volume Replaced	294.65	%

Amount of RemOx S ISCO Reagent Estimated **91,047 pounds** ***

Injection Volumes for RemOx L		
RemOx L Injection Concentration	**40.0%**	%
Calculated Specific Gravity	1.366492	g/ml
Total Volume of Injection Fluid	17,924	gal
Pore Volume Replaced	12.10	%

Amount of RemOx L ISCO Reagent Estimated **204,400 pounds**
17,883 gallons

*** Compared to 317,000 lbs on MACTEC Calculation sheet. Use MACTEC's cals to be conservative.

CARUS

CARUS REMEDIATION TECHNOLOGIES

In Situ Chemical Oxidation (ISCO) *In Situ* Bioremediation (BIO) *In Situ* Biogeochemical Stabilization (ISBS)

RemOx® S and L ISCO Reagents Estimation Spreadsheet

Input data into boxes with blue font.

Proj/Area: Diamond Cleaners - Downgradient Area. NOD=6.

	Estimates	Units
Treatment Area Volume		
Length	**70**	ft
Width	**110**	ft
Area	7700	sq ft
Thickness	**25**	ft
Total Volume	7130	cu yd
Soil Characteristics/Analysis		
Porosity	**30**	%
Total Plume Pore Volume	432000	gal
Avg Contaminant Conc	**50**	ppm
Mass of Contaminant	180.26	lb
PNOD	**6**	g/kg
Effective PNOD	**100**	%
Effective PNOD Calculated	6	
PNOD Oxidant Demand	127050	lb
Avg Stoichiometric Demand	**2.4**	lb/lb
Contaminant Oxidant Demand	432.62	lb
Theoretical Oxidant Demand	127482.62	lb
Confidence Factor	**1**	
Calculated Oxidant Demand	127482.6244	
Injection Volumes for RemOx S		
RemOx S Injection Concentration	**2.5%**	%
Total Volume of Injection Fluid	611,061	gal
Pore Volume Replaced	141.45	%

Amount of RemOx S ISCO Reagent Estimated **127,483 pounds**

Injection Volumes for RemOx L		
RemOx L Injection Concentration	**40.0%**	%
Calculated Specific Gravity	1.366492	g/ml
Total Volume of Injection Fluid	25,098	gal
Pore Volume Replaced	5.81	%

Amount of RemOx L ISCO Reagent Estimated **286,198 pounds** ***
25,039 gallons

*** Compared to 84,000 lbs on MACTEC Calculation sheet. Neither is used since soil will be removed from the area. See email from XDD for quantities used in cost estimate.

Information		
Soil Bulk Density (lb/cf)	110	*Assumes 1.5 tons/CY*
Total Treatment Area (sf)	11,000	
Source Zone (sf)	3,320	*From OU-1: Source area treatment zone is below excavation area from 10ft-30 ft.*
Remaining Treatment Area (sf)	7,680	*Treatment zone is from 10 ft to 35 ft.*

Unit Costs for Permanganate:		Including Tax/Shipping	
Potassium Permanganate (100%) =	$2.02/lb + ship/Tax	$2.53	*Unit costs are based on conversations with Carus on 10/14/0*
Sodium Permanganate (40%) =	$2.25/lb + ship/Tax	$2.81	*Unit costs are based on conversations with Carus on 10/14/0*

	Treatment Volume	Soil weight	Soil mass	PNOD[1] (g/kg)		Oxidant Demand For full volume (lbs)	
	(CF)	(lbs)	(kg)	Potassium Permanganate	Sodium Permanganate	Potassium Permanganate	Sodium Permanganate
Source Zone 1 (12-14 feet) Treat from 10-15 feet	16,600	1,826,000	828,260	15.56	13.98	28,412	25,527
Source Zone 2 (14-16 feet) Treat from 15-30 feet	49,800	5,478,000	2,484,779	10.17	9.14	55,711	50,068
Outside of Source Zone Treat from 10-35 feet	192,000	21,120,000	9,579,871	6	6	126,719	126,719

SOURCE ZONE (ASSUMES SOIL IS NOT REMOVED PRIOR TO TREATMENT) -*Not used in cost estimate see Note 2.*

Total Lbs Permanganate (assuming 100%):	84,123	75,596
Conversion factor for delivery (see Note 1):	1.0	2.5
Total Lbs Permanganate to order:	84,123	188,989
Unit Costs:	$2.53	$2.81
Total Costs:	$212,410	$531,532
Average Cost per CF of treatment area:	$3.20	$8.00

REMAINING TREATMENT AREA (VIA INJECTION)

Total Lbs Permanganate	126,719	126,719
Conversion factor for delivery (see Note 1):	1.0	2.5
Total Lbs Permanganate to order:	126,719	316,797
Unit Costs:	$2.53	$2.81
Total Costs:	$319,965	$890,991
Average Cost per CF of treatment area:	$1.67	$4.64

Notes:

1. The PNOD results represent results using 100% permanganate. Potassium permanganate is delivered as a powder at 100% concentration. Sodium permanganate is delivered as a solution at 40% concentration. Therefore to calculate the amount of sodium permanganate that would need to be ordered as a 40% solution, multiply the total lbs by 2.5.

2. The permanganate natural oxidant demand (PNOD) for soil in the source zone (located beneath the area to be excavated) is based on bench scale testing conducted by Sirem in 2007 for samples collected within the source area. The oxidant demand results for permanganate appear to be high for the sand/gravel nature of the soil. Additional oxidant demand testing is recommended as part of pre-design investigations, but the results were conservatively used for costing purposes in the source area. These quantities are high, therefore the conceptual design is to remove the soil from the excavation and treat the water within the excavation prior to replacing the excavated (assumed non-impacted) soil. See email correspondence from XDD for quantities required to treat only the groundwater within the source area.

3. The PNOD for the remaining treatment area was assumed to be 6 g/kg which is about half of the weighted average of the two values reported for the source zone soil, and is still at the high-end of typical PNOD values for the type of soil at the site. Reduced oxidant demand numbers are assumed because of the sand/gravel nature of the soil, and in addition because the contaminant concentrations are lower in groundwater outside of the source area.

4. The cost for the quantities of potassium and sodium permanganate per cubic foot of treatment area changes by $0.27 and $1.28 respectively for every 1 g/kg change in oxidant demand.

Prepared By/Date:	JDW 11/18/2009
Checked By/Date:	RTB 11/24/09

Welch, Jamie

From: Welch, Jamie
Sent: Friday, November 20, 2009 2:14 PM
To: Welch, Jamie
Subject: FW: NYSDEC - DC site - Chemical Oxidation bench/laboratory study

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From: Scott Crawford [mailto:crawford@xdd-llc.com]
Sent: Wednesday, November 18, 2009 2:30 PM
To: Welch, Jamie
Subject: RE: NYSDEC - DC site - Chemical Oxidation bench/laboratory study

Hi Jamie, we ran a few calculations, and the final dose will depend on a few things:

1. To treat just the water, you would theoretically only need about 700 to 1,000 Lbs of potassium permanganate ($KMnO_4$ at less than 0.2 g/L concentration) – it doesn't take much to treat groundwater only, so long as the groundwater doesn't have any additional or unusually high organic levels
2. I assumed that you'd want enough excess permanganate to treat up to 5 feet of soil at the bottom of the cell – assuming 10 to 15 g/Kg SOD, this comes out to an additional 19,000 to 29,000 LBs of permanganate (or 4 to 6 g/L concentration)
3. Depending on how you backfill, and what the backfill is comprised of, this will make a big difference for the remaining amounts. If the backfill is added immediately after the swimming pool is treated, the backfill material will exert an SOD on the permanganate in the swimming pool. So if we assume that the SOD of the fill that is being replaced is that same as the impacted soil (which it very well could be, since it is from the same area, albeit hopefully cleaner), this could require a lot of additional permanganate. Assuming 20 feet of backfill in the cell, this adds an additional 77,000 to 115,500 Lbs of permanganate (or 16 to 24 g/L more) - *Assume not needed (soil is assumed clean)*

So in summary, if you treat the water in the pool, treat 20 feet of backfill, and want enough oxidant left over for 5 feet of soil below the treatment cell, you could require between 97,000 and 145,000 Lbs of permanganate (20 to 30 g/L concentration).

It's the backfill volume and the SOD that makes the huge difference. I'm sure no one would want to buy over a 100,000 Lbs of permanganate to be wasted on reportedly clean fill. So what you might want to consider is to allow the permanganate to percolate for a few weeks prior to backfilling (if this is practical) – this would allow the permanganate to treat the water, and for some of the permanganate to seep through the floor of the excavation for some benefit. If you are truly only going after the VOCs mass in the swimming pool, then this is a very small dose required.

Thanks, please let me know if this is what you needed, give me a call if you need anything else of would like to discuss more,
Scott

KMnO4 Mass (for Water Only)	SOD (Below Cell)	SOD (Fill)	Total	SOD	Notes
(LBs)	(LBs)	(LBs)	(LBs)	g/Kg	

743	28,875	115,500	145,118	15	High SOD
743	19,250	77,000	96,993	10	Low SOD

Conc. (Water only)	Conc. (for Below Cell)	Conc. (for Fill)	Conc. Total	SOD	Notes
(g/L)	(g/L)	(g/L)	(g/L)	g/Kg	
0.2	6.0	24.0	30.2	15	High SOD
0.2	4.0	16.0	20.2	10	Low SOD

Scott Crawford
Senior Project Manager

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Stratham, NH 03885
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Cell: 603-321-6985
www.XDD-LLC.com

From: Welch, Jamie [mailto:JDWELCH@mactec.com]
Sent: Tuesday, November 17, 2009 3:50 PM
To: Scott Crawford
Subject: RE: NYSDEC - DC site - Chemical Oxidation bench/laboratory study

Scott. Here are the results of VOCs in groundwater that we'd expect to see in the "swimming pool" for the Diamond Cleaners Site.

1,2-DCE 20,000 μg/l
PCE 150 μg/l
TCE 20 μg/l
VC 1,900 μg/l

As previously mentioned the entire perimeter would be steel shoring. The bottom however, would be in contact with soil. As indicated in the attachment that Ryan sent you, NOD for permanganate in soil in the area ranged from 10-15 g/kg (the lower of the two was the deeper sample, but only half the depth of the proposed excavation). So I'm hoping you could give me a ballpark estimate of the quantity of potassium permanganate (and concentration) that would be required to treat the water. There will be approximately 575,000 gallons (20 feet deep, 55 feet wide, 70 feet long). I'll then bump up the number by ~50% or so to account for any residual contamination in the soil (we're assuming the soil is clean for now, and that any extra is "just in case").

Let me know if you have any other questions. Thanks.

Jamie D Welch | Project Engineer
MACTEC Engineering and Consulting, Inc.
511 Congress Street Portland, ME 04112
Office 207-775-5401

Direct 207-828-3479

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Email jdwelch@mactec.com

APPENDIX I

COST BACKUP

Alternative 2 - In-Situ Enhanced Biodegradation
Prepared By/Date: **JDW 7/23/09**
Checked By/Date: **KAW 7/29/09**
Modified By/Date: **JDW 11/17/09**
Checked By/Date: **RTB 11/24/09**

Task	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Comments/ Assumptions
CAPITAL COSTS								
Pre-Design Investigation								1 monitoring well, water injection test
Monitoring Well Installation								
33220112	Field Technician	10	HR	$ 11.01	$ 40.57	$ -	$ 515.88	one day, 10 hrs, includes per diem
33010102	Van Rental	1	DAY	$ 44.61	$ -	$ -	$ 44.61	
33010101	Mobilize/DeMobilize Drilling Rig & Crew	1	LS	$ -	$ 3,309.73	$ 1,124.22	$ 4,433.95	Assume level D
33231178	Move Rig/Equipment Around Site	1	EA	$ 67.24	$ 116.85	$ 161.60	$ 345.70	
33231504	Surface Pad, Concrete, 2' x 2' x 4"	1	EA	$ 46.13	$ 85.32	$ 2.04	$ 133.49	
33020303	Organic Vapor Analyzer Rental, per Day	1	DAY	$ 134.33	$ -	$ -	$ 134.33	
33170808	Decontaminate Rig, Augers, Screen (Rental Equipment)	1	DAY	$ -	$ 125.90	$ -	$ 125.90	
33231101	Hollow Stem Auger, 8" Dia Borehole, Depth <=100 ft	35	LF	$ -	$ 7.43	$ 35.45	$ 1,500.85	1 wells to 35 ft bgs + one boring
33230101	2" PVC, Schedule 40, Well Casing	25	LF	$ 1.39	$ 2.71	$ 8.28	$ 309.41	25 ft riser
33230201	2" PVC, Schedule 40, Well Screen	10	LF	$ 3.22	$ 3.50	$ 10.68	$ 173.97	10 ft screen
33230301	2" PVC, Well Plug	1	EA	$ 6.78	$ 4.07	$ 12.40	$ 23.25	
33231401	2" Screen, Filter Pack	25	LF	$ 3.62	$ 2.31	$ 7.04	$ 324.02	
33231811	2" Well, Portland Cement Grout	10	LF	$ 1.35	$ -	$ -	$ 13.50	10 ft grout
33232101	2" Well, Bentonite Seal	1	EA	$ 10.74	$ 9.15	$ 27.92	$ 47.80	
33231189	DOT steel drums, 55 gal., open,	2	EA	$ 93.90	$ -	$ -	$ 187.80	
20836142	Load soil into 55 gal drums	2	EA	$ -	$ 34.00	$ -	$ 68.00	
33190303	Transport/Dispose (non-haz)	2	EA	$ 296.51	$ -	$ -	$ 593.02	
Monitoring Well Development, Groundwater Sampling, Injection Testing								Sample new well
33010102	Van Rental	3	DAY	$ 44.61	$ -	$ -	$ 133.83	
33220112	Field Technician	30	HR	$ 11.01	$ 40.57	$ -	$ 1,547.63	2 day
33231186	Well Development Equipment	1	WK	$ 264.04	$ -	$ -	$ 264.04	

Alternative 2 - In-Situ Enhanced Biodegradation
Prepared By/Date: **JDW 7/23/09**
Checked By/Date: **KAW 7/29/09**
Modified By/Date: **JDW 11/17/09**
Checked By/Date: **RTB 11/24/09**

Task	**Description**	**Quantity**	**Unit of Measure**	**Material Unit Cost**	**Labor Unit Cost**	**Equipment Unit Cost**	**Extended Cost**	**Comments/ Assumptions**
	Rental (weekly)							
33231189	DOT steel drums, 55 gal., open,	2	EA	$ 93.90			$ 187.80	1.5 drum each new well for development
33190303	Transport/Dispose (non-haz)	2	EA	$ 296.51	$ -	$ -	$ 593.02	
Quote	Pilot Water Injection	1	LS	$ 200.00	$ 500.00	$ 800.00	$ 1,500.00	
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1	WK	$ 264.04	$ -	$ -	$ 264.04	
33020401	Disposable Materials per Sample	1	EA	$ 9.74	$ -	$ -	$ 9.74	
33020402	Decontamination Materials per Sample	1	EA	$ 8.22	$ -	$ -	$ 8.22	
33232407	PVC bailers, disposable polyethylene, 1.50" OD x 36"	1	EA	$ 11.15	$ -	$ -	$ 11.15	
33021618	Volitile Organic Analysis (EPA 624) (624, 8260B)	1	EA	$ 245.42	$ -	$ -	$ 245.42	
	Task Subtotal						**$ 13,740.36**	

Alternative 2 - In-Situ Enhanced Biodegradation

Prepared By/Date: **JDW 7/23/09**
Checked By/Date: **KAW 7/29/09**
Modified By/Date: **JDW 11/17/09**
Checked By/Date: **RTB 11/24/09**

Task	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Comments/ Assumptions
Full Scale								
Additional Excavation to 30 feet								Assume no shoring cost was included in OU-1, shoring to 40 feet; additional 20 deep of excavation (10-30); stage material on-site, no disposal. Assume 4 weeks to install sheeting, excavate, backfill. Assume all dewatering costs are covered under OU-1.
33220112	Field Technician	200	HR	$ -	$ 40.57	$ -	$ 8,114.92	
33010102	Van Rental	20	DAY	$ 44.61	$ -	$ -	$ 892.18	
33020303	Organic Vapor Analyzer Rental, per Day	20	DAY	$ 134.33	$ -	$ -	$ 2,686.66	
17030904	Steel Sheeting, Install, Pull and Salvage, to 40 ft	10000	SF	$ 3.37	$ 2.82	$ 3.71	$ 99,002.01	
17030277	Excavate and load, 2CY Excavator, medium material	2900	CY	$ -	$ 0.94	$ 1.72	$ 7,698.74	
17030415	Backfill with Excavated Material	2900	CY	$ 0.38	$ 2.82	$ 0.94	$ 12,001.96	No compaction since underwater.
Add & Mix Reagents Into the Water inside the excavation								Assume one day
33220112	Field Technician	10	HR	$ -	$ 40.57	$ -	$ 405.75	includes per diem
OU-1	Equipment	1	LS	$ -	$ 2,500.00	$ -	$ 2,500.00	Assume day rate to add/mix reagent into water.
	HRC added to open hole (lbs) 10-30 feet (below excavation)	3630	lbs	$ 7.20	$ -	$ -	$ 26,136.00	Based on HRC worksheet.
Temporary Injection Points (60), 7 monitoring wells & development								60 injection wells, assume 3/day. 7 monitoring wells & development, 5 days.
33220112	Field Technician	250	HR	$ -	$ 40.57	$ -	$ 10,143.65	includes per diem
33010102	Van Rental	25	DAY	$ 44.61	$ -	$ -	$ 1,115.22	
33020303	Organic Vapor Analyzer Rental, per Day	25	DAY	$ 134.33	$ -	$ -	$ 3,358.32	
Geoprobe Injections								
Quote	Mobilize Geoprobe Rig & Crew	1	LS	$ -	$ 1,000.00	$ -	$ 1,000.00	
Quote	Day Rate for Geoprobe Rig & Crew	20	Day	$ -	$ 1,600.00	$ -	$ 32,000.00	
33170808	Decontaminate Rig, Augers, Screen (Rental Equipment)	20	DAY	$ -	$ 125.90	$ -	$ 2,517.94	
HRC Backup	HRC Material	10320	LBS	$ 7.20	$ -	$ -	$ 74,304.00	Including 20% for tax, shipping, and inflation from 2008
Monitoring Well Installation								
33010101	Mobilize/Demobilize Drilling Rig & Crew (monitoring wells)	1	LS	$ -	$ 3,309.73	$ 1,124.22	$ 4,433.95	Assume level D
33231178	Move Rig/Equipment Around Site (monitoring wells)	7	EA	$ 67.24	$ 116.85	$ 161.60	$ 2,419.88	
33231504	Surface Pad, Concrete, 2' x 2' x 4" (monitoring wells)	7	EA	$ 46.13	$ 85.32	$ 2.04	$ 934.44	
33170808	Decontaminate Rig, Augers, Screen (Rental Equipment)	3	DAY	$ -	$ 125.90	$ -	$ 377.69	
33231101	Hollow Stem Auger, 8" Dia Borehole, Depth <=100 ft	245	LF	$ -	$ 7.43	$ 35.45	$ 10,505.98	wells to 35 ft bgs
33230101	2" PVC, Schedule 40, Well Casing	175	LF	$ 1.39	$ 2.71	$ 8.28	$ 2,165.87	25 ft risers

Alternative 2 - In-Situ Enhanced Biodegradation
Prepared By/Date: **JDW 7/23/09**
Checked By/Date: **KAW 7/29/09**
Modified By/Date: **JDW 11/17/09**
Checked By/Date: **RTB 11/24/09**

Task	**Description**	**Quantity**	**Unit of Measure**	**Material Unit Cost**	**Labor Unit Cost**	**Equipment Unit Cost**	**Extended Cost**	**Comments/ Assumptions**
33230201	2" PVC, Schedule 40, Well Screen	70	LF	$ 3.22	$ 3.50	$ 10.68	$ 1,217.79	10 ft screens
33230301	2" PVC, Well Plug	7	EA	$ 6.78	$ 4.07	$ 12.40	$ 162.74	
33231401	2" Screen, Filter Pack	70	LF	$ 3.62	$ 2.31	$ 7.04	$ 907.25	
33231811	2" Well, Portland Cement Grout	175	LF	$ 1.35	$ -	$ -	$ 236.31	
33232101	2" Well, Bentonite Seal	7	EA	$ 10.74	$ 9.15	$ 27.92	$ 334.63	
33231189	DOT steel drums, 55 gal., open,	14	EA	$ 93.90	$ -	$ -	$ 1,314.62	
20836142	Load soil into 55 gal drums	14	EA	$ -	$ 34.00	$ -	$ 476.02	
33190303	Transport/Dispose (non-haz)	14	EA	$ 296.51	$ -	$ -	$ 4,151.11	
Monitoring Well Development (7)								
33231186	Well Development Equipment Rental (weekly)	1	WK	$ 264.04	$ -	$ -	$ 264.04	
33231189	DOT steel drums, 55 gal., open,	10	EA	$ 93.90			$ 939.01	1.5 drum each new well for development
33190303	Transport/Dispose (non-haz)	10	EA	$ 296.51	$ -	$ -	$ 2,965.08	
	Task Subtotal						**$ 317,683.73**	
ANNUAL AND PERIODIC COSTS								
Long-Term Monitoring (per sampling event - assume 16 wells)								
Groundwater Monitoring								Includes additional 20% for QC
33010102	Van Rental	5	DAY	$ 44.61	$ -	$ -	$ 223.04	
33220112	Field Technician	40	HR	$ 11.01	$ 40.57	$ -	$ 2,063.51	person 1 week(includes per diem)
33231186	Well Development Equipment Rental (weekly)	1	WK	$ 264.04	$ -	$ -	$ 264.04	
33231189	DOT steel drums, 55 gal., open, 17C	3	EA	$ 97.66			$ 292.97	
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1	WK	$ 264.04	$ -	$ -	$ 264.04	assumes 4 well per day
33020401	Disposable Materials per Sample	16	EA	$ 9.74	$ -	$ -	$ 155.87	20 sampling locations (all existing on-site wells) plus 20% QA\QC
33020402	Decontamination Materials per Sample	16	EA	$ 8.22	$ -	$ -	$ 131.56	
33232407	PVC bailers, disposable polyethylene, 1.50" OD x 36"	16	EA	$ 11.15	$ -	$ -	$ 178.44	
33021618	Volatile Organic Analysis (EPA 624) (624, 8260B)	16	EA	$ 245.42	$ -	$ -	$ 3,926.74	
	Task Subtotal						**$ 7,500.20**	
Annual Reporting								
95010102	Annual Report	1	LS	$ -	$ 20,000.00	$ -	$ 20,000.00	Including bioremediation evaluation
	Task Subtotal						**$ 20,000.00**	

PRESENT VALUE OF ANNUAL AND PERIODIC COSTS FOR ALTERNATIVE 2 (Enhanced Biodegradation)

Year	Cost*	Number of Annual Periods	Annual Discount Rate	Number of 2-Year Periods	2-Year Discount Rate	Number of 4-Year Periods	4-Year Discount Rate	Total Non-Discounted Cost	Present Value Cost
Capital (Year 0)	$ 492,000	1	0	NA	NA	NA	NA	$ 492,000.00	$ 492,000.00
Quarterly Monitoring (Years 1-2)	$ 38,000	2	0.027	NA	NA	NA	NA	$ 76,000.00	$ 73,029.19
Semi-Annual Monitoring (Years 3-4)	$ 19,000	2	0.027	1	0.054729	NA	NA	$ 38,000.00	$ 34,619.88
Annual Monitoring (Years 5-30)	$ 9,000	26	0.027	NA	NA	1	0.112453	$ 234,000.00	$ 149,750.55
Annual Long Term Monitoring Reporting (Years 1-30)	$ 25,000	30	0.027	NA	NA	NA	NA	$ 750,000.00	$ 509,571.74
Totals								**$ 1,590,000.00**	**$ 1,258,971.35**

*Annual and periodic costs include 10% for technical support and 15% contingency for unforeseen project complexities, including insurance, taxes, and licensing costs.
Capital costs include 15% contingency, as well as and project management, remedial design, and construction management costs per DER-10 guidance.

Discount rate of 2.7 (for 30-years) percent based on OMB Circular No. A-94 App. C (Revised Dec. 2008)

Prepared By/Date:	**JDW 7/23/09**
Checked By/Date:	**KAW 7/29/09**
Modified By/Date:	**JDW 11/17/09**
Checked By/Date:	**RTB 11/24/09**

Alternative 3 - In-Situ Chemical Oxidation
Prepared By/Date: **JDW 7/23/09**
Checked By/Date: **KAW 7/29/09**
Modified By/Date: **JDW 11/17/09**
Checked By/Date: **RTB 11/24/09**

Task	Description	Quantity	Unit of Measure	Mateiral Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Comments/ Assumptions
CAPITAL COSTS								
Pre-Design Investigation								
Monitoring Well Installation								1 monitoring well, water injection test
33220112	Field Technician	10	HR	$ 11.01	$ 40.57	$ -	$ 515.88	one day, 10 hrs, includes per diem
33010102	Van Rental	1	DAY	$ 44.61	$ -	$ -	$ 44.61	
33010101	Mobilize/DeMobilize Drilling Rig & Crew	1	LS	$ -	$ 3,309.73	$ 1,124.22	$ 4,433.95	Assume level D
33231178	Move Rig/Equipment Around Site	1	EA	$ 67.24	$ 116.85	$ 161.60	$ 345.70	
33231504	Surface Pad, Concrete, 2' x 2' x 4"	1	EA	$ 46.13	$ 85.32	$ 2.04	$ 133.49	
33020303	Organic Vapor Analyzer Rental, per Day	1	DAY	$ 134.33	$ -	$ -	$ 134.33	
33170808	Decontaminate Rig, Augers, Screen (Rental Equipment)	1	DAY	$ -	$ 125.90	$ -	$ 125.90	
33231101	Hollow Stem Auger, 8" Dia Borehole, Depth <=100 ft	35	LF	$ -	$ 7.43	$ 35.45	$ 1,500.85	1 wells to 35 ft bgs + one boring
33230101	2" PVC, Schedule 40, Well Casing	25	LF	$ 1.39	$ 2.71	$ 8.28	$ 309.41	25 ft riser
33230201	2" PVC, Schedule 40, Well Screen	10	LF	$ 3.22	$ 3.50	$ 10.68	$ 173.97	10 ft screen
33230301	2" PVC, Well Plug	1	EA	$ 6.78	$ 4.07	$ 12.40	$ 23.25	
33231401	2" Screen, Filter Pack	25	LF	$ 3.62	$ 2.31	$ 7.04	$ 324.02	
33231811	2" Well, Portland Cement Grout	10	LF	$ 1.35	$ -	$ -	$ 13.50	10 ft grout
33232101	2" Well, Bentonite Seal	1	EA	$ 10.74	$ 9.15	$ 27.92	$ 47.80	
33231189	DOT steel drums, 55 gal., open,	2	EA	$ 93.90	$ -	$ -	$ 187.80	
20836142	Load soil into 55 gal drums	2	EA	$ -	$ 34.00	$ -	$ 68.00	
33190303	Transport/Dispose (non-haz)	2	EA	$ 296.51	$ -	$ -	$ 593.02	
Monitoring Well Development, Groundwater Sampling, Injection Testing								Sample new well
33010102	Van Rental	3	DAY	$ 44.61	$ -	$ -	$ 133.83	
33220112	Field Technician	30	HR	$ 11.01	$ 40.57	$ -	$ 1,547.63	2 day
33231186	Well Development Equipment Rental (weekly)	1	WK	$ 264.04	$ -	$ -	$ 264.04	
33231189	DOT steel drums, 55 gal., open,	2	EA	$ 93.90			$ 187.80	1.5 drum each new well for development
33190303	Transport/Dispose (non-haz)	2	EA	$ 296.51	$ -	$ -	$ 593.02	
Quote	Pilot Water Injection	1	LS	$ 200.00	$ 500.00	$ 800.00	$ 1,500.00	
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1	WK	$ 264.04	$ -	$ -	$ 264.04	
33020401	Disposable Materials per Sample	1	EA	$ 9.74	$ -	$ -	$ 9.74	
33020402	Decontamination Materials per Sample	1	EA	$ 8.22	$ -	$ -	$ 8.22	
33232407	PVC bailers, disposable polyethylene, 1.50" OD x 36"	1	EA	$ 11.15	$ -	$ -	$ 11.15	
33021618	Volatile Organic Analysis (EPA 624)	1	EA	$ 245.42	$ -	$ -	$ 245.42	

Alternative 3 - In-Situ Chemical Oxidation
Prepared By/Date: **JDW 7/23/09**
Checked By/Date: **KAW 7/29/09**
Modified By/Date: **JDW 11/17/09**
Checked By/Date: **RTB 11/24/09**

Task	Description	Quantity	Unit of Measure	Mateiral Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Comments/ Assumptions
	(624, 8260B)							
Geoprobe Sampling of Soil and Groundwater								Collect soil and groundwater from two locations for VOC testing as well as bench scale testing for two oxidants.
33220112	Field Technician	10	HR	$ -	$ 40.57	$ -	$ 405.75	1 day
33010102	Van Rental	1	DAY	$ 44.61	$ -	$ -	$ 44.61	
33020303	Organic Vapor Analyzer Rental, per Day	1	DAY	$ 134.33	$ -	$ -	$ 134.33	
Recent Quote	Mobilize Geoprobe Rig & Crew	1	LS	$ -	$ 1,000.00	$ -	$ 1,000.00	
Recent Quote	Day Rate for Geoprobe Rig & Crew	1	Day	$ -	$ 1,600.00	$ -	$ 1,600.00	
33021618	Volatile Organic Analysis (EPA 624) (624, 8260B)	4	EA	$ 245.42	$ -	$ -	$ 981.68	Two soil and two water samples
	Task Subtotal						**$ 17,906.73**	
Bench Scale Testing								
	Bench scale test	2	Each	$ 15,000.00	$ -	$ -	$ 30,000.00	
	Task Subtotal						**$ 30,000.00**	
Full Scale								
Additional Excavation to 30 feet								Assume no shoring cost was included in OU-1, shoring to 40 feet; additional 20 deep of excavation (10-30); stage material on-site, no disposal. Assume 4 weeks to install sheeting, excavate, backfill. Assume all dewatering costs are covered under OU-1.
33220112	Field Technician	200	HR	$ -	$ 40.57	$ -	$ 8,114.92	
33010102	Van Rental	20	DAY	$ 44.61	$ -	$ -	$ 892.18	
33020303	Organic Vapor Analyzer Rental, per Day	20	DAY	$ 134.33	$ -	$ -	$ 2,686.66	
17030904	Steel Sheeting, Install, Pull and Salvage, to 40 ft	10000	SF	$ 3.37	$ 2.82	$ 3.71	$ 99,002.01	
17030277	Excavate and load, 2CY Excavator, medium material	2900	CY	$ -	$ 0.94	$ 1.72	$ 7,698.74	
17030415	Backfill with Excavated Material	2900	CY	$ 0.38	$ 2.82	$ 0.94	$ 12,001.96	No compaction since underwater.
Add & Mix Chemicals Into Bottom of Open Excavation								Assume one day
33220112	Field Technician	10	HR	$ -	$ 40.57	$ -	$ 405.75	includes per diem
OU-1	Equipment	1	LS	$ -	$ 2,500.00	$ -	$ 2,500.00	Assume day rate to add/mix reagent into water.
Unit costs from Carus	Permanganate per CF Area from 10-30 feet (below excavation)	30000	lb	$ -	$ 2.53	$ -	$ 75,900.00	Based on amount of Potassium permanganate required to treat water (XDD estimate from concentrations), include NOD for the soil at the bottom of the excavation. Assumes soil to be used as backfill is clean and does not require treatment.
Temporary Injection Points (28), 7 monitoring wells & development								28 temp injection pts, assume 3/day. 7 monitoring wells & development, 5 days.
33220112	Field Technician	150	HR	$ -	$ 40.57	$ -	$ 6,086.19	includes per diem
33010102	Van Rental	15	DAY	$ 44.61	$ -	$ -	$ 669.13	
33020303	Organic Vapor Analyzer Rental, per Day	15	DAY	$ 134.33	$ -	$ -	$ 2,014.99	
Geoprobe Injections								
Recent Quote	Mobilize Geoprobe Rig & Crew	1	LS	$ -	$ 1,000.00	$ -	$ 1,000.00	
Recent Quote	Day Rate for Geoprobe Rig & Crew	10	Day	$ -	$ 1,600.00	$ -	$ 16,000.00	

Alternative 3 - In-Situ Chemical Oxidation
Prepared By/Date: **JDW 7/23/09**
Checked By/Date: **KAW 7/29/09**
Modified By/Date: **JDW 11/17/09**
Checked By/Date: **RTB 11/24/09**

Task	Description	Quantity	Unit of Measure	Mateiral Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Comments/ Assumptions
33170808	Decontaminate Rig, Augers, Screen (Rental Equipment)	10	DAY	$ -	$ 125.90	$ -	$ 1,258.97	
	Permanganate per CF Area via injections in downgradient area	317000	lb	$ -	$ 2.81	$ -	$ 890,770.00	Based on current price of sodium permanganate (lbs of 40% sodium permanganate)
Monitoring Well Installation								
33010101	Mobilize/Demobilize Drilling Rig & Crew	1	LS	$ -	$ 3,309.73	$ 1,124.22	$ 4,433.95	Assume level D
33231178	Move Rig/Equipment Around Site	7	EA	$ 67.24	$ 116.85	$ 161.60	$ 2,419.88	
33231504	Surface Pad, Concrete, 2' x 2' x 4"	7	EA	$ 46.13	$ 85.32	$ 2.04	$ 934.44	
33170808	Decontaminate Rig, Augers, Screen (Rental Equipment)	3	DAY	$ -	$ 125.90	$ -	$ 377.69	
33231101	Hollow Stem Auger, 8" Dia Borehole, Depth <=100 ft	245	LF	$ -	$ 7.43	$ 35.45	$ 10,505.98	6 wells to 35 ft bgs
33230101	2" PVC, Schedule 40, Well Casing	175	LF	$ 1.39	$ 2.71	$ 8.28	$ 2,165.87	25 ft risers
33230201	2" PVC, Schedule 40, Well Screen	70	LF	$ 3.22	$ 3.50	$ 10.68	$ 1,217.79	10 ft screens
33230301	2" PVC, Well Plug	7	EA	$ 6.78	$ 4.07	$ 12.40	$ 162.74	
33231401	2" Screen, Filter Pack	70	LF	$ 3.62	$ 2.31	$ 7.04	$ 907.25	
33231811	2" Well, Portland Cement Grout	175	LF	$ 1.35	$ -	$ -	$ 236.31	
33232101	2" Well, Bentonite Seal	7	EA	$ 10.74	$ 9.15	$ 27.92	$ 334.63	
33231189	DOT steel drums, 55 gal., open,	14	EA	$ 93.90	$ -	$ -	$ 1,314.62	
20836142	Load soil into 55 gal drums	14	EA	$ -	$ 34.00	$ -	$ 476.02	
33190303	Transport/Dispose (non-haz)	14	EA	$ 296.51	$ -	$ -	$ 4,151.11	
Monitoring Well Development (7)								
33231186	Well Development Equipment Rental (weekly)	1	WK	$ 264.04	$ -	$ -	$ 264.04	
33231189	DOT steel drums, 55 gal., open,	10	EA	$ 93.90			$ 939.01	1.5 drum each new well for development
33190303	Transport/Dispose (non-haz)	10	EA	$ 296.51	$ -	$ -	$ 2,965.08	
		Task Subtotal					**$ 1,160,807.88**	
ANNUAL AND PERIODIC COSTS								
Long-Term Monitoring (per sampling event - assume 16 wells)								
Groundwater Monitoring								Includes additional 20% for QC
33010102	Van Rental	5	DAY	$ 44.61	$ -	$ -	$ 223.04	
33220112	Field Technician	40	HR	$ 11.01	$ 40.57	$ -	$ 2,063.51	person 1 week(includes per diem)
33231186	Well Development Equipment Rental (weekly)	1	WK	$ 264.04	$ -	$ -	$ 264.04	
33231189	DOT steel drums, 55 gal., open, 17C	3	EA	$ 97.66			$ 292.97	
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1	WK	$ 264.04	$ -	$ -	$ 264.04	assumes 4 well per day
33020401	Disposable Materials per Sample	16	EA	$ 9.74	$ -	$ -	$ 155.87	20 sampling locations (all existing on-site wells) plus 20% QA\QC

Alternative 3 - In-Situ Chemical Oxidation

Prepared By/Date: **JDW 7/23/09**
Checked By/Date: **KAW 7/29/09**
Modified By/Date: **JDW 11/17/09**
Checked By/Date: **RTB 11/24/09**

Task	Description	Quantity	Unit of Measure	Mateiral Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Comments/ Assumptions
33020402	Decontamination Materials per Sample	16	EA	$ 8.22	$ -	$ -	$ 131.56	
33232407	PVC bailers, disposable polyethylene, 1.50" OD x 36"	16	EA	$ 11.15	$ -	$ -	$ 178.44	
33021618	Volatile Organic Analysis (EPA 624) (624, 8260B)	16	EA	$ 245.42	$ -	$ -	$ 3,926.74	
	Task Subtotal						**$ 7,500.20**	
Annual Reporting								
95010102	Annual Report	1	LS	$ -	$ 20,000.00	$ -	$ 20,000.00	Including bioremediation evaluation
	Task Subtotal						**$ 20,000.00**	

PRESENT VALUE OF ANNUAL AND PERIODIC COSTS FOR ALTERNATIVE 3 (ISCO)

Year	**Cost***	**Number of Annual Periods**	**Annual Discount Rate**	**Number of 2-Year Periods**	**2-Year Discount Rate**	**Number of 4-Year Periods**	**4-Year Discount Rate**	**Total Non-Discounted Cost**	**Present Value Cost**
Capital (Year 0)	$ 1,760,000	1	0	NA	NA	NA	NA	$ 1,760,000.00	$ 1,760,000.00
Quarterly Monitoring (Years 1-2)	$ 38,000	2	0.027	NA	NA	NA	NA	$ 76,000.00	$ 73,029.19
Semi-Annual Monitoring (Years 3-4)	$ 19,000	2	0.027	1	0.054729	NA	NA	$ 38,000.00	$ 34,619.88
Annual Monitoring (Years 5-30)	$ 9,000	26	0.027	NA	NA	1	0.112453263	$ 234,000.00	$ 149,750.55
Annual Long Term Monitoring Reporting (Years 1-30)	$ 25,000	30	0.027	NA	NA	NA	NA	$ 750,000.00	$ 509,571.74
Totals								**$ 2,858,000.00**	**$ 2,526,971.35**

*Annual and periodic costs include 10% for technical support and 15% contingency for unforeseen project complexities, including insurance, taxes, and licensing costs.
Capital costs include 15% contingency, as well as and project management, remedial design, and construction management costs per DER-10 guidance.

Discount rate of 2.7 (for 30-years) percent based on OMB Circular No. A-94 App. C (Revised Dec. 2008)

Prepared By/Date: **JDW 7/23/09**
Checked By/Date: **KAW 7/29/09**
Modified By/Date: **JDW 11/17/09**
Checked By/Date: **RTB 11/24/09**

Alternative 4 - Combined In-Situ Chemical Oxidation/Reduction and Enhanced Biodegradation

Modified By/Date: **JDW 11/17/09**
Checked By/Date: **RTB 11/24/09**

Task	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Comments/ Assumptions
CAPITAL COSTS								
Pre-Design Investigation								
Monitoring Well Installation								1 monitoring well, water injection test
33220112	Field Technician	10	HR	$ 11.01	$ 40.57	$ -	$ 515.88	one day, 10 hrs, includes per diem
33010102	Van Rental	1	DAY	$ 44.61	$ -	$ -	$ 44.61	
33010101	Mobilize/Demobilize Drilling Rig & Crew	1	LS	$ -	$ 3,309.73	$ 1,124.22	$ 4,433.95	Assume level D
33231178	Move Rig/Equipment Around Site	1	EA	$ 67.24	$ 116.85	$ 161.60	$ 345.70	
33231504	Surface Pad, Concrete, 2' x 2' x 4"	1	EA	$ 46.13	$ 85.32	$ 2.04	$ 133.49	
33020303	Organic Vapor Analyzer Rental, per Day	1	DAY	$ 134.33	$ -	$ -	$ 134.33	
33170808	Decontaminate Rig, Augers, Screen (Rental Equipment)	1	DAY	$ -	$ 125.90	$ -	$ 125.90	
33231101	Hollow Stem Auger, 8" Dia Borehole, Depth <=100 ft	35	LF	$ -	$ 7.43	$ 35.45	$ 1,500.85	1 wells to 35 ft bgs + one boring
33230101	2" PVC, Schedule 40, Well Casing	25	LF	$ 1.39	$ 2.71	$ 8.28	$ 309.41	25 ft riser
33230201	2" PVC, Schedule 40, Well Screen	10	LF	$ 3.22	$ 3.50	$ 10.68	$ 173.97	10 ft screen
33230301	2" PVC, Well Plug	1	EA	$ 6.78	$ 4.07	$ 12.40	$ 23.25	
33231401	2" Screen, Filter Pack	25	LF	$ 3.62	$ 2.31	$ 7.04	$ 324.02	
33231811	2" Well, Portland Cement Grout	10	LF	$ 1.35	$ -	$ -	$ 13.50	10 ft grout
33232101	2" Well, Bentonite Seal	1	EA	$ 10.74	$ 9.15	$ 27.92	$ 47.80	
33231189	DOT steel drums, 55 gal., open,	2	EA	$ 93.90	$ -	$ -	$ 187.80	
20836142	Load soil into 55 gal drums	2	EA	$ -	$ 34.00	$ -	$ 68.00	
33190303	Transport/Dispose (non-haz)	2	EA	$ 296.51	$ -	$ -	$ 593.02	
Monitoring Well Development, Groundwater Sampling, Injection Testing								Sample new well
33010102	Van Rental	3	DAY	$ 44.61	$ -	$ -	$ 133.83	
33220112	Field Technician	30	HR	$ 11.01	$ 40.57	$ -	$ 1,547.63	2 day
33231186	Well Development Equipment Rental (weekly)	1	WK	$ 264.04	$ -	$ -	$ 264.04	
33231189	DOT steel drums, 55 gal., open,	2	EA	$ 93.90			$ 187.80	1.5 drum each new well for development
33190303	Transport/Dispose (non-haz)	2	EA	$ 296.51	$ -	$ -	$ 593.02	
Quote	Pilot Water Injection	1	LS	$ 200.00	$ 500.00	$ 800.00	$ 1,500.00	
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1	WK	$ 264.04	$ -	$ -	$ 264.04	
33020401	Disposable Materials per Sample	1	EA	$ 9.74	$ -	$ -	$ 9.74	
33020402	Decontamination Materials per Sample	1	EA	$ 8.22	$ -	$ -	$ 8.22	
33232407	PVC bailers, disposable polyethylene, 1.50" OD x 36"	1	EA	$ 11.15	$ -	$ -	$ 11.15	
33021618	Volatile Organic Analysis (EPA 624) (624, 8260B)	1	EA	$ 245.42	$ -	$ -	$ 245.42	
Geoprobe Sampling of Soil and Groundwater								Collect soil and groundwater from two locations for VOC testing as well as bench scale testing for two oxidants.
33220112	Field Technician	10	HR	$ -	$ 40.57	$ -	$ 405.75	1 day

Alternative 4 - Combined In-Situ Chemical Oxidation/Reduction and Enhanced Biodegradation

Modified By/Date: **JDW 11/17/09**
Checked By/Date: **RTB 11/24/09**

Task	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Comments/ Assumptions
33010102	Van Rental	1	DAY	$ 44.61	$ -	$ -	$ 44.61	
33020303	Organic Vapor Analyzer Rental, per Day	1	DAY	$ 134.33	$ -	$ -	$ 134.33	
Recent Quote	Mobilize Geoprobe Rig & Crew	1	LS	$ -	$ 1,000.00	$ -	$ 1,000.00	
Recent Quote	Day Rate for Geoprobe Rig & Crew	1	Day	$ -	$ 1,600.00	$ -	$ 1,600.00	
33021618	Volatile Organic Analysis (EPA 624) (624, 8260B)	2	EA	$ 245.42	$ -	$ -	$ 490.84	one soil and one water samples
	Task Subtotal						**$ 17,415.89**	
Bench Scale Testing								
	Bench scale test	1	LS	$ 15,000.00	$ -	$ -	$ 15,000.00	Includes bench scale testing for Chem Ox in the source zone area.
	Task Subtotal						**$ 15,000.00**	
Full Scale								
Additional Excavation to 30 feet								Assume no shoring cost was included in OU-1, shoring to 40 feet; additional 20 deep of excavation (10-30); stage material on-site, no disposal. Assume 4 weeks to install sheeting, excavate, backfill. Assume all dewatering costs are covered under OU-1.
33220112	Field Technician	200	HR	$ -	$ 40.57	$ -	$ 8,114.92	
33010102	Van Rental	20	DAY	$ 44.61	$ -	$ -	$ 892.18	
33020303	Organic Vapor Analyzer Rental, per Day	20	DAY	$ 134.33	$ -	$ -	$ 2,686.66	
17030904	Steel Sheeting, Install, Pull and Salvage, to 40 ft	10000	SF	$ 3.37	$ 2.82	$ 3.71	$ 99,002.01	
17030277	Excavate and load, 2CY Excavator, medium material	2900	CY	$ -	$ 0.94	$ 1.72	$ 7,698.74	
17030415	Backfill with Excavated Material	2900	CY	$ 0.38	$ 2.82	$ 0.94	$ 12,001.96	No compaction since underwater.
Add & Mix Chemicals Into Bottom of Open Excavation								Assume one day
33220112	Field Technician	10	HR	$ -	$ 40.57	$ -	$ 405.75	includes per diem
OU-1	Equipment	1	LS	$ -	$ 2,500.00	$ -	$ 2,500.00	Assume day rate to add/mix reagent into water.
Unit costs from Carus	Permanganate per CF Area from 10-30 feet (below excavation)	30000	lb	$ -	$ 2.53	$ -	$ 75,900.00	Based on amount of Potassium permanganate required to treat water (XDD estimate from concentrations), include NOD for the soil at the bottom of the excavation. Assumes soil to be used as backfill is clean and does not require treatment.
Temporary HRC Injection Points (60), 7 monitoring wells & development								60 injection wells, assume 3/day. 7 monitoring wells & development, 5 days.
33220112	Field Technician	250	HR	$ -	$ 40.57	$ -	$ 10,143.65	includes per diem
33010102	Van Rental	25	DAY	$ 44.61	$ -	$ -	$ 1,115.22	
33020303	Organic Vapor Analyzer Rental, per Day	25	DAY	$ 134.33	$ -	$ -	$ 3,358.32	
Geoprobe Injections								
Recent Quote	Mobilize Geoprobe Rig & Crew	1	LS	$ -	$ 1,000.00	$ -	$ 1,000.00	
Recent Quote	Day Rate for Geoprobe Rig & Crew	23	Day	$ -	$ 1,600.00	$ -	$ 36,800.00	
33170808	Decontaminate Rig, Augers, Screen (Rental Equipment)	23	DAY	$ -	$ 125.90	$ -	$ 2,895.63	
HRC Backup	HRC Material	10320	LBS	$ 7.20	$ -	$ -	$ 74,304.00	Including 20% for tax, shipping, and inflation from 2008
Monitoring Well Installation								
33010101	Mobilize/Demobilize Drilling Rig & Crew	1	LS	$ -	$ 3,309.73	$ 1,124.22	$ 4,433.95	Assume level D
33231178	Move Rig/Equipment Around Site	7	EA	$ 67.24	$ 116.85	$ 161.60	$ 2,419.88	
33231504	Surface Pad, Concrete, 2' x 2' x 4"	7	EA	$ 46.13	$ 85.32	$ 2.04	$ 934.44	

Alternative 4 - Combined In-Situ Chemical Oxidation/Reduction and Enhanced Biodegradation

Modified By/Date: **JDW 11/17/09**
Checked By/Date: **RTB 11/24/09**

Task	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Comments/ Assumptions
33170808	Decontaminate Rig, Augers, Screen (Rental Equipment)	3	DAY	$ -	$ 125.90	$ -	$ 377.69	
33231101	Hollow Stem Auger, 8" Dia Borehole, Depth <=100 ft	245	LF	$ -	$ 7.43	$ 35.45	$ 10,505.98	6 wells to 35 ft bgs
33230101	2" PVC, Schedule 40, Well Casing	175	LF	$ 1.39	$ 2.71	$ 8.28	$ 2,165.87	25 ft risers
33230201	2" PVC, Schedule 40, Well Screen	70	LF	$ 3.22	$ 3.50	$ 10.68	$ 1,217.79	10 ft screens
33230301	2" PVC, Well Plug	7	EA	$ 6.78	$ 4.07	$ 12.40	$ 162.74	
33231401	2" Screen, Filter Pack	70	LF	$ 3.62	$ 2.31	$ 7.04	$ 907.25	
33231811	2" Well, Portland Cement Grout	175	LF	$ 1.35	$ -	$ -	$ 236.31	
33232101	2" Well, Bentonite Seal	7	EA	$ 10.74	$ 9.15	$ 27.92	$ 334.63	
33231189	DOT steel drums, 55 gal., open,	14	EA	$ 93.90	$ -	$ -	$ 1,314.62	
20836142	Load soil into 55 gal drums	14	EA	$ -	$ 34.00	$ -	$ 476.02	
33190303	Transport/Dispose (non-haz)	14	EA	$ 296.51	$ -	$ -	$ 4,151.11	
Monitoring Well Development (6)								Sample 2 new wells
33231186	Well Development Equipment Rental (weekly)	1	WK	$ 264.04	$ -	$ -	$ 264.04	
33231189	DOT steel drums, 55 gal., open,	10	EA	$ 93.90			$ 939.01	1.5 drum each new well for development
33190303	Transport/Dispose (non-haz)	10	EA	$ 296.51	$ -	$ -	$ 2,965.08	
		Task Subtotal					**$ 372,625.42**	
ANNUAL AND PERIODIC COSTS								
Long-Term Monitoring (per sampling event - assume 16 wells)								
Groundwater Monitoring								Includes additional 20% for QC
33010102	Van Rental	5	DAY	$ 44.61	$ -	$ -	$ 223.04	
33220112	Field Technician	40	HR	$ 11.01	$ 40.57	$ -	$ 2,063.51	person 1 week(includes per diem)
33231186	Well Development Equipment Rental (weekly)	1	WK	$ 264.04	$ -	$ -	$ 264.04	
33231189	DOT steel drums, 55 gal., open, 17C	3	EA	$ 97.66			$ 292.97	
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1	WK	$ 264.04	$ -	$ -	$ 264.04	assumes 4 well per day
33020401	Disposable Materials per Sample	16	EA	$ 9.74	$ -	$ -	$ 155.87	20 sampling locations (all existing on-site wells) plus 20% QA\QC
33020402	Decontamination Materials per Sample	16	EA	$ 8.22	$ -	$ -	$ 131.56	
33232407	PVC bailers, disposable polyethylene, 1.50" OD x 36"	16	EA	$ 11.15	$ -	$ -	$ 178.44	
33021618	Volatile Organic Analysis (EPA 624) (624, 8260B)	16	EA	$ 245.42	$ -	$ -	$ 3,926.74	
		Task Subtotal					**$ 7,500.20**	
Annual Reporting								
95010102	Annual Report	1	LS	$ -	$ 20,000.00	$ -	$ 20,000.00	Including bioremediation evaluation
		Task Subtotal					**$ 20,000.00**	

PRESENT VALUE OF ANNUAL AND PERIODIC COSTS FOR ALTERNATIVE 4 (Combined ISCO and Biodegradation)

Year	Cost*	Number of Annual Periods	Annual Discount Rate	Number of 2-Year Periods	2-Year Discount Rate	Number of 4-Year Periods	4-Year Discount Rate	Total Non-Discounted Cost	Present Value Cost
Capital (Year 0)	$ 640,000	1	0	NA	NA	NA	NA	$ 640,000.00	$ 640,000.00
Quarterly Monitoring (Years 1-2)	$ 38,000	2	0.027	NA	NA	NA	NA	$ 76,000.00	$ 73,029.19
Semi-Annual Monitoring (Years 3-4)	$ 19,000	2	0.027	1	0.054729	NA	NA	$ 38,000.00	$ 34,619.88
Annual Monitoring (Years 5-30)	$ 9,000	26	0.027	NA	NA	1	0.112453263	$ 234,000.00	$ 149,750.55
Annual Long Term Monitoring Reporting (Years 1-30)	$ 25,000	30	0.027	NA	NA	NA	NA	$ 750,000.00	$ 509,571.74
Totals								**$ 1,738,000.00**	**$ 1,406,971.35**

*Annual and periodic costs include 10% for technical support and 15% contingency for unforeseen project complexities, including insurance, taxes, and licensing costs.
Capital costs include 15% contingency, as well as and project management, remedial design, and construction management costs per DER-10 guidance.

Discount rate of 2.7 (for 30-years) percent based on OMB Circular No. A-94 App. C (Revised Dec. 2008)

Prepared By/Date:	**JDW 11/17/09**
Checked By/Date:	**RTB 11/24/09**

Alternative 5 Groundwater Extraction and Treatment

Prepared By/Date: **JDW 7/23/09**
Checked By/Date: **KAW 7/29/09**
Modified By/Date: **JDW 11/17/09**
Checked By/Date: **RTB 11/24/09**

Task	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Comments/ Assumptions
CAPITAL COSTS								
Pre-Design Investigation								
Boring/Monitoring Well Installation								two 2-inch wells, one 4-inch well
33220112	Field Technician	32	HR	$ 11.01	$ 40.57	$ -	$ 1,650.81	4 days (include per diem)
33010102	Van Rental	3	DAY	$ 44.61	$ -	$ -	$ 133.83	
33010101	Mobilize/Demobilize Drilling Rig & Crew	1	LS	$ -	$ 3,309.73	$ 1,124.22	$ 4,433.95	Assume level D
33231178	Move Rig/Equipment Around Site	3	EA	$ 67.24	$ 116.85	$ 161.60	$ 1,037.09	
33231504	Surface Pad, Concrete, 2' x 2' x 4"	3	EA	$ 46.13	$ 85.32	$ 2.04	$ 400.47	
33020303	Organic Vapor Analyzer Rental, per Day	3	DAY	$ 134.33	$ -	$ -	$ 403.00	
33170808	Decontaminate Rig, Augers, Screen (Rental Equipment)	3	DAY	$ -	$ 125.90	$ -	$ 377.69	
33231101	Hollow Stem Auger, 8" Dia Borehole, Depth <=100 ft	70	LF	$ -	$ 7.43	$ 35.45	$ 3,001.71	2 2-inch wells to 35 ft
33231103	Hollow Stem Auger, 11" Dia Borehole, Depth <=100 ft	35	LF	$ -	$ 13.47	$ 38.41	$ 1,815.71	1 4-inch well to 35 ft
33230101	2" PVC, Schedule 40, Well Casing	50	LF	$ 1.39	$ 2.71	$ 8.28	$ 618.82	25 ft risers
33230201	2" PVC, Schedule 40, Well Screen	20	LF	$ 3.22	$ 3.50	$ 10.68	$ 347.94	10 ft screens
33230301	2" PVC, Well Plug	2	EA	$ 6.78	$ 4.07	$ 12.40	$ 46.50	
33231401	2" Screen, Filter Pack	20	LF	$ 3.62	$ 2.31	$ 7.04	$ 259.21	25 feet of grout
33231811	2" Well, Portland Cement Grout	50	LF	$ 1.35	$ -	$ -	$ 67.52	
33232101	2" Well, Bentonite Seal	2	EA	$ 10.74	$ 9.15	$ 27.92	$ 95.61	
33230122	4" Stainless Steel, Well Casing	25	LF	$ 33.58	$ 4.07	$ 11.59	$ 1,230.98	25 ft risers
33230222	4" Stainless Steel, Well Screen	10	LF	$ 33.58	$ 4.07	$ 11.59	$ 492.39	10 ft screens
33231402	4" Screen, Filter Pack	10	LF	$ 6.38	$ 4.07	$ 11.59	$ 220.40	
33231802	4" Well, Grout	25	LF	$ 5.90	$ 23.16	$ 66.08	$ 2,378.41	25 ft grout
33232102	4" Well, Bentonite Seal	2	EA	$ 26.85	$ 22.86	$ 65.22	$ 229.86	
33232205	Well Vault for equipment	1	EA	$ 1,094.69	$ 967.16	$ 2,356.80	$ 4,418.65	
33231189	DOT steel drums, 55 gal., open,	10	EA	$ 93.90	$ -	$ -	$ 939.01	
20836142	Load soil into 55 gal drums	10	EA	$ -	$ 34.00	$ -	$ 340.02	
33190303	Transport/Dispose (non-haz)	10	EA	$ 296.51	$ -	$ -	$ 2,965.08	
Monitoring Well Development (3), Groundwater Sampling (3 wells), Hydraulic conductivity Test (1 well)								

Alternative 5 Groundwater Extraction and Treatment

Prepared By/Date: **JDW 7/23/09**
Checked By/Date: **KAW 7/29/09**
Modified By/Date: **JDW 11/17/09**
Checked By/Date: **RTB 11/24/09**

Task	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Comments/ Assumptions
33010102	Van Rental	2	DAY	$ 44.61	$ -	$ -	$ 89.22	
33220112	Field Technician	20	HR	$ 11.01	$ 40.57	$ -	$ 1,031.75	2 days, one person (includes per diem)
33231186	Well Development Equipment Rental (weekly)	1	WK	$ 264.04	$ -	$ -	$ 264.04	
33231189	DOT steel drums, 55 gal., open,	4	EA	$ 93.90			$ 375.60	1.25 drum each well for development
33190303	Transport/Dispose (non-haz)	4	EA	$ 296.51	$ -	$ -	$ 1,186.03	
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1	WK	$ 264.04	$ -	$ -	$ 264.04	
33020401	Disposable Materials per Sample	3	EA	$ 9.74	$ -	$ -	$ 29.22	
33020402	Decontamination Materials per Sample	3	EA	$ 8.22	$ -	$ -	$ 24.67	
33232407	PVC bailers, disposable polyethylene, 1.50" OD x 36"	3	EA	$ 11.15	$ -	$ -	$ 33.46	
33021618	Volatile Organic Analysis (EPA 624) (624, 8260B)	3	EA	$ 245.42	$ -	$ -	$ 736.26	
33021668	Testing, sulfur: sulfate, sulfide, sulfite	3	EA	$ 31.88	$ -	$ -	$ 95.64	
33021645	Iron (Metal) - (EPA 200.7)	3	EA	$ 53.54	$ -	$ -	$ 160.63	
Pump Test (1 well), while monitoring at 2 wells								
33010102	Van Rental	4	DAY	$ 44.61	$ -	$ -	$ 178.44	
33220112	Field Technician	32	HR	$ 11.01	$ 40.57	$ -	$ 1,650.81	Assume ~72 hr pump test
MACTEC	Submersible Pump Rediflow	4	DAY	$ -	$ -	$ 80.00	$ 320.00	
MACTEC	Troll Datalogger	8	DAY	$ -	$ -	$ 65.00	$ 520.00	2 trolls, 4 days each, price based on mastic's costs
MACTEC	Misc Equipment	1	LS	$ -	$ -	$ 2,000.00	$ 2,000.00	Generator, water tank, extension cords, etc
		Task Subtotal					**$ 36,864.44**	
Full Scale								
Site Preparation/Mobilization								
Site Trailer and Utilities								
99040101	Temporary Office 20' x 8'	5.00	MO	$ 239.30	$ -	$ -	$ 1,196.49	
	Delivery and Setup of Office	1.00	LS	$ 579.64	$ -	$ -	$ 579.64	
99140201	Temporary Storage Trailer 16' x 8'	5.00	MO	$ 93.58	$ -	$ -	$ 467.88	
99040501	Portable Toilets	5.00	MO	$ 95.81	$ -	$ -	$ 479.07	
99040801	Temporary Electrical Power - Avg	1.60	CSF	$ 104.95	$ -	$ -	$ 167.92	
Extraction Well Installation								Total of 7 extraction wells. Assume 1/day.
33220112	Field Technician	70	HR	$ 11.01	$ 40.57	$ -	$ 3,611.14	7 days, includes per diem

Alternative 5 Groundwater Extraction and Treatment

Prepared By/Date: **JDW 7/23/09**
Checked By/Date: **KAW 7/29/09**
Modified By/Date: **JDW 11/17/09**
Checked By/Date: **RTB 11/24/09**

Task	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Comments/ Assumptions
33010102	Van Rental	7	DAY	$ 44.61	$ -	$ -	$ 312.26	
33010101	Mobilize/Demobilize Drilling Rig & Crew	1	LS	$ -	$ 3,309.73	$ 1,124.22	$ 4,433.95	Assume level D
33231178	Move Rig/Equipment Around Site	7	EA	$ 67.24	$ 116.85	$ 161.60	$ 2,419.88	
33232205	Well Vault for equipment	7	EA	$ 1,094.69	$ 967.16	$ 2,356.80	$ 30,930.58	
33020303	Organic Vapor Analyzer Rental, per Day	7	DAY	$ 134.33	$ -	$ -	$ 940.33	
33170808	Decontaminate Rig, Augers, Screen (Rental Equipment)	7	DAY	$ -	$ 125.90	$ -	$ 881.28	
33231103	Hollow Stem Auger, 11" Dia Borehole, Depth <=100 ft	245	LF	$ -	$ 13.47	$ 38.41	$ 12,709.99	7 wells to 35 ft bgs
33230122	4" Stainless Steel, Well Casing	175	LF	$ 33.58	$ 4.07	$ 11.59	$ 8,616.83	25 ft risers
33230222	4" Stainless Steel, Well Screen	70	LF	$ 33.58	$ 4.07	$ 11.59	$ 3,446.73	10 ft screens
33231402	4" Screen, Filter Pack	70	LF	$ 6.38	$ 4.07	$ 11.59	$ 1,542.78	
33231802	4" Well, Grout	175	LF	$ 5.90	$ 23.16	$ 66.08	$ 16,648.89	25 ft grout
33232102	4" Well, Bentonite Seal	14	EA	$ 26.85	$ 22.86	$ 65.22	$ 1,609.04	
33230526	4" Submersible pumps. 8-14 GPM, <80ft, with controls	8	EA	$ 1,836.29	$ 76.48	$ -	$ 15,302.14	Includes extra pump
MACTEC	Pressure Transducers & Float Switches	8	EA	$ 2,782.26	$ 76.48	$ -	$ 22,869.88	Includes one extra
33270441	4" PVC, Sch 80, Ball Valve	8	EA	$ 308.39	$ 76.48	$ -	$ 3,078.94	Includes on extra
33310209	Pressure Gauge	8	EA	$ 75.38	$ 76.48	$ -	$ 1,214.83	Includes on extra
MACTEC	Flow transmitting meters	8	EA	$ 405.75	$ 76.48		$ 3,857.79	
25575772	4' X 4' Hatch	7	EA	$ 644.78	$ 812.88	$ 2,318.55	$ 26,433.45	
33231189	DOT steel drums, 55 gal., open,	33	EA	$ 93.90	$ -	$ -	$ 3,098.74	
20836142	Load soil into 55 gal drums	33	EA	$ -	$ 34.00	$ -	$ 1,122.05	
33190303	Transport/Dispose (non-haz)	33	EA	$ 296.51	$ -	$ -	$ 9,784.75	
Overburden Monitoring Wells								Total of 3 for additional monitoring of GW capture.
33220112	Field Technician	16	HR	$ 11.01	$ 40.57	$ -	$ 825.40	2 days, include per diem
33010102	Van Rental	2	DAY	$ 44.61	$ -	$ -		
33010101	Mobilize/Demobilize Drilling Rig & Crew	1	LS	$ -	$ 3,309.73	$ 1,124.22	$ 4,433.95	Assume level D
33231178	Move Rig/Equipment Around Site	3	EA	$ 67.24	$ 116.85	$ 161.60	$ 1,037.09	
33231504	Surface Pad, Concrete, 2' x 2' x 4"	3	EA	$ 46.13	$ 85.32	$ 2.04	$ 400.47	
33020303	Organic Vapor Analyzer Rental,	2	DAY	$ 134.33	$ -	$ -	$ 268.67	

Alternative 5 Groundwater Extraction and Treatment

Prepared By/Date:	**JDW 7/23/09**
Checked By/Date:	**KAW 7/29/09**
Modified By/Date:	**JDW 11/17/09**
Checked By/Date:	**RTB 11/24/09**

Task	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Comments/ Assumptions
	per Day							
33170808	Decontaminate Rig, Augers, Screen (Rental Equipment)	2	DAY	$ -	$ 125.90	$ -	$ 251.79	
33231101	Hollow Stem Auger, 8" Dia Borehole, Depth <=100 ft	105	LF	$ -	$ 7.43	$ 35.45	$ 4,502.56	3 wells 35 feet deep
33230101	2" PVC, Schedule 40, Well Casing	75	LF	$ 1.39	$ 2.71	$ 8.28	$ 928.23	25 ft risers
33230201	2" PVC, Schedule 40, Well Screen	30	LF	$ 3.22	$ 3.50	$ 10.68	$ 521.91	10 ft screens
33230301	2" PVC, Well Plug	3	EA	$ 6.78	$ 4.07	$ 12.40	$ 69.75	
33231401	2" Screen, Filter Pack	30	LF	$ 3.62	$ 2.31	$ 7.04	$ 388.82	
33231811	2" Well, Portland Cement Grout	75	LF	$ 1.35	$ -	$ -	$ 101.27	25 feet grout
33232101	2" Well, Bentonite Seal	3	EA	$ 10.74	$ 9.15	$ 27.92	$ 143.41	
33231189	DOT steel drums, 55 gal., open,	4	EA	$ 93.90	$ -	$ -	$ 375.60	
20836142	Load soil into 55 gal drums	4	EA	$ -	$ 34.00	$ -	$ 136.01	
33190303	Transport/Dispose (non-haz)	4	EA	$ 296.51	$ -	$ -	$ 1,186.03	
TREATMENT SYSTEM								
33220112	Field Technician	480	HR	$ 11.01	$ 40.57	$ -	$ 24,762.09	Oversight of GWTS Installation, Assume 3 mths
33010102	Van Rental	60	DAY	$ 44.61	$ -	$ -	$ 2,676.53	
TRENCHING								Piping from wells to treatment system,
20461760	Remove Pavement	3000	SF	$ -	$ 2.89	$ 1.38	$ 12,798.39	Assume paved throughout (1000'), trench 3' wide
17030255	Trenching, backfill & Compaction	560	CY	$ -	$ 4.42	$ 1.18	$ 3,135.60	1000 feet long, 5 feet deep, 3 feet wide
18010102	Gravel, Delivered, Dumped & graded	225	CY	$ 24.47	$ 2.06	$ 1.88	$ 6,393.11	Assume 2' (1.5 ft around pipe, 6" below asphalt
18010105	Asphalt Base Course	55	CY	$ 37.54	$ 0.71	$ 1.48	$ 2,185.06	Assume 6 inch throughout
18010312	Asphalt Wearing Course	30	TON	$ 35.91	$ 16.53	$ 16.51	$ 2,068.61	
33260430	4", sch80 PVC	1000	LF	$ 2.81	$ 6.46	$ -	$ 9,262.60	Piping from wells to GWTS, then to catch basin
BUILDING & Major Equipment								
MACTEC	20' X 24' Pre-engineered building	1	EA	$ 7,709.17	$ 5,332.66	$ -	$ 13,041.83	Get-A-Quote
23101150	Fine Grading for Slab on Grade	85	SY	$ -	$ 1.11	$ 0.51	$ 137.95	
2.3003E+10	Compaction for Slab on Grade Vibrating roller (4 passes), 2 lifts	85	CY	$ -	$ 0.36	$ 1.23	$ 135.00	
A1030120452	20' X 24' Concrete Slab (6" thick)	480	SF	$ 3.49	$ 3.64	$ -	$ 3,422.18	
A2020110	2' high concrete walls (2nd containment)	88	LF	$ 14.20	$ 46.95	$ 1.00	$ 5,469.35	
MACTEC	Master control panel	1	EA	$ 2,000.00	$ 2,000.00		$ 4,000.00	Get-A-Quote
33130726	4' diam, 6.5' high, Air stripper with blower, 150 GPM, 7,500 CFM	1	EA	$ 12,636.09	$ 4,193.09	$ 605.47	$ 17,434.65	

Alternative 5 Groundwater Extraction and Treatment

Prepared By/Date: **JDW 7/23/09**
Checked By/Date: **KAW 7/29/09**
Modified By/Date: **JDW 11/17/09**
Checked By/Date: **RTB 11/24/09**

Task	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Comments/ Assumptions
33130741	Electrical Controls for Air Stripper	1	EA	$ 5,032.41	$ 1,554.59	$ 100.02	$ 6,687.02	
33109716	1,000 Gallon Double-Walled Storage Tank W/Leak detection	1	EA	$ 1,044.78	$ -	$ -	$ 1,044.78	
33290124	Pump from tank to AS (150 gpm)	1	EA	$ 4,996.47	$ 2,126.11	$ -	$ 7,122.58	
33131918	Vapor Phase Carbon (8,000 CFM)	1	EA	$ 26,779.23	$ 1,385.33	$ 200.55	$ 28,365.12	
33290121	Pump from VLS to Tank (50 gpm)	1	EA	$ 3,112.65	$ 976.11	$ -	$ 4,088.76	
33290404	Sump Pump (150 gpm) 2nd containment	1	EA	$ 3,009.48	$ 659.63	$ -	$ 3,669.10	
33130116	0-50 GPM Cartridge Filter Equipment	1	EA	$ 2,647.78	$ 53.37	$ -	$ 2,701.15	
MACTEC	Plumbing and Electrical	1	LS	$ 17,574.00	$ 5,550.00	$ -	$ 23,124.00	Get-A-Quote - includes pump controls, gauges
MACTEC	Heat System	1	LS	$ 8,000.00	$ 2,000.00	$ -	$ 10,000.00	
	Task Subtotal						**$ 387,053.66**	
ANNUAL AND PERIODIC COSTS								
Annual Treatment System Operation, Maintenance, and Monitoring								
	O&M (Technician 10 hrs/week)	520	HR	$ 11.01	$ 40.57	$ -	$ 26,825.60	10 hrs per week
	Analytical for Discharge	12	EA	$ 1,000.00	$ -	$ -	$ 12,000.00	budgeted analytical program
	Monthly Discharge Monitoring Reports	12	EA	$ -	$ -	$ 1,350.00	$ 16,200.00	incl. data management/monthly reports
	Routine Maintenance	4	EA	$ 4,000.00	$ 1,000.00	$ 750.00	$ 23,000.00	
	Non-Routine Maintenance	1	EA	$ 6,000.00	$ 2,000.00	$ 1,000.00	$ 9,000.00	
	Task Subtotal						**$ 87,025.60**	
Long-Term Monitoring (per sampling event - assume 16 wells)								
Groundwater Monitoring								Includes additional 20% for QC
33010102	Van Rental	5	DAY	$ 44.61	$ -	$ -	$ 223.04	
33220112	Field Technician	40	HR	$ 11.01	$ 40.57	$ -	$ 2,063.51	person 1 week(includes per diem)
33231186	Well Development Equipment Rental (weekly)	1	WK	$ 264.04	$ -	$ -	$ 264.04	
33231189	DOT steel drums, 55 gal., open, 17C	3	EA	$ 97.66			$ 292.97	
33021509	Monitor well sampling equipment, rental, water quality testing parameter device rental	1	WK	$ 264.04	$ -	$ -	$ 264.04	assumes 4 well per day
33020401	Disposable Materials per Sample	16	EA	$ 9.74	$ -	$ -	$ 155.87	20 sampling locations (all existing on-site wells) plus 20% QA\QC
33020402	Decontamination Materials per Sample	16	EA	$ 8.22	$ -	$ -	$ 131.56	
33232407	PVC bailers, disposable	16	EA	$ 11.15	$ -	$ -	$ 178.44	

Alternative 5 Groundwater Extraction and Treatment

Prepared By/Date: **JDW 7/23/09**
Checked By/Date: **KAW 7/29/09**
Modified By/Date: **JDW 11/17/09**
Checked By/Date: **RTB 11/24/09**

Task	Description	Quantity	Unit of Measure	Material Unit Cost	Labor Unit Cost	Equipment Unit Cost	Extended Cost	Comments/ Assumptions
	polyethylene, 1.50" OD x 36"							
33021618	Volatile Organic Analysis (EPA 624) (624, 8260B)	16	EA	$ 245.42	$ -	$ -	$ 3,926.74	
	Task Subtotal						**$ 7,500.20**	
Annual Long-Term Monitoring Reporting								
95010102	Annual Report	1	LS	$ -	$ 20,000.00	$ -	$ 20,000.00	Including bioremediation evaluation
	Task Subtotal						**$ 20,000.00**	
Capital Replacement - GWTP System								
		1	LS	$ 193,526.83	$ -	$ -	$ 193,526.83	Est upgrades and equip replacement (1/2 of original costs)
	Task Subtotal						**$ 193,526.83**	

PRESENT VALUE OF ANNUAL AND PERIODIC COSTS FOR ALTERNATIVE 5 (Groundwater Extraction and Treatment)

Year	Cost*	Number of Annual Periods	Annual Discount Rate	Number of 2-Year Periods	2-Year Discount Rate	Number of 4-Year Periods	4-Year Discount Rate	Number of 15-Year Periods	15-Year Discount Rate	Total Non-Discounted Cost	Present Value Cost
Capital (Year 0)	$ 628,000	1	0	NA	NA	NA	NA	NA	NA	$ 628,000.00	$ 628,000.00
Treatment System Operation, Maintenance, and Monitoring (1-30)	$ 109,000	30	0.027	NA	NA	NA	NA	NA	NA	$ 3,270,000.00	$ 2,221,732.78
Quarterly Monitoring (Years 1-2)	$ 38,000	2	0.027	NA	NA	NA	NA	NA	NA	$ 76,000.00	$ 73,029.19
Semi-Annual Monitoring (Years 3-4)	$ 19,000	2	0.027	1	0.054729	NA	NA	NA	NA	$ 38,000.00	$ 34,619.88
Annual Monitoring (Years 5-30)	$ 9,000	26	0.027	NA	NA	1	0.112453	NA	NA	$ 234,000.00	$ 149,750.55
Annual Performance Reporting (Years 1-30)	$ 25,000	30	0.027	NA	NA	NA	NA	NA	NA	$ 750,000.00	$ 509,571.74
Major Equipment Repair/Replacement (year 15)	$ 193,527	1	0.027	NA	NA	NA	NA	1	0.491271	$ 193,526.83	$ 129,773.06
Totals										**$ 5,189,526.83**	**$ 3,746,477.19**

*Annual and periodic costs include 10% for technical support and 15% contingency for unforeseen project complexities, including insurance, taxes, and licensing costs.
Capital costs include 15% contingency, as well as and project management, remedial design, and construction management costs per DER-10 guidance.

Discount rate of 2.7 (for 30-years) percent based on OMB Circular No. A-94 App. C (Revised Dec. 2008)

Prepared By/Date: **JDW 7/23/09**
Checked By/Date: **KAW 7/29/09**
Modified By/Date: **JDW 11/17/09**
Checked By/Date: **RTB 11/24/09**