DE&S
Duke Engineering & Services

932036

Phase II Remedial Investigation of the Former Carborundum Company Electric Products Division, Hyde Park Facility, Town of Niagara, Niagara County, New York

FINAL REPORT

SITE NO. 932036

Prepared For:
BP America
200 Public Square, 7-1
Cleveland, Ohio
44114-2375

Prepared By:
Duke Engineering & Services Inc.
Austin, Texas

August 1998

TM7077

DE&S
Duke Engineering & Services (Canada), Inc.

3075 14th Avenue, Suite 207
Markham, Ontario L3R 0G9

905-513-9400
Fax 905-513-9405

RECEIVED
NOV 20 1998
NYSDEC - REG. 9
FOIL
__REL __UNREL

Phase II Remedial Investigation of the Former Carborundum Company Electric Products Division, Hyde Park Facility, Town of Niagara, Niagara County, New York

FINAL REPORT

SITE NO. 932036

Prepared For:	BP America 200 Public Square, 7-1 Cleveland, Ohio 44114-2375
Prepared By:	Duke Engineering & Services Inc Austin, Texas

TM7077

August 1998

EXECUTIVE SUMMARY

The Former Carborundum Company's Electric Products Division facility in Niagara Falls is listed on the New York State Department of Environmental Conservation's (NYSDEC) list of Inactive Hazardous Waste Disposal Sites. Prior to 1993, NYSDEC had classified the site as 2a, indicating that there was insufficient information about the site to make further classification. Following a Preliminary Site Assessment (PSA) in 1992, NYSDEC classified the site as a Class 2 Inactive Hazardous Waste Disposal Site.

Duke Engineering and Services [DE&S] (formerly INTERA Inc.) was retained by The Carborundum Company to undertake a remedial investigation/feasibility study (RI/FS) of its former Electric Products Division facility in 1996. The RI included the installation of shallow and deep monitoring wells, collection of soil and groundwater samples, a fish and wildlife survey, and a risk assessment. The results of the RI are presented in the final RI report (INTERA 1997a). Following completion of the RI, some questions remained about the extent and character of the soil and groundwater contamination at the site. A Phase II RI was performed to address these questions. This report presents the results of the Phase II RI.

Specifically, the purpose of the Phase II RI was to:

- Determine groundwater quality in bedrock down gradient of the facility,
- Establish groundwater quality across the site through a round of groundwater sampling
- Determine soil quality along the eastern property boundary, and
- Incorporate the soil quality data into the existing risk assessment.

To address these questions, a field program was implemented that included the installation of one bedrock monitoring well down gradient of the site, purging and re-sampling of all groundwater monitoring wells on site, installation of four boreholes for soil sampling along the eastern fence line, and the collection of four surface soil samples along the eastern fence line. All soil and groundwater samples were submitted to a laboratory for volatile organic compounds (VOCs) analysis.

The results of VOC analysis on the groundwater sample collected from the newly-installed, down-gradient bedrock well indicate that vinyl chloride and 1,2-dichloroethene exist in groundwater down gradient of the site at concentrations that exceed NYSDEC Water Quality Standards/Regulations.

The results of VOC analysis on groundwater samples collected from the shallow, overburden wells on-site indicate that vinyl chloride, 1,2-dichloroethene, trichloroethene, benzene and 1,1-dichloroethane exist in groundwater in the overburden at concentrations that exceed NYSDEC Water Quality Standards/Regulations. In general, concentrations of VOCs have decreased since the last sampling event except for the following increases:

- 1,1-dichloroethane in MW-2A,
- vinyl chloride in MW-4A ,
- 1,2-dichloroethene and 1,1-dichloroethane in MW-7A , and
- vinyl chloride and 1,2-dichloroethene in MW-10A.

The results of VOC analysis on groundwater samples collected from the bedrock wells onsite indicate that vinyl chloride, 1,2-dichloroethene, and trichloroethene exist in groundwater in the bedrock at concentrations that exceed NYSDEC Water Quality Standards/Regulations. In general, concentrations of VOCs have decreased since the last sampling event except for the following increases:

- vinyl chloride and cis- and trans-1,2-dichloroethene in MW-11B,
- vinyl chloride in MW-12B, and
- vinyl chloride in MW-14B.

The results of VOC analysis on soil samples collected from boreholes completed to 20 ft below ground surface along the eastern fence line indicate that 1,2-dichloroethene exists in subsurface soils at a concentration that exceeds NYSDEC Soil Cleanup Objectives. The extent of soil contamination in the eastern portion of the site determined during the RI was therefore modified to incorporate the area of newly discovered contaminated soil. This modification added another 800 yds^3 to the existing estimate for a total volume of VOC-contaminated soil of 19,800 yds^3.

The results of VOC analysis on surface soil samples collected along the eastern fence line indicate that VOCs are not present in shallow soils in this area.

The results of the VOC analyses were used to update the preliminary risk assessment performed during the RI.

It is recommended that:

1. An Interim Remedial Measure be undertaken to remove the soils from the property.
2. A program of groundwater monitoring be implemented to monitor the change in COC concentrations in groundwater on and off-site, over time; and
3. The FS component of the RI/FS process be initiated to proceed concurrently with the Interim Remedial Measure.

TABLE OF CONTENTS

Page

1. INTRODUCTION

The Carborundum Company's Hyde Park facility ("site" or "facility") in Niagara Falls is listed on the New York State Department of Environmental Conservation's (NYSDEC) list of Inactive Hazardous Waste Disposal Sites, and is classified as a Class 2 site. By definition, a Class 2 site presents a significant threat to public health or the environment and requires mitigative action.

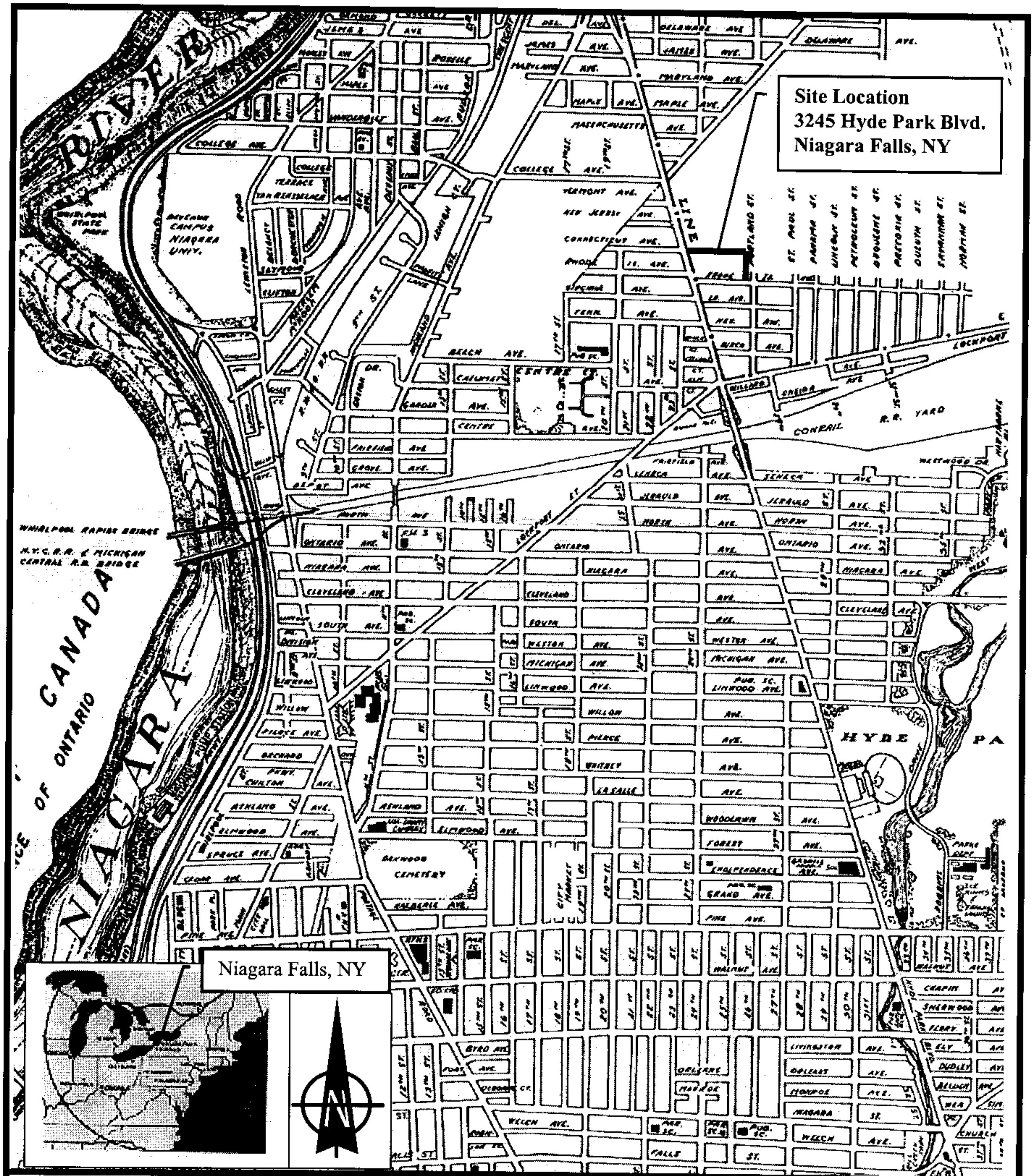
A Remedial Investigation (RI) was undertaken at the site by INTERA Consultants, Ltd. (now Duke Engineering and Services [DE&S]) during the period April and May 1996. The RI was documented in a report entitled "Remedial Investigation of the former Carborundum Company Electrical Products Division, Hyde Park Facility, Town of Niagara, Niagara County, New York". The final report was dated August 1997. NYSDEC and New York State Department of Health (NYSDOH) requested that further work be conducted in the form of a Phase II RI to address specific concerns raised by the State. This report presents the results of the Phase II RI and is intended for use in conjunction with the RI report (INTERA, 1997a).

A location map is provided in Figure 1.1

1.1 PURPOSE

The purpose of this Phase II RI is to supplement data collected during the RI and to accomplish the following specific objectives:

i) determine groundwater quality in bedrock down gradient of the facility,
ii) establish groundwater quality across the site through a round of groundwater sampling,
iii) determine soil quality along the eastern property boundary, and
iv) incorporate the soil quality data into the existing risk assessment.



Duke Engineering & Services (Canada), Inc.

Figure 1.1

Site Location Map

1.2 SCOPE OF WORK

The scope of work for the Phase II RI is outlined in the sections below.

1.2.1 Project Plans

A Phase II RI Work Plan was prepared and submitted to NYSDEC for approval prior to commencing the field investigation. Several documents used during the RI were approved for use during the Phase II RI and, therefore, were not resubmitted. These documents include the Health and Safety Plan, Quality Assurance Project Plan and Citizen Participation Plan. These plans are referenced as follows:

Intera Inc. (1997b)	Phase II Remedial Investigation Work Plan for The Former Carborundum Company - Electric Products Division Hyde Park Facility, Town of Niagara, Niagara County, New York, Site No. 932036, August 1997
Intera Inc. (1995a)	Remedial Investigation/Feasibility Study Health and Safety Plan for The Former Carborundum Company - Electric Products Division Hyde Park Facility, Town of Niagara, Niagara County, New York, Site No. 932036, August 1995
Intera Inc. (1995b)	Quality Assurance Project Plan for Remedial Investigation/Feasibility Study of the Former Carborundum Company - Electric Products Division Hyde Park Facility, Town of Niagara, Niagara County, New York, Site No. 932036, August 1995.
BP Oil (1996)	Citizen Participation Plan for the Carborundum Globar Site Remedial Investigation/Feasibility Study, Niagara Falls, New York. February 12, 1996.

1.2.2 Field Investigation

The field investigation involved the following tasks:

- Borehole and groundwater monitor well installation,
- Groundwater monitoring and sampling, and
- Soil sampling.

1.2.2.1 Borehole and Groundwater Monitor Well Installation

A single borehole and groundwater monitor well was installed southwest and down gradient of the facility. The well was completed in bedrock for the purpose of determining groundwater quality off-site and down gradient.

1.2.2.2 Groundwater Monitoring and Sampling

Existing monitor wells and the newly installed bedrock groundwater monitor well were sampled following purging and well development. Groundwater samples were submitted for laboratory analysis for previously determined contaminants of concern (COCs) including vinyl chloride, trichloroethene, 1,2-dichloroethene, benzene, and 1,1-dichloroethane. Water level monitoring was conducted in all wells, and the newly installed groundwater monitor well was surveyed for elevation.

1.2.2.3 Soil Sampling

Soil samples were collected from four boreholes located east of the eastern property boundary but within the fenced area of the facility to supplement previous soil sampling and to further define the extent of soil contamination in the fill material and in the natural overburden in the eastern portion of the site. In addition, four surface soil samples were collected from the fence line along the eastern portion of the facility. Surface soil sample locations were selected by the NYSDOH. Soil samples were analyzed for VOCs.

1.2.3 Preliminary Risk Assessment

The preliminary risk assessment completed during the RI was updated by incorporating the Phase II RI soil sampling results. This updated risk assessment was performed to determine potential impacts to residential property owners to the east.

2. PHASE II REMEDIAL INVESTIGATION

The Phase II RI is described under the following headings:

- Previously Determined Nature and Extent of Soil and Groundwater Contamination,
- Phase II RI Field Investigation, and
- Updated Preliminary Risk Assessment.

2.1 PREVIOUSLY DETERMINED NATURE AND EXTENT OF CONTAMINATION

A discussion of the nature and extent of contamination as determined by the 1996 RI is provided as a background to the Phase II Remedial Investigation.

2.1.1 Groundwater Contamination

Groundwater from 13 of the 14 bedrock wells sampled during the 1996 RI contained VOCs above NYSDEC Water Quality Regulations (1991, 6NYCRR Part 703) or Ambient Water Quality Standards (1991, TOGS 1.1.1). Groundwater from 6 of the 11 overburden wells contained VOCs above NYSDEC Water Quality Regulations/Standards. Figure 2.1 depicts selected groundwater VOC analytical results from the RI.

2.1.2 Soil Contamination

Four areas at the site were found during the RI to contain VOCs, polycyclic aromatic hydrocarbons (PAHs), acetone, and/or xylenes in soil samples above NYSDEC Recommended Cleanup Objectives (NYSDEC HWR-92-4046, Nov. 1992). These areas of soil contamination include:

- A large area in the central eastern portion of the site and extending to the eastern property boundary that is contaminated with trichloroethene and 1,2-dichloroethene,
- A smaller area in the northern portion of the site contaminated with VOCs and PAHs,
- A small area in the southeastern corner of the site contaminated with acetone, and

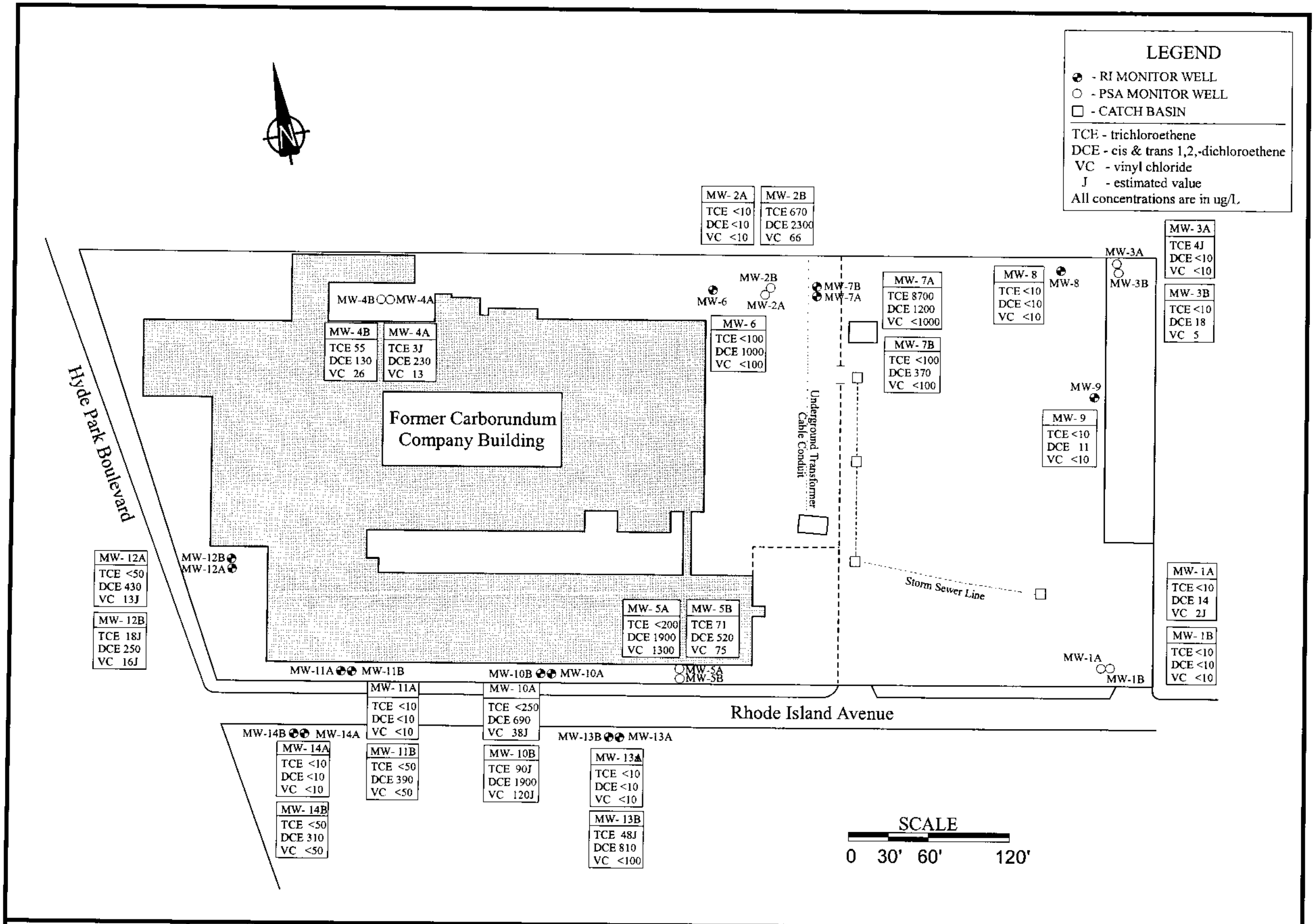


Figure 2.1	Job #: 97-077	Selected Groundwater VOC Analytical Results - May 1996	DE&S Duke Engineering & Services (Canada), Inc.
Date: April 2, 1998	Drawn/File Name: KJS/gvalu085.cdr	Former Carborundum Company - Electric Products Division	

- A small area in the southwestern portion of the site contaminated with xylenes.

Figure 2.2 depicts the previously determined extent of soil contamination.

2.1.3 Contaminants of Concern

Contaminants of concern (COCs) in soils at the site were identified as VOCs and PAHs.

Specific VOCs of concern in soil are listed below.

1,2-dichloroethene
vinyl chloride
acetone
xylenes
trichloroethene
toluene
ethyl benzene

The PAHs are restricted to a small area in the vicinity of the north property fence and railroad spur. Specific PAHs of concern in soil are listed below.

naphthalene
fluorene
anthracene
benzo(a)anthracene
benzo(b)fluoranthene
benzo(a)pyrene
acenaphthylene
phenanthrene
pyrene
chrysene
benzo(k)fluoranthene
indeno(1,2,3cd)pyrene

Other organic and metal contaminants were assessed during previous investigations and are not considered to be COCs.

In groundwater, COCs include soluble VOCs that exceeded NYSDEC Water Quality Regulations/Standards. Specific VOCs of concern in groundwater are listed below.

vinyl chloride
1,2-dichloroethene
trichloroethene
benzene
1,1-dichloroethane

Semi-volatile organic compounds including PAHs, PCBs and pesticides were not detected in any of the groundwater samples collected during previous investigations.

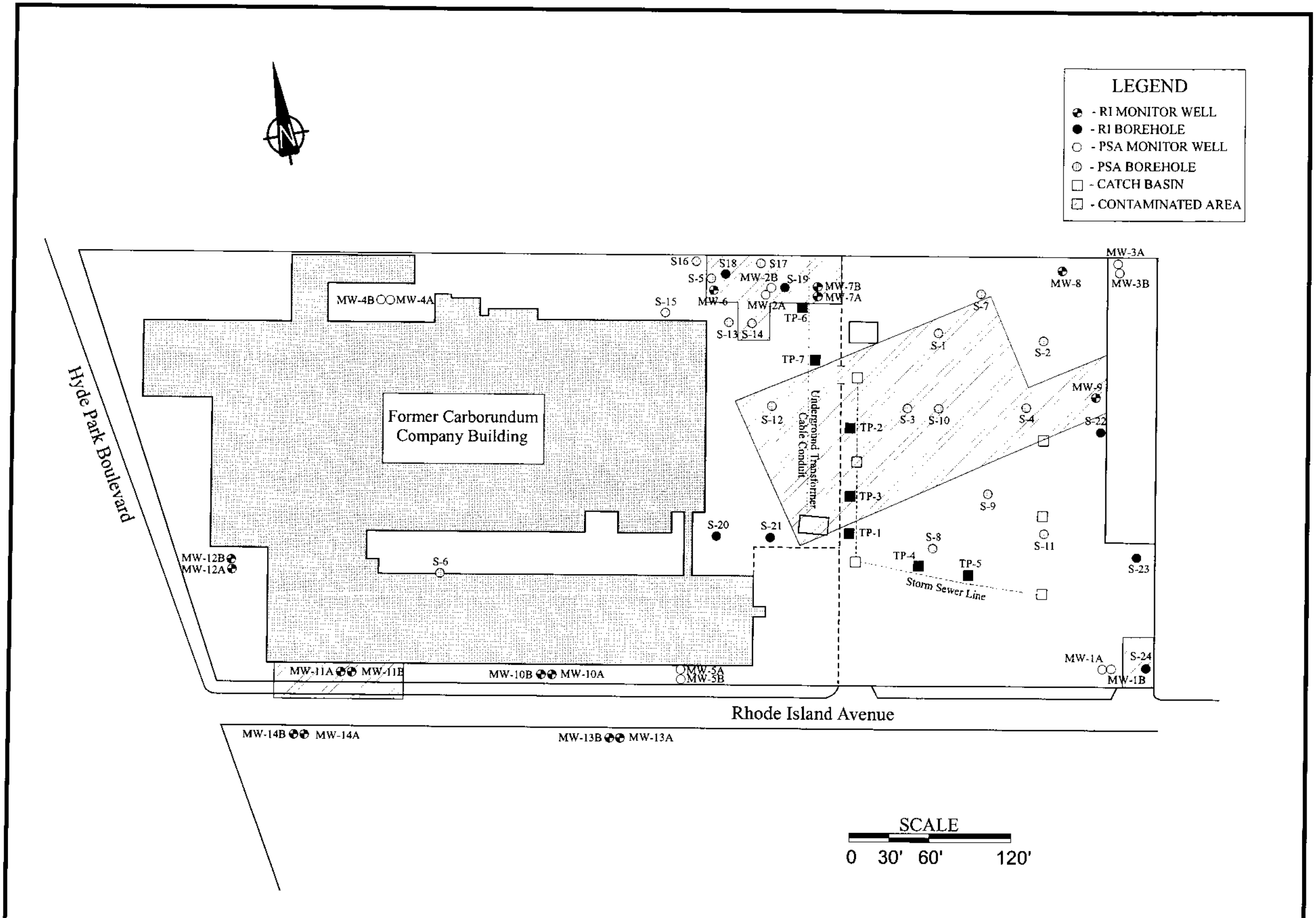


Figure 2.2	Job #: 97-077	Previously Determined Extent of Soil Contamination	DE&S Duke Engineering & Services (Canada), Inc.
Date: April 2, 1998	Drawn/File Name: KJS/carea085.cdr	Former Carborundum Company - Electric Products Division	

2.2 PHASE II RI FIELD INVESTIGATION

The Phase II RI field investigation at the former Carborundum Electric Products Division facility was conducted during the period November 17 to 24, 1997, and is described in this report under the following headings:

- Groundwater Sampling Program and
- Soil Sampling Program.

All on-site activities were conducted according to the health and safety protocols outlined in the Health and Safety Plan (INTERA, 1995a).

2.2.1 Groundwater Sampling Program

The groundwater investigation was conducted according to the program work plan (INTERA, 1997b). The groundwater investigation included: installation and development of one bedrock groundwater monitoring well, water level monitoring and groundwater sampling in all wells for quality.

2.2.1.1 Rationale for Additional Monitoring Well Location

A single borehole and groundwater monitor well was installed southwest and down gradient of the facility for the purpose of determining off-site groundwater quality. The well was installed in the centre lane of Hyde Park Boulevard south of the intersection with Rhode Island Avenue at the location shown on Figure 2.3. The well was identified as MW-15, which is a continuation of previous well numbering.

Drilling on Hyde Park Blvd. was chosen to avoid having to drill on private property, and because of space restrictions associated with overhead wires along the side of the road. Approval to drill in the Highway right-of-way was obtained from New York State Department of Transportation.

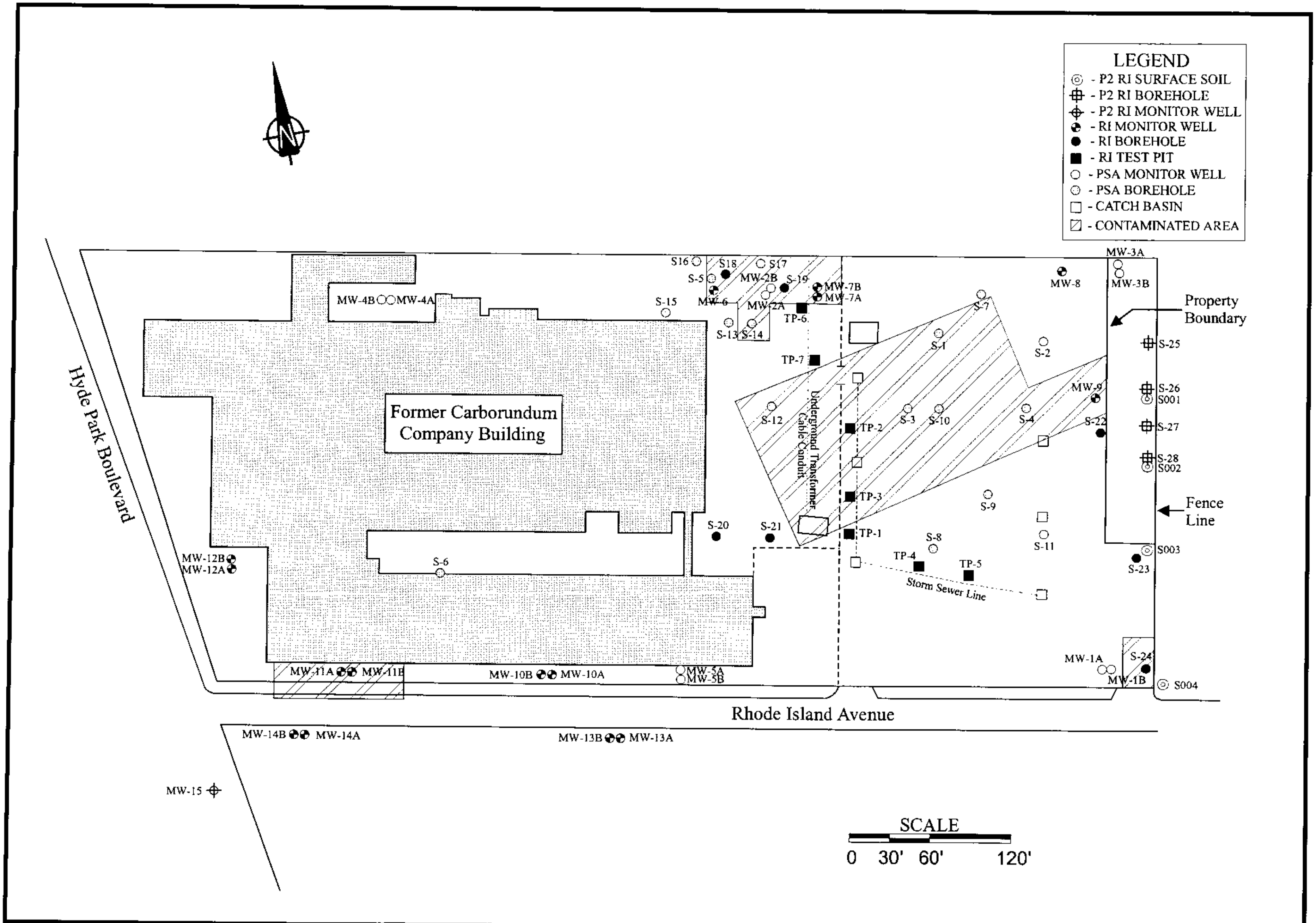


Figure 2.3

Job #: 97-077

Soil and Groundwater Sampling Locations

Date: April 2, 1998

Drawn/File Name: KEH/samploc.cdr

Former Carborundum Company - Electric Products Division

DE&S
Duke Engineering & Services (Canada), Inc.

2.2.1.2 Monitor Well Installation

Drilling for MW-15 was conducted by SJB Services, Inc. of Buffalo, New York on November 20 and 21, 1997 using a truck-mounted CME 55 drill rig with capability for hollow stem augering and air rotary coring. Air rotary was the drilling method of choice because it eliminates the introduction of water into bedrock during drilling An exclusion zone was established around the drill rig with caution tape to prevent unauthorized entry. The drilling contractor placed 6 mil plastic sheeting over the ground surface at the well location to minimize surface contamination. A four foot by eight foot sheet of 5/8-inch thick plywood was placed over the plastic as a working surface and a hole was cut into the plywood to accommodate down-hole tools.

The monitor well was installed into the upper 15 feet of the Lockport Dolomite and completed as a 2-inch ID well. The borehole was advanced using 4.25-inch ID hollow stem augers to the top of bedrock. A temporary 4-inch ID steel casing with a spin bit was advanced into the top of bedrock. An HQ-sized core barrel and drill rods fitted with a diamond bit were used to complete the borehole into bedrock using air rotary methods. The air compressor was equipped with a filter to prevent introduction of contaminants into the borehole.

Ambient air sampling was performed in accordance with the Health and Safety Plan (INTERA, 1995a) during air rotary drilling to ensure that excessive volatilization did not occur. Drill cores were logged by a geologist for lithology, color, texture, fracture density and evidence of contamination. Core was stored in labeled core boxes and retained by BP America.

The monitor well consists of a 10-ft long Schedule 40 PVC screen installed between 18.5 and 28.5 ft below ground surface (BGS). The screen is attached to Schedule 40 PVC riser pipe. A sand pack was backfilled around the screen and extends to approximately 1 ft above the top of the screen. A bentonite seal, 2 ft in thickness, was placed above the sand pack and the hole was completed with a bentonite/Portland cement grout to surface. The well was protected with a flush mounted, surface casing.

2.2.1.3 Well Development

The newly-installed bedrock well was developed by bailing. Development was conducted until three well volumes of water had been removed or until turbidity reached 50 nephelometric turbidity units (NTU) and temperature, pH and conductivity stabilized. Groundwater produced during well development was containerized and stored in a secure area for future disposal.

2.2.1.4 Water Level Monitoring

A complete round of water level monitoring was conducted in monitor wells MW-1 to MW-14, inclusive, on Nov. 17, 1997. Following installation and development of MW-15, its water level was recorded on Nov. 21, 1997.

Water levels were measured relative to the top of the PVC well casing using an electric water level tape accurate to within 0.2 inches. After each measurement the tape was decontaminated using the following protocol:

- paper towel wipe,
- non-phosphate detergent wash,
- deionized water rinse, and
- paper towel wipe.

Ground surface elevation and the elevation to the top of the PVC in monitor well MW-15 were surveyed by Advance Survey Group of Niagara Falls, New York on Nov. 22, 1997. Elevations were surveyed to the top of the receiver at the southeast corner of Hyde Park Blvd. and Rhode Island Ave. and surveyed into the elevation survey loop used for the existing monitoring wells.

2.2.1.5 Groundwater Sampling and Analysis

Following purging, each well was sampled using a dedicated hand inertial pump during the period Nov. 18 to 24, 1997. Hand inertial pumps were installed in each well following well construction and consist of a delrin foot valve attached to high density polyethylene riser tube.

Wells were sampled following the purging of 3-5 borehole volumes of water from each well. A borehole volume was calculated as the volume of the standing water in the well and the water contained within the sandpack. Purge water was containerized in 55-gallon drums pending off-site disposal. During purging, groundwater was monitored for pH, temperature, conductivity and turbidity. In addition, observations of discharge water were made for color, odor and turbidity as well as for the presence of non-aqueous phase liquids. Weather conditions at the time of sampling and all other observations were recorded in a field notebook.

Groundwater samples were collected unfiltered for analysis of the COCs that have been previously identified. Each sample was collected in two clean, 40ml glass vials, laboratory prepared and pre-labeled. During transfer of the sample from the pump to the sample bottle, unnecessary agitation which could result in loss of VOCs was avoided. Samples were stored in sealed, iced coolers and were delivered to American Environmental Network (AEN) of Whippany, New Jersey within 48 hours of collection. The holding time for the samples was seven days from verifiable receipt by the laboratory. Samples were analyzed using SW-846 protocols and method 8260. Twenty-six groundwater samples were collected along with two field duplicates, one blank, and six laboratory matrix spikes for quality assurance purposes. A summary of groundwater sampling is provided in Table 2.1.

Table 2.1 Summary of Groundwater Sampling

Well No.	Date Sampled	Lab I.D.	Weather Conditions (° = degrees Celsius)	Volume Purged (gallons)	Final Turbidity (NTU)
MW-1A	Nov 20/97	7077G012	partly sunny, 4°	4	>200
MW-1B	Nov 20/97	7077G013	partly sunny, 4°	13	24.3
MW-2A	Nov 18/97	7077G003	sunny, 4°	4	108.8
MW-2B	Nov 18/97	7077G004	sunny, 4°	30	6.9
MW-3A	Nov 19/97	7077G009	overcast, 4°	8	>200
MW-3B	Nov 19/97	7077G010	overcast, 4°	32	12.6
MW-4A	Nov 18/97	7077G006	dark, 0°	14	>200
MW-4B	Nov 24/97	7077G030	clear, -2°	14	50-200
MW-5A	Nov 20/97	7077G019	sunny, 4°	5	>200
MW-5B	Nov 20/97	7077G020	clear, 3°	15	124.3
MW-6	Nov 18/97	7077G005	sunny, 4°	32	12.9
MW-7A	Nov 18/97	7077G001	partly sunny, 6°	14	>200
MW-7B	Nov 18/97	7077G002	partly sunny, 4°	33	2.2
MW-8	Nov 19/97	7077G008	overcast, 4°	34	19.04
MW-9	Nov 19/97	7077G007	overcast, 4°	32	53
MW-10A	Nov 20/97	7077G014	sunny, 5°	5	>200
MW-10A*	Nov 20/97	7077G015	sunny, 5°	5	>200
MW-10B	Nov 20/97	7077G016	sunny, 4°	37	7.14
MW-11A	Nov 20/97	7077G017	sunny, 4°	2 (dry)	>200
MW-11B	Nov 20/97	7077G018	sunny, 4°	33	122.7
MW-12A	Nov 21/97	7077G022	rain, 6°	5	>200
MW-12B	Nov 21/97	7077G021	rain, 6°		4.7
MW-13A	Nov 21/97	7077G026	rain 4°	5	>200
MW-13B	Nov 21/97	7077G025	rain, 4°	14	>200
MW-14A	Nov 21/97	7077G024	rain, 6°	3	>200
MW-14B	Nov 21/97	7077G023	rain, 6°	12	nm
MW-15	Nov 21/97	7077G028	Dark, overcast, 4°	30	nm
MW-15*	Nov 21/97	7077G029	Dark, overcast, 4°	30	nm

note:

note:	NTU	nephelometric turbidity units
	*	duplicate groundwater sample
	nm	not measured

2.2.2 Soil Sampling Program

The soil sampling program was conducted on November 19 and 21, 1997, and consisted of two sets of samples. The first sample set involved continuous soil sampling of the overburden to a depth of 20 ft. BGS using hollow stem auger drilling techniques and split-spoon sampling. The second set involved surface grab samples at locations chosen by NYSDOH. Soil sampling locations are depicted on Figure 2.3.

2.2.2.1 Rationale for Sample Locations

Boreholes for the continuous soil sampling were located along the eastern fence line to supplement previous soil sampling, to further define the extent of soil contamination in the fill material and natural overburden and to assess the potential for contamination extending onto adjacent properties. Soil borehole locations are labeled S-25 to S-28. These identification numbers continue the sample numbering from the RI. The surface grab samples were collected from locations along the eastern fence line to assess the potential for surface contaminants that could migrate off-site and expose nearby residents. These four sampling locations, identified as S001 through S004, were chosen by a representative of the NYSDOH. Samples were collected from 0-2 inches BGS and analyzed for VOCs. Soil sampling locations are provided in Figure 2.3.

2.2.2.2 Soil Sampling and Analysis

Continuous Soil Sampling

Continuous soil sampling of fill and natural overburden materials was conducted using a 2-inch diameter, split-spoon sampler, 2 ft in length. The split-spoon sampler was advanced inside hollow stem augers following ASTM-D-1586 standards. The stratigraphy of each split-spoon sample was logged in the field for color and texture. Organic vapours in soil were scanned using a PID immediately upon opening the split-spoon. A representative portion of each soil sample was placed in a labeled, wide-mouthed glass jar and retained on the subject property for future reference. The glass jars were lined with foil, and organic vapours in the jar headspace were measured a short time after sample collection using a PID.

Soil samples from each borehole were collected using the following criteria:

a. Each split-spoon sample was scanned with a PID. If a reading above background was obtained, a discrete sample was collected for analysis of COCs from the split-spoon registering the highest PID reading.

b. If no indication of contamination was found in a specific horizon by the PID scan, but suspected contamination was visually observed, then a discrete sample was collected from the area judged to represent the area of maximum contamination.

c. If no indication of contamination was found in a specific horizon with the PID or by visual inspection, then a representative field composited sample was collected from all split-spoon samples taken from the borehole.

Surface Grab Samples

Surface grab samples were collected using a stainless steel trowel at each of the four locations. The sample was transferred to a labelled, wide-mouthed glass jar using the methodology described above for continuous soil samples.

Laboratory Analyses

Soil analytical work for VOCs was completed by AEN in accordance with SW 846 protocols using method 8260. Eight soil samples were collected along with one field duplicate, one field blank, and three laboratory matrix spikes for quality assurance purposes. Samples were stored in sealed, iced coolers and were delivered to the laboratory within 48 hours of collection. The holding time for analysis was seven days from the time of verifiable sample receipt by the laboratory. A summary of all soil sample intervals is provided in Table 2.2.

Table 2.2 Summary of Soil Sample Intervals

Borehole/ Location No.	Date Sampled	Sample Interval	Analysis	Laboratory I.D.
S-25	Nov 19/97	8-10 ft	VOC	7077S005
S-26	Nov 19/97	4-6 ft	VOC	7077S006
S-26	Nov 19/97	4-6 ft	VOC	7077S008
S-27	Nov 19/97	10-12 ft	VOC	7077S007
S-28	Nov 21/97	8-10 ft	VOC	7077S009
S001	Nov 19/97	0-2 in	VOC	7077S001
S002	Nov 19/97	0-2 in	VOC	7077S002
S003	Nov 19/97	0-2 in	VOC	7077S003
S004	Nov 19/97	0-2 in	VOC	7077S004

2.2.2.3 Decontamination Procedures

Decontamination of drilling equipment took place on a decontamination pad constructed at a secure location within the former Carborundum Company facility. The pad consisted of 6 mil plastic sheeting attached to 2-inch by 6-inch boards. The pad was fitted with a sump. Decontamination of equipment consisted of removing accumulated solids by scraping and brushing followed by steam cleaning. A portable steam cleaner was used to decontaminated the drilling assembly and all downhole materials including augers, temporary casing, drill rods and core barrels. Equipment was moved to the pad for decontamination before drilling commenced and after the completion of each borehole.

Decontamination effluent consisting of water and suspended matter was removed from the sump into 55-gallon drums that were labeled as "Liquid Purging/Decontamination Waste". Formation water collected during bedrock coring and well purging was also pumped into 55-gallon drums and similarly labeled. The monitor well/borehole number was also identified on the drums, where applicable. Solid wastes and used PPE such as Tyvek coveralls and latex gloves were stored in 55-gallon drums and were labeled as "Solid Drilling/Decontamination Waste". Drums were temporarily stored in a secure area on the subject property.

2.3 UPDATED PRELIMINARY RISK ASSESSMENT

The preliminary risk assessment that was completed for the 1996 RI was revised to include COC concentrations from the Phase II RI soil sampling program. This revised risk assessment considered the additional pathway of residential property owners located adjacent to the CESIWID plant encountering COCs through inhalation of ambient air.

3. RESULTS AND DISCUSSION OF PHASE II REMEDIAL INVESTIGATION

The results of the Phase II Remedial Investigation are discussed under the following headings:

- Geology;
- Hydrogeology;
- Data Validation;
- Groundwater Sampling;
- Soil Sampling; and
- Revised Risk Assessment.

3.1 GEOLOGY

The site geology has been previously discussed in the RI report. The results of the RI identified the following stratigraphic sequence at the former Carborundum Company facility:

- An upper fill layer, consisting of 4 to 6 feet of gravel and disturbed silty clay fill;
- A silty clay unit extending to approximate depths of 10 to 11 feet;
- A silty clay till that extends to depths of 16 to 32 feet; and
- Bedrock consisting of dolostone of the Lockport Dolomite.

Four boreholes were drilled along the eastern fence line during this investigation. Split-spoon samples collected from these boreholes to a depth of 20 ft contained a gravel and disturbed silty clay fill material to a depth of 6 ft BGS; silt and clayey silt between 6 and 14 ft BGS and clay and silty clay between 14 and 20 ft BGS. These subsurface materials are similar to those encountered during the RI, described above. Bedrock was not encountered in any of the boreholes installed in the eastern property area during the Phase II RI.

Monitoring well MW-15 was drilled on Hyde Park Blvd. just south of the intersection of Rhode Island Ave. to a depth of 28.5 ft BGS. Silt and clayey silt were encountered to a depth of 14.17 ft BGS, where the Lockport Dolomite bedrock was encountered. The Lockport Dolomite was observed in MW-15 to be fractured and vuggy with some mineralization in the fractures. This is consistent with the description of the bedrock in wells installed during the RI. The elevation of the top of bedrock in MW-15 is 577.8 ft above sea level. An updated bedrock topography map showing the elevation of the top of bedrock is provided in Figure 3.1 A borehole stratigraphic log showing the monitor well completion details for MW-15 is provided in Appendix A.

3.2 HYDROGEOLOGY

Groundwater occurs at depths ranging from 4.25 to 12.19 ft BGS. A summary of equilibrium groundwater elevations for May 24, 1992; August 24, 1996 and November 17, 1997 is provided in Table 3.1. The water level in monitor well MW-15, installed on November 21, 1997, was measured on November 21 after the well had reached an equilibrium following well development.

Figure 3.2 depicts potentiometric groundwater contours in the overburden material, based on Nov. 1997 groundwater elevations. Groundwater elevations are lower than those measured on either Aug. 1992 or May 1996. Groundwater elevations measured in each overburden monitoring well fluctuate by as much as 4.94 ft over the three sampling events. The general direction of groundwater flow beneath the site toward the southwest has not changed from that determined during the RI.

Figure 3.3 depicts potentiometric groundwater contours in the Lockport Dolomite bedrock, based on Nov. 1997 groundwater elevations. Groundwater elevations are lower than those measured on either Aug. 1992 or May 1996. Groundwater elevations measured in each bedrock monitoring well fluctuate by as much as 5.41 ft over the three sampling events. The direction of groundwater flow toward the west southwest has not changed from that determined during the RI.

Equilibrium water level elevations in monitor wells MW-2, 3 and 7 have higher groundwater elevations in the overburden well than in the adjacent bedrock well at each monitor well couplet. This condition indicates downward hydraulic gradients and that groundwater is potentially recharging to the Lockport Dolomite through the overburden. These wells are all located on the northeast side of the subject property. The equilibrium water level elevations at MW-5, and MW-10 to MW-14, located in the south and southwest portions of the subject property, and beyond the south property boundary, are higher in the Lockport Dolomite than in the overburden,

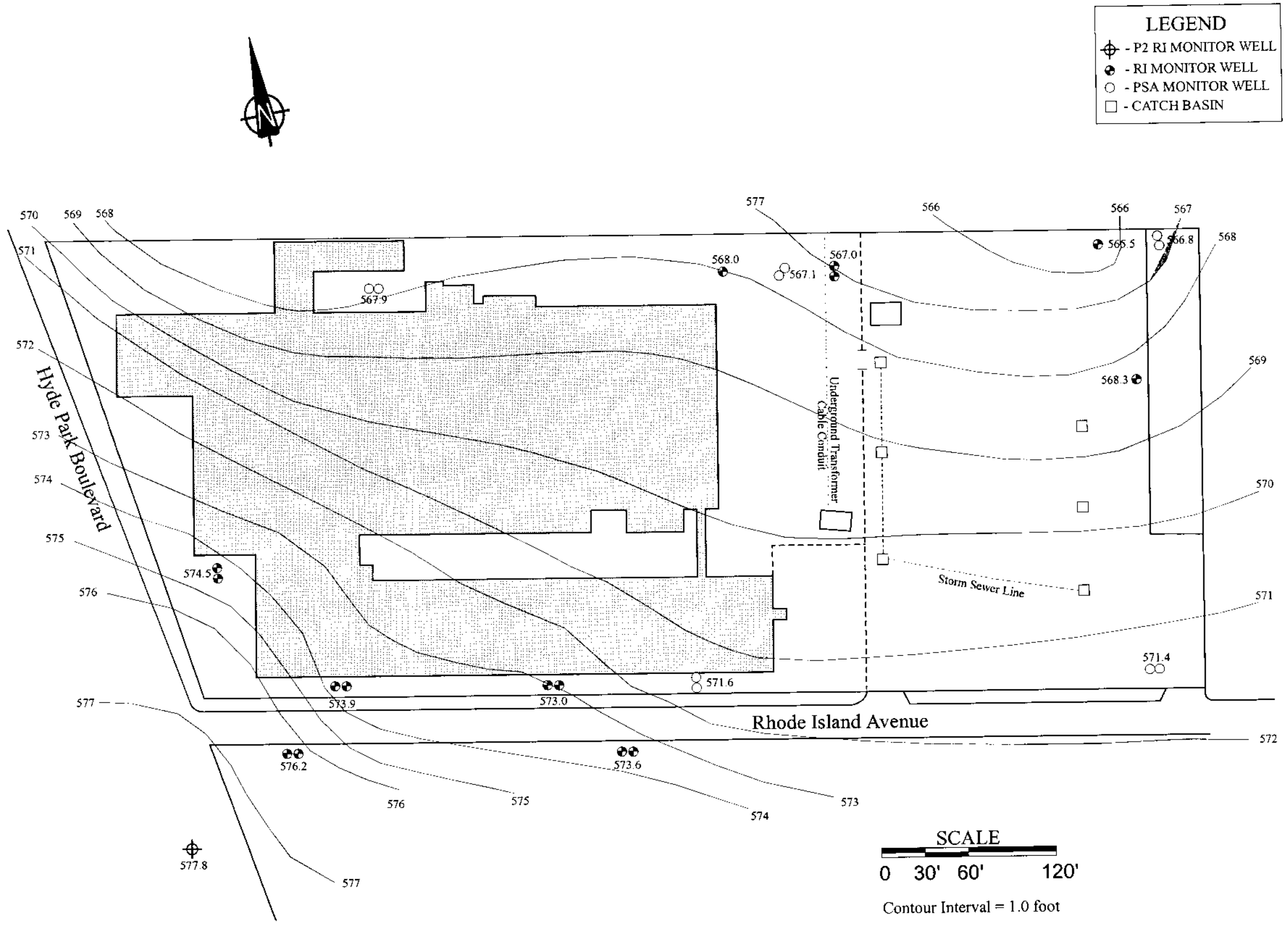


Figure 3.1	Job #: 97-077	Bedrock Elevations (ft AMSL)	DE&S Duke Engineering & Services (Canada), Inc.
Date: April 2, 1998	Drawn/File Name: KEH/rock085.cdr	Former Carborundum Company - Electric Products Division	

Table 3.1 Summary of Ground Surface, Casing and Static Groundwater Elevations

Well No.	Elevation Ground Surface (ft a.m.s.l.)	Elevation Top of Monitor Well Casing (ft a.m.s.l.)	Elevation Static Water Level Aug. 24, 1992 (ft a.m.s.l.)	Elevation Static Water Level May 24, 1996 (ft a.m.s.l.)	Depth of Static Level Nov. 17, 1997 (ft. below top of well casing)	Elevation Static Water Level Nov. 17, 1997 (ft a.m.s.l.)
MW-1a	595.41	597.55	592.62	590.48	9.66	587.89
MW-1b	595.41	597.60	592.64	590.45	9.87	587.73
MW-2a	593.60	595.72	593.25	591.13	6.76	588.96
MW-2b	593.60	595.80	591.92	589.72	8.91	586.89
MW-3a	597.80	599.68	597.37	595.49	5.38	594.30
MW-3b	597.80	599.96	592.63	590.47	12.19	587.77
MW-4a	591.92	591.61	nm	nm	4.82	586.79
MW-4b	591.88	591.51	nm	nm	4.71	586.80
MW-5a	595.86	597.93	591.18	589.11	11.33	586.60
MW-5b	595.88	597.81	591.48	589.55	11.00	586.81
MW-6	594.00	596.59	592.26	589.67	9.74	586.85
MW-7a	593.90	596.58	593.62	590.94	7.90	588.68
MW-7b	594.00	596.66	592.59	589.93	9.40	587.26
MW-8	597.50	599.63	592.51	590.38	11.86	587.77
MW-9	596.30	598.46	592.39	590.23	10.92	587.54
MW-10a	594.62	596.89	591.17	588.90	10.38	586.51
MW-10b	594.52	596.73	591.71	589.50	9.94	586.79
MW-11a	593.40	595.52	589.97	587.85	9.54	585.98
MW-11b	593.42	595.59	591.53	589.36	9.18	586.41
MW-12a	591.30	590.79	586.33	586.84	5.44	585.35
MW-12b	591.30	590.90	588.85	589.25	4.25	586.65
MW-13a	595.68	595.20	588.56	589.04	8.69	586.51
MW-13b	595.61	594.73	588.62	589.50	7.95	586.78
MW-14a	593.30	592.98	585.55	585.87	7.38	585.60
MW-14b	593.30	592.35	588.35	589.30	5.63	586.72
MW-15	591.98	591.44	nm	nm	5.22[1]	586.22

Note: nm = not measured

a.m.s.l. = above mean sea level

[1] note: MW-15 water level was measured on Nov. 21, 1997.

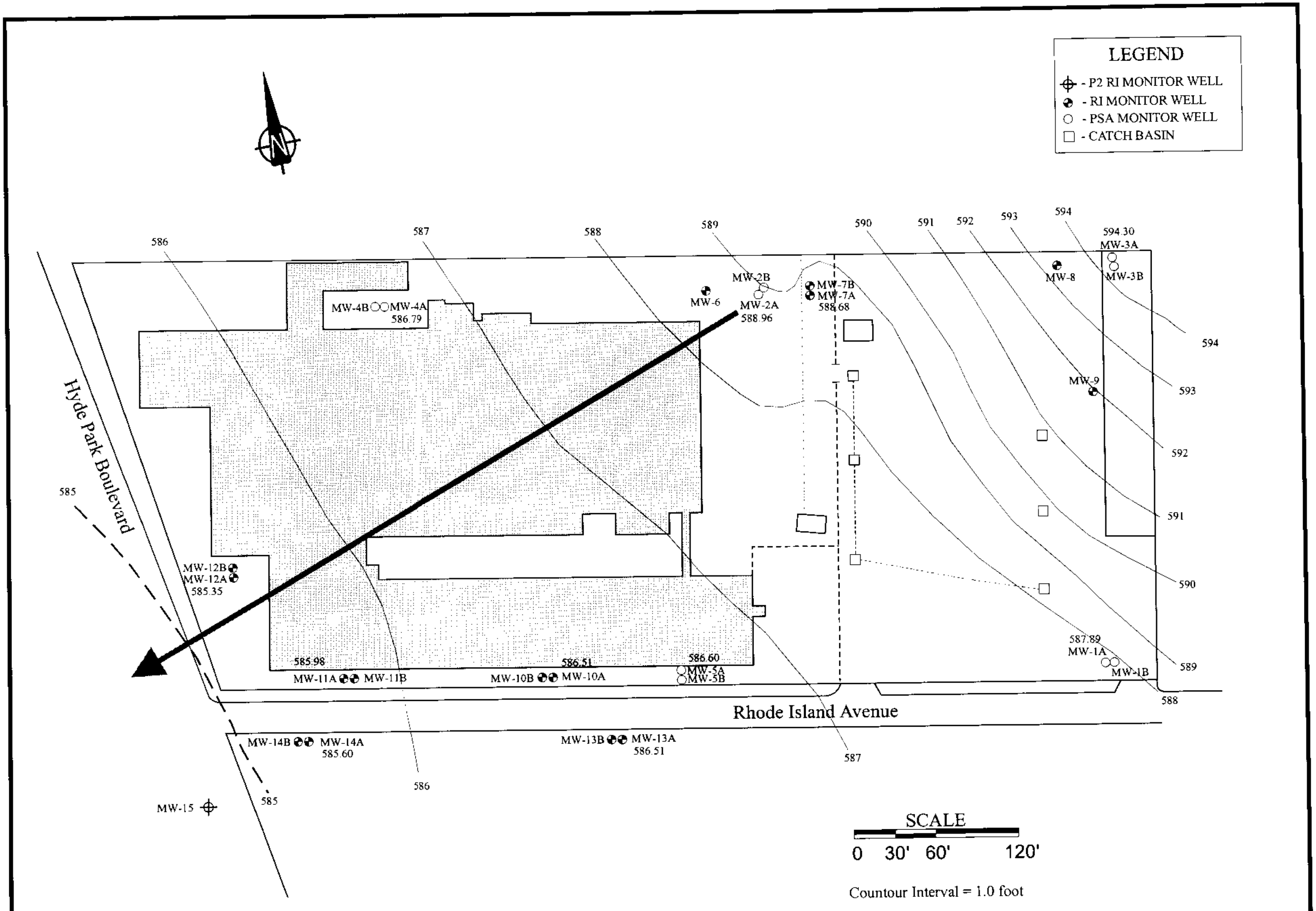
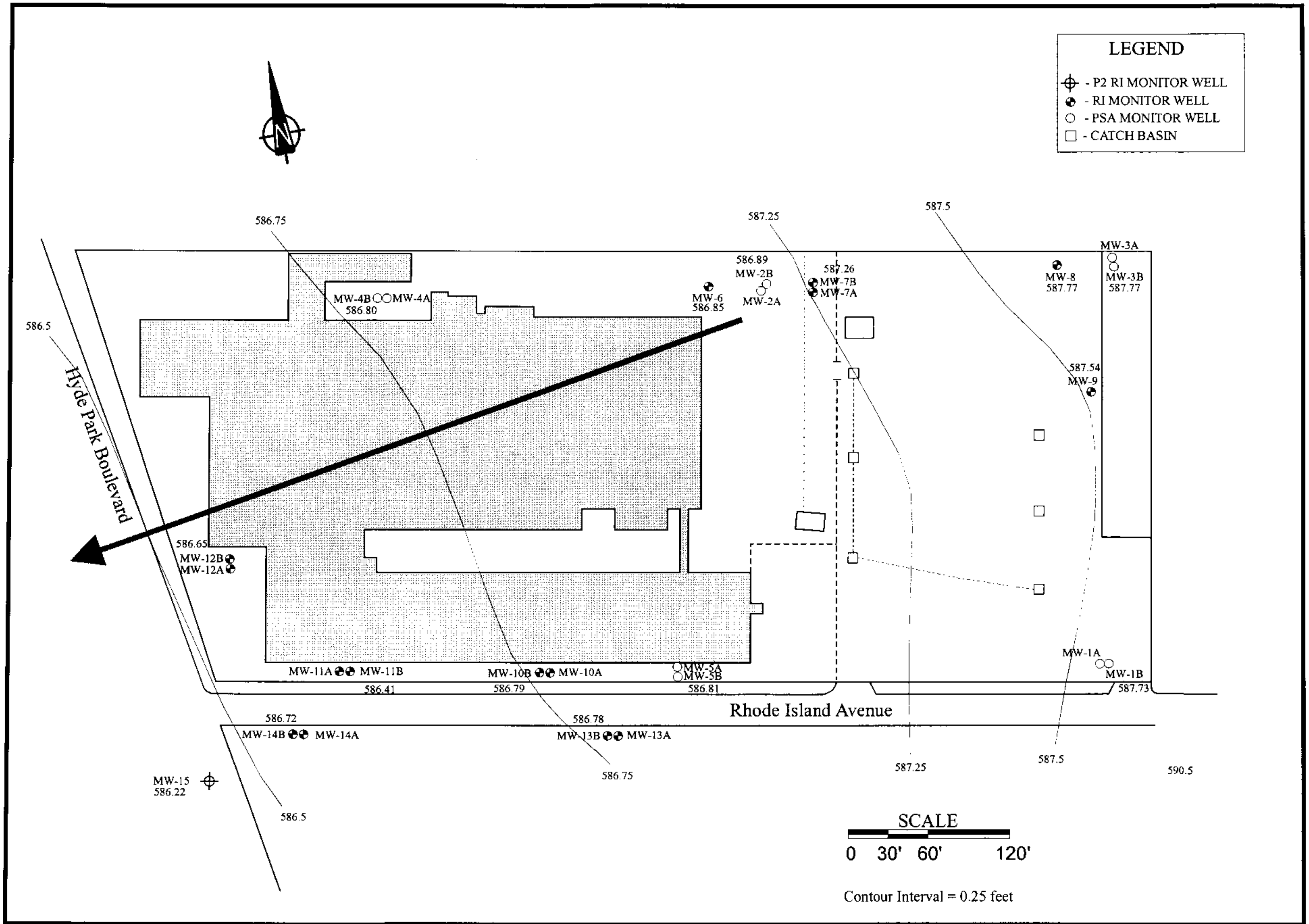


Figure 3.2	Job #: 97-077	Overburden Groundwater Flow
Date: April 2, 1998	Drawn/File Name: KEH/ovrfl085.cdr	Former Carborundum Company - Electric Products Division

DE&S
Duke Engineering & Services (Canada), Inc.



Contour Interval = 0.25 feet

Figure 3.3	Job #: 97-077	Bedrock Groundwater Flow	DE&S Duke Engineering & Services (Canada), Inc.
Date: April 2, 1998	Drawn/File Name: KEH/brkfl085.cdr	Former Carborundum Company - Electric Products Division	

indicating upward hydraulic gradients and potential discharge conditions. These vertical gradient conditions remain consistent with each round of groundwater elevation measurements. During the PSA in Aug. 1992, a slight upward hydraulic gradient was noted in MW-1, located near the southeast corner of the property. During the RI in May 1996, the vertical groundwater gradient in MW-1 changed to a slightly downward gradient. Groundwater elevations collected in Nov. 1997 indicate a downward hydraulic gradient of 0.013 ft/ft in MW-1. A very slight upward gradient of 0.001 ft/ft was noted in MW-4 in Nov. 1997. Figure 3.4 depicts the vertical hydraulic gradients calculated at the site for Nov. 1997. Vertical hydraulic gradients were calculated for each well cluster based on the following equation:

$$i = \frac{\Delta h}{\Delta l}$$ where:

$\Delta h =$ difference between groundwater elevations at a well couplet

$\Delta l =$ distance between the midpoint of the overburden well screen and the bedrock well screen

As shown on Figure 3.4, the area in the northeastern portion of the property is a groundwater recharge area and the area in the southwestern portion of the property is a groundwater discharge area. The area between that contains well couplets MW-1 and MW-4 is neither a strongly recharging nor strongly discharging area. This confirms the findings of the RI report.

Groundwater elevations and, hence, the groundwater gradient in both the overburden and bedrock have changed since the last water level monitoring in May 1996. The groundwater gradient in the overburden in November 1997 is $1.3\text{x}10^{-2}$ft/ft. The geometric mean of hydraulic conductivity for the overburden, calculated during the PSA, is $4.3\text{x}10^{-6}$ft/s. Using an assumed porosity of 0.3, the estimated velocity of groundwater flow in the overburden is 6 ft/year, based on the following equation from Freeze and Cherry (1970):

$$\overline{V} = \frac{Ki}{n}$$ Where: $\overline{V}$ = average linear groundwater velocity (ft/s)

K = hydraulic conductivity (ft/s)

i = hydraulic gradient (ft/ft)

n = porosity (dimensionless)

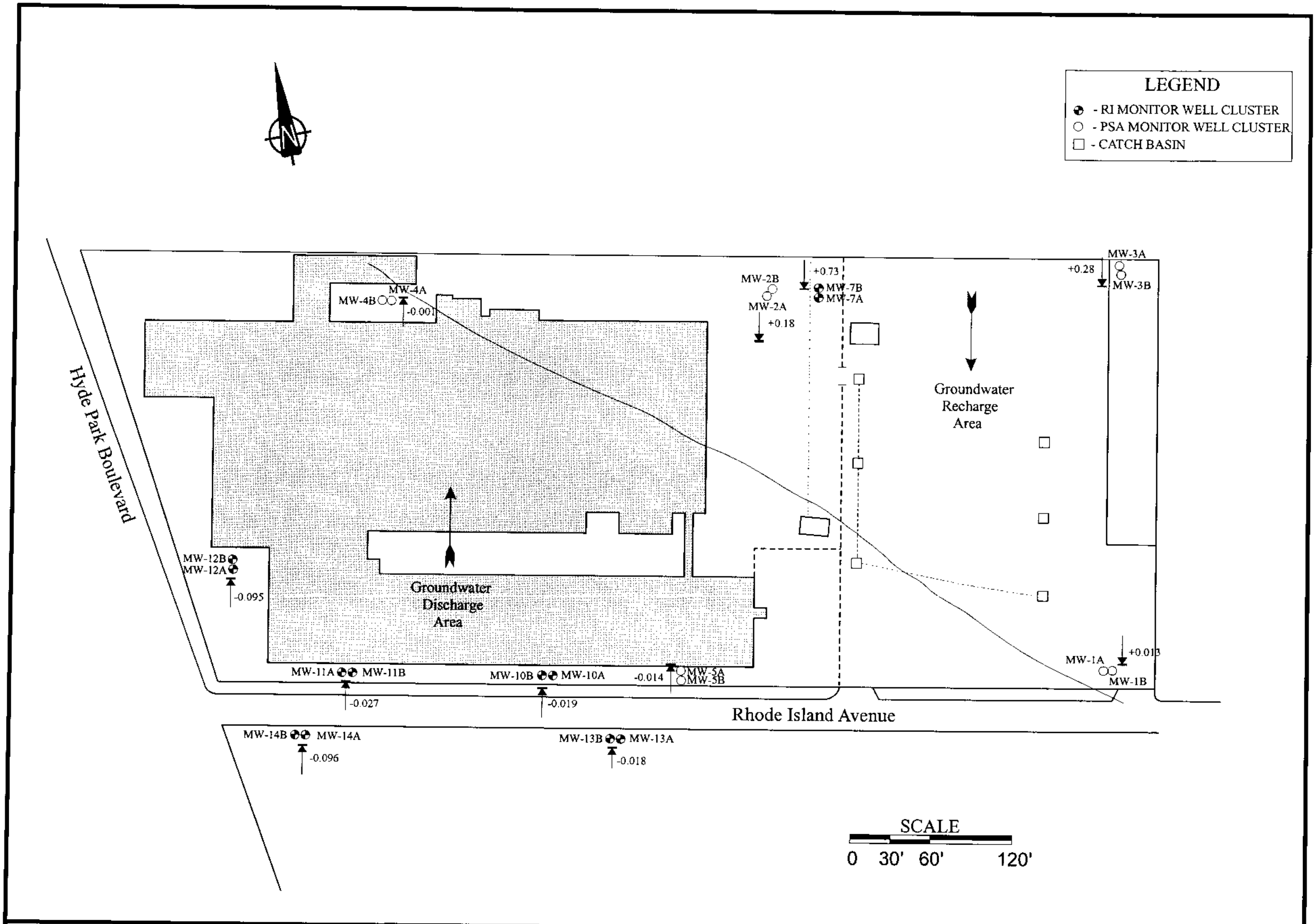


Figure 3.4	Job #: 97-077	Vertical Groundwater Gradients
Date: April 2, 1998	Drawn/File Name: KEH/verfl085.cdr	Former Carborundum Company - Electric Products Division

DE&S
Duke Engineering & Services (Canada), Inc.

The estimated velocity of groundwater flow in the overburden calculated during the RI was 3.5 ft/year.

The groundwater gradient in the bedrock in November 1997 is 1.7 x 10^{-3}ft/ft. The geometric mean of hydraulic conductivity for the bedrock, calculated during the RI is 3.43 x 10^{-5}ft/s. Using an assumed porosity of 10^{-2}, the estimated velocity of groundwater flow in bedrock is 184 ft/year. The estimated groundwater flow velocity in the bedrock calculated during the RI was 110 ft/year.

3.3 DATA VALIDATION

Validation of the data was completed for both field and laboratory aspects of the sampling program. Data validation consisted of:

- Assessment of the field sampling protocols and Quality Assurance/Quality Control (QA/QC) procedures, and
- Assessment of the laboratory analytical methodology and QA/QC procedures.

3.3.1 Field Sampling QA/QC

To ensure that representative samples were collected in the field and were delivered to the laboratory without degradation or contamination of the sample, the following field QA/QC measures were taken:

- Stainless steel sampling equipment including split-spoon samplers, stainless steel sampling spatulas or trowels and water level tapes were rinsed in detergent solution and distilled water after each sample.
- Field staff used new latex rubber gloves during monitoring well installation, groundwater sampling and soil sampling.
- A portable steam cleaner was used to decontaminate the drilling assembly and all downhole materials including augers, temporary casing, drill rods and core barrels. Equipment was moved to the on-site decontamination pad before drilling commenced and after the completion of each pair of monitor wells.
- All monitoring well materials were factory cleaned and delivered to the job site wrapped in plastic.

- Groundwater monitoring wells were fitted with dedicated sampling pumps to prevent cross contamination.
- Sampling for VOCs in water was undertaken using extreme care to avoid agitating the sample and losing VOCs through volatilization.
- Soil samples were immediately screened for organic vapors using a PID, and were transferred to clean glass jars.
- Samples were delivered to the laboratory in sealed, iced coolers under chain-of-custody within 48 hours of sampling.

During sampling, duplicate samples and field and travel blanks were collected to assess analytical precision and to identify potential sample contamination during sampling or transportation. The additional samples, all analyzed for VOCs, included the following:

- Duplicate groundwater sample collected from MW-10A (sample no. 7077G015),
- Duplicate groundwater sample collected from MW-15 (sample no. 7077G029),
- Replicate soil sample collected from S-26 at a depth of 4-6 ft BGS (sample no. 7077S008),
- Travel blank (sample no. 7077G011) shipped to the laboratory on Nov. 19, 1997 along with soil and groundwater samples collected Nov. 18 and 19, 1997, and
- Field and travel blank (sample no. 7077G027) filled at MW-13A at the time of sampling and shipped to the laboratory on Nov. 21, 1997 along with groundwater samples collected Nov. 20 and 21, 1997.

Relative percent differences (RPDs) between sets of duplicate samples were calculated as follows:

$$RPD = \frac{X_1 - X_2}{\overline{X}} x100$$

where X_1 = concentration of first duplicate
X_2 = concentration of second duplicate
$\overline{X}$ = mean concentration

Duplicate samples showed good correlation in the groundwater samples, with RPDs of less than 45% between analytes for all parameters. The overall sample quality is considered to be acceptable. The soil sample replicate did not show good correlation, with RPDs of greater than

100% for five analytes. This may be due to inhomogeneities in the soil. RPDs of all field duplicate samples are provided in Tables 3.2 and 3.3.

Table 3.2 RPD's for Field Duplicate Groundwater Samples

Analyte:	**Vinyl Chloride**	**1,1-Dichloroethane**	**cis- and trans-1,2-Dichloroethene**	**Trichloroethene**	**Benzene**
MW-10A 7077G014 (µg/L)	65	18	1212	<5	<0.7
MW-10A dup. 7077G015 (µg/L)	67	18	1213	<5	<0.7
RPD	3%	0%	0.08%	0%	0%
MW-15 7077G028 (µg/L)	68	<10	640	<10	<1
MW-15 dup. 7077G029 (µg/L)	43	<10	410	<10	<1
RPD	45%	0%	44%	0%	0%

Table 3.3 RPD's for Field Duplicate Soil Sample

Analyte	**Vinyl Chloride**	**Acetone**	**cis- and trans- 1,2- Dichloroethene**	**Trichloroethene**	**Toluene**	**Ethyl benzene**	**Total Xylenes**
S-26 (4-6ft) 7077S014 (µg/kg)	<12	46J	26	660	150	13	70
S-26 (4-6ft) dup. 7077G015 (µg/kg)	<13	<13	230	4000	<1600	<6	270
RPD	8%	112%	159%	143%	166%	36%	118%

All travel and field blank samples were analyzed for VOCs. VOCs were not detected in the blank samples.

Duplicate and blank analyses are included with the data validation report, which is provided in Appendix B.

3.3.2 Laboratory QA/QC

AEN provided Category B deliverables for all analyses. Soil and groundwater samples were analyzed for VOCs using EPA SW-846 Method 8260A, as specified in the Phase II RI Work Plan. The results showed that all samples were analyzed within the required holding time. Internal laboratory QA/QC procedures were sufficient to meet the criteria outlined in the method.

Data was validated by Treatek-CRA of Niagara Falls, New York. Their report is provided in Appendix B. QA/QC was generally acceptable, however, results for some samples were qualified as estimated to reflect the possible analyte loss due to a sample temperature greater than 4°C. Qualified samples were collected on Nov. 18, 19, 20 and 21, 1997 and include the following: MW-7A, 7B, 2A, 2B, 6, 4A, 9, 8, 3A, 3B, S001, S002, S003, S004, 5B, 12A, 12B, 14A, 14B, 13A, 13B, and the field/travel blank (sample no. 7077G027 Results for three soil samples were qualified due to outlying laboratory instrument calibration results for acetone, a common laboratory contaminant. The results for acetone are qualified as estimated for the following soil samples: S-25, S-26, and S-27.

High concentrations found in several groundwater samples necessitated sample dilution. This resulted in high detection limits for COCs in these samples.

3.4 GROUNDWATER SAMPLING

Analytical results for groundwater samples are provided in Table 3.4. The analytical results from groundwater sampling during the 1992 PSA and the 1996 RI have been included in this table and are referred to in the discussion.

Table 3.4 Groundwater Analytical Results

Contaminant Of Concern	Well ID, Sample Date and Concentration (µg/L)												Water Quality Standard (µg/L)	
	MW-1A		MW-1B		MW-2A		MW-2B		MW-3A		MW-3B			
	8/92	11/97	8/92	11/97	8/92	11/97	8/92	11/97	8/92	11/97	8/92	11/97	1.	2.
Vinyl chloride	2J	<2	<10	<2	<10	<2J	**66**	**59J**	<10	<2	**5**	<2J	2	
cis- and trans-1,2-dichloroethene	**14**	<5	**10**	<5	<10	<5J	**2300**	**450J**	<10	<5	**18**	5J		5
Trichloroethene	<10	<5	<10	<5	<10	<5J	**670**	**6J**	4J	<5	<10	<5J		5
Benzene	<10	<0.7	<10	<0.7	<10	<0.7J	1J	<0.7J	<10	<5	0.6J	<5J	0.7	
1,1-dichloroethane	2J	<5	3J	<5	3J	**12J**	<10	<5J	<10	<0.7	<10	<0.7J		5

Note: 1. NYSDEC (1991) (6NYCRR Part 703)
2. NYSDEC (1991) (TOGS 1.1.1)
* well located on upgradient boundary
J indicates estimated value

1200 indicates that concentration exceeds water quality standard

Wells MW-1A, 1B, 2A, 2B, 3A, 3B, 4A, 4B, 5A, and 5B sampled August 1992 during the Preliminary Site Assessment

Wells MW-6, 7A, 7B, 8, 9, 10A, 10B, 11A, 11B, 12A, 12B, 13A, 13B, 14A, and 14B sampled May 1996 during the Remedial Investigation

All wells sampled November 1997 during the Phase II Remedial Investigation

Table 3.4 Groundwater Analytical Results (continued)

Contaminant Of Concern	Well ID, Sample Date and Concentration (µg/L)												Water Quality Standard (µg/L)	
	MW-4A		MW-4B		MW-5A		MW-5B		MW-6*		MW-7A*			
	8/92	11/97	8/92	11/97	8/92	11/97	8/92	11/97	5/96	11/97	5/96	11/97	1.	2.
Vinyl chloride	**13**	**32J**	**26**	**22**	**1300**	**14**	**75**	**33J**	<100	**68J**	<1000	**11J**	2	
cis- and trans-1,2-dichloroethene	**230**	**49J**	**130**	**45**	**1900**	**110**	**520**	**270J**	**1000**	**595J**	**1200**	**5206J**		5
Trichloroethene	3J	<5J	5J	<5	<200	<5	**71**	5J	<100	<5J	**8700**	**1400J**		5
Benzene	<10	<5J	<10	<0.7	<200	<0.7	<10	<0.7J	<100	<0.7J	<1000	**4J**	**0.7**	
1,1-dichloroethane	2J	<0.7J	<10	2J	<200	<5	3J	<5J	<100	<5J	<100	**1500J**		5

Note: 1. NYSDEC (1991) (6NYCRR Part 703)
2. NYSDEC (1991) (TOGS 1.1.1)
* well located on upgradient boundary
J indicates estimated value

1200 indicates that concentration exceeds water quality standard

Wells MW-1A, 1B, 2A, 2B, 3A, 3B, 4A, 4B, 5A, and 5B sampled August 1992 during the Preliminary Site Assessment

Wells MW-6, 7A, 7B, 8, 9, 10A, 10B, 11A, 11B, 12A, 12B, 13A, 13B, 14A, and 14B sampled May 1996 during the Remedial Investigation

All wells sampled November 1997 during the Phase II Remedial Investigation

Table 3.4 Groundwater Analytical Results (continued)

Contaminant Of Concern	Well ID, Sample Date and Concentration (µg/L)												Water Quality Standard (µg/L)	
	MW-7B*		MW-8*		MW-9		MW-10A		MW-10B		MW-11A			
	5/96	11/97	5/96	11/97	5/96	11/97	5/96	11/97	5/96	11/97	5/96	11/97	1.	2.
vinyl chloride	<100	**23J**	<10	<2J	<10	**4J**	**38J**	**65**	**120J**	**52**	<10	<2	**2**	
cis- and trans-1,2-dichloroethene	**370**	**110J**	<10	**6J**	**11**	**6J**	**690**	**1212**	**1900**	**921**	<10	<5		**5**
Trichloroethene	<100	<5J	<10	<5J	<10	<5J	<250	<5	**90J**	**28**	<10	<5		**5**
Benzene	<100	<0.7J	<10	<0.7J	<10	<0.7J	<250	<0.7	<250	<0.7	<10	<0.7	**0.7**	
1,1-dichloroethane	<100	<5J	<10	<5J	<10	<5J	<250	**18**	<250	<5	<10	<5		**5**

Note: 1. NYSDEC (1991) (6NYCRR Part 703)
2. NYSDEC (1991) (TOGS 1.1.1)
* well located on upgradient boundary
J indicates estimated value

1200 indicates that concentration exceeds water quality standard

Wells MW-1A, 1B, 2A, 2B, 3A, 3B, 4A, 4B, 5A, and 5B sampled August 1992 during the Preliminary Site Assessment

Wells MW-6, 7A, 7B, 8, 9, 10A, 10B, 11A, 11B, 12A, 12B, 13A, 13B, 14A, and 14B sampled May 1996 during the Remedial Investigation

All wells sampled November 1997 during the Phase II Remedial Investigation

Table 3.4 Groundwater Analytical Results (continued)

Contaminant Of Concern	Well ID, Sample Date and Concentration (µg/L)												Water Quality Standard (µg/L)	
	MW-11B		MW-12A		MW-12B		MW-13A		MW-13B		MW-14A			
	5/96	11/97	5/96	11/97	5/96	11/97	5/96	11/97	5/96	11/97	5/96	11/97	1.	2.
vinyl chloride	<50	**56**	**13J**	**14J**	**16J**	**53J**	<10	<2J	<100	**31J**	<10	<2J	2	
cis- and trans-1,2-dichloroethene	**390**	**705J**	**430**	**120J**	**250**	**250J**	<10	<5J	**810**	**410J**	<10	<5J		5
Trichloroethene	<50	<5	<50	<5J	**18J**	<5J	<10	<5J	**48J**	**36**	<10	<5J		5
Benzene	<50	<0.7	<50	<0.7J	<50	<0.7J	<10	<0.7J	<100	<1J	<10	<0.7J	0.7	
1,1-dichloroethane	<50	<5	<50	<5J	<50	<5J	<10	<5J	<100	<10J	<10	<5J		5

Note: 1. NYSDEC (1991) (6NYCRR Part 703)
2. NYSDEC (1991) (TOGS 1.1.1)
* well located on upgradient boundary
J indicates estimated value

1200 indicates that concentration exceeds water quality standard

Wells MW-1A, 1B, 2A, 2B, 3A, 3B, 4A, 4B, 5A, and 5B sampled August 1992 during the Preliminary Site Assessment

Wells MW-6, 7A, 7B, 8, 9, 10A, 10B, 11A, 11B, 12A, 12B, 13A, 13B, 14A, and 14B sampled May 1996 during the Remedial Investigation

All wells sampled November 1997 during the Phase II Remedial Investigation

Table 3.4 Groundwater Analytical Results (continued)

Contaminant of Concern	**Well ID, Sample Date and Concentration (µg/L)**				**Water Quality Standard (µg/L)**	
	MW-14B		**MW-15**			
	5/96	**11/97**	**5/96**	**11/97**	**1.**	**2.**
Vinyl chloride	<50	**65J**	n/a	**68**	**2**	
cis- and trans-1,2-dichloroethene	**310**	**765J**	n/a	**640**		**5**
Trichloroethene	<50	<5J	n/a	<10		**5**
benzene	<50	<0.7J	n/a	<1	**0.7**	
1,1-dichloroethane	<50	<5J	n/a	<10		**5**

Note: 1. NYSDEC (1991) (6NYCRR Part 703)
2. NYSDEC (1991) (TOGS 1.1.1)
* well located on upgradient boundary
J indicates estimated value
1200 indicates that concentration exceeds water quality standard

Wells MW-1A, 1B, 2A, 2B, 3A, 3B, 4A, 4B, 5A, and 5B sampled August 1992 during the Preliminary Site Assessment
Wells MW-6, 7A, 7B, 8, 9, 10A, 10B, 11A, 11B, 12A, 12B, 13A, 13B, 14A, and 14B sampled May 1996 during the Remedial Investigation. All wells sampled November 1997 during the Phase II Remedial Investigation.

The analytical results for groundwater were compared against the following New York State groundwater criteria:

- Water Quality Regulations for Surface Waters and Groundwaters (NYSDEC 1991 - 6NYCRR, Part 703)
- Ambient Water Quality Standards and Guidance Values TOGS 1.1.1 (NYSDEC 1991)

3.4.1 Overburden Wells

Overburden monitoring wells MW-1A, 2A, 3A, 4A, and 5A were sampled during the PSA in Aug. 1992. Overburden wells MW-7A, 10A, 11A, 12A, 13A, and 14A were sampled during the RI in May 1997. All overburden wells were sampled during this Phase II RI investigation.

VOCs were detected in most overburden wells, with the exception of MW-1A, 3A, 11A, 13A, and 14A, The most commonly detected compounds in the remaining wells were cis- and trans-1,2-dichloroethene, vinyl chloride and trichloroethene.

Groundwater samples collected from wells MW-4A, 5A, 7A, 10A, and 12A contained vinyl chloride, cis- and trans-1,2-dichloroethene, trichloroethene, benzene, and 1,1-dichloroethane at concentrations that exceed the NYSDEC Water Quality Regulations (1991, 6NYCRR Part 703) or NYSDEC Ambient Water Quality Standards (1991, TOGS 1.1.1).

The maximum concentrations of 1,2-dichloroethene, vinyl chloride and trichloroethene have changed since the last sampling event (PSA or RI). The maximum concentration of 1,2-dichloroethene increased from 1900 µg/L to 5206 µg/L during this sampling event. The maximum concentration of vinyl chloride dropped from 1300 µg/L to 68 µg/L. The maximum concentration of trichloroethene dropped from 8700 µg/L to 1400 µg/L. In general, concentrations of VOCs have decreased since the last sampling event except for the following increases:

- 1,1-dichloroethane in MW-2A (from 3 to 12 µg/L),
- vinyl chloride in MW-4A (from 13 to 32 µg/L),
- 1,2-dichloroethene and 1,1-dichloroethane in MW-7A (from 1200 to 5206 µg/L and <100 to 1500 µg/L, respectively), and

- vinyl chloride and 1,2-dichloroethene in MW-10A (from 38 to 65 μg/L and 690 to 1212 μg/L, respectively).

Overburden well MW-7A, which is located along the north property boundary, showed the highest level of contamination. Overburden wells MW-1A, 3A, 11A, 13A and 14A did not show any evidence of contamination. MW-1A and 3A are located in the southeast and northeast corner of the site, respectively. MW-11A is located near the southwestern corner of the site. Wells MW-13A and 14A are located off-site to the south. A summary of selected VOC analytical results for groundwater samples is provided in Figure 3.5.

3.4.2 Bedrock Wells

Bedrock monitoring wells MW-1B, 2B, 3B, 4B, and 5B were sampled during the PSA in Aug. 1992. Bedrock wells MW-6, 7B, 8, 9, 10B, 11B, 12B, 13B, and 14B were sampled during the RI in May 1997. All bedrock wells, including newly installed MW-15, were sampled during this Phase II RI investigation.

VOCs were detected in most bedrock wells, with the exception of MW-1B. MW-3B had only a trace concentration of 1,2-dichloroethene. The most commonly detected compounds in the remaining wells were cis- and trans-1,2-dichloroethene, vinyl chloride and trichloroethene. Benzene was not detected in any of the bedrock wells.

Groundwater samples collected from wells MW-2B, 4B, 5B, 6, 7B, 8, 9, 10B, 11B, 12B, 13B, 14B, and 15 contained vinyl chloride, cis- and trans-1,2-dichloroethene, and trichloroethene at concentrations that exceed the NYSDEC Water Quality Regulations (1991, 6NYCRR Part 703) or NYSDEC Ambient Water Quality Standards (1991, TOGS 1.1.1).

The maximum concentrations of 1,2-dichloroethene, vinyl chloride and trichloroethene have changed since the last sampling event (PSA or RI). The maximum concentration of 1,2-dichloroethene decreased from 2300 μg/L to 921 μg/L during this sampling event. The maximum concentration of vinyl chloride dropped from 120 μg/L to 68 μg/L. The maximum concentration of trichloroethene dropped from 670 μg/L to 36 μg/L. In general, concentrations of VOCs have decreased since the last sampling event except for the following increases:

- vinyl chloride and cis- and trans-1,2-dichloroethene in MW-11B (from <50 to 56 μg/L and 390 to 705 μg/L, respectively),
- vinyl chloride in MW-12B (from 16 to 53 μg/L), and
- vinyl chloride in MW-14B (from <50 to 65 μg/L).

Bedrock well MW-10B, which is located along the southern property boundary, showed the highest level of contamination. Bedrock wells MW-1B and 3B showed little or no evidence of contamination. MW-1B and 3B are located in the southeast and northeast corner of the site, respectively. The groundwater analytical results for MW-15, the newly installed well located off-site to the southwest, show detectable concentrations of contaminants of concern within the bedrock outside of the site boundaries toward the southwest. A summary of selected VOC analytical results for groundwater samples was provided in Figure 3.5.

3.5 SOIL SAMPLING

Analytical results for soil samples collected during the Phase II RI are provided in Table 3.5. NYSDEC has developed Recommended Cleanup Objectives that include cleanup objectives for the COCs at the former Carborundum Company facility (NYSDEC Technical and Administrative Guidance Memorandum: Determination of Soil Cleanup Objectives and Cleanup Levels. TAGM HWR-944046, January 24, 1994).

The purpose of the TAGM was to provide generic soil cleanup objectives that, if attained, would eliminate significant threats to human health and the environment. The soil cleanup objectives in the TAGM assume a soil total organic carbon (TOC) content of 1%. Using the following equation from the TAGM:

$$Cs = f \cdot cw \cdot Koc$$

Where:
Cs = allowable soil concentration (ppm)
f = fraction of TOC
cw = groundwater standard (mg/L)
Koc = partition co-efficient between water and soil media

The geometric mean of TOC content for 10 soil samples collected from the site during the RI was 1.4%. The calculated site specific soil cleanup objectives are listed in Table 3.5. Soil cleanup objectives are $Cs \cdot 100$.

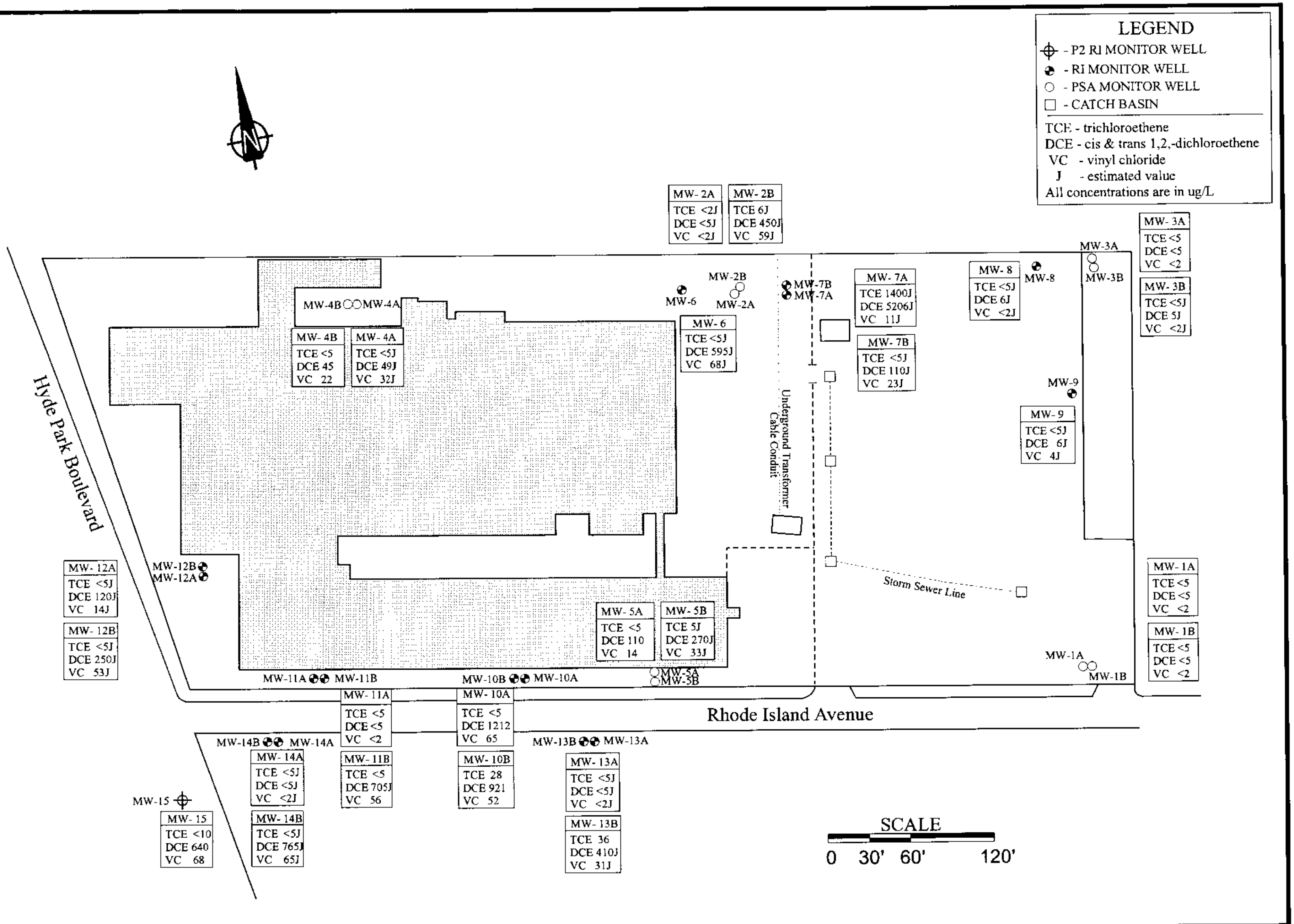


Figure 3.5	Job #: 97-077	Selected Groundwater VOC Analytical Results - Nov. 1997	DE&S Duke Engineering & Services (Canada), Inc.
Date: April 2, 1998	Drawn/File Name: KEH/gvalu077.cdr	Former Carborundum Company - Electric Products Division	

The results for soil sampling during this investigation are discussed under the following headings:

- Soil Borehole Samples, and
- Surface Soil Samples

3.5.1 Soil Borehole Samples

Soil borehole samples collected during the Phase II RI program were collected from locations S-25 to S-28, inclusive and included one sample from each borehole.

Analytical results for VOC COCs in soil samples collected from boreholes are summarized on Table 3.5. VOCs were not detected in the soil sample collected from S-28. A trace concentration of acetone was detected in the soil sample collected from S-25 but, this could be due to laboratory contamination of the sample (see P.7 of Data Validation Report – Appendix B). Soil from 4-6 ft BGS in S-26 contained detectable concentrations of VOCs that are all lower than the NYSDES Soil Cleanup Objectives. The soil sample collected from 10-12 ft BGS in S-27 contained detectable concentrations of VOCs and a concentration of cis- and trans-1,2-dichloroethene that is eight times the NYSDEC Soil Cleanup Objective of 300 μg/kg.

The exceedance in S-27 indicates that the VOC soil contamination in the eastern portion of the site extends to the eastern fence line in the vicinity of S-27.

3.5.2 Surface Soil Samples

Surface soil samples collected during the Phase II RI program were collected from locations S001 through S004, inclusive and included one sample from 0-2 inches BGS at each location. Surface sampling locations were shown on Figure 2.3.

Analytical results for VOC COCs in surface soil samples are summarized on Table 3.5. VOCs were not detected in any of the soil samples collected. The absence of VOCs in surface soils along the eastern property boundary indicates that human health risk from exposure to these soils is not a serious concern.

Table 3.5 Soil Analytical Results from Boreholes and Surface Samples

Contaminant Of Concern	Borehole/Location ID, Sample Depth and Concentration (µg/kg)								
	S-25 8-10 FT	**S-26 4-6 FT**	**S-27 10-12 FT**	**S-28 8-10 FT**	**S001 0-2 IN**	**S002 0-2 IN**	**S003 0-2 IN**	**S004 0-2 IN**	**Soil Cleanup Objectives (µg/kg)[1]**
Vinyl chloride	<12	<12	3J	<12	<11J	<11J	<11J	<14J	**200**
Acetone	6J	46J	5J	<12	<11J	<11J	<11J	<14J	**200**
cis- and trans-1,2-Dichloroethene	<6	26	**2400**	<6	<5J	<6J	<6J	<7J	**410**
Trichloroethene	<6	660	630	<6	<5J	<6J	<6J	<7J	**880**
Toluene	<6	150	180	<6	<5J	<6J	<6J	<7J	**2100**
Ethylbenzene	<6	13	66	<6	<5J	<6J	<6J	<7J	**770**
Total xylenes	<6	70	220	<6	<5J	<6J	<6J	<7J	**1680**

Note: 1. Recommended Soil Cleanup Objectives (NYSDEC TAGM HWR-94-4046, January 24, 1994)

J indicates estimated value

1200 Indicates that concentration exceeds recommended soil cleanup objective

3.6 EXTENT OF SOIL CONTAMINATION

Based on these results the extent of soil contamination in four areas at the site was estimated.

The previous determination of the extent of the main zone of soil contamination was based on boreholes located within the site property boundary.

During this Phase II RI, four boreholes were installed along the eastern fence line. Results from one soil sample collected indicate that 1,2-dichloroethene exists in soils in this area at concentrations in excess of the Soil Cleanup Objectives. Because the extent of soil contamination extends farther east than previously believed, the extent of soil contamination for this area has been modified and is depicted on Figure 3.6.

The modification of the area of VOC-contaminated soils incorporates the S-27 sample location into the contaminated zone. In addition, S-22 has been incorporated into the contaminated zone. During the 1996 RI, exceedances of the NYSDEC Soil Cleanup Objectives were noted at depths of 10 ft or greater in boreholes S-4 and MW-9 that surround S-22. Samples were not collected below 6 ft in S-22. Because an exceedance of the NYSDEC Soil Cleanup Objectives has been noted in boreholes that surround S-22 (S-27, S-4 and MW-9) at depths of greater than 10 ft BGS, the area of soil contamination has been modified to incorporate S-22 as well as S-27.

A revised estimate of the amount of contaminated soil includes the following areas and estimated amounts:

(i)	VOC main area	(a) 210ft x 150ft x 14ft =	441,000 ft^3
	(modified)	(b) 50ft x 40ft x 16ft =	32,000 ft^3
		(c) 40ft x 30ft x 12ft=	14,400 ft^3
		(d) (40ft x 30ft x 12ft)÷2=	7,200 ft^3
			494,600 ft^3

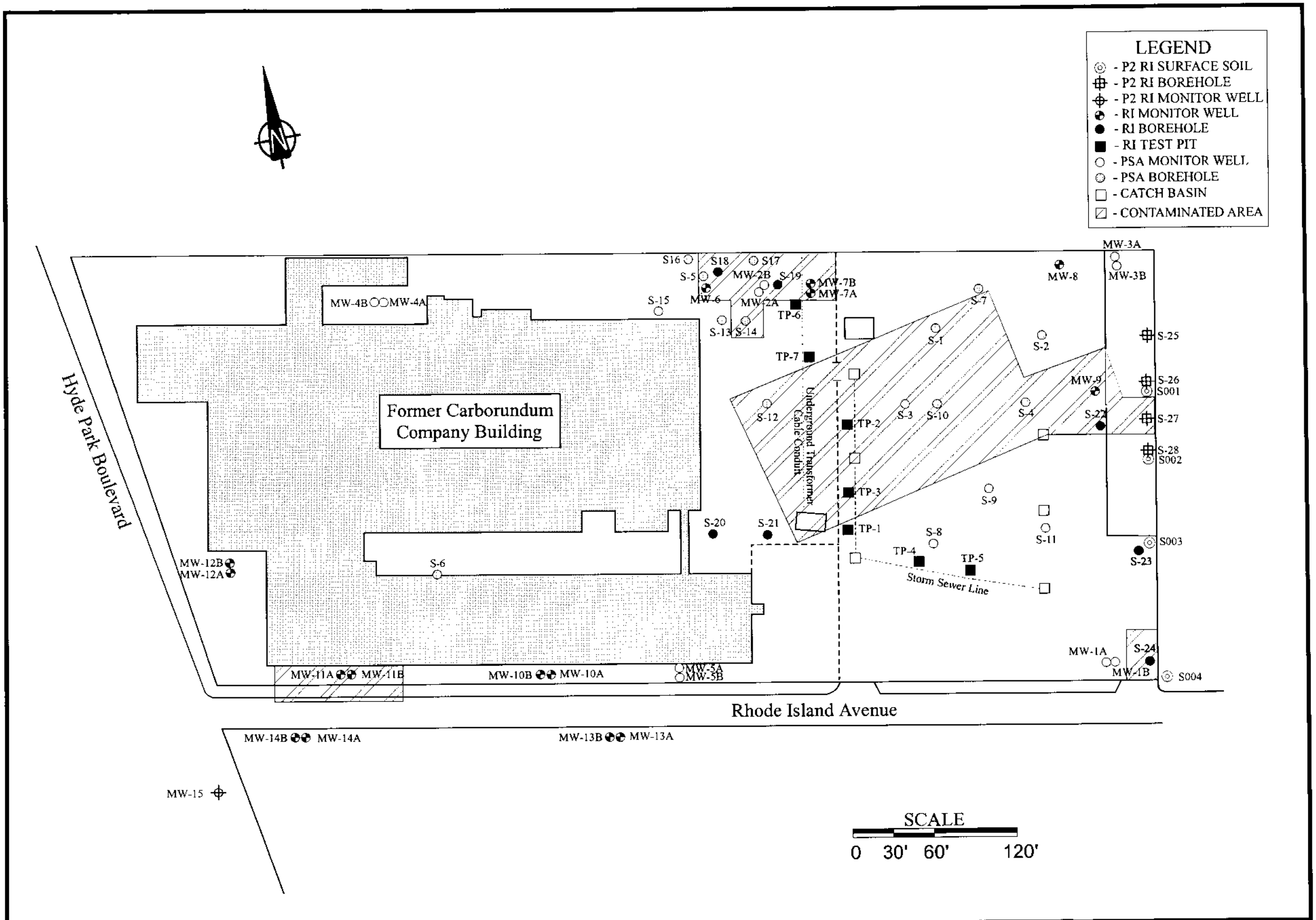


Figure 3.6	Job #: 97-077	Modified Extent of Soil Contamination
Date: April 2, 1998	Drawn/File Name: KEH/modcarea.cdr	Former Carborundum Company - Electric Products Division

DE&S
Duke Engineering & Services (Canada), Inc.

(ii)	VOC/PAH area at north end of site		
		(a) 100ft x 40ft x 4ft =	16,000 ft^3
		(b) 30ft x 30ft x 6ft =	<u>5,400 ft^3</u>
			21,400 ft^3
(iii)	Acetone contamination at S-24	25ftx 40ft x 6ft =	6,000 ft^3
(iv)	Xylene contamination at MW-11	100ft x 30ft x 4ft =	12,000 ft^3
			534,000 ft^3
TOTAL VOLUME			**(19,800 yds^3)**

4. RISK ASSESSMENT

The preliminary risk assessment that was discussed in the 1996 RI report considered only impacts to workers at the CESIWID plant. It did not assess potential impacts to adjacent residential property owners. The purpose of the Phase II RI surface soil sampling program was to provide additional information that would allow a preliminary assessment of the potential exposure and risk to residential property owners in the vicinity of the plant from the inhalation of ambient air, direct contact with soils, incidental ingestion of airborne dust or particulates, and ingestion of homegrown fruits and vegetables. The four surface soil samples that were selected by NYSDOH were taken from the ground surface to a depth of 2 inches. VOCs were not detected in any of the four samples. Because the surficial soils did not contain detectable concentrations of COCs, there is no measurable exposure to residential property owners in the vicinity of the plant through inhalation of ambient outdoor air, direct contact with soils, incidental ingestion of airborne dust or particulates, or ingestion of homegrown fruits and vegetables.

5. CONCLUSIONS

1. Groundwater flow is approximately west-southwesterly across the site in both the overburden and the Lockport Dolomite. Using the geometric mean of hydraulic conductivity, as determined in the PSA, of 4.32 x 10^{-6} ft/s, a gradient of 1.3 x 10^{-2} and an assumed porosity of 0.3, the estimated velocity of groundwater flow in the overburden is 6 ft/year. The average linear groundwater velocity in the upper portion of the Lockport Dolomite is estimated to be 184 ft/year based on the geometric mean of the measured hydraulic conductivities of 3.43 x 10^{-5} ft/sec, a measured hydraulic gradient of 1.7 x 10^{-3} and an assumed porosity of 10^{-2}.

2. Analytical results from the bedrock monitoring well MW-15, installed off-site and down gradient indicate detectable concentrations of VOCs within the bedrock. Vinyl chloride and 1,2-dichloroethene were detected in the groundwater sample collected from MW-15 at concentrations that exceed the NYSDEC Water Quality Standards/Regulations (1991, 6NYCRR Part 703 and TOGS 1.1.1).

3. Results of groundwater sampling show that monitor wells MW-1A, 3A, 11A, 13A and 14A were the least contaminated of the overburden wells. MW-11A is located near the southwest corner of the property, and MW-13A and 14A are located on the south side of Rhode Island Avenue south of the subject property. Overburden well MW-7A, which is located along the north property boundary, showed the highest level of contamination. These results indicate that groundwater impacted with VOCs within the overburden has not migrated off-site.

4. VOCs were detected in each of the bedrock wells at concentrations that exceed NYSDEC Water Quality Standards/Regulations, with the exception of MW-1B, located in the southeast corner of the subject property, and MW-3B, located in the northeast corner of the property.

5. VOCs were detected in soil samples collected from boreholes along the eastern fence line. One sample, collected at a depth of 10-12 ft BGS in S-27, contained 1,2-dichloroethene at a concentration in excess of NYSDEC Soil Cleanup Objectives (HWR-94-4046, January

1994). Trichloroethene was detected in boreholes S-27 and S-26 at concentrations just below the NYSDEC Soil Cleanup Objective. The remaining two boreholes did not contain detectable levels of VOCs.

6. The presence of VOCs in excess of NYSDEC Soil Cleanup Objectives along the eastern fence line suggests that the extent of soil contamination defined during the RI should be modified to incorporate a greater area. The area of VOC soil contamination in the eastern portion of the site was extended to the eastern fence line. This modification resulted in the addition of 800 yds^3 of soil to the previously reported volume of 19,000 yds^3 for an estimated total volume of 19,800 yds^3. Soil that exceeds NYSDEC Soil Cleanup Objectives occurs in four areas on the site, see Figure 3.6.

7. The contaminant levels in soil and groundwater do not pose an immediate threat to human health or the environment. Appropriate precautions should be taken if any excavation is undertaken in contaminated areas to ensure that workers or the surrounding communities are not exposed to contaminants through either dermal contact or inhalation. Such precautions would include air quality monitoring, the use of rubberized protective clothing and cartridge type respirators where appropriate.

8. The additional sampling of surface soils at locations selected by NYSDOH showed no detectable levels of COCs. Consequently there is no measurable exposure to residential dwellers in the vicinity of the plant through inhalation of ambient outdoor air, direct contact with soils, incidental ingestion of airborne dust or particulates, or ingestion of homegrown fruits and vegetables.

6. RECOMMENDATIONS

1. An Interim Remedial Measure should be undertaken to remove contaminated soil from the property.

   Components of the Interim Remedial Measure should include:

   (i) Work Plan preparation
   (ii) Excavation and testing of VOC-contaminated soil
   (iii) An Interim Remedial Measure report

2. A program of groundwater monitoring should be implemented to monitor the change in COC concentrations in groundwater on and off-site, over time.

3. The FS component of the RI/FS process should be initiated and can proceed concurrently with the Interim Remedial Measure.

7. REFERENCES

BP Oil (1996)	Citizen Participation Plan for the Carborundum Globar Site Remedial Investigation/Feasibility Study, Niagara Falls, New York. February 12, 1996.
Feenstra,S., J.A. Cherry and D.M. Mackay (1990)	Evaluation of the Presence of Residual NAPL Based on Organic Chemical Concentrations in Soil Samples. In University of Waterloo Short Course on "Dense, Immiscible Phase Liquid Contaminants (DNAPLs) in Porous and Fractured Media". June 18-21, 1990 Kitchener, Ontario
Freeze,R.A. and J.A. Cherry (1979)	Groundwater. Prentice Hall Inc. Englewood Cliffs, New Jersey. 604p.
Intera Inc. (1993)	Report on the Preliminary Site Assessment of the Carborundum Company - Electric Products Division, Hyde Park Facility, Town of Niagara, Niagara County, New York
Intera Inc. (1995a)	Remedial Investigation/Feasibility Study Health and Safety Plan for The Former Carborundum Company - Electric Products Division Hyde Park Facility, Town of Niagara, Niagara County, New York, Site No. 932036, August 1995
Intera Inc. (1995b)	Quality Assurance Project Plan for Remedial Investigation/Feasibility Study of the Former Carborundum Company - Electric Products Division, Hyde Park Facility, Town of Niagara, Niagara County, New York, Site No. 932036, August 1995
Intera Inc. (1997a) Company	Remedial Investigation of the Former Carborundum Electric Products Division, Hyde Park Facility, Town of Niagara, Niagara County, New York. Final Report. Site No. 932036, August 1997.
Intera Inc. (1997b)	Phase II Remedial Investigation Work Plan for the Former Carborundum Company - Electric Products Division, Hyde Park Facility, Town of Niagara, Niagara County, New York. Final Report. Site No. 932036, August 1997.

NYSDEC (1991a)	Water Quality Regulations for Surface Waters and Groundwater NYSDEC - 6NYCRR, Part 703
NYSDEC (1991b)	Ambient Water Quality Standards and Guidance Values NYSDEC TOGS 1.1.1
NYSDEC (1992)	Determination of Soil Cleanup Objectives and Cleanup Levels NYSDEC TAGM HWR-92-4046, November 16, 1992

APPENDIX A

Stratigraphic Logs

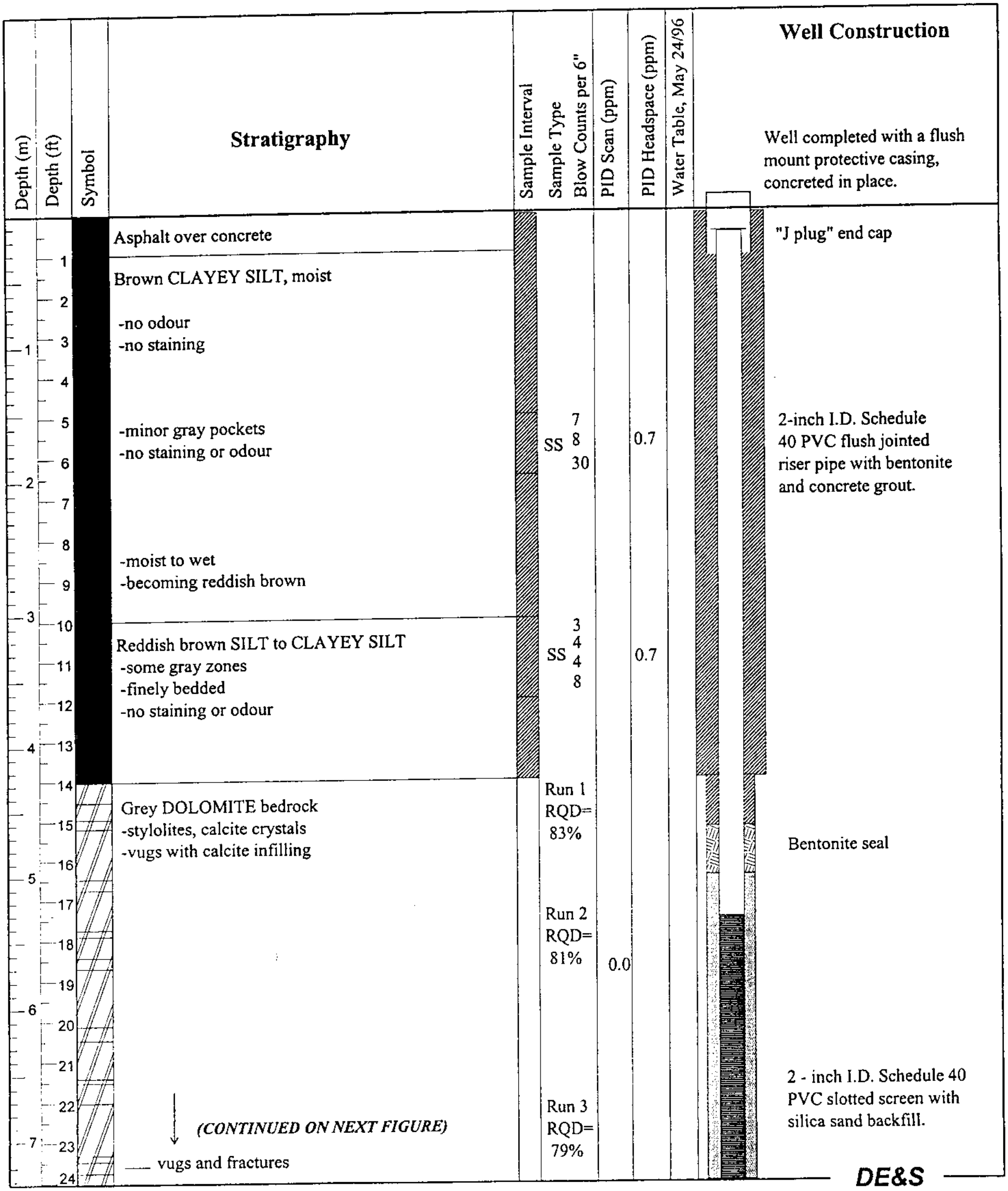
Monitor Wells, Boreholes, and Surface Soil

BOREHOLE LOG

MW-15

Client:	*The Carborundum Company*	Date:	*Nov. 20, 1997*
Project Title:	*Phase II RI*	Field Crew:	*G.H.*
Project Ref.:	*7077*	Equipment:	*H.S.A., air rotary*
		Ground Elevation:	*591.98ftASL*

File Name: MW157077.TCW



Depth (ft)	Stratigraphy	Sample Type	Blow Counts per 6"	PID Scan (ppm)	PID Headspace (ppm)	Well Construction
0	Asphalt over concrete					Well completed with a flush mount protective casing, concreted in place. "J plug" end cap
1	Brown CLAYEY SILT, moist					
2.5	-no odour -no staining					
5–6	-minor gray pockets -no staining or odour	SS	7 8 30		0.7	2-inch I.D. Schedule 40 PVC flush jointed riser pipe with bentonite and concrete grout.
8.5	-moist to wet -becoming reddish brown					
10–12	Reddish brown SILT to CLAYEY SILT -some gray zones -finely bedded -no staining or odour	SS	3 4 4 8		0.7	
14–16	Grey DOLOMITE bedrock -stylolites, calcite crystals -vugs with calcite infilling	Run 1 RQD= 83%				Bentonite seal
17–18		Run 2 RQD= 81%		0.0		
22–24	(CONTINUED ON NEXT FIGURE) vugs and fractures	Run 3 RQD= 79%				2 - inch I.D. Schedule 40 PVC slotted screen with silica sand backfill.

DE&S

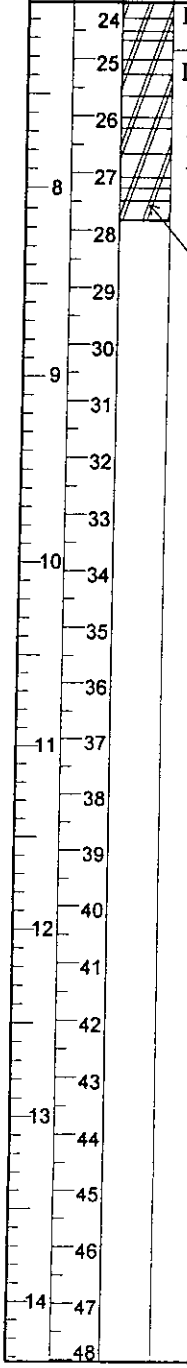
BOREHOLE LOG

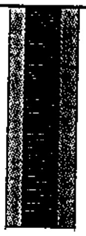
MW-15 (continued)

Client:	*The Carborundum Company*	Date:	*Nov. 20, 1997*
Project Title:	*Phase II RI*	Field Crew:	*G.H.*
Project Ref.:	*7077*	Equipment:	*H.S.A., air rotary*
		Ground Elevation:	*591.98ftASL*

File Name: W15B7077.TCW

Depth (m)	Depth (ft)	Symbol	Stratigraphy	Sample Interval	Sample Type	Blow Counts per 6"	PID Scan (ppm)	PID Headspace (ppm)	Water Table, May 24/96	Well Construction
	24		Run 3 (cont'd)							2-inch I.D. Schedule 40 PVC slotted screen with silica sand backfill.
	25		Dark grey DOLOMITE -calcite infilling along fractures -stylolites -more vuggy from 20' to 28'							
8	27									PVC threaded end cap
	28		vugs and fractures							





DE&S

Borehole Stratigraphic Logs

BOREHOLE	DEPTH (Ft)	VAPOUR READING	SOIL TYPE	DESCRIPTION
S-25	0 – 2		GRAVEL/SAND	black, wet, gravel & fine sand to 1', then hard clayey silt - brown, moist, no odour
	2 –4		SILTY CLAY	moist, hard, layered, reddish-brown, no staining or odour
	4 – 6	PID - 0.2	CLAYEL SILT	brown, some reddish, clayey silt, minor log-like pockets damp-moist, no staining or odour
	6 – 8	PID - 0.4	SILT	reddish brown, silt, moist, wet, no staining or odour
	8 – 10	CGI - 1.4 ppm PID - 0.9	SILT	reddish brown, silt, moist, wet, no staining or odour
	10 – 12	CGI - 1.4 ppm PID - 0.3	SILT	reddish brown, silt, moist, wet, no staining or odour
	12 – 14	CGI - 1.7 ppm PID - 0.4	SILT	reddish brown, silt, moist, wet, no staining or odour
	14 – 16	CGI - 1.5 ppm PID - 2.5	SILT CLAY	reddish grey, moist, wet, sticky, no staining or odour
	16 – 18	CGI - 1.2 ppm PID - 4.8	CLAY	brown-grey, wet, sticky (minor silt), no staining or odour
	18 – 20	CGI- 1.2 ppm PID - 0	SILTY CLAY	reddish brown, wet, silty clay, no staining or odour
S-26	0 – 2	CGI - 0 ppm PID - 3.1	GRAVEL/SAND	black, moist, gravel & sand, with brown, moist, silt no odour
	2 –4	CGI - 6 ppm PID - 41.5	CLAYEY SILT	brown, damp-moist, clayey silt no staining or odour
	4 – 6	CGI - 1.8 ppm PID - 349	CLAYEY SILT	brown-reddish, moit, clayey silt, may be fill
	6 – 8	CGI - 0ppm PID - 100	SILT	reddish-brown, moist, wet silt some light grey bands, no staining or odour
	8 – 10	CGI- 3.9 ppm PID - 19.1	SILT	reddish-brow, moist, silt no staining or odour
	10 – 12	CGI - 0 ppm PID - 3.7	CLAYEY SILT	moist-wet, reddish brown, some grey-brown clayey silt, no staining or odour
	12 – 14	CGI - 0 ppm PID - 1.6	CLAYEY SILT	reddish-brown, silt to clayey silt, moist, wet no staining or odour
	14 – 16	CGI - 1.1 ppm PID - 0.6	CLAY	grey-brown, wet, sticky clay, no staining or odour
	16 – 18	CGI - 0.8 ppm PID - 1.4	CLAY	grey-brown, wet, sticky clay no staining or odour
	18 – 20	CGI - 0.3 ppm PID -1.9	CLAY	reddish-brown, silty clay, wet, sticky, no staining or odour

Borehole Stratigraphic Logs

BOREHOLE	DEPTH (Ft)	VAPOUR READING	SOIL TYPE	DESCRIPTION
S-27	0 – 2.5		CONCRETE	
	2.5 – 4.5	CGI - 0 PID - 3.4	SILT	grey-brown, moist, silt with minor gravel, no staining or odour
	4.5 - 6	CGI - 0 ppm PID - 20.1	CLAYEY SILT	reddish brown, clayey silt, hard, damp-moist, minor gravel (fill)
	6 – 8	CGI- 0.3 ppm PID - 12.0	SILT	reddish brown, wet, silt no staining or odour
	8 – 10	CGI - 0 ppm PID - 111	SILT	reddish-brown silt, moist-wet, massive, minor gravel, no staining or odour
	10 – 12	CGI - 0 PID - 152	CLAYEY SILT	reddish brown, hard, clayey silt, some greyish silty clay, moist no staining or odour
	12 –14	CGI - 0 ppm PID - 10.5	SILT	reddish brown silt, softer, wet no staining or odour
	14 – 16	CGI - 0ppm PID - 0.8	STICKY CLAY	grey brown sticky clay, wet, no staining or odour
	16 – 18	CGI - 0 PID -2.5	CLAY	brownish-grey, sticky, wet clay, no staining or odour
	18 – 20	CGI - 0 PID - 0.5	SILTY CLAY	brown, wet, sticky, silty clay no staining or odour
S-28	0 - 2	CGI - 0 ppm PID - 34.2 ppm	SAND	black medium sand and gravel, some grey rock layers, moist no odour
	2 - 4	CGI- 0ppm PID- 36.3 ppm	CLAYEY SILT	reddish-brown, moist, clayey silt, no staining or odour
	4 - 6	CGI - PID- 39.0 ppm	CLAYEY SILT	red-brown, moist, clayey silt, some black gravel sloughing no staining or odour
	6 – 8	CGI - 0ppm PID - 36.4	CLAYEY SILT	light reddish-brown, moist, clayey silt. Darker with depth no staining or odour
	8 – 10	CGI - 0 ppm PID - 34.2 ppm	CLAYEY SILT	reddish-brown, moist silt to clayey silt, no staining or odour
	10 – 12	?	?	No recovery
	12 –14	CGI - 0 ppm PID - 34.7 ppm	CLAYEY SILT	moist, little sample, lots of sloughing, asbestos, no staining or odour
	14 – 16	CGI - 9 ppm PID - 32.7 ppm	SILTY CLAY	reddish brown, sticky, silty clay, moist-wet, no staining or odour
	16 – 18	CGI - 0ppm PID - 2.1 ppm	SILTY CLAY	red-brown, clay to silty clay, sticky, wet, no staining or odour
	18 – 20	CGI - 0 ppm PID - 7.5 ppm	CLAY	red-brown, wet, sticky clay. no staining or odour

Surface Soil Stratigraphic Logs

SAMPLE LOCATION	DEPTH (INCHES)	SOIL TYPE	DESCRIPTION
S001	0 – 2	SAND	dark brown medium sand with minor gravel, damp to moist
S002	0 – 2	SAND	dark brown medium sand with minor gravel, damp to moist
S003	0 – 2	SAND	dark brown medium sand with minor gravel, damp to moist
S004	0 – 2	SAND	dark brown medium sand with minor gravel, damp to moist

APPENDIX B

Data Validation Report/Analytical Results

ANALYTICAL RESULTS AND QA/QC REVIEW
DUKE ENGINEERING AND SERVICES
CARBORUNDUM
NOVEMBER 1997

TABLE OF CONTENTS

Page

LIST OF TABLES
(Following Report)

1.0 INTRODUCTION

The following details an assessment and validation of analytical results reported by American Environmental Network (AEN) for thirty groundwater and nine soil samples collected in November 1997 at Carborundum by Duke Engineering and Services, Inc. (formerly Intera Consultants).

All samples were analyzed for Site Specific Parameter List (SSPL) volatile organic compounds according to Method 8260 referenced from "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", USEPA SW-846, 3rd Edition, 1986 (with revisions). Summaries of the analytical results are presented in Tables 1 and 2.

The Quality Assurance/Quality Control (QA/QC) criteria by which these data have been assessed is outlined in the analytical method and the document entitled "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review", EPA 540/R-94/012, February 1994.

2.0 SAMPLE HOLDING TIMES

Based on the method the following sample holding time requirements have been established:

Parameter	*Matrix*	*Holding Time Criteria*
SSPL Volatiles	Water	14 days from collection to analysis
SSPL Volatiles	Soil	14 days from collection to analysis

All samples were analyzed within the required holding time. Method 8260 does not specify temperature preservation, but it is recommended that samples be received at the laboratory at 4°C (±2°C). Samples were received at the proper temperature with the exception of samples collected November 18, 19, 20 and 21, 1997. All results for the associated samples were qualified as estimated to reflect the possible analyte loss due to the elevated temperatures (see Table 3). Non-detect sample results for samples received at 24°C are highly suspect.

3.0 GAS CHROMATOGRAPH/MASS SPECTROMETER (GC/MS) TUNING AND MASS CALIBRATION - VOLATILES

Prior to analysis, GC/MS instrumentation is tuned to ensure optimization over the mass range of interest. To evaluate instrument tuning, the compound bromofluorobenzene (BFB) is analyzed and the resulting spectra must meet specific criteria before analysis is initiated. Analysis of the tuning compound must then be repeated every 12 hours throughout the sample analysis period to ensure the continued optimization of the instrument.

The tuning compound was analyzed at the required frequency and all tuning criteria were met.

4.0 INSTRUMENT CALIBRATION

4.1 INITIAL CALIBRATION

To quantify compounds of interest in samples, calibration of the GC/MS over a specific concentration range must be performed. Initially, a five-point calibration curve containing all compounds of interest is analyzed. The linearity of the curve, as well as instrument sensitivity, is then evaluated using specific criteria outlined in the method.

The initial calibration was performed as required and acceptable sensitivity was demonstrated for all analytes of interest. The calibration curves generated showed acceptable linearity for all compounds of interest with the exception of acetone. All positive acetone results were qualified as estimated (see Table 4). All non-detect results were judged to be acceptable based on acceptable analyte sensitivity.

4.2 CONTINUING CALIBRATION

To ensure that instrument calibration is acceptable throughout the sample analysis period, continuing calibration standards must be analyzed and compared to the initial calibration curve every 12 hours. Criteria for evaluating the results of the continuing calibration are specified in the analytical method.

All continuing calibration criteria were in compliance with the method requirements.

5.0 INTERNAL STANDARDS PERFORMANCE

To ensure that changes in GC/MS response and sensitivity do not affect sample analysis results, internal standards are added to each sample prior to analysis. All results are then calculated as a ratio of the internal standard response.

All internal standard results reported for the volatiles analysis of the samples met the method-specified criteria, and all results were calculated correctly using the internal standard responses.

6.0 SURROGATE SPIKE RECOVERIES

All samples and blanks are spiked with surrogate compounds prior to sample analysis. Surrogate recoveries provide a means to evaluate the effects of individual sample matrices on analytical efficiency.

All samples were spiked with the proper surrogate compounds and all surrogate recoveries showed acceptable analytical efficiency.

7.0 LABORATORY BLANK ANALYSES

The purpose of assessing the results of laboratory blank analyses is to determine the existence and magnitude of contamination introduced during analysis. Laboratory blanks were analyzed at a minimum frequency of one per 20 investigative samples and/or one per analytical sequence.

Laboratory blanks were analyzed at the required frequency and all results were non-detect for the compounds of interest with the exception of acetone present at 2 µg/kg in the blank analyzed on November 20, 1997. All associated sample results were non-detect for acetone and would not have been affected.

8.0 BLANK SPIKE (BS)

BSs are prepared and analyzed as samples to assess the analytical efficiencies of the methods employed, independent of sample matrix effects.

BSs were analyzed at the proper frequency and all recoveries were acceptable indicating adequate analytical efficiency.

9.0 MATRIX SPIKE/MATRIX SPIKE DUPLICATE (MS/MSD) ANALYSIS

The recoveries of MS/MSD analyses are used to assess the effects of sample matrices on analytical accuracy. MS/MSD samples are prepared and analyzed at a minimum frequency of one per 20 investigative samples. The Relative Percent Difference (RPD) between the MS and MSD analyses indicates the quality of analytical precision achieved.

MS/MSD analyses were performed at the proper frequency. All recoveries and RPD values were acceptable indicating adequate analytical accuracy and precision.

10.0 CONCLUSION

Based on the preceding assessment, the data were acceptable with the qualifications noted.

TABLE 1

ANALYTICAL RESULTS SUMMARY - GROUNDWATER SAMPLES
CARBORUNDUM COMPANY
NOVEMBER 1997

	Sample ID:	*7077G001*	*7077G002*	*7077G003*	*7077G004*	*7077G005*	*7077G006*
	Collection Date:	*11/18/97*	*11/18/97*	*11/18/97*	*11/18/97*	*11/18/97*	*11/18/97*
Parameters	*Units*						
TCL Volatiles							
Vinyl chloride	µg/L	11 J	23 J	2 UJ	59 J	68 J	32 J
1,1-Dichloroethane	µg/L	1500 J	5 UJ	12 J	5 UJ	5 UJ	5 UJ
cis-1,2-Dichloroethene	µg/L	5200 J	110 J	5 UJ	450 J	590 J	49 J
trans-1,2-Dichloroethene	µg/L	6 J	5 UJ	5 UJ	5 UJ	5 J	5 UJ
Trichloroethene	µg/L	1400 J	5 UJ	5 UJ	6 J	5 UJ	5 UJ
Benzene	µg/L	4 J	0.7 UJ	0.7 UJ	0.7 UJ	0.7 UJ	0.7 UJ

	Sample ID:	*7077G007*	*7077G008*	*7077G009*	*7077G010*	*7077G011*	*7077G012*
	Collection Date:	*11/19/97*	*11/19/97*	*11/19/97*	*11/19/97*	*11/19/97*	*11/20/97*
TCL Volatiles							
Vinyl chloride	µg/L	4 J	2 UJ	2 U	2 UJ	2 UJ	2 U
1,1-Dichloroethane	µg/L	5 UJ	5 UJ	5 U	5 UJ	5 UJ	5 U
cis-1,2-Dichloroethene	µg/L	6 J	6 J	5 U	5 J	5 UJ	5 U
trans-1,2-Dichloroethene	µg/L	5 UJ	5 UJ	5 U	5 UJ	5 UJ	5 U
Trichloroethene	µg/L	5 UJ	5 UJ	5 U	5 UJ	5 UJ	5 U
Benzene	µg/L	0.7 UJ	0.7 UJ	0.7 U	0.7 UJ	0.7 UJ	0.7 U

TABLE 1
ANALYTICAL RESULTS SUMMARY - GROUNDWATER SAMPLES
CARBORUNDUM COMPANY
NOVEMBER 1997

Parameters	*Sample ID:* *Collection Date:* *Units*	*7077G013* *11/20/97*	*7077G014* *11/20/97*	*7077G015* *11/20/97*	*7077G016* *11/20/97*	*7077G017* *11/20/97*	*7077G018* *11/20/97*
TCL Volatiles							
Vinyl chloride	µg/L	2 U	65	67	52	2 U	56
1,1-Dichloroethane	µg/L	5 U	18	18	5 U	5 U	5 U
cis-1,2-Dichloroethene	µg/L	5 U	1200	1200	910	5 U	700
trans-1,2-Dichloroethene	µg/L	5 U	12	13	11	5 U	5 J
Trichloroethene	µg/L	5 U	5 U	5 U	28	5 U	5 U
Benzene	µg/L	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U	0.7 U

	Sample ID: *Collection Date:*	*7077G019* *11/20/97*	*7077G020* *11/20/97*	*7077G021* *11/21/97*	*7077G022* *11/21/97*	*7077G023* *11/21/97*	*7077G024* *11/21/97*
TCL Volatiles							
Vinyl chloride	µg/L	14	33 J	53 J	14 J	65 J	2 UJ
1,1-Dichloroethane	µg/L	5 U	5 UJ	5 UJ	5 UJ	5 UJ	5 UJ
cis-1,2-Dichloroethene	µg/L	110	270 J	250 J	120 J	760 J	5 UJ
trans-1,2-Dichloroethene	µg/L	5 U	5 UJ	5 UJ	5 UJ	5 J	5 UJ
Trichloroethene	µg/L	5 U	5 J	5 UJ	5 UJ	5 UJ	5 UJ
Benzene	µg/L	0.7 U	0.7 UJ	0.7 UJ	0.7 UJ	0.7 UJ	0.7 UJ

TABLE 1

ANALYTICAL RESULTS SUMMARY - GROUNDWATER SAMPLES
CARBORUNDUM COMPANY
NOVEMBER 1997

	Sample ID:	*7077G025*	*7077G026*	*7077G027*	*7077G028*	*7077G029*	*7077G030*
	Collection Date:	*11/21/97*	*11/21/97*	*11/21/97*	*11/21/97*	*11/21/97*	*11/24/97*
Parameters	*Units*						
TCL Volatiles							
Vinyl chloride	µg/L	31 J	2 UJ	2 UJ	68	43	22
1,1-Dichloroethane	µg/L	10 UJ	5 UJ	5 UJ	10 U	10 U	2 J
cis-1,2-Dichloroethene	µg/L	410 J	5 UJ	5 UJ	640	410	45
trans-1,2-Dichloroethene	µg/L	10 UJ	5 UJ	5 UJ	10 U	10 U	5 U
Trichloroethene	µg/L	36	5 UJ	5 UJ	10 U	10 U	5 U
Benzene	µg/L	1 UJ	0.7 UJ	0.7 UJ	1 U	1 U	0.7 U

Notes:

J	Estimated.
TCL	Target Compound List
U	Not detected at or above associated value.

TABLE 2

ANALYTICAL RESULTS SUMMARY - SOIL SAMPLES
CARBORUNDUM COMPANY
NOVEMBER 1997

Parameters	*Sample ID:* *Collection Date:* *Units*	*7077S001* *11/19/97*	*7077S002* *11/19/97*	*7077S003* *11/19/97*	*7077S004* *11/19/97*	*7077S005* *11/19/97*
TCL Volatiles						
Vinyl chloride	µg/kg	11 UJ	11 UJ	11 UJ	14 UJ	12 U
Acetone	µg/kg	11 UJ	11 UJ	11 UJ	14 UJ	6 J
cis-1,2-Dichloroethene	µg/kg	5 UJ	6 UJ	6 UJ	7 UJ	6 U
trans-1,2-Dichloroethene	µg/kg	5 UJ	6 UJ	6 UJ	7 UJ	6 U
Trichloroethene	µg/kg	5 UJ	6 UJ	6 UJ	7 UJ	6 U
Toluene	µg/kg	5 UJ	6 UJ	6 UJ	7 UJ	6 U
Ethyl benzene	µg/kg	5 UJ	6 UJ	6 UJ	7 UJ	6 U
Total Xylenes	µg/kg	5 UJ	6 UJ	6 UJ	7 UJ	6 U

	Sample ID: *Collection Date:*	*7077S006* *11/19/97*	*7077S007* *11/19/97*	*7077S008* *11/19/97*	*7077S009* *11/21/97*
TCL Volatiles					
Vinyl chloride	µg/kg	12 U	3 J	13 U	12 U
Acetone	µg/kg	46 J	5 J	13 U	12 U
cis-1,2-Dichloroethene	µg/kg	26	2400	230	6 U
trans-1,2-Dichloroethene	µg/kg	6 U	6 U	6 U	6 U
Trichloroethene	µg/kg	660	630	4000	6 U
Toluene	µg/kg	150	180	1600 U	6 U
Ethyl benzene	µg/kg	13	66	6 U	6 U
Total Xylenes	µg/kg	70	220	270	6 U

Notes:

J	Estimated.
TCL	Target Compound List.
U	Not detected at or above associated value.

TABLE 3

QUALIFIED SAMPLE DATA DUE TO TEMPERATURE EXCEEDANCES
CARBORUNDUM COMPANY
NOVEMBER 1997

Parameter	*Sample ID*	*Received Temperature (°C)*	*Temperature Criteria (°C)*
VOCs	7077G001	14	2-6
VOCs	7077G002	14	2-6
VOCs	7077G003	14	2-6
VOCs	7077G004	14	2-6
VOCs	7077G005	14	2-6
VOCs	7077G006	14	2-6
VOCs	7077G007	14	2-6
VOCs	7077G008	14	2-6
VOCs	7077G010	14	2-6
VOCs	7077G011	14	2-6
VOCs	7077S001	14	2-6
VOCs	7077S002	14	2-6
VOCs	7077S003	14	2-6
VOCs	7077S004	14	2-6
VOCs	7077G020	24	2-6
VOCs	7077G021	24	2-6
VOCs	7077G022	24	2-6
VOCs	7077G023	24	2-6
VOCs	7077G024	24	2-6
VOCs	7077G025	24	2-6
VOCs	7077G026	24	2-6
VOCs	7077G027	24	2-6

Notes:

VOCs	Volatile Organic Compounds.

TABLE 4

QUALIFIED SAMPLE DATA DUE TO OUTLYING CALIBRATION RESULTS
CARBORUNDUM COMPANY
NOVEMBER 1997

Parameter	*Compound*	*Calibration Date*	*%D*	*Associated Sample ID*	*Sample Results*	*Units*	*Qualifier*
VOCs	Acetone	11/17/97	42	7077S005	6 J	µg/L	*
				7077S006	46	µg/L	J
				7077S007	5 J	µg/L	*

Notes:

%D	Percent Difference.
*	Sample results previously qualified as estimated by the laboratory.
J	Associated value is estimated.
VOCs	Volatile Organic Compounds.

DE&S

Duke Engineering & Services