8976 Wellington Road
Manassas, VA 20109

April 30, 2009

Mr. Gary R. Holmes, P.E.
Environmental Engineer 2
Kirkwood Sub-Office, Region 7
New York State Department of Environmental Conservation
1679 NY Route 11
Kirkwood, NY 13795

Re: Site Investigation Work Plan (Revised)
Broadway Complex Site, Owego, Tioga County, New York
VCA Index # A7-0407-0001, Site # V00290-7

Dear Mr. Holmes:

The purpose of this letter is to transmit four copies (including one unbound copy) of the revised Site Investigation Work Plan (SI Work Plan) for the Broadway Complex. This revised SI Work Plan has been prepared in response to comments from the New York State Department of Environmental Conservation (NYSDEC) and the New York State Department of Health (NYSDOH) regarding the Site Investigation Status Report, dated July 25, 2008, and numerous subsequent written communications between IBM and NYSDEC including IBM's April 30, 2009 letter (submitted under separate cover).

If you have any questions or require further information, please contact me at 703-257-2583.

Sincerely yours,

Dean W. Chartrand

Dean W. Chartrand
IBM Corporate Environmental Affairs

cc: Gregg A. Townsend, P.E.	NYSDEC - Syracuse
Julia Kenney	NYSDOH – Troy
Stephen Sill	Sanmina-SCI
Edward Hinchey	ERM
Doreen Simmons, Esq.	Hancock & Estabrook

SUPPLEMENTAL SITE INVESTIGATION WORK PLAN FOR THE BROADWAY COMPLEX

1200 TAYLOR ROAD
OWEGO, TIOGA COUNTY, NEW YORK

Voluntary Cleanup Agreement Index # A7-0407-0001
Site # V00290-7

Prepared for:

IBM Corporation
Manassas, Virginia

November 26, 2008
(Revised April 30, 2009)

Prepared by:

Groundwater Sciences Corporation

2601 Market Place Street, Suite 310
Harrisburg, Pennsylvania 17110

560 Route 52, Suite 202
Beacon, New York 12508

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Vestal, New York 13850

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1 INTRODUCTION AND PURPOSE

This Supplemental Site Investigation Work Plan (Work Plan) has been prepared by Groundwater Sciences Corporation (GSC) at the request of IBM Corporation (IBM) for the former IBM leased property known as the Broadway Complex (the "Site") located in the Town of Owego, Tioga County, New York. This Work Plan has been revised to address New York State Department of Environmental Conservation (NYSDEC) comments (in a March 17, 2009 letter) to an earlier version of this Work Plan, dated November 26, 2008.

1.1 Purpose

The Site (ID # V00290-7) is subject to a Voluntary Cleanup Agreement (VCA), Index # A7-0407-0001, between IBM and the New York State Department of Environmental Conservation (NYSDEC). The Site has been extensively investigated via field explorations performed in 1997, 1998, 1999, and April 2008. Results of these investigations have identified a chlorinated volatile organic compound (CVOC) contaminant source area; however, additional investigation activities are recommended: (1) to confirm the April 2008 screening level results that further defined the nature and extent of on-Site CVOC contamination originating from the former septic tank area, and (2) to produce data of sufficient quantity and quality to support the development of a Remedial Action Work Plan.

1.2 Organization

This Work Plan is organized as follows. Section 1 describes the purpose and organization of this Work Plan. Section 2 presents Site background information, including a physical description of the Site, a description of Site and surrounding land uses, a summary of pertinent Site history regarding past Site operations and removal of the former septic tank, and a summary of previous Site hydrogeologic investigations focused on the former septic tank. Section 3 presents the objectives, scope and rationale for the proposed investigation work. Section 4 presents the proposed field activities plan. Section 5 presents the scope of the Qualitative Human Health Exposure Assessment. Sections 6 and 7 present the QA/QC Plan and Health and Safety Plans, respectively. Section 8 presents a schedule for performing and reporting on these activities. References are provided in Section 9.

2 SITE DESCRIPTION AND HISTORY

2.1 Physical Description and Setting

The Site, known as the Broadway Complex, is located at 1200 Taylor Road (County Route 606) in the Town of Owego, Tioga County (Tax Map Identifier Number 129.07-1-10). The Site consists of a portion of the property currently owned and occupied by Sanmina-SCI (formerly Hadco). The Site is used by Sanmina-SCI to manufacture printed circuit boards and related operations. Figure 2-1 shows the location of the Site on a portion of the USGS 7-½ minute Apalachin topographic quadrangle map.

As shown on the Aerial Site Map provided as Figure 2-2, the Site is bounded on the west and north by other portions of the Sanmina-SCI Corporation property, on the east by Broadway Avenue, Barnes Creek, and the Lockheed Martin manufacturing facility, and on the south by a wooded undeveloped property (Warneke property). The Site consists of an approximately 60,000 square foot building (Broadway Building or Building 911) with adjacent lawn and asphalt-paved portions of the Sanmina-SCI property to the east and west, and a roughly two-acre parking lot to the south. A Site Map showing the Broadway Complex building and parking lot is provided as Figure 2-3.

2.2 Historical Site Use

IBM began leasing the Broadway Complex Site in 1956 for engineering and manufacturing purposes. From 1957 to 1987, IBM leased this property from Owego Enterprises, which was the Owner and Operator. From 1987 to 1994, IBM leased this property from Gordon D. and Jean Teeter (Owners) with Harder Teeter Entrepreneurs as the Operator. IBM ceased leasing this property in 1994. In 1995, Hadco Corporation purchased the Broadway Property from the Teeters and became the Owner and Operator of the property.

During IBM's occupation, the Broadway Building on the Site was known as Building 911. Available records indicate that activities at this former IBM facility included, but may not have been limited to, the following operations: offices, carpentry shop, model shop, harness assembly and test, carriage assembly and test, card sorter assembly and test HIMACS assembly and test, photo lab, reprographic area, paint shop, parts cleaning, semi-coating, develop, etch and strip lines, durographic process, Mark 48 testing and Page prep and coat.

2.3 Source Removal

In May 1989, IBM removed a 10,000-gallon inactive, steel septic tank that was located near the southeast corner of Building 911. The approximate area of the former septic tank excavation is shown on Figure 2-3. Sanitary wastes were reportedly directed to the tank for about one year before construction of the nearby Town of Owego wastewater treatment plant was completed. Prior to connection to the municipal sanitary sewer, IBM reportedly shared use of the septic tank with Mutual Design, which owned and occupied a facility to the north. During the 1989 tank removal, "pinhole" leaks were noted in the bottom of the tank. A discharge pipe from the tank was identified, but no information was available regarding the potential location of an associated leachfield. Sludge samples collected from within the tank and soil samples collected at locations around the tank indicated the presence of CVOCs, including trichloroethene (TCE) and 1,1,1-trichloroethane (TCA). Based on these analyses, the predominant chemical was determined to be TCE and its transformation products, 1,2-dichloroethene and vinyl chloride.

The presence of TCE, TCA, and their transformation products in soil and groundwater beneath a portion of the Site has also been attributed to a former chemical storage area located north of the Site within the Sanmina-SCI property. The approximate location of this former storage area is shown on Figure 2-3.

2.4 Previous Investigations

Previous hydrogeologic investigations were conducted at the Site in 1997, 1998, 1999, and April 2008. In general, the investigations focused on soil and groundwater in the area of the former septic tank and areas believed to be downgradient and sidegradient from the former tank to the west, southwest, and south. The multi-phased investigations completed in 1997, 1998, and 1999 included: (1) a soil reconnaissance survey consisting of completion of thirty-six soil sampling probes; (2) two soil borings near the southeastern corner of Building 911 in the area of a six-inch sanitary sewer line that was connected to the former septic tank; (3) five monitoring well installations, designated 911-1 through 911-5; (4) groundwater level monitoring and groundwater sampling of Site monitoring wells and accessible off-Site monitoring wells within the Sanmina-SCI property and Lockheed Martin property; and (5) *in-situ* hydraulic conductivity testing of Site monitoring wells. Results of the investigations completed between 1997 and 1999 are summarized in the December 28, 2005 Site Investigation Work Plan. The Site Investigation Work Plan was revised on January 31, 2008 and March 27, 2008 to address questions and comments by NYSDEC and the New York State Department of Health (NYSDOH).

The April 2008 investigation was completed to further define the lateral and vertical extent of CVOCs at the Site. Field activities performed as part of this investigation included: (1) a review of subsurface utilities in the area of proposed field explorations; (2) direct-push Membrane Interface Probes (MIPs) to screen for the presence of CVOCs in the vadose zone and saturated zone; (3) groundwater sampling probes and fixed-base analytical laboratory testing to supplement the MIP screening data in the area of the apparent CVOC plume; (4) soil sampling probes to supplement MIP screening data in the area of the former septic tank; (5) water level monitoring and groundwater sampling at existing monitoring well locations; and (6) a field location and elevation survey. Results of the April 2008 investigations are provided in a Site Investigation Status Report, dated July 25, 2008.

On the basis of the findings of the investigations performed from 1997 to 1999, and in April 2008 the following conclusions have been made regarding Site conditions:

- Shallow groundwater flow in the area of the former septic tank is generally from the northeast to the southwest. The inferred southwesterly direction of groundwater flow is possibly due to leakage and water table mounding from Barnes Creek, located east of the former septic tank, and/or off-Site groundwater extraction operations by Sanmina-SCI.

- The spatial pattern of MIP data, soil quality data, and groundwater quality data indicate two separate CVOC plumes in the area of the field investigations. One plume is centered near the central rear entrance of the Broadway Building and the other smaller plume emanates from the area of the former septic tank. The two plumes are inferred to commingle in the northeastern portion of the parking lot.

- The majority of CVOC mass identified at the Site is located in the saturated zone. Specifically, results of numerous MIPs performed in the area of the former septic tank suggest the CVOC presence is below the water table at depths at or below the 14-foot depth of the former septic tank excavation.

3 OBJECTIVES, SCOPE AND RATIONALE

The objective of this Work Plan is to obtain chemical and physical data of sufficient quality and quantity to further define the horizontal and vertical extent of CVOCs in groundwater and soil at the Site. This data will be used to prepare a remedial action work plan.

The scope of this Work Plan will be the soil and groundwater on-Site in the vicinity of and downgradient from the former septic tank.

The rationale and purpose of this Work Plan are presented in Section 1.1.

4 FIELD ACTIVITIES PLAN

This section describes the field activities that will be performed in the completion of the Supplemental Site Investigation. Overall, the field explorations include six work tasks that are designed to further refine our understanding of hydrogeologic conditions and the nature and extent of on-Site CVOC contamination in the area of the former septic tank. Results of the field activities will produce data of sufficient quantity and quality to support the development of a Remedial Action Work Plan. Detailed descriptions of field investigation procedures are provided in Appendix A.

4.1 Soil Borings and Monitoring Well Installations

Soil borings with continuous split-spoon sampling are proposed at nine locations in the area of the former septic tank and northeastern portion of the parking lot. The borings will be advanced using 4-$^{1}/_{4}$-inch inner diameter (I.D.) hollow-stem auger drilling techniques. Soil samples will be screened in the field using a photoionization detector (PID) via jar headspace analysis techniques. Upon completion of the borings, nominal two-inch diameter monitoring wells will be installed. One monitoring well or two couplet wells will be installed at each drilling location. A third well may also be installed at one of the proposed well couplet locations. A separate soil boring will be performed for each well installation. Proposed soil boring and monitoring well locations are shown on Figure 4-1 and include:

- Couplet (shallow and deep) monitoring well installations at MIP locations MIP-26, MIP-27, MIP-42A, MIP-33, and MIP-19.
- Couplet (shallow and deep) monitoring well installations at a location between MIP-29 and MIP-35, and a location south of the former septic tank, south of MIP-30 and MIP-31.
- Deep monitoring well installations adjacent to water table wells 911-2 and 911-5.

Depending on soil conditions (soil texture and soil density), a third well may be constructed at the MIP-19 location. The need for a third well will be determined in consultation with NYSDEC prior to completing the well installations.

The soil borings will provide additional information concerning Site stratigraphy and soil density, and allow for sampling and analysis of Site soils for fraction of organic carbon (foc) and natural oxidant demand (NOD). The monitoring well installations will provide nine monitoring well couplets (or eight couplets and one triplet) to allow for assessment of lateral and vertical hydraulic gradients, confirm and further refine the nature and extent of CVOC presence likely attributable to the former septic tank, and provide locations for monitoring of remedial progress.

Soil samples will also be collected from two soil borings in the area of the former septic tank and analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and metals in accordance with 6 NYCRR Part 375-6.8(b). The soil samples will be collected at a depth of 14 to 16 feet below ground surface in soil borings performed adjacent to monitoring well 911-5, located in the area of the former septic tank, and monitoring well 911-4, located in a position upgradient of the former septic tank.

A location and elevation survey of newly installed monitoring wells will be performed by Butler Land Surveying LLC of East Meadows, Pennsylvania. Consistent with previous Site investigations, the wells will be surveyed relative to the New York State Central NAD83 coordinate system. The locations will be surveyed to the nearest 0.1 foot and reference point elevations will be surveyed to the nearest 0.01 foot.

Procedures developed to guide performance of the monitoring well installations, soil sampling, and jar headspace analysis are described in Appendices A.1 and A.2. Each newly installed monitoring well will be developed using the procedures described in Appendix A.3.

4.2 Staff Gauge Installations

Staff gauge installations are proposed at three locations along Barnes Creek in the area of the former septic tank. The staff gauges will consist of metal stakes installed at the approximate locations shown on Figure 4-1. A location and elevation survey of the three staff gauge installations will be performed by Butler Land Surveying LLC. The locations will be surveyed to the nearest 0.1 foot and reference point elevations for the top of each stake will be surveyed to the nearest 0.01 foot. Measurement of surface water level elevations at the three staff gauge locations will be reviewed in conjunction with groundwater level elevations to determine the influence of Barnes Creek on groundwater levels and flow directions.

4.3 Groundwater Quality Sampling

Groundwater and surface water level elevations will be recorded at the time of groundwater sampling for the monitoring points shown on Figure 4-1. The water level elevations will be used to calculate hydraulic gradients, groundwater flow directions and sample purging information. The groundwater levels will be measured using an electronic water level measurement device capable of measuring in increments of 0.01 feet. Surface water levels will be recorded relative to the top of the gauge using a measuring tape graduated in 0.01 foot increments.

The existing and newly installed monitoring wells will be sampled using low-flow (minimal drawdown) sampling techniques and will be analyzed for volatile organic compounds, inorganic parameters, and transformation indicator parameters to assess water quality conditions at the water table and at greater depths within and outside the apparent limits of the CVOC plume associated with the septic tank. Specific analytes include: chemical oxygen demand (COD); total hardness; total organic carbon; total suspended solids; total and dissolved iron and manganese; ferric and ferrous iron; dissolved calcium, potassium, and sodium; total alkalinity; total ammonia; chloride; fluoride; sulfate, nitrate and nitrite (as nitrogen), ethane; ethene; and methane. The samples will also be screened in the field for pH, temperature, specific conductance, turbidity, dissolved oxygen, and oxidation-reduction potential (ORP). In addition to the analytes list above, groundwater samples from wells 911-5 and 911-4 will be analyzed for Target Compound List SVOCs and Target Analyte List Metals in accordance with 6 NYCRR Part 375 table 375-6.8(b). Groundwater sampling and analysis procedures are described in Appendix A-4.

4.4 Hydraulic Testing

Pulse (slug) tests will be performed on the newly installed monitoring wells to supplement existing data and estimates concerning groundwater and CVOC plume fate and transport. The slug tests will be performed using a physical displacement slug and an automated water level recorder. Hydraulic testing procedures are described in Appendix A-5.

5 QUALITATIVE HUMAN HEALTH EXPOSURE ASSESSMENT

A Qualitative Human Health Exposure Assessment (QHHEA) will be performed to characterize all actual or potential public health and environmental exposures due to site contamination. The QHHEA will also identify exposure pathways and evaluate contaminant fate and transport. The assessment of exposure pathways will document five elements: (1) contaminant source (e.g., former septic tank), (2) potential contaminant release and transport mechanisms (e.g., leaks in the former septic tank that resulted in a discharge of CVOCs to shallow groundwater, shallow groundwater flowing toward the southwestern property line), (3) potential point of exposure, (4) potential route of exposure, and (5) potential receptor population.

6 QA/QC PLAN

In accordance with Appendix B of the Voluntary Cleanup Program Guide, this section documents specific quality assurance points in lieu of a separate Quality Assurance Project Plan.

6.1 Project Description and Project Goals

The Site's environmental history and project goals are described in Sections 2 and 3 of this Work Plan.

6.2 Project Organization

IBM's project manager for this investigation will be Dean Chartrand. Groundwater Sciences Corporation (GSC) will perform the investigation work. GSC's project team will include Craig G. Robertson, P.G., who will serve as Project Director. He will be assisted by Robert C. Watson, P.G., Project Manager; Dorothy A. Bergmann, Quality Assurance Officer; and Charles A. Rine, P.G., Assistant Project Manager. The resumes of these individuals are presented in Appendix B.

The drilling subcontractor for the soil borings and monitoring well installations will be Parratt-Wolff, Inc. of East Syracuse, New York. Butler Land Surveying LLC of East Meadows, Pennsylvania, a New York State licensed surveyor, will provide surveying services.

6.3 Laboratories

Fixed-base analytical services for VOC, SVOC, and metals analyses of groundwater and soil samples will be provided by Lancaster Laboratories, Inc. of Lancaster, Pennsylvania. Lancaster Laboratories is NYSDOH ELAP CLP-certified. The reporting level for the groundwater and soil analyses will be NYSDEC Analytical Services Protocol (ASP) Category B deliverables, and the data will be evaluated according to the NYSDEC Division of Environmental Remediation (DER) Data Usability Summary Report (DUSR) guidelines. These DUSR guidelines are described in Section 6.5. Additional groundwater analyses for other inorganic parameters and transformation indicator parameters will performed by Microseeps, Inc. of Pittsburgh, Pennsylvania. Analysis of soil samples for foc will be completed by Analytical Laboratory Services, Inc. of Middletown, Pennsylvania and analysis of soil samples for NOD will be completed by Carus Chemical Company of LaSalle, Illinois.

6.4 Standard Operating Procedures

Standard Operating Procedures (SOPs) for drilling and soil sampling, monitoring well construction, groundwater sampling, decontamination procedures, field instruments, and field screening methods are presented in Appendix A.

6.5 Data Usability Summary Reports

The Data Usability Summary Report (DUSR) provides a thorough evaluation of analytical data without the costly and time-consuming process of third party data validation. The primary objective of a DUSR is to determine whether the data, as presented, meets the site/project specific criteria for data quality and data use.

The DUSR will be prepared by the project's Quality Assurance Officer, Dorothy A. Bergmann, who is capable of conducting a full data validation and holds a certificate in Organic Data Validation from Westchester Community College in a course sponsored by EPA Region 2 and NYSDEC. Ms. Bergmann holds Bachelors and Master's Degrees in Geology, and has completed 20 credit hours in chemistry coursework at the undergraduate and graduate levels. She has over 19 years of experience in environmental sampling, data analysis, review, and validation at six RCRA and state Superfund sites in New York State. Ms. Bergmann's resume is presented in Appendix B.

The DUSR will be prepared based on a review of a full NYSDEC ASP Category B or a USEPA CLP deliverables package. During the course of this review the following questions will be answered:

1. Is the data package complete as defined under the requirements for the NYSDEC ASP Category B or USEPA CLP deliverables?

2. Have all holding times been met?

3. Do all the QC data (i.e., blanks, instrument tunings, calibration standards, calibration verifications, surrogate recoveries, spike recoveries, replicate analyses, laboratory controls and sample data) fall within the protocol required limits and specifications?

4. Have all of the data been generated using established and agreed upon analytical protocols?

5. Does an evaluation of the raw data confirm the results provided in the data summary sheets and quality control verification forms?

6. Have the correct data qualifiers been used?

Once the data package has been reviewed and the questions listed above have been answered, the DUSR will proceed to a description of the samples and analytical parameters. Data deficiencies, analytical protocol deviations, and quality control problems will be identified and their effect on the data will be discussed. The DUSR will also include recommendations on resampling and/or reanalysis. All data qualifications must be documented in accordance with NYSDEC ASP guidelines.

If the DUSR and the data deliverables package indicate significant problems with some or all of the data in the package, then the data will be either rejected or validated to determine whether it can be used. In some cases, the data may be usable for screening purposes only.

7 HEALTH AND SAFETY PLANS

7.1 Site-Specific Health and Safety Plan

Health and safety issues are addressed in the site-specific Health and Safety Plan (HASP) provided as Appendix C. The HASP addresses field activities, including drilling and soil sampling, monitoring well installation, staff gauge installation, water level monitoring, and groundwater sampling. The HASP will be reviewed by all workers prior to commencement of field activities.

7.2 Community Air Monitoring Plan

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of the designated work area when certain activities are in progress at the Site. The Site is covered by a building and paved parking lot and, therefore, particulates are not contaminants of concern. The intent of the CAMP is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses, on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The nearest off-site businesses and residences are at least a quarter-mile away and the expected VOC exposures are such that impacts to the downwind community are expected to be negligible. The CAMP will also help to confirm that work activities do not spread contamination off-site through the air. In addition to the CAMP, simple, common-sense measures will be used to keep VOCs, dust, and odors at a minimum around the work.

The CAMP during the Investigation Work Plan activities at the Site will consist of real-time air monitoring for VOCs. Monitoring for VOCs will be performed at the downwind perimeter of the immediate work area (i.e., the exclusion zone) during ground intrusive activities, such as the soil borings and monitoring well installations. The air monitoring will be performed using organic vapor analyzers (e.g., photoionization detector for chlorinated ethenes and flame ionization detector for chlorinated ethanes) appropriate to measure the types of contaminants known or suspected to be present. The equipment will be calibrated at least daily for an appropriate surrogate and will be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below. Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background conditions. Increased monitoring, corrective actions to abate emissions, and/or work shutdown may be required in the event that concentrations are measured at levels in excess of the action levels specified herein.

If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities will be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities will resume with continued monitoring.

If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind from the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

If the organic vapor level exceeds 25 ppm at the perimeter of the work area, work activities will be halted.

All 15-minute readings will be recorded and be available for NYSDEC and NYSDOH personnel to review. Instantaneous readings, if any, used for decision purposes also will be recorded.

8 REPORTING AND SCHEDULE

The total time for completing the Supplemental Site Investigation is projected to be six months from the start of field coordination activities through submittal of a final report. This projected timeframe assumes:

- The field investigation activities described in this Work Plan will be completed in about eight weeks following approval of this Work Plan by NYSDEC. Specifically, the soil borings, monitoring well installations, and staff gauge installations are anticipated to be completed in two weeks with well development, groundwater sampling, and hydraulic testing completed within a six week time period.

- Analytical laboratory analyses, data validation, and data compilation and review activities projected will be completed in ten weeks.

- Performance of the Qualitative Human Health Exposure Assessment, will require four to six weeks and will be done concurrently with the data compilation, review and analysis activities.

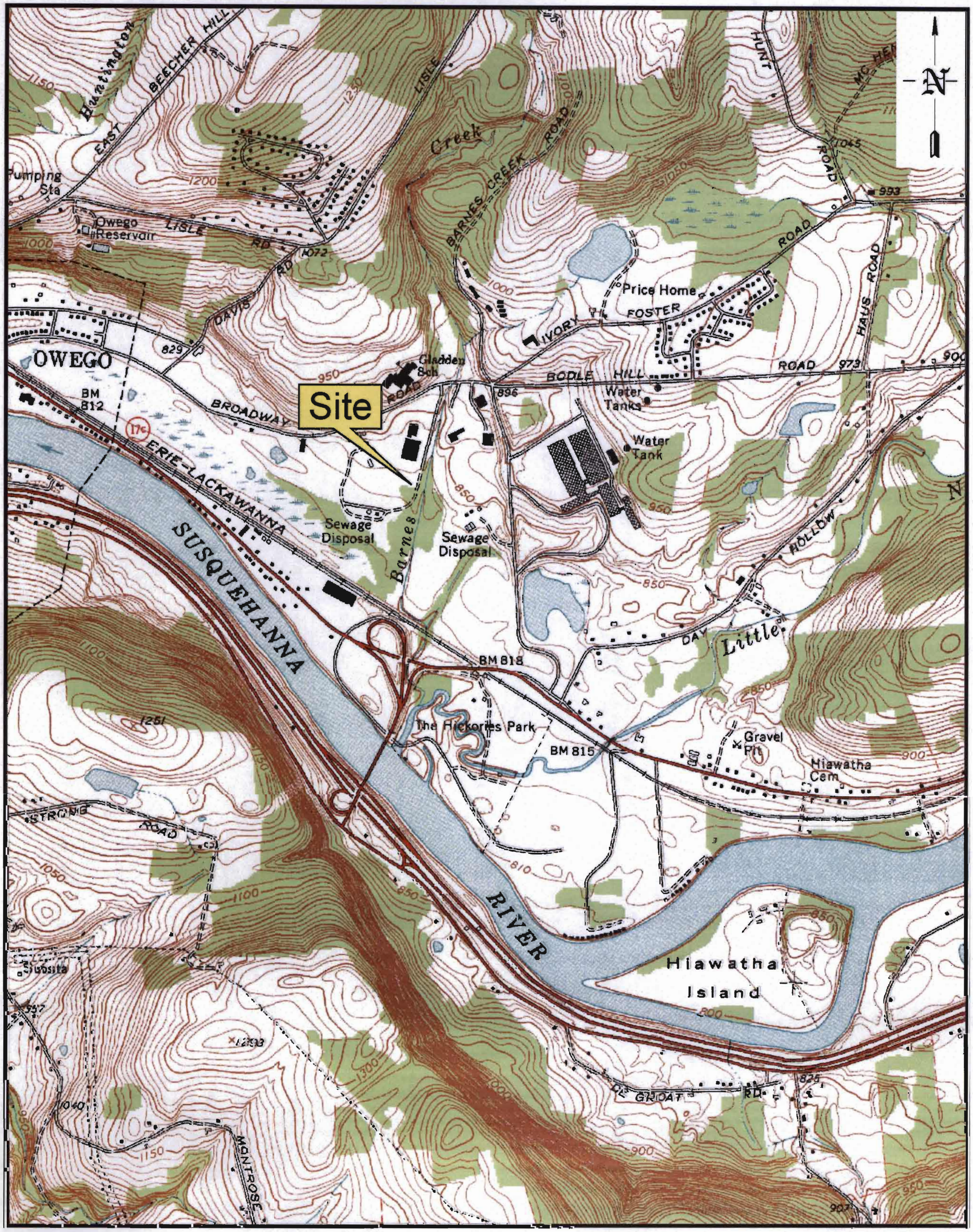
- Report preparation, including preparation of DUSRs, will be completed in six weeks.

Monthly progress reports will continue to be submitted by the 10^{th} day of each month.

9 REFERENCES

Groundwater Sciences Corporation, December 28, 2005, revised January 31, 2008 and March 27, 2008, *Site Investigation Work Plan for the Broadway Complex, 1200 Taylor Road, Owego, Tioga County, New York,* prepared for IBM Corporation.

Groundwater Sciences Corporation, July 25, 2008, *Site Investigation Status Report for the Broadway Complex, 1200 Taylor Road, Owego, Tioga County, New York,* prepared for IBM Corporation.



Portion of the Apalachin, NY
7.5-minute USGS Quadrangle
(1988)

Scale
0 1000' 2000'

Figure 2-1

IBM

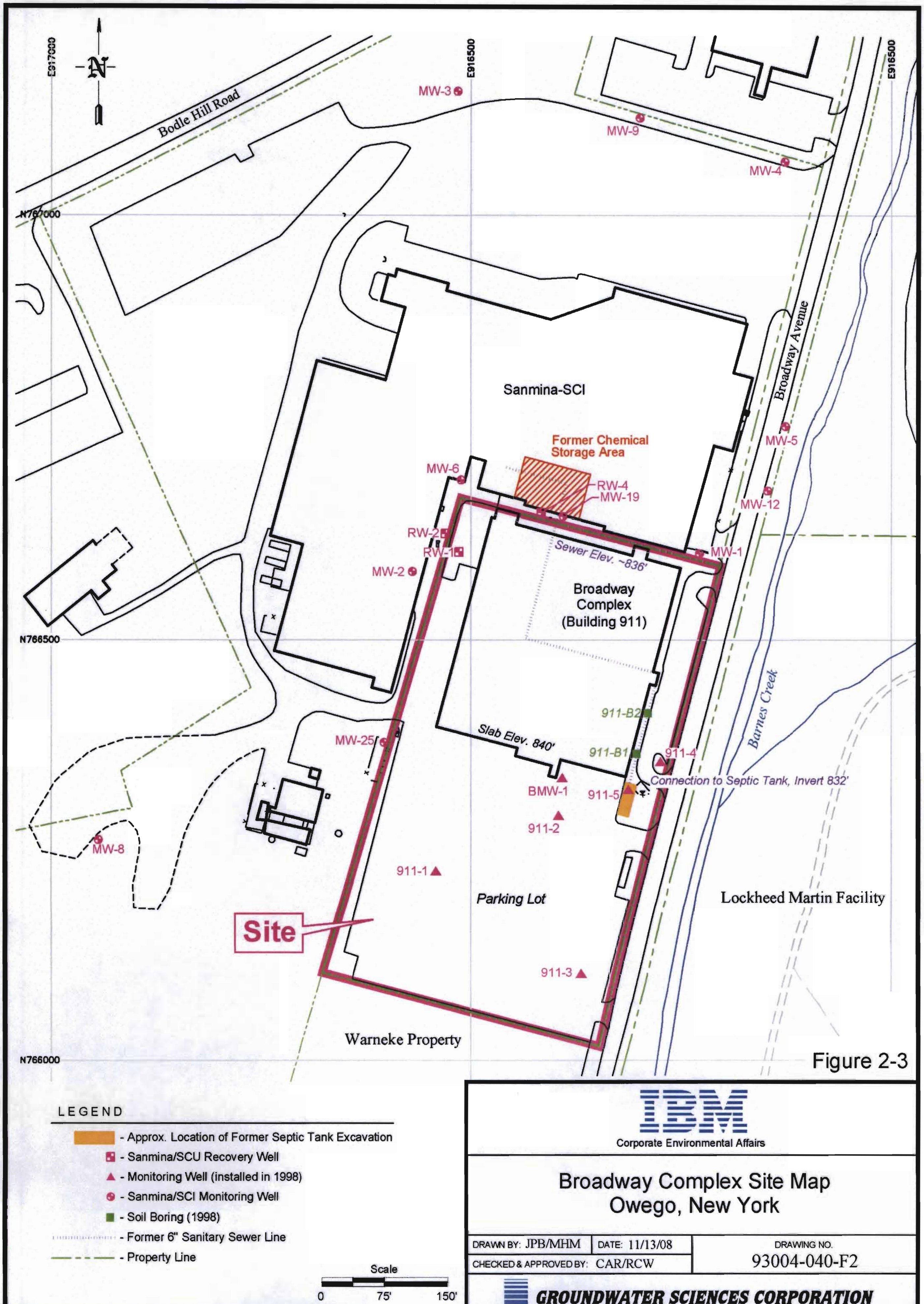
Owego, New York

Site Location Map

GROUNDWATER SCIENCES CORPORATION

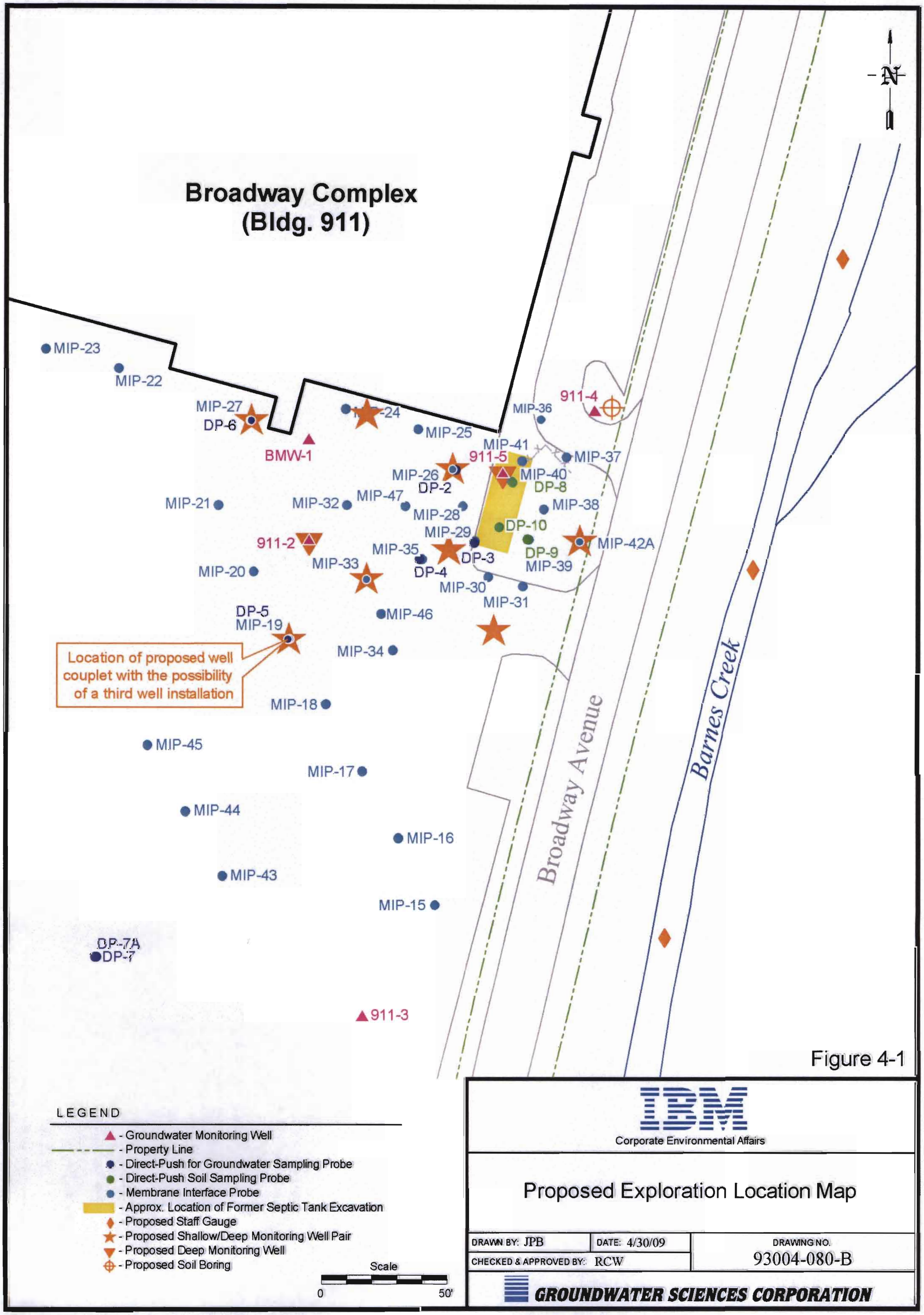
93004-068-A4 / 11-13-08

Broadway Complex Site
Broadway Complex Building
Sanmina-SCI Property Line
Lockheed Martin Facility
Warneke Property
Barnes Creek
Town of Owego POTW
Route 17C
Railroad Tracks
Figure 2-2
IBM
Corporate Environmental Affairs
Aerial Site Map
DRAWN BY: JPB
DATE: 11/13/08
DRAWING NO.
93004-066-A3
CHECKED & APPROVED BY: RCW
GROUNDWATER SCIENCES CORPORATION
Map Source: USGS Aerial Orthophotos from NYS GIS Clearinghouse, dated 2002.
Approximate Scale
0
250'
500'



N
E917000
E916500
N767000
N766500
N766000
Bodle Hill Road
Broadway Avenue
Barnes Creek
MW-3
MW-9
MW-4
MW-5
MW-12
MW-1
MW-6
MW-2
MW-25
MW-8
RW-4
MW-19
RW-2
RW-1
Sanmina-SCI
Former Chemical Storage Area
Sewer Elev. ~836'
Broadway Complex (Building 911)
Slab Elev. 840'
911-B2
911-B1
911-4
911-5
BMW-1
911-2
911-1
911-3
Connection to Septic Tank, Invert 832'
Parking Lot
Site
Lockheed Martin Facility
Warneke Property
LEGEND
- Approx. Location of Former Septic Tank Excavation
- Sanmina/SCU Recovery Well
- Monitoring Well (installed in 1998)
- Sanmina/SCI Monitoring Well
- Soil Boring (1998)
- Former 6" Sanitary Sewer Line
- Property Line
Scale
0
75'
150'
IBM
Corporate Environmental Affairs
Broadway Complex Site Map
Owego, New York
DRAWN BY: JPB/MHM
DATE: 11/13/08
DRAWING NO.
93004-040-F2
CHECKED & APPROVED BY: CAR/RCW
GROUNDWATER SCIENCES CORPORATION

Figure 2-3



N
Broadway Complex
(Bldg. 911)
MIP-23
MIP-22
MIP-27
DP-6
-24
MIP-25
BMW-1
MIP-36
911-4
MIP-41
911-5
MIP-37
MIP-26
DP-2
MIP-40
DP-8
MIP-21
MIP-32
MIP-47
MIP-28
MIP-38
MIP-29
DP-10
911-2
MIP-35
DP-3
DP-9
MIP-42A
MIP-33
DP-4
MIP-39
MIP-20
MIP-30
MIP-31
MIP-46
DP-5
MIP-19
Location of proposed well couplet with the possibility of a third well installation
MIP-34
MIP-18
MIP-45
MIP-17
MIP-44
MIP-16
MIP-43
MIP-15
DP-7A
DP-7
911-3
Broadway Avenue
Barnes Creek
LEGEND
- Groundwater Monitoring Well
- Property Line
- Direct-Push for Groundwater Sampling Probe
- Direct-Push Soil Sampling Probe
- Membrane Interface Probe
- Approx. Location of Former Septic Tank Excavation
- Proposed Staff Gauge
- Proposed Shallow/Deep Monitoring Well Pair
- Proposed Deep Monitoring Well
- Proposed Soil Boring
Scale
0
50'
IBM
Corporate Environmental Affairs
Proposed Exploration Location Map
DRAWN BY: JPB
DATE: 4/30/09
DRAWING NO.
93004-080-B
CHECKED & APPROVED BY: RCW
GROUNDWATER SCIENCES CORPORATION

Figure 4-1

Appendix A: Standard Operating Procedures

Appendix A-1

Site # V00290-7

SOIL MONITORING WELL INSTALLATION PROCEDURE

December 28, 2005

The following is a procedure for installation and development of groundwater monitoring wells constructed to monitor water levels and water quality in the soil.

Decontamination Procedures

The drilling equipment, tools, and well casing materials will be decontaminated to remove foreign materials, particularly petroleum-based products. All of the materials referenced above will be decontaminated prior to arrival at the site, and before being used in any well bore, by high pressure steam cleaning with super-heated water (above 100°C). The drilling rig and other equipment or materials that come into contact with soil, water, or rock cuttings will also be decontaminated using this procedure before the rig is moved to the next well location and before it is demobilized. This steam cleaning and all other decontamination activities will be conducted at a decontamination area to be designated by IBM.

The decontamination pad consists of a bermed area lined with heavy-mil plastic such that the drilling rig and tools are cleaned inside the bermed area, and the decontamination water is contained by the berm. Field-generated decontamination water will be placed in drums, moved to a secure location, and transported to IBM's groundwater treatment facility at the adjacent Lockheed Martin site or another designated treatment location.

All materials used to construct monitoring wells will be new and will be supplied in appropriate containers (e.g. bagged sand, not bulk sand). Electronic equipment (e.g. electronic water level measuring devices, pressure transducers) shall be decontaminated by washing with a laboratory-grade detergent-and-water solution, followed by an organic-free water rinse.

The threaded flush joint PVC or stainless steel pipe and screen used in constructing monitoring wells will be steam-cleaned immediately prior to use unless it is delivered in intact sealed plastic wrappings and is certified by the manufacturer to be factory-decontaminated for monitoring well use. All other materials used during well construction or monitoring (with the exception of sand and bentonite) will be decontaminated prior to being introduced to the well bore by the following procedure:

1. High pressure steam cleaning with super-heated water (over 100°C) until equipment is hot to the touch and any visible contamination is removed. All water used shall be brought to the site from a municipal or private potable water supply designated by IBM.

2. Following steam cleaning, all materials will be handled only by personnel wearing nitrile or other chemical-resistant gloves. After being decontaminated, equipment will be handled such that it is not recontaminated prior to being used. This may involve placing on plastic, wrapping in plastic, or placing in similarly decontaminated containers.

All decontamination activities will be performed by, or directly supervised by, qualified technical or scientific personnel.

Soil Monitoring Well Installation Procedure

The following procedure specifies procedures to be followed for the drilling and installation of soil monitoring wells in the project area.

Drilling

Drilling locations shall be selected on the basis of program objectives and the presence of buried and overhead utilities. Prior to drilling, all locations will be approved by IBM and/or the site owner with regard to utilities. New York's One-Call utility clearance hotline will be notified by the driller at least three working days in advance of drilling.

A truck-mounted hollow-stem auger drilling rig equipped with 8-inch O.D. and 4-1/4-inch I.D. augers and 2-inch or 3-inch O.D., two-foot-long split-spoon samplers typically will be used. Soil samples will be collected continuously as the well is being drilled in accordance with the soil sampling procedures as described in Appendix A-2. Blow counts from the standard penetration test will be recorded for each six-inch depth interval. After being advanced 2 feet by blows of 140-lb. hammer falling 30 inches (standard penetration test), the split spoon and sample will be removed and the augers will be advanced through the same 2-foot interval. In this way, only undisturbed soil samples will be collected.

Drilling will continue to the designated depth. Screen length will depend on the thickness of the soil aquifer and screen slot size will depend on a visual inspection and physical evaluation of the formation gradation.

Removal of Soil Cuttings at Drilling Locations

Cuttings generated during will drilling will be stockpiled on plastic sheeting (if necessary) next to the well. A relatively small volume of cuttings is expected to be produced from each boring. The cuttings will be placed in drums, labeled, and stored at a designated location prior to disposal in accordance with IBM-approved disposal procedures.

Monitoring Well Construction

In the construction of all soil monitoring wells, a basic design will be followed to maintain uniformity. This basic soil monitoring well design includes the following elements:

1. Two-inch diameter, Schedule 40, threaded flush joint PVC screen (maximum length of 15 feet) and riser pipe.

2. Morie #00N silica sand pack and 20-slot (0.020-inch) screen size. (For screening fine-textured soil, e.g. silt, Morie #00 sand and 10-slot screens will be used.) The sand will be installed to a minimum of six inches but no more than 2 feet above the screen such that the entire monitoring interval (screen and sand pack) does not exceed 20 feet, unless approved by NYSDEC.

3. A minimum of one foot of bentonite chips/pellets, as appropriate, will extend to a level of at least two feet above the top of the sand pack.

4. Bentonite slurry (granular bentonite/water mix) to seal the remainder of the borehole to a depth of three feet from ground surface.

Variations on this basic design will be determined by the elevation of the static water level and soil characteristics.

Surface Completions

The surface soil around the outer casing will be excavated to a depth of at least one foot around the area of the outer casing. This excavation will be filled with concrete. The steel well casing or protector pipe, when installed and grouted, shall extend above the ground surface approximately 2.5 feet. Where site-specific activities prevent this type of standpipe completion or where the property owner does not want the well casing to extend above the ground surface, the riser pipe and outer casing (if present) shall be cut off below grade and placed inside a manhole. The area around the manhole will be excavated to a depth of at least one foot and will be filled with concrete. Where these flush-mount surface completions are required, an expanding water-tight locking plug will be installed on the PVC or stainless steel riser pipe inside the manhole to prevent surface water or contaminants from entering the well.

Supervision and Quality Control

Each drilling rig and its operators and crew will be supervised by a geologist. The geologist will maintain a record of the geologic materials encountered and the construction of the well. It is the responsibility of the geologist to select an appropriate well completion design and to ensure that the well is constructed according to these procedures. Additional responsibilities include measurement and recording of static water levels, field logging of soil returns and rock cuttings, and implementation of decontamination and health and safety procedures.

Appendix A-2

Site # V00290-7

SOIL SAMPLING AND ANALYSIS PROCEDURES

November 26, 2008

(Revised April 30, 2009)

1. Procedure for Collecting Soil Samples from Split-Spoons

Soil samples will be recovered using steam-cleaned standard split-spoon samplers assembled without lubricated threads. After each sample has been brought to the surface by the drilling contractor, it will be opened in the presence of the supervising geologist. The geologist will then screen the sample using an organic vapor analyzer (FID or PID) at the 2 ppm level (above background) by holding the detector wand over each split spoon as it is opened but prior to being otherwise physically disturbed. Elevated readings from the screening device (FID or PID) will be recorded on the field log. Where there is sufficient recovery, soil samples will then be collected from each split spoon sampler. These samples may include a sample for jar headspace analysis (Section 2) and a sample for possible laboratory analysis (Section 3).

The length of recovery will be measured and recorded on the log, and the sample will be cut in half longitudinally using a clean stainless steel knife or single-use sterile plastic spatula designed for soil sampling. The sample will then be logged for lithology, texture, weathering, color, density, moisture, sample depth interval, penetration, and recovery, with descriptions following the Unified Soil Classification System (USCS) or Burmeister System. If no sample is required for chemical or headspace analysis, the soil will be placed in a glass jar or sealable plastic bag, which will be individually labeled with the boring number, the depth interval of the sample, the date of collection, and the name or initials of the sampling personnel.

From each split-spoon sample for which a laboratory or jar headspace analysis may be required, a soil sample will be collected in accordance with Sections 2 and 3.

2. Procedure for Jar Headspace Analysis

For soil samples requiring a jar headspace analysis, each sample will be placed in an appropriately-sized glass jar such that one-half to two-thirds of the jar is filled with the soil sample, loosely packed, and the remainder is headspace. The top of the jar then will be covered with aluminum foil secured by a rubber band around the neck of the bottle, and will be allowed to stand at ambient temperature in the best available temperature-controlled space for a period of at least 15 minutes. As an alternative, the samples will be placed in a cooler or on ice to be removed within 24 hours and allowed to equilibrate to room temperature. The probe of the field survey instrument (PID or FID) will then be inserted through the aluminum foil to just above the surface of the soil. The initial reading on the field survey instrument will be noted and monitored for a period of at least five seconds, with the maximum concentration then being noted on the field log at the appropriate sample depth.

3. Sampling and Analysis of Soil Samples

Soil samples for Natural Oxidant Demand (NOD) analysis will be collected in 4 ounce glass jars, placed in coolers with ice and shipped via chain-of-custody protocols to Carus Chemical Company (Carus) located in LaSalle, Illinois. Soil samples for fraction of organic carbon (foc) analysis will be collected in 4 ounce glass jars, placed in coolers with ice and shipped via chain-of-custody protocols to Analytical Laboratory Services, Inc. (ALSI) of Middletown, Pennsylvania. The foc analyses will be performed by ALSI using SW-846 Method 9060.

Soil samples for VOCs, SVOCs, and metals analyses will performed by Lancaster Laboratories, Inc. (LLI) of Lancaster, Pennsylvania. Soil samples collected for VOC analysis will be placed in 40-ml VOA vials in accordance with SW-846 Method 5035. The low level and high level VOC analyses will be performed using SW-846 Method 8260B. Soil samples collected for SVOC TCL analyses will be placed in 100 gram glass containers and analyzed for SVOC TCL SW-846 Method 8270C. Soil samples collected for TAL metals (arsenic, barium, beryllium, cadmium, chromium, copper, lead, manganese, nickel, selenium, silver, and zinc), mercury, and total cyanide will be placed in 100 gram glass jars. Soil samples collected TAL metals analysis will be analyzed by SW-846 Method 6010B. Soil samples collected for mercury analysis will be analyzed by SW-846 Method 7471A. Soil samples collected for total cyanide analyses will be analyzed by SW-846 Method 9012A. Soil samples for VOCs, SVOCs, and metals analyses will be placed in coolers with ice and shipped via chain-of-custody protocols to LLI.

Soil samples will be labeled in such a way as to include a unique sample identifier for the location and depth of the soil sample (e.g., a soil sample collected from a depth of 12 to 14 feet at boring 911-7 might be labeled "B91171214SS" where "SS" is used to indicate a soil sample). Blank chain-of-custody forms for Carus, ALSI, and LLI are attached.

CARUS®
1500 Eighth Street
LaSalle, IL 61301
(800) 435-6856

CHAIN OF CUSTODY RECORD

*ITEMS LISTED IN RED MUST BE COMPLETED BY CLIENT

CLIENT*	PROJECT NAME	SITE LOCATION	P.O. NUMBER	ANALYSIS REQUESTED	(FOR LAB USE ONLY)
ADDRESS	PHONE NUMBER	FAX NUMBER	DATE SHIPPED		TECH # ______
CITY STATE ZIP	SAMPLER (PLEASE PRINT)		REMOX ISCO REAGENT ☐ SOLID ☐ LIQUID ☐ EITHER		LOGGED BY: ______
PROJECT MANAGER	SAMPLER'S SIGNATURE				

SAMPLE DESCRIPTION	DATE COLLECTED	TIME COLLECTED	SAMPLE TYPE SOIL	SAMPLE TYPE GW	SOIL TYPE	# OF CONT	Soil / GW Permanganate Demand							REMARKS

TURNAROUND TIME REQUESTED (PLEASE CIRCLE) NORMAL RUSH
(RUSH IS SUBJECT TO CARUS CHEMICAL APPROVAL)

SEND RESULTS TO:

ADDITIONAL COMMENTS:

RELINQUISHED BY: (SIGNATURE)	DATE TIME	RECEIVED BY: (SIGNATURE)	DATE TIME	COMMENTS: (FOR LAB USE ONLY) ______ ______
RELINQUISHED BY: (SIGNATURE)	DATE TIME	RECEIVED AT LAB BY: (SIGNATURE)	DATE TIME	SAMPLE(S) RECEIVED ON ICE Y OR N BOTTLES RECEIVED IN GOOD CONDITION Y OR N BOTTLES FILLED WITH ADEQUATE VOLUME Y OR N SAMPLES RECEIVED WITHIN HOLD TIME(S) Y OR N

Analytical
Laboratory Services, Inc.
Environmental • Industrial Hygiene • Field Services
34 Dogwood Lane • Middletown, PA 17057 • 717.944.5541 • Fax: 717.944.1430

CHAIN OF CUSTODY/ REQUEST FOR ANALYSIS

ALL SHADED AREAS MUST BE COMPLETED BY THE CLIENT / SAMPLER. INSTRUCTIONS ON THE BACK.

COC #:   of

ALSI Quote #:

Client Name:
Address:
Contact:
Phone#:
Project Name/#:
Bill To:
TAT: ☐ Normal-Standard TAT is 10-12 business days.
☐ Rush-Subject to ALSI approval and surcharges.
Date Required: Approved By:
Email? ☐ Y
Fax? ☐ Y No

***Container Type
***Container Size
***Preservative

ANALYSES/METHOD REQUESTED

Receipt Information (completed by Receiving Lab)

Cooler Temp: ____ Therm. ID: ____
No. of Coolers: ____

	Y	N	Initial
Custody Seals Present?			
(if present) Seals Intact?			
Received on Ice?			
COC/Labels Complete/Accurate?			
Cont. in Good Cond.?			
Correct Containers?			
Correct Sample Volumes?			
Correct Preservation?			
Headspace/Volatiles?			

Courier/Tracking #:

Sample Description/Location (as it will appear on the lab report)	Sample Date	Military Time	*G or C	**Matrix	Enter Number of Containers Per Analysis Requested or Field Results Below.	Sample/COC Comments
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

SAMPLED BY (Please Print):

LOGGED BY(signature):   DATE: TIME:
REVIEWED BY(signature):   DATE: TIME:

Relinquished By / Company Name	Date	Time	Received By / Company Name	Date	Time
1 SAMPLED BY			2		
3			4		
5			6		
7			8		
9			10		

Data Deliverables: ☐ Standard ☐ CLP-like ☐ NJ-Reduced ☐ NJ-Full ☐ (other)
EDDs Required? ☐ If yes, format type:

State Samples Collected in	SDWA Forms Required?
NC ☐	yes ☐
NJ ☐	yes ☐
NY ☐	yes ☐
PA ☐	yes ☐

Other:
PWSID:
DOD Criteria Required?

ALSI Field Services
☐ Pickup
☐ Labor
☐ Composite Sampling
☐ Rental Equipment
☐ Other:

* G=Grab; C=Composite   **Matrix: AI=Air; DW=Drinking Water; GW=Groundwater; OI=Oil; OL=Other Liquid; SL=Sludge; SO=Soil; WP=Wipe; WW=Wastewater

Copies: WHITE-ORIGINAL CANARY-CUSTOMER COPY   ***Container Type: AG-Amber Glass; CG-Clear Glass, PL-Plastic. Container Size: 250ml, 500ml, 1L, 8oz., etc. Preservative: HCl, HNO3, NaOH, etc.

Rev 5/06

Analysis Request/ Environmental Services Chain of Custody

Lancaster Laboratories

For Lancaster Laboratories use only

Acct. # ____________ Group# ____________ Sample # ____________

COC #

Please print. Instructions on reverse side correspond with circled numbers.

For Lab Use Only
FSC: ____________
SCR#: ____________

1
Client: ____________ Acct. #: ____________
Project Name/#: ____________ PWSID #: ____________
Project Manager: ____________ P.O.#: ____________
Sampler: ____________ Quote #: ____________
Name of state where samples were collected: ____________

2 Sample Identification	Date Collected	Time Collected	3 Grab	Composite	4 Matrix: Soil	Water (Potable / NPDES, check if applicable)	Other	Total # of Containers	5 Analyses Requested / Preservation Codes									Remarks	6 Temperature of samples upon receipt (if requested)

Preservation Codes
H=HCl **T**=Thiosulfate
N=HNO_3 **B**=NaOH
S=H_2SO_4 **O**=Other

7 **Turnaround Time Requested** (TAT) (please circle): Normal Rush
(Rush TAT is subject to Lancaster Laboratories approval and surcharge.)
Date results are needed: ____________
Rush results requested by (please circle): Phone Fax E-mail
Phone #: ____________ Fax #: ____________
E-mail address: ____________

8 **Data Package Options** (please circle if required)
Type I (validation/NJ Reg) TX TRRP-13
Type II (Tier II) MA MCP CT RCP
Type III (Reduced NJ)
Type IV (CLP SOW)
Type VI (Raw Data Only)

SDG Complete? Yes No

Site-specific QC (MS/MSD/Dup)? Yes No
(If yes, indicate QC sample and submit triplicate volume.)
Internal COC Required? Yes / No____________

Relinquished by:	Date	Time	Received by:	Date	Time 9
Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time
Relinquished by:	Date	Time	Received by:	Date	Time

Appendix A-3

Site # V00290-7

WELL DEVELOPMENT PROCEDURE

December 28, 2005

The primary purpose of well development is to remove fine formation particles, remove fluids introduced during drilling activities, and promote the exchange of groundwater from the formation into the well. Well development will be performed by one or more field services technicians, possibly with the assistance and oversight of a geologist. Information relating to well development will be recorded on a Well Development Field Data Sheet (attached). Upon completion of a well installation a determination of the amount of time to allow prior to initiating well development activities will be made by the Project Manager or Assistant Project Manager based on observations recorded during borehole advancement and well construction.

Specific development procedures are outline below.

1. Initial development to remove fines from the sand pack and surrounding formation will be performed using an inertial pump equipped with an appropriately sized surge block, or a PVC- or stainless-steel purge bailer. If an inertial pump is used, the position of the surge block will be varied through the entire screen length during this process.

2. Following this initial surging of the well, development will continue using a submersible pump, peristaltic pump, or an inertial pump. If an inertial pump is used, the surge block will be replaced with a simple check valve. The well will be stressed using one of these options until field parameters stabilize or at least ten well volumes are removed, whichever is longer. Conditions will be considered to have stabilized when:

    a. the discharge achieves visual clarity,

    b. the range in pH values for three consecutive well volumes is within 0.5 pH units,

c. specific conductance is within 10% for three consecutive well volumes, and

d. temperature is within 2°C for three consecutive well volumes.

Development water will be placed in containers, moved to a secure location, and transported for treatment at one of IBM's treatment facilities as soon as possible after well development.

3. Documentation regarding produced water clarity during initial surge block development and subsequent overpumping will be maintained on the Well Development Field Data Sheet. Observations regarding clarity will be recorded in the "Remarks & Clarity" column on this form.

Appendix A-4

Site # V00290-7

GROUNDWATER SAMPLING AND ANALYSIS PROCEDURES

November 26, 2008

(Revised April 30, 2009)

This appendix presents detailed procedures for pre-sampling preparation and sample collection. Sample handling, documentation, field quality assurance sampling procedures and health and safety issues are also described. The organization of this information generally follows the order in which these tasks will be performed.

1 PREPARATION FOR SAMPLING

This section describes the procedures to be followed by field sampling personnel prior to the initiation of the sampling event. Sampling personnel will be trained in the use of the sampling plan, and a copy of the plan will be available to the samplers when performing field activities.

1.1 Equipment Procurement, Inspection, Calibration, and Maintenance

Prior to the sampling event, sampling equipment will be inspected to verify cleanliness and to ensure proper working order. Worn parts will be replaced prior to the sampling event and preventive maintenance of field measuring instruments and field sampling devices will be accomplished during the sampling event by daily inspection of these instruments and sampling devices.

Field parameter data (i.e., pH, Temperature, Specific Conductance, Dissolved Oxygen, Oxidation-Reduction Potential ORP, and Turbidity) will be collected using multiple field meters (Cole-Parmer®, Hydrolab®, or equivalent). Calibration activities will be recorded on a form and will be performed according to the manufacturer's instructions.

1.2 Procurement and Preparation of Sample Containers

Field personnel will collect samples in containers that are appropriate for the required analytical methods. These containers, preservatives, and holding times will conform to the requirements of SW-846 and will be provided by the laboratory. Sample containers will be either hand-delivered to the sampling team by laboratory personnel, picked up at the laboratory by the sampling personnel, or shipped with intact custody seals.

Samples to be analyzed for volatile organic compounds may be preserved with hydrochloric acid or sodium bisulfate with the following considerations:

1. If a sample effervesces upon collection, then a statement of this occurrence will be noted in the comments section of the field sampling data sheet.

2. If samples for volatile organic analysis are received by the laboratory with visible headspace (such as bubbles), then these samples will not be used for analysis, and a statement of this occurrence will be noted on the chain-of-custody form. If this situation affects all of the sample containers for a particular sample, then the laboratory would immediately notify the sampling manager and the affected sample would be re-collected.

1.3 Storage and Handling of Sampling Gear

Sampling equipment will be stored in such a way and in such a place as to prevent contact with contaminated equipment or materials. Whenever possible, dedicated sampling equipment will be used to reduce the need for field decontamination of non-dedicated equipment. Purging and sampling equipment will be handled with gloved hands. These gloves will be changed following each activity that may contaminate them and, at a minimum, will be changed between wells being sampled.

1.4 Decontamination Procedures

The principal hazardous constituents being monitored in groundwater are primarily volatile organic compounds (VOCs); therefore, all non-dedicated well evacuation and sampling devices will be decontaminated between uses. Dedicated well evacuation and sampling equipment will be decontaminated prior to being placed in service, and whenever it is being removed for inspection and repair. Non-dedicated field measurement devices such as water level indicators or field screening meters will be decontaminated prior to obtaining a measurement in such a manner as to not damage the equipment. Delicate non-dedicated field equipment such as water level indicators and field meters will be decontaminated using the following procedure:

1. Wash the equipment with a non-phosphate detergent.

2. Rinse the equipment with tap water.

3. Rinse with deionized water or organic-free reagent water.

Equipment used for well purging and sampling will be decontaminated by high-pressure, high-temperature steam cleaning at the decontamination area, or by the alternate procedure described above.

1.5 Personal Protective Equipment/Health and Safety Measures

A Health and Safety Plan (HASP) has been prepared specifically for the Site. The HASP presents an assessment of chemical hazards identified through extensive and continuing sampling, and describes the personal protective equipment required for sampling personnel.

2 SAMPLING PROCEDURES

Specific sampling procedures, including water level measurement, monitoring well purging, purge water containment, sample collection, documentation, and shipping are discussed in this section. In addition to these tasks, a general check of well integrity and needed well maintenance will be performed each time a well is sampled.

2.1 Water Level Measurements

Depth to water will be measured and recorded on a Field Sampling Data Sheet (sample attached), and will also be entered into a spreadsheet that will calculate groundwater elevations. This water level data will be used to calculate hydraulic gradients, groundwater flow directions and sample purging information. Measurements will be obtained using an electronic water level measuring device and will be taken at the designated permanent surveyed reference point marked on each well casing. Typically, this surveyed reference point is identified as a notch, saw cut or series of drill holes in the well casing. Equipment used to measure these depths will be decontaminated prior to being placed in the well by the method described in Section 1.4 of this document.

Prior to purging and sampling, the static water level will be measured using the electronic water level measurement device with increments of 0.01 feet. This measurement will be recorded to the nearest 0.01 feet from the designated survey point.

2.2 Monitoring Well Purging

The appropriate purge volume for each well will be calculated based on water level measurement, reference well depth measurement, and well diameter. The depth to the bottom of the well as noted on the geologist's log will be used along with the measured depth to water for calculating the purge volume. All relevant information will be recorded on the Field Sampling Data Sheet (Section 2.5.1).

Well purging will be performed in a manner consistent with calculated well volumes and past recovery history or yield data. The intake structure of a purge device will be positioned in a manner that allows for the removal of all stagnant water from the well. Confirmation of the removal of all stagnant water will be accomplished by verifying the drawdown of the pump used for purging or by bailing from the top of the water column.

For purposes of determining the purging requirements, a "high-yield well" is defined as a well that can be purged of three well volumes in two hours or less. Such wells will be purged of three well volumes within two hours. All other wells ("low-yield wells"), will be evacuated to remove all water that can be removed using the most appropriate, practicable and feasible method of purging.

Monitoring wells will be purged using one of the following configurations or equivalent methods:

1. <u>A non-dedicated submersible pump constructed of stainless steel and Teflon® components equipped with appropriate low-sorption discharge tubing.</u>

2. <u>A dedicated submersible pump constructed of stainless steel and Teflon® components equipped with appropriate dedicated low-sorption discharge tubing.</u>

3. <u>A variable-speed Teflon®-and-stainless-steel submersible pump with low sorption discharge tubing.</u> This device and discharge tubing may be either dedicated or non-dedicated. If non-dedicated, then it will be decontaminated between uses.

4. <u>A self-priming variable-speed low-volume peristaltic pump equipped with Teflon®/silicone tubing.</u> The Teflon® tubing is typically dedicated to the well whereas the silicone tubing is typically replaced with new tubing between purging events.

5. <u>A bailer constructed of either PVC, Teflon® or stainless steel.</u> This device may be either dedicated or non-dedicated. If non-dedicated, then it will be decontaminated between uses.

6. Other equipment approved by NYSDEC.

If any of the above equipment is dedicated, then it will be stored in the well or in a dedicated storage container (PVC canisters or plastic bags) between sampling rounds. All dedicated equipment that is not stored in the well will be fully cleaned and decontaminated between sampling events in accordance with the procedures outlined in Section 1.4.

2.3 Groundwater Containment/Disposal of Purge Water

Purge water will be contained or discharged to the ground surface based on 1) the NYSDEC "Contained In" rule for managing soil and groundwater and 2) the groundwater quality standards listed in 6NYCRR Part 703. For the purpose of implementing this rule, the maximum concentration of the constituents in groundwater to be purged will be determined using data from the previous four sampling events. Water from any well that had a maximum during the previous four sampling events greater than or equal to the action levels listed in the "Contained In" rule or the 6NYCRR Part 703 Groundwater Standards will be contained. Such purge water will be placed in portable containers and will be taken to IBM's groundwater treatment facility at the adjacent Lockheed Martin site or another designated treatment location.

2.4 Sample Collection

Sampling will begin within two hours after purging has been completed. The only exception to this requirement will occur when a sufficient volume of water for all of the required samples is not present in the well at the end of the two-hour period following purging. In that case, VOC samples will be collected immediately at the end of the two-hour period. Sampling for other parameters then will be delayed until the required volume is present for the remaining samples, but in no case for longer than 24 hours without purging the well again. Every effort will be made to collect samples within two hours of the end of purging.

Disposable surgical-type gloves will be used for all sampling, regardless of the level of contamination. Gloves will be changed following each activity that may contaminate them and, at a minimum, between wells.

2.4.1 Sampling Order

Samples should be collected and containerized in the order of the parameter's stability or volatilization/reaction sensitivity. The collections order for groundwater parameters selected for testing is:

1. Dissolved Oxygen, Temperature, pH, Specific Conductance, Oxidation-Reduction Potential, and Turbidity (during purging);
2. Volatile Organic Compounds (post-purge)
3. Ethane, ethene, and methane (post-purge)
4. Semi-Volatile Organic Compounds (post-purge)
5. TAL Metals (post-purge)
6. Mercury (post-purge)
7. Total Cyanide (post-purge)
8. Other transformation indicator and natural attenuation parameters (e.g. chemical oxygen demand; total hardness; total organic carbon; total suspended solids; total and dissolved iron and manganese; ferric iron; ferrous iron; dissolved calcium, potassium, and sodium; total alkalinity; total ammonia; chloride; fluoride; sulfate; and nitrate and nitrite as nitrogen)(post-purge)

2.4.2 Sampling Techniques and Methods

During sampling efforts will be made to minimize physical alteration of samples and to prevent chemical cross-contamination during the sampling process. VOC samples will be transferred to sampling containers in such a way as to minimize agitation and aeration. To the extent practicable, the same type of sampling device will be used in wells of similar construction and yield characteristics. The following is a list of sampling equipment and techniques that may be used to collect groundwater samples:

1. <u>Teflon® or stainless steel bailers equipped with double check valves and valved bottom emptying devices.</u> The bailers will be lowered slowly into the water column so as to minimize agitation of the water column. After the sample is brought to the surface, it will be emptied into the sample container using the bottom emptying device.

2. <u>A variable-speed Teflon®-and-stainless-steel submersible pump as described in Section 2.2.</u> Samples for VOCs and dissolved gases will be collected using a bailer. Groundwater samples for other parameters will be collected directly from the discharge line of the pump with the flow rate adjusted until as slow and steady a flow as possible is achieved.

3. <u>A self-priming variable-speed low-volume peristaltic pump as described in Section 2.2.</u> Samples for VOCs and dissolved gases will be collected using a bailer. Groundwater samples for other parameters will be collected directly from the discharge line of the pump with the flow rate adjusted until as slow and steady a flow as possible is achieved.

4. Other equipment approved by NYSDEC.

2.4.3 Filtering Procedures for Metals Samples

Standard procedures require that metals samples be collected unfiltered and acidified in the field. However, some formations produce turbid groundwater samples in spite of the best well construction methods and the use of low-flow purging and sampling techniques. In these cases, excessive turbidity in the sample derived from formation solids adjacent to the well can produce metals analysis results that are not representative of the concentrations of those metals in groundwater flowing through the formation. When this is the case, it is necessary to filter the samples to avoid results that are much higher than the actual ambient groundwater concentrations. Because it is possible for colloidal particles to be mobile in groundwater, such filtering should be designed to only remove particles larger than colloidal size. Therefore, the filters used should permit particles of ten microns or less in diameter to pass through and be analyzed in the groundwater sample. Therefore, when sampling for metals is required, both filtered and unfiltered samples will be collected and analyzed.

The filtered or dissolved metals samples will be field-filtered through a 10-micron filter made of Teflon, polypropylene, nylon, cellulose, or borosilicate glass. A new filter, sample transfer bottle and tubing will be used for each sample collected. Samples will be collected into clean sample transfer containers prior to undergoing filtration and will be filtered immediately into properly preserved sample containers. Dissolved and total metals samples will be acidified to pH<2. The preservative is to be added to the sampling containers prior to sample collection.

Both samples will be analyzed for turbidity. If the difference in the turbidity of the unfiltered versus the filtered sample is greater than 10 NTUs, then the results of the filtered sample will be used in lieu of those from the unfiltered sample and the results of the unfiltered sample will be considered unrepresentative. However, both the filtered and unfiltered sample results will be reported and the results believed to be unrepresentative due to turbidity will be flagged and noted as such.

2.4.4 Field Quality Assurance/Quality Control Samples

A QA/QC program will be followed in the field to ensure the reliability and validity of field data generated by this GMP. The field QA/QC program is based on the routine collection and analysis of three types of QC samples: trip blanks, duplicate samples, and equipment rinse blanks.

<u>Trip blanks</u> will be prepared prior to each sampling event. A trip blank will be prepared for each container (e.g., cooler) used to hold multiple groundwater samples collected during the course of the sampling event. The trip blank consists of two 40-ml bottles filled with organic-free water. These trip blanks will be transported with the other samples and equipment to locations visited for that day. At the end of that day, the trip blanks will be returned to the laboratory in a manner identical to the handling procedure used for VOCs. The trip blanks will be analyzed for VOCs and will serve to detect contamination that may occur during transportation and storage.

<u>Duplicate groundwater samples</u> will be collected for routine samples. They will serve as a check on the validity of the sample, sampling technique, and laboratory precision. A minimum of 5 percent of all groundwater samples will be duplicated.

<u>Equipment rinse blanks</u> will be collected in the field by passing organic-free water over decontaminated non-dedicated equipment. These samples will confirm the effectiveness of decontamination procedures and will be collected once per sampling day from a piece of non-dedicated equipment, such as a water level indicator, non-dedicated purge pump, or disposable bailer. Equipment rinse blanks will be analyzed for VOCs.

A bottle filled with water will be placed in each cooler by the sampling personnel to serve as a temperature blank for each day of sampling. The temperature of this blank will be checked and recorded on the chain-of-custody form upon receipt of the samples by the laboratory. As an alternative, the laboratory may use an infrared measuring device to determine the temperature of the samples upon receipt.

All field QA/QC samples except temperature blanks will be included in the sampling database. Equipment rinse blanks and trip blanks will be recorded on index forms and will be noted on the chains of custody.

2.4.5 Measurement of Field Parameters

Field parameters (Dissolved Oxygen, Temperature, pH, Specific Conductance, Oxidation-Reduction Potential, and Turbidity) will be determined using calibrated field meters during purging and after all samples have been collected. Field parameters will be measured using a flow-through cell during purging and sampling or at the surface immediately after retrieving the sample from the well. After allowing the meter reading to stabilize, the field parameter measurement will be recorded. Field measurements will be recorded on the Field Sampling Data Sheet (Section 2.5.1).

2.5 Documentation, Labels, Storage, Shipment, and Chain of Custody

Sample documentation, including the field data sheets, bottle labels, and chain-of-custody forms, is described in this section. Sample storage and shipment procedures from the time of sample collection until delivery to the laboratory are also described.

2.5.1 Field Sampling Data Sheets and Sampling Log Book

All field documentation will be the responsibility of the designated field sampling custodian, who may be any one of the field sampling personnel. Field Sampling Data Sheets (sample attached) will be used to record specific information regarding the wells to be sampled during a particular sampling period. Specific information on these sheets will also be entered into an electronic database. The FSDSs may be bound, and preprinted, with sequentially numbered pages, and will be completed at the time of purging and sampling of each well. Each Field Sampling Data Sheet will record the following information: well number, date, personnel, reference depth to bottom, depth to water before and after purge, purging start/stop times, water contained (yes/no), calculated target and actual purge volumes, purge method and rate (if applicable), purge equipment type, sample identification number, sampling start/stop times, duplicate identification number (if applicable), sampling method, and important field observations related to sample integrity. The Field Sampling Data Sheet will be signed and dated by the sampler and will also include the analytical laboratory to which the sample is being sent, the specific analyses requested, and the field parameters that were measured.

2.5.2 Chain of Custody

The chain of custody allows for the tracing of possession and handling of individual samples from the time of field collection through laboratory analysis. The chain of custody will contain, at a minimum, the following information: unique sample identification number, analyses requested, name of sample custodian, date and time of collection, date and time of sample receipt in laboratory, preservative (if any), volume/type of bottles, temperature of samples upon receipt (if applicable), signature of person(s) relinquishing/receiving samples, and requested turn-around time. Information relating to condition of samples upon receipt will be written on the chain-of-custody form as a comment. A sample chain-of-custody form is attached.

2.5.3 Sample Numbering and Labeling

A unique sample identification numbering system will be used for all trip blanks, equipment rinse blanks, groundwater samples and duplicate samples. All containers from one sample will be labeled with this unique identification number. Samples will be labeled as follows:

2.5.3.1 Environmental Samples

B9999YYMMDDX where "B9999" represents the location ID (e.g., "B9114" for well 911-4 at the Broadway Complex ("B"); "YYMMDD" is the date the sample was collected (e.g., 090212 = February 12, 2009) and "X" is an optional identifier that can be used for marking the sample as a duplicate sample (using a "D") or a routine groundwater sample (using a "G")

2.5.3.2 Trip Blanks

BTBYMMDDMMDD where "B" designates the "Broadway," "TB" indicates the sample is a trip blank; "Y" is the last digit of the year (e.g., 9 = 2009) or sampler's initial; and "MMDDMMDD" is the period for which the trip blank is valid (e.g. 01230124 is January 23 through January 24)

2.5.3.3 Equipment Rinse Blanks

BEQYMMDDXXXX where "B" designates the "Broadway," "EQ" indicates the sample is an equipment rinse blank, "YMMDD" is the date that the rinse blank was collected and "XXXX" is an abbreviation for the type of rinse blank collected (e.g. "BALR" is bailer, "PUMP" is non-dedicated pump, "WLID" is water level indicator)

Samples will be transferred in the field from the sampling equipment directly into the container specifically prepared for that analysis.

2.5.4 Sample Storage

In the field, samples will be kept in a cooler containing ice until such time as the samples can be refrigerated or received at the laboratory. Refrigerated samples will be kept at 4 degrees C or lower.

2.5.5 Sample Shipment

Samples will be hand-delivered to the laboratory or shipped via a commercial priority overnight delivery service. In cases where the samples leave the immediate control of the sampling team (i.e. shipment via common carrier), the shipping container will be sealed and a custody seal will be provided on the shipping container to ensure that the samples have not been tampered with during transport. Samples that are at all times in the possession of the field crew or their designee will not require custody seals on the coolers.

3 ANALYSIS OF GROUNDWATER SAMPLES

Groundwater samples will be analyzed for VOCs by SW-846 Method 8021B or 8260B unless another method is approved by NYSDEC. Table 3-1 indicates the target analytes, the expected detection limits (for samples not requiring serial dilution), and the practical quantitation limits (PQLs). The listed PQLs were obtained from the *Water Quality Analysis Tables* presented in *6NYCRR Part 360, Solid Waste Management Facilities*. (Several of the target analytes do not have PQLs listed in Part 360.) The detection limits and analytes shown on this table apply specifically to the primary analytical laboratory for groundwater (Lancaster Laboratories Inc.), although other laboratories typically are capable of achieving the listed detection limits and reporting the listed analytes.

In addition to VOCs, Lancaster Laboratories Inc. (LLI) will analyze groundwater samples collected from two monitoring well locations near the former septic tank for Target Compound List SVOCs by SW-846 Method 8270C, Target Analyte List Metals by SW-846 Method 6010B, Mercury by SW-846 7470A, and Total Cyanide by SW-846 9012A. A blank chain-of-custody form for LLI is included at the end of Appendix A-2.

Groundwater samples will also be analyzed by Microseeps, Inc. of Pittsburgh, Pennsylvania for ethane, ethene, methane, and other transformation indicator and natural attenuation parameters (e.g. chemical oxygen demand; total hardness; total organic carbon; total suspended solids; total and dissolved iron and manganese; ferric iron; ferrous iron; dissolved calcium, potassium, and sodium; total alkalinity; total ammonia; chloride; fluoride; sulfate; and nitrate and nitrite as nitrogen). A blank chain-of-custody form for Microseeps, Inc. is attached at the end of this appendix.

Laboratory internal quality controls will conform to SW-846 requirements and are documented in the laboratory's Quality Assurance Project Plan.

Table 3-1. Table of Analytes, Expected Detection Limits, and Practical Quantitation Limits for Groundwater Samples

Analyte	Expected Detection Limit (ug/l)	Practical Quantitation Limit (PQL)* (ug/l)
Acetone	10	100
Benzene	1	5
Bromodichloromethane	1	5
Bromoform	2	5
Bromomethane	1	--
2-Butanone (MEK)	2	100
n-Butyl Acetate	2	--
Carbon Disulfide	1	100
Carbon Tetrachloride	1	10
Chlorobenzene	1	5
Chloroethane	1	10
Chloroform	1	5
Chloromethane	1	--
Dibromochloromethane	1	5
1,2-Dichlorobenzene	1	5
1,3-Dichlorobenzene	1	5
1,4-Dichlorobenzene	1	5
Dichlorodifluoromethane	1	5
1,1-Dichloroethane	1	5
1,2-Dichloroethane	1	5
1,1-Dichloroethene	1	5
cis-1,2-Dichloroethene	1	5
trans-1,2-Dichloroethene	1	5
1,2-Dichloropropane	1	5
cis-1,3-Dichloropropene	2	10
trans-1,3-Dichloropropene	2	10
Ethylbenzene	1	5
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	1	--
1,2-Dichloro-1,2,2-trifluoroethane (Freon 123a)	1	--
2-Hexanone (MBK)	1	50
Isopropyl Alcohol (IPA)	10	--
Methylene Chloride (Dichloromethane)	1	10
4-Methyl-2-Pentanone (MIBK)	1	100
Methyl tert-butyl ether (MTBE)	1	--
Styrene	1	10
1,1,1,2-Tetrachloroethane	1	5
1,1,2,2-Tetrachloroethane	1	5

Table 3-1. Table of Analytes, Expected Detection Limits, and Practical Quantitation Limits for Groundwater Samples

Tetrachloroethene	1	5
Tetrahydrofuran (THF)	10	--
Toluene	1	5
1,1,1-Trichloroethane	1	5
1,1,2-Trichloroethane	1	5
Trichloroethene	1	5
Trichlorofluoromethane	1	5
Vinyl Acetate	2	50
Vinyl Chloride	1	10
o-Xylene	1	5
m,p-Xylene	2	10

*Practical Quantitation Limits (PQLs) are the lowest concentrations of analytes in groundwater that can be reliably determined within specified limits of precision and accuracy by the indicated methods under routine laboratory operating conditions. The PQLs listed are generally stated to one significant figure. PQLs are based on 5 ml samples for volatile organics and 1 L samples for semivolatile organics. CAUTION: The PQL values in many cases are based only on a general estimate for the method and not on a determination for individual compounds; PQLs are not a part of the regulation.

CHAIN - OF - CUSTODY RECORD

Phone: (412) 826-5245 Microseeps, Inc. - 220 William Pitt Way - Pittsburgh, PA 15238 Fax No. : (412) 826-3433

Company :
Co. Address :
Proj. Manager:
Proj. Location:
Proj. Number:
Phone # : Fax # :

Sampler's signature :

Parameters Requested

Results to :

Invoice to :

Cooler ID	Cooler Temp.

Sample ID	Sample Description	Date	Time	Comp.	Grab	# Cont.									Remarks

Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :
Relinquished by :	Company :	Date :	Time :	Received by :	Company :	Date :	Time :

WHITE COPY : Accompany Samples YELLOW COPY : Laboratory File PINK COPY : Submitter

Appendix A-5

Site # V00290-7

HYDRAULIC TESTING PROCEDURES

November 26, 2008

Two procedures will be used to determine hydraulic characteristics of the water-bearing strata identified in monitoring wells at the Site. These two procedures are commonly referred to as pulse tests and constant rate extraction tests. Both of these procedures will be used as appropriate to complete hydraulic testing in monitoring wells at the Site. The procedure for pulse testing is presented in the following subsections. The procedure for extraction tests and shutdown tests will be included in a separate aquifer testing plans to be submitted to NYSDEC for review and approval before testing begins.

Pulse Test Preparation

To assess that the pulse test is applicable to a given well, a thorough review of the physical well data is necessary. A data package shall be prepared for each well to be pulse tested and will include, at a minimum, the following information:

Well Construction Detail: The well construction detail will include the screen length, well depth and diameter, and the specifications of the screen and riser pipe.

Stratigraphic Log: The stratigraphic log will include the stratigraphy in the screened interval of the well. Depths of major changes in the hydrostratigraphy should be noted for use in the analysis of hydraulic data.

Representative Groundwater Elevations: Historical groundwater elevations will be used to determine whether both rising head and falling head tests may be performed. If the static water level in the well is lower than the top of the screened interval, only a rising head test may be performed.

Available Hydraulic Data: Previous slug test, pump test, or well development data will be used to estimate the length of time needed to complete the pulse test. Any previous hydraulic conductivity values will also be compared to the pulse test results to determine whether the well is in need of redevelopment or repair.

Chemistry Data: Chemistry data will be reviewed to determine whether pressure transducers are suitable for use in the wells. The chemistry data also will be the basis for the determination of the level of respiratory and/or dermal protection needed during the pulse tests.

Pulse Test Equipment

A 0-10 psi or 0-50 psi pressure transducer (Troll® or equivalent) can be used in wells screened in sand or sand and gravel that are expected to exhibit relatively moderate to high hydraulic conductivities. Wells screened in silt or clay that are expected to exhibit relatively low hydraulic conductivities can be pulse tested using an electronic water-level indicator to record water levels.

The physical displacement (slug) used for the pulse test shall be chosen based on well diameter and the induced head differential the slug will produce when inserted into the well. An induced head differential of at least 1.5 feet is acceptable.

The data logger will be set to collect measurements at a logarithmic frequency such that more frequent measurements (e.g., every 0.1 seconds) are collected during the first few seconds of the test and the measurement intervals grow successively longer (e.g., 2 to 5 minutes) as the test progresses.

Pulse Test

A field data sheet shall be prepared for each well to be pulse tested and will include the following information: well name, date, time, depth to water, well diameter, slug dimensions, the calculated induced head from the insertion of the slug, pressure transducer serial number, the name of the computer file in which the data is being stored, and fields for time and water level if a water level indicator is used rather than a data logger/pressure transducer. A sample test data form is attached.

The properly decontaminated pressure transducer shall be placed below the top of the water surface such that the pressure transducer is operating near the middle of its specified pressure range. Several water levels should be recorded by the data logger before the slug is inserted. The slug will be inserted slowly into the well until it is just above the water surface. The slug will then be lowered quickly and smoothly so that the entire slug is immersed below the initial static water level. The data logger will be started at the instant the slug is immersed. As the induced head decays, the water levels will return to near the level of the static water level. When at least 90 percent of the induced head has decayed, a rising head test may then be conducted by smoothly pulling the slug from the well and resetting the data logger. The rising head test will be over when the rising water level reaches approximately 90 percent or more of the initial static water level. The above procedures also will be used when the elevation of the water surface is below the top of the screened interval. However, the falling head portion of the test should not be analyzed.

When possible, results from the falling head and rising head tests will be compared for major discrepancies. The pressure transducer will then be decontaminated by washing with a laboratory-grade detergent-and-water solution and rinsing with potable water. The slug and rope will be decontaminated by steam cleaning.

Analysis of the Hydraulic Data

The data from the pulse test will be transformed to a format which can be plotted on a semilogarithmic plot of change-in-head (Δh) versus time with Δh on the logarithmic axis. The resulting curves will be analyzed by the method of Bouwer and Rice[1,2] for both the rising and falling head test at each well. The values for each phase of the test should fall within the same order of magnitude for hydraulic conductivity. The calculated hydraulic conductivities will then be compared to values that would be expected from the surrounding stratigraphy. Any major discrepancies between expected hydraulic conductivities and measured hydraulic conductivities will be noted and possible explanations will be given.

1 Bouwer, H.B., and Rice, R.C., A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers With Completely or Partially Penetrating Wells, Water Resources Research, Vol. 12, No. 3, June 1976.
2 Bouwer, H.B., The Bouwer and Rice Slug Test – An Update, Groundwater, Vol. 27, No. 3, May-June 1989.

Appendix B: Qualifications of Project Team

CRAIG G. ROBERTSON, P.G., CGWP
Hydrogeologist

EDUCATION

Mr. Robertson received his bachelor's degree in geology from Franklin and Marshall College in Lancaster, Pennsylvania in 1970. Subsequent graduate training was received at Southern Illinois University in the areas of hydrogeology, engineering geology, and civil and wastewater engineering.

PROFESSIONAL MEMBERSHIPS AND REGISTRATIONS

Professional Advisory Groups

- PaDEP Cleanup Standards Scientific Advisory Board - Member and Past Chairperson.
- PaDEP Lower Susquehanna Regional Water Resources Committee.

Professional Associations

- Pennsylvania Council of Professional Geologists - Charter Member.
- Association of Ground Water Scientists and Engineers - Member.
- American Water Resources Association - Member.
- American Geophysical Union - Member.
- International Association of Hydrogeologists - Member.

Professional Registrations and Certifications

- Registered Professional Geologist - Pennsylvania (No. 0166-G)
- Registered Professional Geologist - North Carolina (No 760)
- Registered Professional Geologist - Delaware (No. 332)
- Registered Professional Geologist - South Carolina (No. 554)
- Registered Professional Geologist - Florida (No. 904)
- Registered Professional Geologist - Indiana (No. 870)
- Registered Professional Geologist - Arkansas (No. 893)
- Registered Professional Geologist - Kentucky (No. 458)
- Registered Professional Geologist - Wisconsin (No. 936)
- Registered Professional Geologist - Georgia (No. 001335)
- Registered Professional Geologist - Virginia (No. 2801 001304)
- Registered Professional Geologist - Minnesota (No. 30197)
- Registered Professional Geologist - Illinois (No. 196-000633)
- Registered Professional Geologist - Nebraska (No. G-0214)
- Registered Professional Geologist - Washington (No. 1974)
- Registered Professional Geologist - New Hampshire (No. 437)
- Registered Professional Geoscientist - Texas (No. 553)
- Registered Professional Geologist - Utah (No. 5323447-2250)
- Certified Ground Water Professional, AGWSE - CGWP (No. 276)

SUMMARY OF EXPERIENCE

Mr. Robertson is president of Groundwater Sciences Corporation. Over the past 38 years, he has worked as a consultant in the field of hydrogeology on projects ranging from water supply development to hazardous waste site investigations with overall site remediation budgets as high as $60 million. He has performed environmental site assessments for transactions ranging from a small office building to a $92 million asset purchase.

Since 1979, he has been involved primarily in site investigation and remediation under RCRA, CERCLA, and the Clean Water Act in EPA Regions 2, 3, 4, 5, 9, and 10; also, in the states of Pennsylvania, New York, New Jersey, Delaware, Maryland, Indiana, North Carolina, California, Washington, D.C., Washington State, Kentucky, Connecticut, Vermont, Maine, Massachusetts, South Carolina, Virginia, West Virginia, Colorado, Texas, Minnesota, Arizona, Nebraska, Ohio, Oregon and Hawaii; and in Ontario, Canada, Mexico, Brazil, Argentina and the United Kingdom.

ROBERT C. WATSON, P.G.
Vice President, Professional Services

EDUCATION

Mr. Watson graduated from Bates College in 1986 with a B.S. in Geology. He received a Master's Degree in Geology and Geophysics from Boston College in 1989, where he did research in structural geology, geochemistry, and regional tectonics. Mr. Watson's continuing education has included courses in field sampling techniques, design of extraction and production wells, and contaminant fate and transport with an emphasis on characterization, monitoring, assessment, and remediation of fractured bedrock.

PROFESSIONAL REGISTRATIONS, CERTIFICATIONS, AND MEMBERSHIPS

Maine, Certified Geologist - license number GE354.
New Hampshire, Registered Professional Geologist - license number 406.
National Ground Water Association - Member.
Geological Society of Maine - Member.

EXPERIENCE

Mr. Watson has over 19 years of experience providing technical guidance, supervision and management of numerous environmental consulting projects conducted in a diversity of hydrogeologic settings in New England, New York, the Midwest, the Southeast, California, the United Kingdom, and Japan. He has been responsible for work scope development, coordination, implementation, data analysis, and report preparation for environmental site assessments, hydrogeologic investigations, and remedial feasibility studies at proposed commercial development sites, municipal and industrial landfill sites, underground storage tank removal sites, hazardous substance release sites, and petroleum release sites. Some of these sites are CERCLA or RCRA sites with programs under EPA or State supervision. His CERCLA and RCRA site experience includes management and implementation of soil vapor, indoor air, and ambient air sampling projects designed to support remedial feasibility assessments and/or assessment of groundwater vapor intrusion.

Mr. Watson has also managed public water supply feasibility, permitting, and development projects. He has also served as project geologist or technical consultant on many geotechnical engineering consulting projects that have involved detailed characterization of bedrock, including: bridge and hydroelectric dam foundation engineering projects, bedrock sewer and water supply tunnel design projects, and bedrock surface/structure evaluations for commercial development sites.

Prior to joining Groundwater Sciences Corporation in 2004, Mr. Watson served as a Senior Project Manager for Sanborn, Head & Associates, Inc.'s (SHA's) Portland, Maine office with primary day-to-day technical and administrative responsibilities for site investigations/remedial feasibility studies performed at RCRA Corrective Action sites, Voluntary or Brownfield Cleanup Program sites, Maine Uncontrolled Hazardous Substance sites, and Massachusetts Contingency Plan sites. While at SHA, Mr. Watson served as an in-house technical resource for field exploration work scope development and a technical reviewer for two CERCLA sites in New England and two Contaminated Land sites in the United Kingdom. Prior to joining SHA in 1995, Mr. Watson served as an Assistant Project Manager for GZA GeoEnvironmental, Inc. (GZA) in their Portland, Maine office where he coordinated and participated in over 100 environmental/geotechnical projects conducted throughout New England. Before joining GZA in 1990, Mr. Watson was employed by Delon Hampton & Associates of Washington, D.C. where he served as an Engineering Geology Field Inspector.

CHARLES A. RINE, P.G.
Senior Associate and Hydrogeologist

EDUCATION

Mr. Rine graduated from Princeton University in 1984 with a B.S. in Civil Engineering and a certificate in Geological Engineering. In 1986, he received a Master's Degree in Geology from Columbia University, where his research activities focused on rock and soil mechanics, structural geology, and tectonophysics. Mr. Rine's continuing education coursework includes geostatistics, vadose zone monitoring, flow simulations, aquifer tests, environmental assessments, fracture analysis, data validation, aeration technologies for soil and groundwater remediation, underground storage tank regulations, and New Jersey Technical Requirements for Site Remediation.

PROFESSIONAL REGISTRATIONS, CERTIFICATIONS, AND MEMBERSHIPS

Pennsylvania, Registered Professional Geologist - license number 0300-G.
Kentucky, Registered Professional Geologist - license number 412.
New York State Division of Hazardous Waste - Certified Organic Data Validator.
Association of Ground Water Scientists and Engineers (National Ground Water Association) - Member.
American Geophysical Union – Member since 1984.

EXPERIENCE

Mr. Rine has over 21 years of experience and was the first Staff Geologist hired by Groundwater Sciences Corporation shortly after it was founded in 1987. He was promoted to Senior Hydrogeologist in 1995, Associate in 2002 and Senior Associate in 2008. Mr. Rine has been actively involved in remedial investigations and feasibility studies for high-profile corporate clients. He is responsible for overall Scientific Development for the firm's consulting scientists.

Mr. Rine has conducted Phase I environmental site assessments in a dozen states, Canada, and Mexico; some of these Phase I assessments required follow-up Phase II investigations. He also has performed site inspections; investigated general site geology, site uses, and histories; evaluated environmental databases and compiled existing physical and chemical data to create new comprehensive databases; and recommended additional investigation activities. Some of these sites are CERCLA or RCRA sites with programs under EPA or State supervision where Mr. Rine has written comprehensive sampling/analysis and quality assurance project plans. Mr. Rine has directed and performed EPA protocol groundwater, surface water, soil, soil gas, sediment, sewer and tank sampling, and has conducted and analyzed many aquifer tests. He has also coordinated the activities of drillers, surveyors, and general contractors in the field and is the company's designated health and safety officer. Mr. Rine is responsible for organic data validation for RCRA facility clients and as such has been designated the Quality Assurance Officer for those projects.

Mr. Rine maintains physical and environmental chemistry databases for large RCRA facility clients. He has broad experience with computer operating systems, non-parametric statistics, and scientific/technical software packages, including groundwater flow and geologic visualization software.

DOROTHY A. BERGMANN, P.G.
Senior Associate and Hydrogeochemist

EDUCATION

Ms. Bergmann received her Bachelor of Arts Degree in Geology from Colgate University in Hamilton, New York in 1985 where she was cited for academic excellence. She received her Master of Science Degree in Geology from Northern Arizona University. Her continuing education has included attending a University of Toledo Field Monitoring Course relating to soil gas sampling and analysis techniques; a three-day sampling theory course conducted by the University of Waterloo; the NGWA Outdoor Action Conference; WCC's Data Validation Techniques for Inorganic and Organic Analyses as Required by the Superfund Program; the Conference on Quality Assurance in Environmental Monitoring; and the NGWA Analysis and Design of Aquifer Tests Course.

PROFESSIONAL REGISTRATIONS, CERTIFICATIONS, AND MEMBERSHIPS

Kentucky, Registered Professional Geologist - license number 1548.
New York State Division of Hazardous Waste - Certified Organic and Inorganic Data Validator.
Soil Science of America - Member.
Association of Ground Water Scientists and Engineers - Member.

EXPERIENCE

Ms. Bergmann joined Groundwater Sciences Corporation in 1989 as a staff geologist and is currently employed as a hydrogeochemist. She became an Associate in 2002 and Senior Associate in 2008, and is the project manager for a wide range of projects involving multimedia investigations including soil, sediment, groundwater, surface water and soil gas. Her responsibilities include investigation design, implementation, and interpretation as well as management of budgets, contracts and personnel. Skills used to conduct and implement investigations include the installation of monitoring wells and USEPA and State protocol sampling of groundwater, surface water, soil, and tank contents. Part of Ms. Bergmann's experience involved the design, mobilization and operation of a field laboratory for on-site analysis of soil gas samples.

Ms. Bergmann is principally responsible for both the Inorganic and Organic Data Validation for several RCRA Facility clients and as such has been designated as the Project Quality Assurance Officer (QAO) for those projects. As the QAO she participated in the development of the Quality Assurance Project Plan and sampling protocols currently approved for use by the state regulatory agency at a New York State RCRA Facility. Other responsibilities include the management of physical and chemical databases for several RCRA Facility clients.

Her software experience for data management, interpretation, and presentation includes: dBaseIII+ and IV; Lotus 123 and Freelance Plus; Golden Software's Surfer and Grapher; CSS, SPSS and WQStat II (statistical packages); Corel QuattroPro; Capture (flow modeling) and proprietary chemical database management programs.

Appendix C: Site-Specific Health & Safety Plan

HEALTH AND SAFETY PLAN
FOR THE
BROADWAY COMPLEX

1200 TAYLOR ROAD
TIOGA COUNTY, NEW YORK

Voluntary Cleanup Agreement Index #A7-0407-0001
Site # V00290-7

Prepared for:

IBM Corporation
Manassas, Virginia

March 2008

Prepared by:

Groundwater Sciences Corporation

2601 Market Place Street, Suite 310
Harrisburg, Pennsylvania 17110

560 Route 52, Suite 202
Beacon, New York 12508

1108 Vestal Parkway East, Suite 2
Vestal, New York 13850

Table of Contents

Table of Appendices

1 SITE DESCRIPTION

This Health and Safety Plan (HASP) has been prepared by Groundwater Sciences Corporation (GSC) in accordance with Section 7.1 of the Site Investigation Work Plan for the Broadway Complex dated December 28, 2005 and revised January 31, 2008. The Site Investigation Work Plan was prepared by GSC for IBM Corporation.

1.1 Site Location

The Site, known as the Broadway Complex, is located at 1200 Taylor Road (County Route 606) in the Town of Owego, Tioga County (Tax Map Identifier Number 129.07-1-10). Figure 1 is a Site Map showing the Broadway Complex building and parking lot. The Site is bounded on the west and north by property of Sanmina-SCI Corporation, on the east by Barnes Creek and the Lockheed Martin facility, and on the south by private property. The Site contains a single-storey building with a footprint of approximately 60,000 square feet and a 2-acre parking lot located adjacent to the south side of the building.

1.2 Background Information

The Site (ID # V00290-7) is subject to a Voluntary Cleanup Agreement (VCA), Index # A7-0407-0001, between IBM and the New York State Department of Environmental Conservation (NYSDEC). As detailed in Section 2 of the Site Investigation Work Plan Section 2, the Site has been extensively investigated and the contaminant source area has been identified; however, additional investigation activities are required and an Investigation Work Plan was prepared in accordance with NYSDEC's Draft Voluntary Cleanup Program Guide (VCP Guide, May 2002). The purpose of this Work Plan is (1) to further define the nature and extent of on-site contamination, both horizontally and vertically, and (2) to produce data of sufficient quantity and quality to support the development of a Remedial Action Work Plan.

1.3 Potential Hazards

Potential hazards are listed in the following subsections.

1.3.1 Chemical Hazards

The primary chemical safety concerns are inhalation of vapor-phase contamination originating from contaminated groundwater and soil as well as dermal contact with contaminated groundwater and soil. The chemical hazards associated with contaminated groundwater and soils are evaluated in Section 4: Chemical Hazard Evaluation.

The chemicals of concern at this Site consist of chlorinated ethenes and chlorinated ethanes in groundwater and soil. The significant chemicals at the Site are described below.

1.3.1.1 Chlorinated Ethenes

The chlorinated ethenes present in groundwater at the Site include trichloroethene (TCE), cis-1,2-dichloroethene (c12-DCE), 1,1-dichloroethene (11-DCE), and vinyl chloride (VC). The highest concentrations of TCE in groundwater were detected in well 911-5 near the former septic tank location. TCE is a solvent used for various industrial applications. c12-DCE is a transformation product of TCE by reductive dechlorination. 1,1-DCE is a transformation product of 1,1,1-trichloroethane (TCA) by an abiotic elimination reaction. Vinyl chloride is a reductive dechlorination product of either c12-DCE or 1,1-DCE.

1.3.1.2 Chlorinated Ethanes

1,1,1-trichloroethane (TCA) is a solvent used in many industrial applications and in printing operations. Its principal transformation products are 1,1-dichloroethane (1,1-DCA) by reductive dechlorination and 1,1-DCE by an abiotic elimination reaction. As noted in Section 1.3.1.1, 1,1-DCE may transform by reductive dechlorination to vinyl chloride.

1.3.2 Physical Hazards

1.3.2.1 Utilities

Electrical shock or electrocution can result from exposed wiring, electrical panels, extension cords, and motors. Extension cords shall be inspected for fraying and shall not be used in a way that creates a tripping hazard. GFCI outlets shall be used whenever possible. Appropriate lock-out/tag-out procedures shall be followed prior to servicing electrical equipment (see Section 9, Lock-out/Tag-out/Control of Hazardous Energy).

1.3.2.2 Confined Space/Excavation

If entry into a confined space is necessary, proper confined space procedures, including the use of a permit, will be followed. The safety concerns in these confined spaces are lack of oxygen and possible inhalation of vapors. These concerns are addressed in Section 8: Confined Space Entry Procedures.

1.3.3 Mechanical Hazards

Heavy equipment, including drilling rigs, support vehicles and backhoes, may be used during Site activities. Loose clothing that could become entangled during operation of devices equipped with cables, chains, or belts shall be removed. Generators shall not be refueled while they are operating.

1.3.4 Biological Hazards

Mosquitoes, bees, and wasps may be present throughout the spring and summer. Ticks may be present near areas of brush on the western and southern perimeter of the work area. The primary hazard associated with ticks is exposure to Lyme disease, which is characterized by a ring-shaped rash on the skin.

1.3.5 Noise Hazards

Hearing protection such as earplugs or earmuffs shall be used during the operation of power tools and equipment that create percussive sounds, particularly in confined areas. Hearing protection shall also be used during drilling, construction, maintenance, testing, and waste management activities where required by Section 7.1 of this HASP.

1.3.6 Eye Hazard

Protective eyewear shall be worn during activities such as welding, cutting, or sawing, and during field activities where a splash hazard exists. A portable eyewash shall be present at all times during such activities.

1.3.7 Heat Stress and Fatigue Hazard

Heat stress monitoring of pulse rates and heat stress/hydration breaks shall be required for personnel in Tyvek® or other protective clothing when the ambient temperature exceeds 85°F. If heat stress or heat stroke symptoms are identified, then immediate medical attention is required.

1.3.8 Cold Stress – Hypothermia and Frostbite

Personnel conducting field activities in exceptionally cold temperatures should take the appropriate precautions to prevent hypothermia or frostbite. Warm, dry clothing should be worn at all times while working in cold temperatures.

Hypothermia usually is caused by extended exposure to cold. Hypothermia results when more heat is lost than the body can generate. Common causes include being outside without enough covering in winter, wearing wet clothing for an extended period of time in windy or very cold weather, or heavy exertion, or poor fluid or food intake in cold weather, even in above-freezing temperatures. The onset of symptoms is usually slow. There is likely to be a gradual loss of mental acuity and physical ability. The person experiencing hypothermia, in fact, may be unaware that he or she is in a state that requires emergency medical treatment. Symptoms of hypothermia include apathy, lethargy, confusion, drowsiness, loss of coordination, pale skin, slowing of breathing, slurred speech, uncontrollable shivering, and weakness. It requires immediate emergency medical attention.

Frostbite is frozen body tissue, usually skin but sometimes deeper, and should be handled carefully to prevent permanent tissue damage or loss. Frostbite can be prevented by dressing in layers, making sure you come indoors at regular intervals, and watching for frostnip, frostbite's early warning signal. Frostnip usually affects areas that are exposed to the cold, such as the cheeks, nose, ears, fingers, and toes, leaving them white and numb. Frostbite is characterized by white, waxy skin that feels numb and hard. It requires immediate emergency medical attention.

1.4 Affected Area and Control Measures

The work zones typically associated with a health and safety plan (exclusion zone, contaminant reduction zone, and support zone) are not applicable to most of the anticipated field activities. The locations of affected areas are noted in the Site Investigation Work Plan.

The work areas requiring possible perimeter control measures are in the immediate vicinity of the well drilling and soil boring locations. The areas where soil and/or groundwater contamination may be present, and where the greatest potential for chemical exposure and physical injury exists, are in the immediate vicinity of drilling and sampling operations. Perimeter control measures will be set up at each drilling or sampling location. The perimeter control area will be determined individually for each location by the Project Manager or Field Team Leader and will be based on the proximity to roads and structures, and on the general nature of the surrounding area. Perimeter control measures shall include one or more of the following: traffic cones, safety fence, caution tape, or fencing. Only OSHA-trained personnel necessary for completion of the specific task will be allowed inside of the bounded areas.

Field personnel and samplers shall use appropriate personal protective equipment and health and safety measures detailed in this HASP to minimize exposure to contaminated groundwater, soil, or soil vapor.

2 WORK OBJECTIVES

Various work plans and sampling plans prepared in accordance with the Order describe the field activities that will be performed by GSC and others. These activities include:

1. Soil and limited groundwater sampling using direct-push probes.

2. Drilling conventional soil borings using hollow-stem auger methods, accompanied by soil sampling.

3. Construction of monitoring wells, followed by well development, groundwater sampling, and hydraulic testing.

4. Surveying and reconnaissance activities.

5. Measuring groundwater elevations.

3 ORGANIZATION, COORDINATION, AND SITE ACCESS

The following personnel are designated to carry out the stated job functions. (Note: One person may carry out more than one job function.)

Project Managers:	Robert C. Watson Charles A. Rine
GSC Health and Safety Officer:	Charles A. Rine
GSC Field Team Leaders/Members:	Kenneth W. Bittner Glenn S. Carson Stephen M. Fisher Matthew T. Luckman Charles A. Rine Mitchell W. Ruchin Douglas F. Stewart C. Edward Stoner Christopher J. Shannon Bruce W. Spence Daniel G. Thorne Brian C. Titone Robert C. Watson
Client Representatives:	IBM Corporate Environmental Affairs: Dean Chartrand Kevin Whalen
Subcontractors:	Peak Investigations, LLC Microseeps, Inc. Parratt-Wolff Inc. Butler Land Surveying

Project personnel may be rotated, added, or dropped as needed. GSC subcontractor personnel conducting field activities shall be authorized to do so by GSC. GSC subcontractor personnel will not be allowed on the Site without proper personal protective equipment and health and safety training.

3.1 Distribution of the HASP

GSC subcontractors working at the Site, or who otherwise could be exposed to health and safety hazards, will be advised of known hazards through distribution of this Health and Safety Plan. They shall be solely responsible for the health and safety of their employees and shall comply with applicable state and federal health and safety laws and regulations. All GSC personnel and subcontractors of GSC working at the Site shall review this Health and Safety Plan in its entirety and shall read and sign Section 11 of this HASP.

3.2 Contractor's Guide

If available, a contractor's guide for the Sanmina/SCI facility shall be distributed and reviewed by personnel working at the Site. A copy of the contractor's guide shall be attached to this HASP (Appendix D). Relevant procedures described in the contractor's guide shall be followed, especially those sections relating to vehicles, electrical equipment, lock-out/tag-out, and use of hand tools.

4 CHEMICAL HAZARD EVALUATION

Ten volatile organic compounds (VOCs) have been identified as significant with regard to concentration and lateral distribution in groundwater at the Site. Only low concentrations in soil vapor are expected to be encountered during field activities because the source of the vapor is typically partitioning from groundwater.

Information from the *NIOSH Pocket Guide to Chemical Hazards* for each of the ten VOCs is presented in Appendix A. These significant VOCs are listed below with their Chemical Abstract Service Registration Numbers (CASRN).

Substances	CASRN
Trichloroethene* (Trichloroethylene)	**79-01-6**
cis-1,2-Dichloroethene (1,2-Dichloroethylene)	**540-59-0**
Vinyl Chloride*	**75-01-4**
1,1,1-Trichloroethane (Methyl Chloroform)	**71-55-6**
1,1-Dichloroethene (Vinylidene Chloride)	**75-35-4**
1,1-Dichloroethane	**75-34-3**
*** - NIOSH suspected carcinogen.**	

This information in Appendix A includes primary routes of exposure and exposure limits. Time-weighted averages (TWAs) and/or short-term exposure limits (STELs) for these and other substances are also summarized in Appendix B of this HASP.

Potential chemical exposures from the work activities detailed in Section 2 of this HASP are via skin contact with, and inhalation of, contaminated media.

Appropriate personal protective equipment will be required as described in Section 7 of this HASP.

5 DECONTAMINATION PROCEDURES

Items that come into contact with potentially contaminated soil and groundwater will be disposed of or decontaminated as described in Appendix A of the Site Investigation Work Plan.

5.1 Personal

Because the degree of contamination is known and the potential for transfer is judged to be minimal, scrubbing and rinsing of personal protective equipment (PPE) generally will not be necessary. PPE, including gloves will be removed, placed in plastic bags, and disposed of properly.

5.2 Equipment

Non-disposable groundwater gauging equipment, such as interface probes and water level meters, will be decontaminated as specified in Appendix A of the Site Investigation Work Plan.

Non-disposable drilling equipment (such as augers, sampling spoons, drill rods, etc.), excavating equipment and other non-disposable tools that come into contact with Site soils and/or groundwater will be decontaminated as specified in the relevant drilling procedure specified in Appendix A of the Site Investigation Work Plan.

5.3 Disposable Items

Decontamination shall not be required for disposable items. Disposable items shall be placed into labeled plastic bags or containers and disposed of properly.

6 AIR MONITORING

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of the designated work area when certain activities are in progress at the Site. The Site is covered by a building and paved parking lot and, therefore, particulates should be a minimal concern. The intent of the CAMP is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses, on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The nearest off-site businesses and residences are at least a quarter-mile away and the expected VOC exposures are such that impacts to the downwind community are expected to be negligible. The CAMP will also help to confirm that work activities do not spread contamination off-site through the air. In addition to the CAMP, simple, common-sense measures will be used to keep VOCs, dust, and odors at a minimum around the work.

The CAMP during the Site Investigation Work Plan activities will consist of real-time air monitoring for VOCs. Monitoring for VOCs will be performed at the downwind perimeter of the immediate work area (i.e., the exclusion zone) during ground intrusive activities, such as the direct-push soil borings and monitoring well installations. The air monitoring will be performed using an organic vapor analyzer (e.g., photoionization detector) appropriate to measure the types of contaminants known or suspected to be present. The equipment will be calibrated at least daily for an appropriate surrogate and will be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below. Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background conditions. Increased monitoring, corrective actions to abate emissions, and/or work shutdown may be required in the event that concentrations are measured at levels in access of the action levels specified herein.

If the ambient air concentration of total organic vapors in the breathing zone and/or the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million on a volumetric basis (ppmv) above background for the 15-minute average, work activities will be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppmv over background, work activities will resume with continued monitoring.

If total organic vapor levels in the breathing zone and/or at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppmv over background but less than 25 ppmv, work activities will be halted, the source of vapors well be identified, corrective actions will be taken to abate emissions, and monitoring will continue. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind from the work area or exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppmv over background for the 15-minute average.

If the organic vapor level exceeds 25 ppmv in the breathing zone and/or at the perimeter of the work area, then work activities will be halted.

A tabular summary of air monitoring action levels is provided below.

PID Reading Above Background (In Breathing Zone and Downwind Perimeter of Exclusion Zone)	**Action**
< 5 ppmv	Continue work and air monitoring
> 5 ppmv and <25 ppmv	Halt work, monitor and resume work when below 5 ppmv
Persistant readings between >5 ppmv and < 25 ppmv	Halt work, identify and mitigate vapor source, resume work when below 5 ppmv
> 25 ppmv	Halt work, reassess work procedures and PPE

All 15-minute readings will be recorded and be available for NYSDEC and NYSDOH personnel to review. Instantaneous readings, if any, used for decision-making purposes also will be recorded.

7 PERSONAL PROTECTIVE EQUIPMENT

Based on an evaluation of potential hazards, level D protection will be designated to perform most sampling, maintenance and monitoring activities. Modified level D (with Tyvek®, Saranex®, or chemical-resistant apron) protection maybe designated where splash protection is necessary. Appropriate ventilation or Level B or C respiratory protection will be required where organic vapor concentrations, as measured with a PID, exceed 5 ppmv above background in the breathing zone. The following levels of personal protection have been designated for the applicable work areas or tasks:

Location	Activity	Level of Protection
Well Drilling and Soil Boring Locations	Monitoring well and soil boring drilling, soil sampling, well construction, and related activities	D, Mod. D, C, or B depending on the organic vapor concentration in the breathing zone and the presence of VC in groundwater
Monitoring Well Locations	Purging and sampling; hydraulic testing	D

Specific levels of protective equipment for each level of protection are as follows:

7.1 Level D

Clothing: Regular work clothes, not loose fitting, shall be worn. Shirt sleeves shall preferably cover the entire arm. Shorts are not permitted.

Hearing protection: Earplugs or earmuffs shall be worn during operations where the 8-hour time-weighted average sound level (slow response) is greater than 85 dB. Exposure to impulsive or impact noise should not exceed 140 dB peak sound pressure level, with or without hearing protection.

Eye protection: Wraparound glasses or goggles shall be worn when operating percussion tools and during sampling activities where the potential for a splash hazard exists. Welding glasses or goggles specifically designed for use during welding or torch cutting shall be used for those activities.

Footwear: Steel toe boots or shoes shall be worn at all times.

Hand protection: Chemical resistant gloves shall be worn for sampling-related activities. Disposable vinyl or nitrile surgical-type gloves are acceptable. Where a puncture risk exists, protective leather or neoprene outer gloves shall be worn over the vinyl inner gloves.

Head protection: ANSI spec hard hats shall be worn while working around heavy equipment.

7.2 Modified Level D

Includes all of the items listed in Level D plus Tyvek® coveralls for particulate protection or Tyvek® Saranex® for splash protection. Disposable boots or boot covers may also be worn. Gloves and boots may be taped to coveralls using duct tape.

7.3 Level C

Includes all of the items listed for Level D and modified Level D plus a chemical cartridge respirator equipped with one or more organic vapor cartridges or a powered, air-purifying respirator equipped with organic vapor cartridges.

7.4 Level B

Includes all of the items listed for Level D and modified Level D plus (1) a self-contained breathing apparatus (SCBA) having a full face piece and operated in a pressure-demand or other positive-pressure mode or (2) a supplied-air respirator having a full face piece and operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus.

Facial hair that interferes with the operation and fit of the respirator face piece shall be removed prior to using such equipment. Contact lenses are not compatible with SCBA or airline respirators and shall not be worn. Eyeglass lens inserts shall be used instead.

Each SCBA and airline respirator unit will be fit- and pressure-tested prior to use. The contact surfaces of all respiratory protection equipment will be cleaned with rubbing alcohol after each use.

Personal protective equipment may be modified at the discretion of the Health and Safety Officer or Field Team Leader. No changes to the specified levels of protection shall be made without the approval of the Health and Safety Officer or Field Team Leader.

8 CONFINED SPACE ENTRY

Confined space entry is defined as inserting any part of the body past the plane of the portal to the confined space. For example, putting one's arm into a large tank constitutes confined space entry; looking into the tank from outside the entrance to the confined space does not. Confined spaces may include shored excavations that are deeper than they are wide, as well as pits and tanks.

CONFINED SPACE ENTRY IS STRICTLY PROHIBITED. UNDER NO CIRCUMSTANCES SHALL A CONFINED SPACE OR VESSEL BE ENTERED DURING THE PERFORMANCE OF SITE INVESTIGATION ACTIVITIES. If the scope of the Site Investigation is modified such that confined space entry is required this plan shall be amended to include descriptions of confined space entry requirements and procedures.

9 LOCK-OUT/TAG-OUT/CONTROL OF HAZARDOUS ENERGY

To ensure that individuals working on the Site are protected from accidental or unexpected activation of mechanical and/or electrical equipment during maintenance, repair, cleaning, servicing, or adjusting of prime movers, machinery, or equipment, a lock-out/tag-out procedure will be followed.

The term "lock-out" refers to the practice of using keyed or combination security devices ("locks") to prevent the unwanted activation of mechanical or electrical equipment. The term "tag-out" refers to the practice of using tags in conjunction with locks to increase the visibility and awareness that equipment is not to be energized or activated until such devices are removed.

Lock-out/tag-out requirements are specified by OSHA in 29CFR1910.147.

9.1.1 Preparation for Lock-out/Tag-out

Make a survey to locate and identify all isolating devices to be certain which switches, valves, or other energy isolating devices apply to the equipment to be locked and tagged out. More than one energy source (electrical, mechanical, stored energy, or others) may be involved.

9.1.2 Sequence of Lock-out or Tag-out System Procedure

Notify affected employees that a lock-out or tag-out system is using used and the reason for its use. The authorized employee shall know the type and magnitude of energy that the machine or equipment uses and shall understand the hazards associated with the machine or equipment.

If the machine or equipment is operating, shut it down by the normal stopping procedure (depress stop button, open toggle switch, etc.).

Operate the switch, valve, or other energy isolating devices so that the equipment is isolated from its energy sources. Stored energy (such as in springs, elevated machine members, rotating flywheels, hydraulic systems, and air, gas, steam, or water pressure) shall be dissipated or restrained by methods such as repositioning, blocking, or bleeding down.

Lock-out/tag-out the energy-isolating devices with assigned individual locks or tags.

To verify that all energy sources have been disconnected, operate the push button or other normal operating controls to make certain the equipment will not operate. CAUTION: Return operating controls to neutral or off position after the test.

The equipment is now locked out or tagged out.

9.1.3 Restoring Machines or Equipment to Normal Operations

After the maintenance activity is complete and equipment is ready for normal operations, check the area around the machines or equipment to ensure that no one is exposed.

After all tools have been removed from the machine or equipment, guards have been reinstalled, and employees are in the clear, remove all lock-out or tag-out devices. Operate the energy-isolating devices to restore energy to the machine or equipment.

9.1.4 Electrical Safety and Lock-out/Tag-out

In the preceding steps, if more than one individual is required to lock-out or tag-out equipment, each shall place his own personal lock-out/tag-out device on the energy-isolating devices. When an energy-isolating device cannot accept multiple locks or tags, a multiple lock-out or tag-out device such as a hasp may be used. If lock-out is used, a single lock may be used to lock out the machine or equipment with the key being placed in a lock-out box or cabinet that allows the use of multiple locks to secure it. Each employee will then use his own lock to secure the box or cabinet. As each person no longer needs to maintain his lock-out protection, that person will remove his lock from the box or cabinet.

9.1.5 Temporary Removal of Lock-out/Tag-out Devices

In situations where lock-out/tag-out devices are temporarily removed from the energy-isolating device and the machine or equipment energized to test or position the machine, equipment, or component, the following sequence of actions will be followed:

1. Remove non-essential items and ensure that the machine or equipment components are operationally intact.

2. Notify affected employees that the lock-out/tag-out devices have been removed and verify that all employees have been safely positioned or removed from the area.

3. Have employees who applied the lock-out/tag-out devices remove the lock-out/tag-out devices.

4. Energize and proceed with testing or positioning.

5. De-energize all systems and reapply energy control measures in accordance with section 9.1.2 of these procedures.

9.1.6 Common Pitfalls of Lock-out/Tag-out

The lock-out/tag-out procedure is to be adhered to in all situations when working on electrically powered equipment. The following is a list of common pitfalls of lock-out/tag-out systems that are to be avoided:

1. Failure to use the lock.

2. Locking through another lock instead of through the device to be locked out.

3. Leaving the key in the lock.

4. Asking others to attached the lock.

5. Failure to use tags.

6. Failure to check inside the switch box to confirm with a voltage meter that the power has been disconnected.

7. Pulling fuses without performing a lock out.

8. Failure to identify all switches and disconnects in-line with equipment.

9. Assuming the equipment is inoperable and failing to lock out.

10. Assuming the job is too small to merit locking out.

10 EMERGENCY PROCEDURES AND EQUIPMENT

10.1 Emergency Contacts and Directions

Emergency Phone Numbers: *AMBULANCE:* *911*

POLICE: *911 or (607) 687-2233*

FIRE: *911 or (607) 687-1201*

Nearest Hospital: **Wilson Memorial Regional Medical Center**

Address: *57 Harrison St*

Johnson City, NY

(607) 763-6000

A Hospital Route Map is attached to this HASP as Appendix C.

Driving directions to Wilson Memorial Regional Hospital (Johnson City, NY) (estimated driving time 22 minutes, distance 19.8 miles):	
Turn left onto CR-20 / Taylor Rd	1.2 miles
Turn left onto SR-17C	1.3 miles
Take ramp right for RT-17 toward Elmira / Binghamton / Jamestown	0.2 mile
Bear right onto RT-17 Access Rd	0.3 mile
Take ramp right and follow signs for SR-17 / Southern Tier Expy East	14.2 miles
At exit 69, take ramp right for SR-17C toward Westover	2.5 miles
Turn right onto Harrison St	0.1 mile
Arrive at 57 Harrison St *The last intersection is SR-17C / Main St. If you reach Park Pl, you've gone too far.*	

Additional Emergency Phone Numbers:

Sanmina-SCI: (607) 689-5000

Agency for Toxic Substances and Disease Registry: (404) 639-0615

National Poison Control Center: (800) 764-7661

10.2 Emergency Equipment

First aid equipment is available at the following locations:

Fire Extinguisher: In GSC vehicles.

Emergency Eye Wash: In GSC vehicles.

First Aid Kit: In GSC vehicles.

10.3 Exposure Symptoms for Chemicals

Emergency medical information for the Site's principal substances is included in Appendix A. This information is from the NIOSH Pocket Guide online at http://www.cdc.gov/niosh/npg/npg.html.

10.4 First Aid

First aid for contact with materials or groundwater contaminated with the ten substances listed as significant in this HASP is described below.

10.4.1 Eye Contact

If contaminated groundwater contacts the eyes, immediately wash the eyes with large amounts of water, occasionally lifting the lower and upper lids.

10.4.2 Skin Contact

If contaminated groundwater contacts the skin, promptly wash the contaminated skin with soap and water. If this chemical penetrates the clothing, promptly remove the clothing and wash the skin with soap and water.

10.4.3 Inhalation

If a person breathes in significant VOC vapors, move the exposed person to fresh air at once.

10.4.4 Ingestion

Ingestion is not considered to be a likely route of exposure.

10.4.5 Contact with Separate-Phase Solvent

In case of contact with separate-phase solvent, follow the first aid procedures described above and get medical attention immediately. If breathing has stopped as a result of vapor inhalation, perform rescue breathing. Keep the affected person warm and at rest and get medical attention immediately.

10.5 Emergency Procedures

10.5.1 Personnel Injury

All injuries, no matter how minor, will be reported to the Project Manager or Health and Safety Officer and will be logged and recorded.

Upon notification of an injury, work will cease and the injured person will be removed from the work area. The Site Safety Officer and/or field team members will assess the nature of the injury, will initiate the appropriate first aid, and will arrange for transportation to the designated medical facility, if required. If the injury increases the risk to other Site workers, activities on site will not resume until the added risk is removed or minimized.

10.5.2 Fire Explosion

In the event of fire or explosion, all personnel will immediately evacuate the site and will move to a safe distance from the affected area. The emergency phone number (911) or local fire department number (607 687-1201) shall be contacted. If it is safe to do so, site personnel may use firefighting equipment available on-site to control or extinguish the fire, and may attempt to isolate flammable materials that may contribute to the fire.

10.5.3 Equipment Failure

If equipment, including personal protective equipment, fails to operate properly, the Site Safety Officer or Project Manager will determine the effect of this failure on continuing the planned activity. If the failure affects the safety of personnel or prevents completion of tasks, work will cease until the equipment is repaired or until other appropriate actions are taken.

Following all emergency situations, work will not resume until:

1. The conditions resulting in the emergency have been corrected.

2. The hazards have been reassessed.

3. This Health and Safety Plan has been reviewed.

4. Site personnel have been briefed on changes to this Health and Safety Plan.

11 ACKNOWLEDGMENT OF PLAN

All site workers performing intrusive work activities shall have completed 40 hours of HAZWOPER safety training under the requirements of 29 CFR 1910.120 and 8 hours of annual HAZWOPER refresher training within the past 12 months. Certificates shall be supplied and kept on file with GSC.

By signing in the designated space below, GSC personnel acknowledge that they have read this Health and Safety Plan and are familiar with its provisions.

Name	Title	Signature

If a subcontractor does not have a site-specific health and safety plan, then they may accept and acknowledge this HASP with their modifications, if any, or prepare a HASP at least as stringent as this HASP. If the subcontractor chooses to accept this HASP for its own use, then the subcontractor shall sign this HASP in the designated space below. In so doing, the subcontractor accepts full responsibility for the use of this HASP by the subcontractor and subcontractor's employees. The subcontractor agrees to fully indemnify GSC and IBM from any and all liability arising out of reliance on this HASP by the subcontractor's employees.

Name	Company	Signature

APPENDIX A

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS INFORMATION FOR SIGNIFICANT VOCs AT THE SITE

NIOSH Pocket Guide to Chemical Hazards

1,1-Dichloroethane	**CAS** 75-34-3
$CHCl_2CH_3$	**RTECS** KI0175000
Synonyms & Trade Names Asymmetrical dichloroethane; Ethylidene chloride; 1,1-Ethylidene dichloride	**DOT ID & Guide** 2362 130

Exposure Limits	NIOSH REL: TWA 100 ppm (400 mg/m^3) See Appendix C (Chloroethanes)
	OSHA PEL: TWA 100 ppm (400 mg/m^3)

IDLH 3000 ppm	**Conversion** 1 ppm = 4.05 mg/m^3

Physical Description
Colorless, oily liquid with a chloroform-like odor.

MW: 99.0	BP: 135°F	FRZ: -143°F	Sol: 0.6%
VP: 182 mmHg	IP: 11.06 eV		Sp.Gr: 1.18
Fl.P: 2°F	UEL: 11.4%	LEL: 5.4%	

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities
Strong oxidizers, strong caustics

Measurement Methods
NIOSH 1003; OSHA 7

Personal Protection & Sanitation Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated Remove: When wet (flammable) Change: No recommendation	**First Aid** (See procedures) Eye: Irrigate immediately Skin: Soap flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Respirator Recommendations NIOSH/OSHA
Up to 1000 ppm: (APF = 10) Any supplied-air respirator
Up to 2500 ppm: (APF = 25) Any supplied-air respirator operated in a continuous-flow mode
Up to 3000 ppm: (APF = 50) Any self-contained breathing apparatus with a full facepiece/(APF = 50) Any supplied-air respirator with a full facepiece
Emergency or planned entry into unknown concentrations or IDLH conditions: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation skin; central nervous system depression; liver, kidney, lung damage

Target Organs Skin, liver, kidneys, lungs, central nervous system

See also: INTRODUCTION

NIOSH Pocket Guide to Chemical Hazards

1,2-Dichloroethylene	**CAS** 540-59-0
ClCH=CHCl	**RTECS** KV9360000
Synonyms & Trade Names Acetylene dichloride, cis-Acetylene dichloride, trans-Acetylene dichloride, sym-Dichloroethylene	**DOT ID & Guide** 1150 132P

Exposure Limits	NIOSH REL: TWA 200 ppm (790 mg/m^3)
	OSHA PEL: TWA 200 ppm (790 mg/m^3)
IDLH 1000 ppm	**Conversion** 1 ppm = 3.97 mg/m^3

Physical Description
Colorless liquid (usually a mixture of the cis & trans isomers) with a slightly acrid, chloroform-like odor.

MW: 97.0	BP: 118-140°F	FRZ: -57 to -115°F	Sol: 0.4%
VP: 180-265 mmHg	IP: 9.65 eV		Sp.Gr(77°F): 1.27
Fl.P: 36-39°F	UEL: 12.8%	LEL: 5.6%	

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities
Strong oxidizers, strong alkalis, potassium hydroxide, copper [Note: Usually contains inhibitors to prevent polymerization.]

Measurement Methods
NIOSH 1003; OSHA 7

Personal Protection & Sanitation	**First Aid** (See procedures)
Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated Remove: When wet (flammable) Change: No recommendation	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Respirator Recommendations NIOSH/OSHA
Up to 2000 ppm: (APF = 25) Any supplied-air respirator operated in a continuous-flow mode£/(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)£/(APF = 50) Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s)/(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/(APF = 50) Any self-contained breathing apparatus with a full facepiece/(APF = 50) Any supplied-air respirator with a full facepiece
Emergency or planned entry into unknown concentrations or IDLH conditions: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, respiratory system; central nervous system depression

Target Organs Eyes, respiratory system, central nervous system

See also: INTRODUCTION

NIOSH Pocket Guide to Chemical Hazards

Methyl chloroform	**CAS** 71-55-6
CH_3CCl_3	**RTECS** KJ2975000
Synonyms & Trade Names Chlorothene; 1,1,1-Trichloroethane; 1,1,1-Trichloroethane (stabilized)	**DOT ID & Guide** 2831 160

Exposure Limits	NIOSH REL: C 350 ppm (1900 mg/m^3) [15-minute] See Appendix C (Chloroethanes)
	OSHA PEL†: TWA 350 ppm (1900 mg/m^3)

IDLH 700 ppm	**Conversion** 1 ppm = 5.46 mg/m^3

Physical Description
Colorless liquid with a mild, chloroform-like odor.

MW: 133.4	BP: 165°F	FRZ: -23°F	Sol: 0.4%
VP: 100 mmHg	IP: 11.00 eV		Sp.Gr: 1.34
Fl.P: ?	UEL: 12.5%	LEL: 7.5%	

Combustible Liquid, but burns with difficulty.

Incompatibilities & Reactivities
Strong caustics; strong oxidizers; chemically-active metals such as zinc, aluminum, magnesium powders, sodium & potassium; water [Note: Reacts slowly with water to form hydrochloric acid.]

Measurement Methods
NIOSH 1003

Personal Protection & Sanitation Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated Remove: When wet or contaminated Change: No recommendation	**First Aid** (See procedures) Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Respirator Recommendations NIOSH/OSHA
Up to 700 ppm: (APF = 10) Any supplied-air respirator*/(APF = 50) Any self-contained breathing apparatus with a full facepiece
Emergency or planned entry into unknown concentrations or IDLH conditions: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin; headache, lassitude (weakness, exhaustion), central nervous system depression, poor equilibrium; dermatitis; cardiac arrhythmias; liver damage

Target Organs Eyes, skin, central nervous system, cardiovascular system, liver

See also: INTRODUCTION

NIOSH Pocket Guide to Chemical Hazards

Trichloroethylene	**CAS** 79-01-6
$ClCH=CCl_2$	**RTECS** KX4550000
Synonyms & Trade Names Ethylene trichloride, TCE, Trichloroethene, Trilene	**DOT ID & Guide** 1710 160

Exposure Limits	NIOSH REL: Ca See Appendix A See Appendix C
	OSHA PEL†: TWA 100 ppm C 200 ppm 300 ppm (5-minute maximum peak in any 2 hours)
IDLH Ca [1000 ppm]	**Conversion** 1 ppm = 5.37 mg/m^3

Physical Description
Colorless liquid (unless dyed blue) with a chloroform-like odor.

MW: 131.4	BP: 189°F	FRZ: -99°F	Sol(77°F): 0.1%
VP: 58 mmHg	IP: 9.45 eV		Sp.Gr: 1.46
Fl.P: ?	UEL(77°F): 10.5%	LEL(77°F): 8%	

Combustible Liquid, but burns with difficulty.

Incompatibilities & Reactivities
Strong caustics & alkalis; chemically-active metals (such as barium, lithium, sodium, magnesium, titanium & beryllium)

Measurement Methods
NIOSH 1022, 3800; OSHA 1001

Personal Protection & Sanitation Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated Remove: When wet or contaminated Change: No recommendation Provide: Eyewash, Quick drench	**First Aid** (See procedures) Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Respirator Recommendations NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen]

Target Organs Eyes, skin, respiratory system, heart, liver, kidneys, central nervous system

Cancer Site [in animals: liver & kidney cancer]

See also: INTRODUCTION

NIOSH Pocket Guide to Chemical Hazards

Vinyl chloride	**CAS** 75-01-4
CH_2=CHCl	**RTECS** KU9625000
Synonyms & Trade Names Chloroethene, Chloroethylene, Ethylene monochloride, Monochloroethene, Monochloroethylene, VC, Vinyl chloride monomer (VCM)	**DOT ID & Guide** 1086 116P

Exposure Limits	NIOSH REL: Ca See Appendix A
	OSHA PEL: [1910.1017] TWA 1 ppm C 5 ppm [15-minute]

IDLH Ca [N.D.]	**Conversion** 1 ppm = 2.56 mg/m^3

Physical Description
Colorless gas or liquid (below 7°F) with a pleasant odor at high concentrations. [Note: Shipped as a liquefied compressed gas.]

MW: 62.5	BP: 7°F	FRZ: -256°F	Sol(77°F): 0.1%
VP: 3.3 atm	IP: 9.99 eV	RGasD: 2.21	
Fl.P: NA (Gas)	UEL: 33.0%	LEL: 3.6%	

Flammable Gas

Incompatibilities & Reactivities
Copper, oxidizers, aluminum, peroxides, iron, steel [Note: Polymerizes in air, sunlight, or heat unless stabilized by inhibitors such as phenol. Attacks iron & steel in presence of moisture.]

Measurement Methods
NIOSH 1007; OSHA 4, 75

Personal Protection & Sanitation Skin: Frostbite Eyes: Frostbite Wash skin: No recommendation Remove: When wet (flammable) Change: No recommendation Provide: Frostbite	**First Aid** (See procedures) Eye: Frostbite Skin: Frostbite Breathing: Respiratory support

Respirator Recommendations NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin, and/or eye contact (liquid)

Symptoms Lassitude (weakness, exhaustion); abdominal pain, gastrointestinal bleeding; enlarged liver; pallor or cyanosis of extremities; liquid: frostbite; [potential occupational carcinogen]

Target Organs Liver, central nervous system, blood, respiratory system, lymphatic system

Cancer Site [liver cancer]

See also: INTRODUCTION

NIOSH Pocket Guide to Chemical Hazards

Vinylidene chloride	**CAS** 75-35-4
$CH_2=CCl_2$	**RTECS** KV9275000
Synonyms & Trade Names 1,1-DCE; 1,1-Dichloroethene; 1,1-Dichloroethylene; VDC; Vinylidene chloride monomer; Vinylidene dichloride	**DOT ID & Guide** 1303 129P (inhibited)

Exposure Limits	NIOSH REL: Ca See Appendix A
	OSHA PEL†: none

IDLH Ca [N.D.]	**Conversion**

Physical Description
Colorless liquid or gas (above 89°F) with a mild, sweet, chloroform-like odor.

MW: 96.9	BP: 89°F	FRZ: -189°F	Sol: 0.04%
VP: 500 mmHg	IP: 10.00 eV		Sp.Gr: 1.21
Fl.P: -2°F	UEL: 15.5%	LEL: 6.5%	

Class IA Flammable Liquid: Fl.P. below 73°F and BP below 100°F.

Incompatibilities & Reactivities
Aluminum, sunlight, air, copper, heat [Note: Polymerization may occur if exposed to oxidizers, chlorosulfonic acid, nitric acid, or oleum. Inhibitors such as the monomethyl ether of hydroquinone are added to prevent polymerization.]

Measurement Methods
NIOSH 1015; OSHA 19

Personal Protection & Sanitation Skin: Prevent skin contact Eyes: Prevent eye contact Wash skin: When contaminated Remove: When wet (flammable) Change: No recommendation Provide: Eyewash, Quick drench	**First Aid** (See procedures) Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Respirator Recommendations NIOSH
At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration: (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus
Escape: (APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms Irritation eyes, skin, throat; dizziness, headache, nausea, dyspnea (breathing difficulty); liver, kidney disturbance; pneumonitis; [potential occupational carcinogen]

Target Organs Eyes, skin, respiratory system, central nervous system, liver, kidneys

Cancer Site [in animals: liver & kidney tumors]

See also: INTRODUCTION

APPENDIX B

RELATIVE RESPONSE TABLE FOR FIELD MONITORING EQUIPMENT

Table 1. Relative Response of Field Monitoring Equipment to Selected Compounds

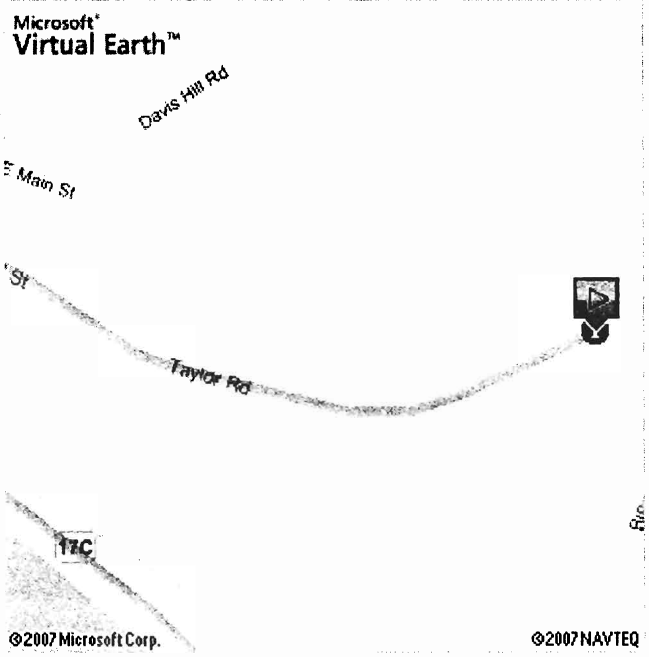
Compound	IP (eV)	PID (<10.2eV)	FID (<15.4eV)	%LEL	Odor Threshold (ppm)	TWA (ppm)	STEL (ppm)
p-xylene	8.44	E	E	1.1	NA	100	150
o,m-xylene	8.56	E	E	0.9	NA	100	150
ethylbenzene	8.76	E	E	0.8	0.092-0.60	100	125
toluene	8.82	E	E	1.1	0.16-37	100 (C300)	150
1,2-dichlorobenzene	9.06	E	NA	2.2	0.70	C50	NA
chlorobenzene	9.07	E	NA	1.3	1.3	75	NA
benzene	9.24	E	E	1.2	34-119	0.1	1
tetrachloroethene	9.32	G	F		47	25 (C200)	NA
trichloroethene	9.45	G	G	8.0	82	50 (C200)	200
methyl ethyl ketone (2-butanone)	9.54	G	G	1.4	1-30	200	300
cis/trans-1,2-dichloroethene	9.65	G	NA	5.6	0.08-17	200	NA
acetone (2-propanone)	9.69	G	E	2.5	3.6-653	250	NA
vinyl chloride	9.99	F	F	3.6	10-20	1 (C5)	NA
1,1-dichloroethene	10.00	G	NA	6.5	NA	1	NA
chloroethane	10.97	NR	E	3.8	4.2	1000	NA
1,1,1-trichloroethane	11.00	NR	E	7.5	390	C350	NA
1,1,2-trichloroethane	11.00	NR	NA	6.0	0.5-167	10	NA
1,2-dichloroethane	11.05	NR	G	6.2	6-185	1	2
1,1-dichloroethane	11.06	NR	NA	5.4	49-1359	100	NA
methylene chloride	11.32	NR	G-E	13	160	25	125
chloroform	11.42	NR	G	NR	133-276		2
dichlorodifluoromethane (Freon 12)	11.75	NR	F-P	NR	NA	1000	NA
trichlorofluoromethane (Freon 11)	11.77	NR	F-P	NR	5-100	C1000	NA
1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113)	11.99	NR	G	NR	0.5-200	1000	1250

IP = ionization potential
PID = photoionization detector
FID = flame ionization detector
%LEL = percent lower explosive limit (for explosimeter)
ppm = parts per million
TWA = 8-hour time-weighted average: value listed is the lowest of NIOSH and OSHA values
STEL = short-term exposure limit: value listed is the lowest of NIOSH and OSHA values
C = ceiling value, do not exceed
NR = no response (i.e., compound is not flammable or has a higher IP than the detector)
NA = not available
Response relative to methane standard for PID or benzene standard for FID:
E = excellent G = good F = fair P = poor

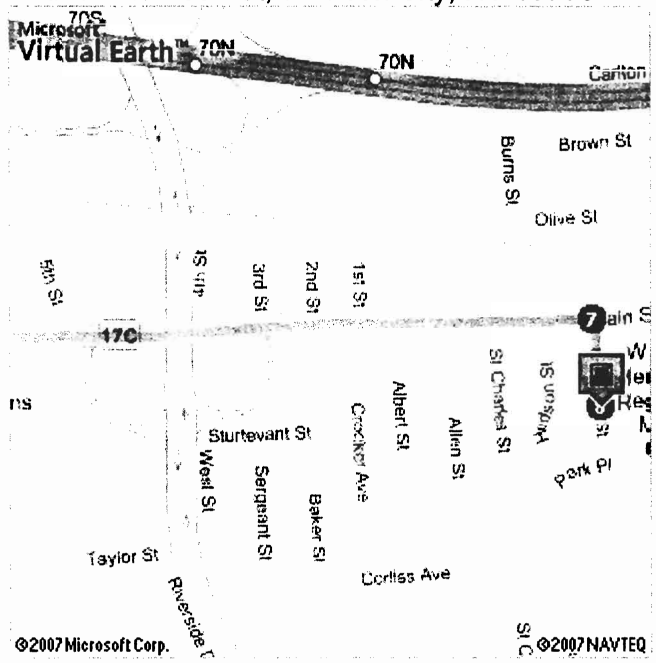
APPENDIX C

HOSPITAL ROUTE MAP

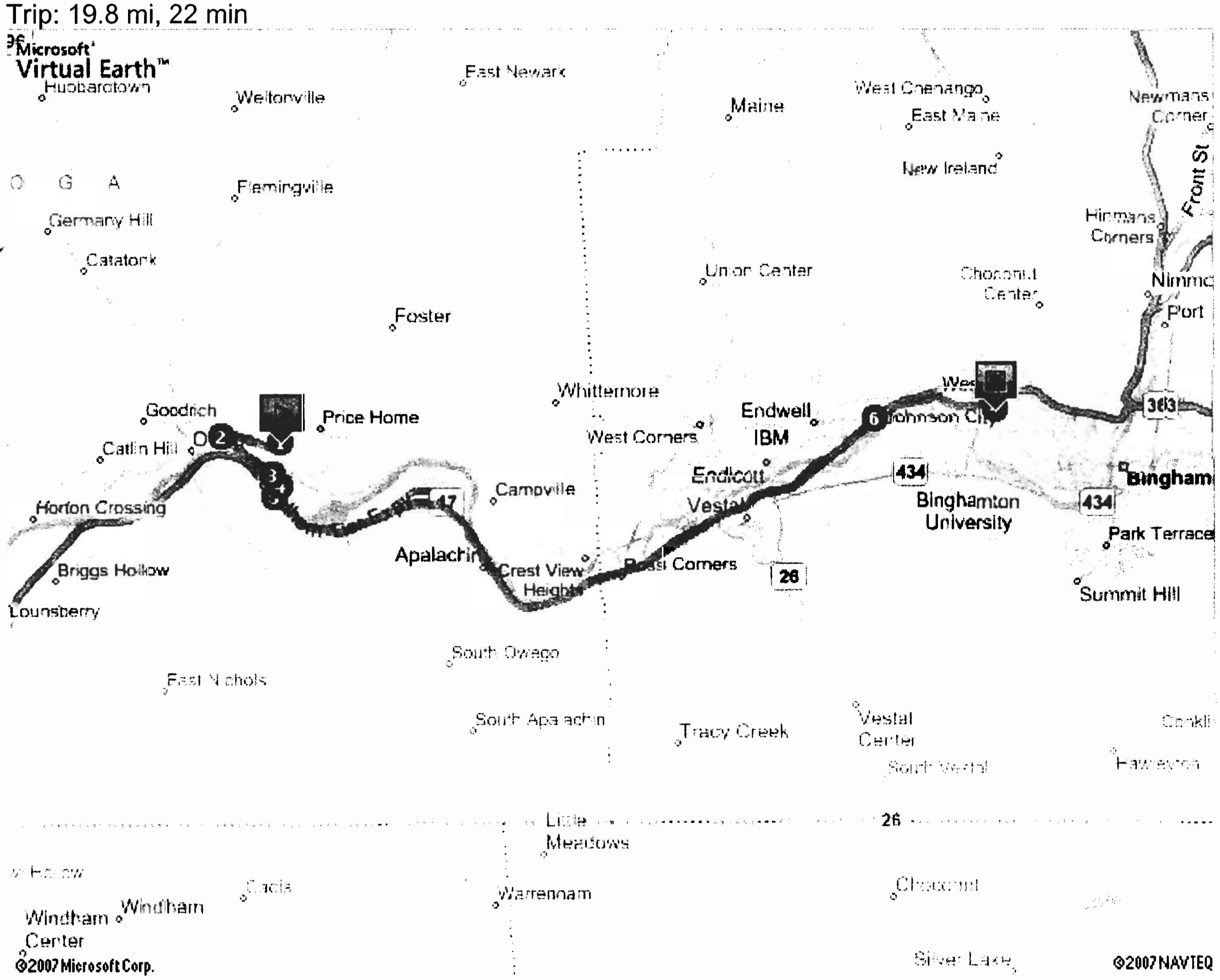
Start: 1200 Taylor Rd, Owego, NY 13827-1292



End: 57 Harrison St, Johnson City, NY 13790



Trip: 19.8 mi, 22 min



The image above reflects the map view when you clicked the print icon

APPENDIX D

CONTRACTOR'S GUIDE