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FINAL REPORT
VOLUME 1 of 2

RCRA FACILITY INVESTIGATION
NEUTRALIZATION POND

BELL AEROSPACE TEXTRON
WHEATFIELD PLANT

Bell Aerospace TEXTRON
Division of Textron Inc.

Prepared by:
Golder Associates
Mt. Laurel, New Jersey

893-6262

JUNE, 1991

Bell

Corrective Measures
Implementation Plan
Onsite System
Golder - 3/93

Copy:

- Sec. 1 through 4 (19)
- Cover Page (1)
- Table of Contents (2)

Golder Associates Inc.
CONSULTING ENGINEERS

FINAL REPORT

RCRA FACILITY INVESTIGATION
NEUTRALIZATION POND
BELL AEROSPACE TEXTRON
WHEATFIELD PLANT

VOLUME 1 OF 2

Submitted to:

Bell Aerospace Textron
2221 Niagara Falls Boulevard
Niagara, New York

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June 1991

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FINAL
DRAFT REPORT

RCRA FACILITY INVESTIGATION
NEUTRALIZATION POND
BELL AEROSPACE TEXTRON
WHEATFIELD PLANT

VOLUME 1 OF 2

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February 1991

Project No.: 893-6262

Golder Associates Inc.
CONSULTING ENGINEERS

February 12, 1991 Project No.: 893-6262

Bell Aerospace Textron
2221 Niagara Falls Blvd.
Niagara, NY 14304

Attn: Mr. Brian Smith

RE: DRAFT FINAL RCRA FACILITY INVESTIGATION REPORT -
NEUTRALIZATION POND WHEATFIELD PLANT
NIAGARA, NEW YORK

Gentlemen:

Please find enclosed 12 copies of the Draft Final RFI report for the Neutralization Pond Solid Waste Management Unit. This report combines the findings of the five phases of site investigations completed at the Wheatfield Plant since 1985, and incorporates the comments of Bill Wertz on the preliminary version of this report.

If you have any questions, please call.

Very truly yours,

GOLDER ASSOCIATES INC.

Richard C.F. King, P. Eng.
Associate

RCFK/bjt
C:6262CSCL

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1.0 INTRODUCTION

1.1 Purpose

Bell Aerospace Textron (BAT) has completed a Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) at the BAT Wheatfield Plant in the town of Wheatfield, Niagara County, New York (see Figures 1-1 and 1-2). This work was undertaken in compliance with Consent Agreement Case No. RCRA 85-010-9 Index No. 051485, with the New York State Department of Environmental Conservation (NYSDEC). The RFI was conducted in accordance with Section 3004 (u) and (v) of RCRA as amended by the Hazardous and Solid Waste Amendments of 1984 (HSWA) and Subpart F of 40 CFR Part 264. The purpose of the RFI was to determine the nature and extent of groundwater degradation associated with the Neutralization Pond Solid Waste Management Unit (SWMU) at the Wheatfield Plant.

The Neutralization Pond SWMU along with 25 other potential SWMUs was identified by a Draft RCRA Facility Assessment - Preliminary Review (RFA) completed by the NYSDEC and received by BAT in April 1989. In addition, BAT identified one further SWMU, a former drum storage area behind the boiler house, the location and current status of these SWMUs are shown on Figure 1-3. BAT has completed studies of all of the 27 potential SWMUs.

In agreement with NYSDEC, and as concurred by the USEPA, BAT has included two of the identified SWMUs, the Helicopter Blade Bonding Building (SWMU No. 9), and the Rocket Test Building (SWMU No. 13) in the investigation of the Neutralization Pond (SWMU No. 1). It is currently envisioned that these three SWMUs will be grouped together in a single Corrective Action Management Unit (CAMU).

BAT is in the process of clean closing two SWMUs. These are:

- o The Former Drum Storage Yard, SWMU No. 27 (identified by BAT)
- o The Former Drum Storage Yard, SWMU No. 2

At the request of BAT, Frontier Technical Associates Inc. will submit the "SWMU Reconnaissance Soiling Sampling, Bell Aerospace Textron" FTA report ETA-418-1, February 1991. This report defines the status of SWMUs other than those associated with the Neutralization Pond.

The RFI for the Neutralization Pond SWMU (the Neutralization Pond investigation) and two contiguous SWMUs has been completed in several phases of site investigation beginning in 1982 (see Section 1.2.3). The last phase of investigation, Phase V, was completed in September 1990. This report provides a compilation and interpretation of the data developed by the previous studies and presents and integrates the results of the Phase V Investigation. A listing of all reports completed for these studies is provided in the bibliography. Section 1.2 discusses the site background. Section 3 provides review of the studies prior to Phase V study.

The findings of the RFI are presently being used as a basis for review and selection of potential remedial technologies and corrective measures for the areas of groundwater contamination identified by the Neutralization Pond investigation.

The specific objectives of this RFI report include the following:

- o Summarize the site history and provide background data;

- Describe the regional and site specific geologic and hydrogeologic characteristics;
- Present and evaluate analytical results from soil, surface water, and groundwater;
- Describe the nature and extent of groundwater degradation associated with the Neutralization Pond SWMU.

The remainder of Section 1 provides the site description, history of the Neutralization Pond closure, synopsis of the previous site investigations, summary of the regulatory history of the site, and an overview of this RFI report.

1.2 Site Background

1.2.1 Site Description History

The Bell Aerospace Textron (BAT) Wheatfield Plant is located near the western boundary of the town of Wheatfield, Niagara County, New York (see Figure 1-1). This large industrial facility is bounded by Niagara Falls Boulevard (U.S. Route 62) to the south, Walmore Road to the east, Carborundum Abrasives Company Plant to the north, and the Niagara Falls International Airport to the northwest and west.

Bell Aircraft Corporation began operations at the Wheatfield Plant in 1942. In 1960, Textron purchased the military defense business from Bell Aircraft Corporation and established the Bell Aerospace Division of Textron (BAT). In 1973, BAT acquired the real property which comprises the Wheatfield plant.

Aircraft construction and a variety of manufacturing and research activities have been conducted at the Plant. A wide range of aerospace related equipment has been manufactured at the plant, including propulsion devices, electronic systems, helicopter components, aircraft prototypes, air cushion vehicles, electrical test equipment, aircraft components, rocket propulsion hardware, lasers, etc. In support of these manufacturing efforts, various industrial processes were developed and utilized by BAT including: pickling, plating, cleaning, machining, painting, heat treating, bonding, rocket test firing, coal gasification, printing, and welding. Figure 1-2 shows the general layout of the manufacturing facility. The plant infrastructure includes various office buildings, large span buildings for aircraft assembly, metal processing shops, metal cleaning facilities, rocket test cells, maintenance areas, and mezzanines.

1.2.2 Neutralization Pond History

The Neutralization Pond was approximately rectangular in shape, about 100 feet by 60 feet in plan dimension. Records and information from employees at the BAT plant indicate the Neutralization Pond was constructed in 1949 and used extensively for waste fluid neutralization and disposal through the 1950's, and to a lesser extent through the 1960's. The use of the Pond for neutralization and disposal apparently decreased significantly in the 1970's and 1980's. During operation, neutralized water from the Pond was discharged to the Plant's sanitary sewer. The Pond was physically closed in 1987.

The Neutralization Pond was initially constructed to collect waste propellants and associated flush waters from rocket engine test firings in the Rocket Test Building. After firing, the propellants were flushed from the engines onto the concrete floors of the test cells, down a ramp, and into drains which discharged by pipe to the Pond. The pH of the fluids were monitored and adjusted with sodium hydroxide and/or calcium hypochlorite to maintain an acceptable range. Few records are available to quantify the type or volume of fluids used in the test programs, but the propellants were primarily hydrazines and the fluids associated with the rocket testing apparently included, but may not have been limited to, methylene chloride, trichloroethylene (TCE), acetone and water. The Rocket Test Cell facilities are now owned by Atlantic Research Corporation (ARC) and are located at the Wheatfield Plant pursuant to a ground lease between BAT and ARC.

In addition to the use of the Pond for neutralizing the waste propellants, it was apparently also used for disposal of solvents and fluids from other parts of the plant. Interviews of previous employees indicates the Pond may have been used for disposal of TCE from a small laboratory in the Rocket Test Building (SWMU No. 13). Other potential sources of TCE, and potentially acetone and methylene chloride, may have included the plating and finishing department and degreasing operations in the rocket engineering department.

The Blade Bonding Building, constructed in 1966, was also investigated as a potential contributor of releases to the groundwater and solvents to the Pond. Employee interviews indicate the operation consisted of dipping and treating helicopter rotor blades in a series of large concrete tanks, one of which was a TCE vapor degreasing process. The tanks were located immediately adjacent to one another allowing insufficient room for significant dripping to the floor. The tanks had no drains and had to be emptied for cleaning by pumping. An outside vendor removed the waste solvent. The employees consistently indicated that the Blade Bonding Facility did not discharge TCE to the Neutralization Pond, even though there was a central floor drain which was piped directly to the Pond. Also because the system used a vapor degreasing process, the TCE evaporated immediately upon the blade's contact with the ambient air.

Between 1976 and 1982, wastewater from coal gasification experiments was intermittently discharged to the Pond. This residue consisted primarily of slag particles and ash from bituminous coal and lignite. Between 1982 and July 1984, the Pond received only occasional small discharges following rocket test firings with the majority of the Pond water consisting of storm water runoff.

The Pond was constructed entirely within the overburden soils and did not contain a synthetic bottom liner. It was approximately 9 feet to 12 feet deep, and contained approximately 3 feet to 6 feet of water depending on the rates of precipitation, waste water inflow, and Pond discharge. Sediment and sludge deposits accumulated on the Pond bottom. The thickness of these deposits was measured by Goldberg-Zoino Associates (GZA) in September 1982 (Reference 16), and was reported to range from 0 feet to 3 feet. BAT periodically dredged the Pond to remove the bottom sediments. This dredging process occurred at approximately eight year intervals with the last dredging completed in 1978.

Studies completed by GZA (Reference 16) from 1982 to 1985 (see Section 3) indicated that organic compounds had been released from the Pond to the groundwater in the overburden soil and underlying bedrock. As a consequence, BAT entered into two Consent Agreements with the NYSDEC: one to provide for immediate closure of the Neutralization Pond and the other to provide for an investigation of the nature and extent of the contaminant plume. BAT submitted a Closure Plan prepared by Frontier Technical Associates (Frontier) (Reference 9).

The following provides a chronology of the Neutralization Pond closure activities:

Date	Item
July 1985	Closure Plan submitted to NYSDEC and USEPA.
October 1985	Revised Closure Plan submitted to NYSDEC and USEPA.
October 8, 1986	Closure Plan approved by NYSDEC.
April 1987	Complete plans and specifications for closure submitted to BAT.
August 5, 1987	Contract awarded to SLC Consultants/Contractors for Pond closure and associated work.
May 19, 1988	Pre-closure inspection by NYSDEC Region IX personnel (Mr. Nelson Schnabel).
June 15, 1988	Closure certified by David M. Harty, P.E., of Frontier Technical Associates, included in Summary of Closure Activities report (Frontier, June 1988).
October 11, 1988	NYSDEC issued a letter accepting the Closure Certification. This letter was signed by Paul Counterman of NYSDEC.

Since closure certification, BAT has erected a tubular steel fence around the perimeter of the Pond to prevent vehicular access and performed routine maintenance of the cover.

The following points are noted from the Frontier Summary of Closure Activities report (Reference 9):

- At the time of closure, the liquid wastes received by the Pond were considered to include one or more of the following constituents:

Nitrogen tetroxide
Hydrazine
Monomethyl hydrazine
u-Dimethyl hydrazine
Sodium hydroxide
Potassium hydroxide
Isopropyl alcohol
Methylene chloride
Trichloroethylene
1,2-trans-dichloroethylene
Acetone
Polychlorinated Biphenols
Polycyclic Aromatic Hydrocarbons

- The overburden beneath the original Pond bottom was excavated to bedrock.
- A geologist from NYSDEC Region IX office (Mr. Larry Thomas) inspected the excavated Pond and determined that all sludge had been removed and that the excavation was completed to the top of rock.
- The excavation was backfilled and capped with recompacted clay and a 6-inch layer of topsoil.
- All pipes entering the Pond were plugged and sealed.
- The in-situ recompacted clay (obtained from the Summit Park Lake clay pit off Walmore road in Niagara County) was determined to have a permeability of 1.08×10^{-8} cm/sec to 5.99×10^{-9} cm/sec.

To determine the initial nature and concentration of constituents in the Pond side walls and sludge, a sample consisting of 28 soil/sludge subsamples from the Pond was taken in August 1987 and analyzed to characterize the matrix prior to closure.

The sampling was performed by Frontier, and the samples were sent to RECRA Environmental Inc. (RECRA) of Amherst, New York for chemical analyses.

The sampling and analytical procedures used by Frontier and RECRA were adapted from:

1. SW846, April 1984, Second Edition
2. EPA methods, 600 Series, October 1984
3. ASTM methods (D-1429, D-1385-78)

The analytical methods used to characterize the Pond material were:

EP Toxicity Test - 8 metals
6 pesticides

RCRA Characteristics - Reactivity
Corrosivity
Ignitability

Priority Pollutants - Volatile organics
Base Neutral/Acid extractables
Pesticide/PCB extractable

Measurements were also made for parameters such as pH, specific gravity, nitrate, sulfide, phenols, cyanide, and total filterable residue.

Results from the EP Toxicity Test indicated that all detected parameters were below the concentrations which would characterize the material as hazardous waste. The RCRA characteristic testing indicated that the soil/sludge sample was non-reactive, non-corrosive, and non-ignitable. Consequently, the material was not hazardous waste by characteristic. The results for the priority pollutant analysis for volatile organics reported detection of trans-1,2-dichloroethylene and trichloroethylene, two compounds associated with the manufacturing activities at the Plant.

The results of the base neutral/acid extractable analyses indicated low concentrations of anthracene (10 ug/g), benzo(a)anthracene (19 ug/g), benzo(a)pyrene, (13 ug/g) Benzo(g,h,i)perylene (10 ug/g), chrysene (22 ug/g), and indeno(1,2,3-cd)pyrene (9.4 ug/g). The following compounds were detected at slightly higher concentrations: Benzo(b)fluoranthene (31 ug/g), fluoranthene (56 ug/g), phenanthrene (40 ug/g), and pyrene (45 ug/g). The results for the pesticide/PCB analysis indicated the presence of only one PCB, Aroclor 1254, at a concentration of 26 ug/g, just slightly above its detection limit of 20 ug/g.

In summary, the results from the EP Toxicity and characteristics testing indicated the material to be "non-hazardous." The volatile organic compounds detected from the priority pollutant analysis have also been detected in monitoring wells surrounding the Pond. The compounds detected from the base neutral/acid extractable analyses may be due to miscellaneous disposal activities such as coal gasification wastes from on-site experimental tests. The source of the PCB Arochlor is unknown.

Pond closure required excavation and removal of sludges and soil until the soil was found to contain lower concentrations of compounds than detected in groundwater wells surrounding the Pond, or until the excavation reached a practical limit such as the water table or the safe structural equilibrium of the side slopes of the excavation. The highest reported concentration of volatile organic compounds for the first ring of wells around the Pond (B-4, B-6, B-10A, and B-11S, see Figure 3-3 for locations) was 1265.6 ppm in well B-4. The highest reported concentration found in the soils samples from the bottom and sides of the Pond was 720.3 ppm. In addition, the contractor had reached the practical limit of excavation. Thus, both closure conditions were met. Additional information related to Pond closure is provided in the Frontier Summary of Closure Activities report (Reference 9).

1.2.3 History of Site Groundwater Investigations

The Neutralization Pond and the groundwater in the area investigated were the subject of a number of investigations reported in the following:

- o 1985 Goldberg-Zoino and Associates Geohydrologic Studies.
- o 1986 Golder Associates Phase I and II.
- o 1987 Golder Associates Phase III.
- o 1988 Golder Associates Phase IV.

The reports of Goldberg-Zoino and Associates and Golder Associates Phase I through IV investigations have been submitted to NYSDEC and USEPA and are referenced by this document. Since the Golder Associates Phase I and II studies re-evaluated the hydrogeologic conditions reported by GZA, only the GZA boring and monitoring well installation logs have been included in this report. All boring and monitoring well logs for all site work completed between 1982 and 1990 are included in Appendix D. The locations of all borings, monitoring wells, and piezometers are shown on Figures 3-1, 3-2, and 3-3.

The GZA studies were undertaken to satisfy the groundwater monitoring requirements of paragraph C of 40 CFR Part 265.90, to determine whether a waiver of the groundwater monitoring requirements would be permissible. These studies were completed between 1982 and 1985 in three phases as follows:

> Phase-1: GZA retained Rochester Drilling Company Inc. of Rochester, New York, and completed six borings within the soil overburden surrounding the Pond (August 11 through August 16, 1982). Five of these borings (B-

1, B-3, B-4, B-5 and B-6) were converted to monitoring wells. Volatile organic compounds were detected in the groundwater samples taken from these wells.

Phase-2: Groundwater flow estimates completed by GZA during their Phase-1 study indicated maximum groundwater flow distances within the overburden of about 300 feet. Four additional wells were installed (B-7, B-8, B-9 and B-12) by Parrat-Wolff Inc. of East Syracuse, New York (June 7 through June 10, 1983). These wells, located at a distance of approximately 300 feet from the Pond, were sealed within the soil overburden. Two more wells (B-10 and B-11) were also installed with separate screen sections sealed within the soil overburden and in the bedrock. Volatile organic compounds were detected in the bedrock groundwater in well B-11.

Phase-3: This was the final phase of investigation by GZA, using Empire Soil Investigations Inc. of Hamburg, New York. It was accomplished between February 14, 1984, and February 20, 1984, and consisted of the installation of four more wells within the bedrock (B-13, B-14, B-15 and B-16). Also, bedrock well B-10 was replaced by well B-10A. Two additional downgradient overburden wells were also installed (B-17 and B-18).

The report regarding all this work was submitted in January 1985 (Reference 16).

Subsequent studies completed by Golder Associates are listed below and discussed in more detailed in Section 3.

- The Phase I investigation was designed to determine the area of contaminated overburden surrounding the Neutralization Pond.
- The Phase II investigation included the drilling of four 90 feet deep coreholes outside the zone of overburden contamination to define site geologic units. Packer testing was completed and piezometer nests were installed to determine the hydrostratigraphic units at the site. A combined Phase I and II report (Reference 19) was submitted in 1987.

- The Phase III investigation was undertaken to define the nature and extent of groundwater contamination in the soil overburden, the Zone 1 bedrock, and the Zone 3 bedrock (see Sections 4 and 5). An area of Dense Non-Aqueous Phase Liquid (DNAPL) was also partially defined. This area appeared to extend to at least Walmore Road from the Neutralization Pond. The dissolved phase plume in the Zone 1 bedrock unit was found to extend past Bergholtz Creek. A limited area of groundwater containing volatile organic compounds was detected in the Zone 3 hydrostratigraphic unit. A sample of DNAPL was taken during the investigation and analyzed to determine the volatile organic compounds. The Phase III report was initially submitted in October 1988 and revised and resubmitted in 1989 (Reference 29).

- The Phase IV investigation defined the extent of the Zone 1 dissolved phase plume south of Bergholtz Creek and re-installed one on-site well. Wells were also installed to determine groundwater levels along the Cayuga Drive Extension Sanitary main sewer line trench south of the site. Water samples were taken from these wells for analysis. A sample of the dissolved phase plume in Zone 1 was taken from well 87-13(1) and submitted for analysis of the Appendix IX list of analytes. This well is the most heavily contaminated at the site. The Phase IV report was submitted in August 1989 (Reference 27).

- The Phase V investigation (described in this report, see Section 4) completed the definition of the northeastern and eastern dissolved phase plume boundaries in Zone 1, the downgradient extent of the Zone 3 dissolved phase plume, and the extent of the DNAPL plume in Zone 1. Also, sediment and water samples from Bergholtz Creek were analyzed.

  DNAPL samples were taken from wells in the vicinity of the Neutralization Pond and submitted for analysis for volatile organic compounds, and PCBs. Additionally, since the Appendix IX analysis completed in the Phase IV investigation had indicated the possibility of furans being present in the DNAPL, an additional sample was taken and analyzed to determine whether such furans are indeed present.

Other studies completed at the site include a survey of all public and private wells in the area potentially impacted by the Zone 1 plume (see Section 2.7). The report of this work was submitted to NYSDEC and New York State Department of Health (NYSDOH) in June 1990 (Reference 35).

To define aquifer hydrogeologic parameters, obtain samples of water for treatability testing, and determine treatability options for groundwater pump and treat remediation technologies, a large scale pump test was completed on well 87-14(1). Additionally, five wells within the Zone 1 dissolved phase plume were tested using long term pump-in tests to determine aquifer characteristics. This work was reported in February 1990 (Reference 33).

1.2.4 Regulatory Setting, Permits, and Consent Order

As required by RCRA, BAT filed a timely Part A Permit Application for all hazardous waste storage and management units at the Plant, including the Pond. In 1984, EPA called for the submission of the detailed Part B Permit Application. Because the GZA investigations indicated that there appeared to be a groundwater contamination problem associated with the Pond, BAT elected to close the Pond and other RCRA units and so advised EPA. Since the Pond had been used after July 1982, clean closure or a post-closure permit was required. BAT, NYSDEC, and EPA determined that a clean closure could not be accomplished and that the contamination needed to be fully investigated before a post-closure permit could define the appropriate remedial measures.

BAT, with the concurrence of EPA, entered into two Consent Agreements with NYSDEC (Case No. RCRA 85-010-9, Index No. 051485), one to provide for the prompt physical closure of the Pond and the other to provide for a phased investigation of the nature and extent of the contaminant plume released from the Pond.

Since 1988, a RCRA corrective action program, developed pursuant to HSWA, has been included in the investigative work conducted at the Site. The results presented in this RFI Report and the information to be included in the Corrective Measures Study Report will provide the basis for establishing the terms and conditions in the post-closure permit for the Pond.

2.0 SITE CHARACTERISTICS

2.1 Site Setting

As described in Section 1.2.1 the BAT Wheatfield Plant is located near the western boundary of the town of Wheatfield, New York. It is bounded by Niagara Falls Boulevard (U.S. Route 62) to the south, Walmore Road to the east and Carborundum Abrasives Company Plant to the north. The Niagara Falls International Airport forms the west and northwest boundary of the plant (see Figure 1-1).

The crest of the Niagara Escarpment is located approximately 5 miles to the north of the Plant at an elevation of about 640 feet MSL. The land slopes gently south via a broad plain to the Plant, at an elevation about 585 feet MSL, and continues southward to the Niagara River, at an elevation of roughly 563 feet MSL, approximately 2.5 miles south of the Plant. The Niagara River, which forms the main groundwater discharge for this area, flows from east to west. Niagara Falls is located about 6 miles west of the site.

Access to the site is via Niagara Falls Boulevard from the city of Niagara Falls. The Niagara Falls International Airport is not used for regularly scheduled commercial passenger airline flights. The nearest municipal airport is at Buffalo, New York. Access from Canada would be via the Queen Elizabeth Way from Toronto and Hamilton to Niagara Falls.

2.2 Demography and Land Use

The Plant is located at the eastern end of the industrial development belt which follows Niagara Falls Boulevard eastward from the City of Niagara Falls.

The Niagara Falls International Airport is located north of Route 62 to the west and northwest of the Plant boundaries. The Carborundum Abrasives Company Plant is located immediately north of the Plant on the west side of Walmore Road.

To the east of Walmore Road and south of Niagara Falls Boulevard, the area is predominantly residential and agricultural with a few small commercial developments. A clay borrow pit and an automotive scrap yard are located about a one-half mile to the northeast of the Plant.

Residential and commercial developments are planned for much of the presently agricultural area between the Plant and the Niagara River.

2.3 Climatology

The climate of the area is well described by the Soil Survey of Niagara County (Reference 39). Excerpts from this document are provided below.

Niagara County has a humid, continental type of climate. Air flow from the south or southwest brings moisture to the region from the Atlantic Ocean and Gulf of Mexico. The county has pleasantly warm summers. The winters are fairly long and cold, and they have frequent spells of cloudy, unsettled weather. Precipitation generally is evenly distributed during the year, though minimum monthly precipitation is slightly less during winter than during other seasons.

The climate is greatly influenced by the close proximity of Lakes Ontario and Erie. In spring the cold lake waters function as a heat sink that retards the normal warming of the air temperature. The lakes tend to restrict the occurrence of extreme high temperatures in summer. Niagara County is, therefore, less subject to severe thunderstorms, caused by strong summer heating, than are other counties farther inland. In fall the lake waters are a source of heat that reduces cooling at night and increases the length of the freeze-free growing season. Lake Ontario, and Lake Erie to a less extent, remains largely unfrozen in the winter; this modifies the occurrence of extreme cold temperatures in comparison with more inland areas of similar elevation and latitude.

The proximity of the Great Lakes is an important factor in the amount of snow that falls in the county. Air flow from the southwest is heated and moistened as it moves across the open, relatively warm waters of Lake Erie. Moving inland, the air masses release moisture in the form of heavy snowfall during winter months. These lake-affected storms are most common in November and December. They are characterized by substantial snow over a wide area and very heavy amounts in narrow bands or local areas.

Data from the Lockport No. 2 Northeast Weather Station, located in Niagara County, has been obtained and summarized. Figure 2-1 provides the monthly average temperature and average precipitation. Characteristic windrose data was obtained from the National Climatic Atlas for the Buffalo area (see Figure 2-2).

2.4 Surface Water Usage

The Niagara River forms the major surface water body in the study area and is located about 2.5 miles south of the BAT Plant. The Niagara River is used for drinking water and for recreation. Three tributary creeks in the area drain southwards into the Niagara River. The creeks are Cayuga Creek, Bergholtz Creek, and Sawyer Creek. Figure 2-3 shows the location of these creeks. None of these creeks are used for drinking water supplies. North and east of the study area these creeks, which are of relatively limited size, may be used for recreational fishing. Within and downstream from the study area these creeks are not known to be used for recreational activities (i.e. boating, swimming, or fishing).

2.5 Regional Geology

2.5.1 Physiographic Province

The Plant site and surrounding study area is situated within the Central Lowlands-Great Lakes Physiographic Province within what is often referred to as the glaciated part of the Allegheny Plateau. The generally rolling topography, formed by a vast glacial till plain, is underlain by sedimentary bedrock strata that, in the Niagara Region, dip gently to the south.

During the glaciation events of the Pleistocene Era, the sedimentary strata were eroded by the influence of ice sheets. The more resistant strata developed cuestas or escarpments. The Niagara Escarpment is one of these features and was developed in the Lockport Dolomite Strata which underlies much of the area.

The site is located near the northern boundary of the Huron Plain which is defined by the Niagara Escarpment to the north and the Onondaga Escarpment to the South. Regionally, the ground surface is relatively flat with a gentle slope toward the Niagara River. Ground surface elevations at the BAT Plant, determined by test boring survey, are typically about 585± 2 feet MSL.

2.5.2 Regional Stratigraphy

Surficial soils in the regional area were formed from glacial tills and glacio-lacustrine sediment (see Figure 2-4). The soil associations in the area are developed on the Huron Plain which is a relatively featureless topographic surface that lies to the south of the Niagara Escarpment. The soils are deep to moderately deep, and well drained to very poorly drained. The imprint of glacial parent material is strong; the subsoil layers are medium textured to fine-textured.

The Odessa-Lakemont-Ovid soil association formed on glacio-lacustrine till clays and silts (Association Number 11, Figure 2-4) and occupies the largest surface area in the region. Soils in this association are generally silty clay loams and silt loams, somewhat poorly drained, occurring on slopes generally less than 5 percent. Odessa soils typically occur in topographically higher positions than the Lakemont and Ovid soils. Ovid soils are confined to depressions adjacent to moraines and other till ridges. Lakemont soils are formed on glacio-lacustrine clays and other lake sediments. Odessa-Lakemont-Ovid soils are dominantly reddish in color and form the surficial soils north of Sawyer Creek.

South of Sawyer Creek, which is located about one-third of a mile south of the BAT Plant (Figure 2-4), the surficial soils are formed of the Canandaigua-Raynham-Rhinebeck association. These soils are deep somewhat poorly drained to very poorly drained soils, and have a dominantly medium textured to fine textured subsoil.

Overburden soils in the region were developed almost entirely during the late Wisconsinan glacial events which advanced the Laurentide ice sheets across the area between 30,000 and 20,000 years ago. This ice advance resulted in the development of glacial till and moraine deposits over much of the region. During the subsequent recession of the ice sheets, successive proglacial lakes, such as Lakes Maumee, Whittlesey, and Warren, developed in the Erie basin. Glacio-lacustrine silt and clay deposits developed in these proglacial lakes.

In the vicinity of the study area, the overburden soils are composed of a silt clay lacustrine till sheet which extends southwards from an area of bedrock outcrops about 3 miles north of the Plant. This till sheet is underlain by a basal till sheet and is overlain by glacio-lacustrine silts and clays which extend from just north of the BAT Plant to the Niagara River. Figures 2-5A and 2-5B show the extent of these glacial deposits. These deposits are about 14 feet to 18 feet thick in the vicinity of the Plant and thicken to about 40 feet at the Niagara County No. 1 Sewage Treatment Plant about 2 miles south of the Plant. Borings completed for a gas pipeline crossing of the Niagara River south of the site (Reference 51) indicate that the river bed is composed of 3 feet of silty clay and about 10 feet of silt till overlying the bedrock.

The Niagara region is underlain by a sequence of Ordovician through Silurian sedimentary rocks. Natural exposures of these units are present along the walls of the Niagara River Gorge located about 6 miles to the northwest of the site. The bedrock beneath the study area is made up of approximately 160 feet to 170 feet of dolomitic strata of the Middle Silurian Lockport Group (Reference 50) underlain by the Rochester Shale formation of the Clinton Group.

Figures 2-6A and 2-6B present the regional bedrock geologic map and stratigraphic column.

The stratigraphic nomenclature for the Niagara Falls area is currently under review by the USGS and the Ontario Geological Survey (OGS). The revision was necessitated because of inconsistencies in the stratigraphic nomenclature adopted for the Silurian strata that straddle the international border across the Niagara River. Regional correlations across the international border were quite difficult because the same strata were allotted different stratigraphic ranks and names (personal communication with the U.S. Geological Survey). Figure 2-7 provides Golder Associates' present understanding of the regional correlation of the Middle Silurian strata. This figure has been drawn to illustrate some of the inconsistencies encountered in correlating borehole logs of the bedrock units encountered in the site area with those in surrounding areas.

It should be noted that it is not the intent of this report to propose new stratigraphic nomenclature in the BAT site area. The purpose of the chart on Figure 2-7 is to illustrate the stratigraphic nomenclature adopted by Golder Associates for the BAT site, particularly as it pertains to the designations of stratigraphic units. In past reports submitted to BAT, lithostratigraphic rock units from the Eramosa through Gasport were classified as being part of the Oak Orchard Formation (a formational name now discontinued). In keeping with the revised USGS classification, the previous stratigraphic terminology has been modified in this report to follow the latest USGS classification scheme. Members that were previously ranked within the Oak Orchard Formation, i.e. the Eramosa Member through the Gasport Member, are now renamed and allotted formational status

(Figure 2-7). The Guelph Formation is retained as before. Golder Associates, however, prefers to retain the Decew Dolomite as being part of the Lockport Group mainly on the basis of its lithological similarity with the overlying strata rather than the underlying Rochester Shale of the Clinton Group.

The hydrogeological investigations at the BAT site have been concentrated within the upper half of the Eramosa Dolomite bedrock sequence. For purposes of evaluation and presentation of the BAT site data, the upper sequence has been subdivided into four hydrostratigraphic zones based on detailed borehole core logging and hydraulic conductivity testing. These zones are considered to be the principal areas of concern with regard to groundwater quality beneath the BAT site study area. The various aspects of the bedrock geology, including the configuration of the bedrock surface, stratigraphy of Zones 1 to 4 and the structural dip of the bedrock, are discussed in Section 5. Though Zone 1 may be correlated with the Guelph Formation, the upper and lower boundaries of Zones 2 through Zone 4 do not correlate with member designations within the Eramosa Dolomite. These hydrostatigraphic units have been developed by Golder Associates especially for this study and are based on their geologic and hydrogeological characteristics.

The overall bedrock geology shown on Figure 2-6A generally reflects the north-south succession of lithologies beneath the site area. Lithological units present in the region were described by Bolton (Reference 1), Fisher (Reference 6), Zenger (Reference 52), Rikard (Reference 48) and Tepper et al (Reference 50) and are briefly summarized below.

The lowest sedimentary stratum is the Ordovician Queenston Formation, which underlies the area from Lake Ontario to the Niagara Escarpment and consists of soft, calcareous shales. The Silurian Cataract and Clinton Groups are exposed along the face of the Escarpment, which is capped by resistant dolomites of the Middle Silurian Lockport Group. Overlying this sequence and south of the Niagara Escarpment are moderately resistant dolomites of the Middle Silurian Guelph Dolomite. This stratum is overlain by the Upper Silurian Salina Group, a thick, easily weathered argillaceous dolomitic unit with evaporite interbeds. It extends a short distance inland from the lake Erie shoreline. Along the north shore of Lake Erie, the cuesta known as the Onondaga Escarpment is capped by the Bertie Formation, composed of resistant dolomite overlain by Devonian limestones of the Onondaga Formation.

The entire sequence dips gently to the south at about 40 feet to 45 feet per mile, though shallower dips as low as 20 feet per mile are not uncommon. Except for the lithological units exposed along the walls of the Niagara River, the escarpments and in nearby quarries, most units are covered by a thick blanket of glacial and postglacial sediment. This is particularly true in areas underlain by the easily eroded Salina Group rocks.

2.5.3 Regional Structural Geology

The BAT site is located within the northern edge of the Appalachian Plateau; i.e. the northern limb of the Appalachian Basin that forms the southern tier to New York state. The site region is far from the immediate effects of Appalachian orogenic events and hence shows very little by way of large scale folds and faults. Thrust faults related to the late Paleozoic Alleghanian orogeny in the Appalachian mountain chain are manifested as blind thrusts in incompetent Devonian shales and limestones south of the Onondaga Escarpment about 20 miles south of the BAT site. Effects of the orogeny are however, displayed in the rocks by regionally pervasive, steeply dipping joint systems (Reference 5 and Reference 51). These joint systems trend roughly northeast-southwest and northwest-southeast.

Yager and Kappel 1990 (Reference 51) have described several northeast-southwest zones of more intensive jointing in the Niagara area. None of these zones have been identified in the study area.

The east-west strike and gentle southerly dips of the bedrock units presents a simple south-dipping homocline when viewed in cross section. Local variation such as small amplitude, large wavelength flexures are observed when formational contacts are contoured.

2.6 Regional Hydrogeology

The overburden soils in the Niagara area, specifically the glacial tills and glacio-lacustrine silts and clays generally yield very low amounts of water. The principal aquifers are the rock strata of the Lockport Group. Groundwater within these strata flows predominantly in the near horizontal bedding planes, especially those from which gypsiferous seams and dolomite have been dissolved and in the vertical joint sets. The bedding planes, which probably transmit most of the water, are traceable for a considerable distance, possibly over 4 miles (Reference 40).

The Lockport Dolomite has historically been divided into two zones (Reference 51). The upper zone is considered to be the upper 10 feet to 25 feet of the Lockport Dolomite. The lower zone is considered to be dominated by discrete waterbearing bedding planes (Reference 40).

Within the Lockport Dolomite, areas of increased well yield have been delineated. These areas are oriented roughly northeast-southwest and may be associated with zones of increased vertical fracturing along this alignment (Reference 51).

Within the study area the interpreted contours of the water table (see Figure 2-8) indicate a southerly flow direction towards the Niagara River. These contours are locally modified by the slightly incised stream channels of Cayuga Creek and Bergholtz Creek.

Personnel communications with Dick Yager of the USGS indicated that Cayuga Creek gains and looses water along its length through the Niagara Falls International Airport area.

Contours of the potentiometric pressure in the upper part of the Lockport Dolomite (Reference 51) also indicate a southerly groundwater flow beneath the study area.

2.7 Groundwater Usage - Private Well Survey

To determine if any private wells are located within the area potentially impacted by the BAT Plant, BAT and Golder Associates conducted door-to-door survey of properties in the vicinity of the Zone 1 volatile organic compound plume. The area covered by the surveys is shown on Figure 2-9. The initial field portion of the survey was completed between November 29, and December 6, 1988.

An extended well survey area was defined on the basis of results from the sampling of monitoring wells completed as part of the Phase IV and Phase V plume definition studies. Properties in this extended area were visited between September 29, 1989, and February 19, 1990.

The four primary objectives defined for the survey were:

- To supplement preliminary well survey data obtained by BAT, thus locating existing wells within the survey area, and to determine whether any of these wells are currently in use or have potential to be used in the future;
- To classify the status of located wells and properties;
- To determine if any of the active wells contain dissolved organic compounds associated with the Neutralization Pond; and,
- To determine if any of the wells could be decommissioned, thus reducing the potential for exposure to groundwater from the dissolved phase plume.

A report regarding this work was submitted to NYSDEC, NYSDOH, and EPA in June 1990 (Reference 35).

A total of 252 properties were visited during the surveys. The status of the wells at the properties (as of October 1990) is shown on Figure 2-10. All of the properties visited were connected to the town of Wheatfield water supply in the early 1950's except for a property located south of Jagow Road. Out of the total of 112 wells located by the survey, seven active wells were identified. These active wells were sampled and tested for volatile organic compounds using EPA Method 624 or EPA Method 524.2. Sampling procedures generally followed the standard sampling procedures for the monitoring wells installed during the site investigations (Appendix B). However, because pumping equipment was located in some wells, water samples were obtained from spigots on the pump discharge line after well purging, rather than by the use of a bailer.

Volatile organic compounds were detected in only one of the active wells. This well (No. 38), which is located on the west side of Walmore Road south of Bergholtz Creek, is relatively deep and extends into the lower section of the Zone 1 aquifer. This well was subsequently decommissioned.

Only one of the active wells was used for drinking water. This was well No. 136, located outside the Zone 1 dissolved phase plume and south of Jagow Road. As a precautionary measure, this well was decommissioned and the home connected to the public supply.

BAT has requested the permission of the homeowners to decommission all exposed and active wells in the study area. To date, twenty-one wells have been decommissioned by this ongoing program.

3.0 PREVIOUS SITE INVESTIGATION

3.1 Preliminary Studies

Initial hydrogeologic investigations were performed by Goldberg-Zoino Associates (GZA) between 1982 and 1985 (Reference 16). The investigations involved the drilling of eighteen boreholes (B-1 through B-18 shown on Figures 3-1 and 3-2) to define the general stratigraphy through the soil and into the bedrock. PVC screen and riser pipes were installed in the boreholes as monitoring wells. The boring and well logs are included in Appendix D.

Groundwater was sampled from these wells for a broad range of major element chemistry and Priority Organic Pollutants as part of the 40 CFR 265 Subpart F groundwater monitoring requirements for the Neutralization Pond. The results of the study revealed the presence of three organic compounds as major constituents in the groundwater: methylene chloride, trichloroethylene, and trans-1,2 dichloroethylene. The concentrations of the organic constituents detected in the groundwater ranged from less than 1 mg/L up to 3,800 mg/L. The area with the highest reported detection of organic compounds was in the vicinity of the Neutralization Pond.

Interim monitoring of the wells was continued by Frontier Technical Associates Inc. in July 1986, October 1986, January 1987, and April 1987. The monitoring included analyses for volatile organic compounds by EPA Method 624. The results continued to indicate the presence of volatile organic compounds, particularly methylene chloride and trichloroethylene. These results necessitated groundwater assessment pursuant to 40 CFR 265 Subpart F.

3.2 Phase I and II Investigations

Golder Associates was retained by Bell Aerospace Textron (BAT) in 1987 to undertake a thorough hydrogeological investigation and groundwater assessment at the site in the vicinity of the Neutralization Pond, to define the potential extent of groundwater contamination and to determine the rate of migration of the compounds in the groundwater. The investigation was proposed in phases in order to have a program of data collection, evaluation, and refinement of the investigation. Phases I and II of the investigation were reported by Golder Associates in May 1987. This report, which was submitted to NYSDEC and EPA in May 1987 (Reference 20), includes the details of the investigation work performed, procedures employed, and results. The results are summarized in the following paragraphs.

The soil overburden was investigated in Phase I by the drilling and sampling of twenty boreholes in the soil overburden. These boreholes are denoted as 86-1 through 86-20 on Figures 3-1 and 3-3. The soil was determined to consist of clayey and silty deposits extending to depths of about 15.5 feet to 17.5 feet below the ground surface within the Rocket Test Cell and Neutralization Pond area. Between the lacustrine silt tills and the basal till an area of silty sand was also defined (see Figures 3-1 and 3-3). Field organic vapor analyses (OVA) of the soil samples and laboratory analyses of selected soil samples indicated the presence of a volatile organic compound contaminant plume in the soil overburden, but also indicated that this was limited in extent to the Rocket Test Cell area and had not reached the eastern boundary of the site.

The bedrock beneath the site was investigated in Phase II with the coring of four exploration holes around the periphery of the overburden volatile organic plume area. This was done in order to define the hydrogeologic formations anticipated to be impacted by releases from the Neutralization Pond prior to actually drilling within the area. These holes are denoted as 86-21 through 86-24 on Figure 3-2 and 3-3. These exploration holes were drilled to a depth of 90 feet. The hydraulic conductivity of the bedrock was measured by packer tests performed at 10-foot intervals as the boreholes were advanced. Four piezometers were nested at each of the rock borehole sites for measurement of water levels. Two piezometers were installed in each deep core hole, one between depths of 70 feet and 90 feet and the other between depths of 35 feet and 55 feet. A third piezometer was installed in a separately cored hole at a depth between 27 feet and 30 feet. The fourth piezometer was installed in the soil overburden at a depth between 12 feet and 13 feet. No samples were obtained for analytical testing.

The bedrock was found to consist of southward dipping dolomite strata. Four hydrostratigraphic zones were characterized on the basis of lithology and hydraulic conductivity as follows:

Zone 1	The upper 7 feet to 13 feet of the bedrock consisting of grey, fine grained, laminated dolomite which is highly weathered with numerous discontinuities. Hydraulic conductivities ranged from $1x10^{-4}$ cm/s to $3x10^{-3}$ cm/s.
Zone 2	A thickly bedded, non-porous, massive dolomite about 10 feet thick beneath the Zone 1 unit. Hydraulic conductivity measured from packer tests was $1x10^{-6}$ cm/s.

Zone 3	A moderately permeable dolomite ranging in thickness from 18 feet to 29 feet (due to the transitional contact with the underlying Zone 4 unit). Permeability in this zone is primarily due to its vuggy and porous nature. The hydraulic conductivity measurements ranged from 1x10^{-5} cm/s to 1x10^{-4} cm/s, although one section in borehole 86-22 was more permeable at 1x10^{-3} cm/s due to vugs and weathered saccharodial dolomite.
Zone 4	A massive, non-porous dolomite with hydraulic conductivity ranging from 1x10^{-6} cm/s to 1x10^{-5} cm/s within intact sections of the strata. The contact between Zones 3 and 4 is transitional and the thickness of each zone is correspondingly variable. However, the combined thickness of the two zones is fairly constant, being between 60 feet and 65 feet.

The direction of groundwater flow in the Zone 1 bedrock was determined to be predominantly southward toward the Niagara Falls Boulevard. The flow direction in the deeper rock strata was determined to be southeastward.

3.3 Phase III Investigation

Phase III of the hydrogeologic investigation was reported by Golder Associates in October 1989 (Reference 29). This report contains the details of the work performed, the methods used and the detailed results. The Phase III investigation was based on the results of the Phase I and II investigations and was designed to define the lateral and vertical extent and nature of groundwater contamination by the installation of soil and bedrock wells.

The Phase III investigation consisted of the installation of thirty-three nested wells (ten in the overburden, sixteen in Zone 1 bedrock, and seven in Zone 3 bedrock), on the BAT property and five overburden wells and five Zone 1 wells at five locations off the BAT property. These wells were completed with 2-inch diameter stainless steel screen and riser pipes, with each screen section sealed in a specific hydrostratigraphic unit. These wells are denoted as the 87 series holes on Figures 3-1 and 3-2.

Groundwater level measurements indicated the lateral flow direction in the soil overburden to be generally south to southeast with some local variation near the Rocket Test Cell Area. Groundwater levels in the soil were generally 1 foot to 5 feet higher than in the bedrock, indicating a downward component of flow. Groundwater flow directions in the Zone 1 bedrock were generally south to southeast and indicated an influence from Bergholtz Creek and sewer lines along Niagara Falls Boulevard and the Cayuga Drive Extension. Water levels in the Zone 3 bedrock also indicated lateral flow toward the south to southeast, but the water levels were 1 foot to 2 feet above the water levels in the Zone 1 bedrock, indicating an upward component of flow toward Zone 1. In general, the water levels measured in Phase III provided consistent hydrogeologic interpretation with the data from Phases I and II (Reference 29).

Groundwater samples from the on-site and off-site wells were analyzed for volatile organic compounds by EPA Method 624. The principal compounds detected in the Zone 1 wells were methylene chloride, trichloroethylene, trans-1,2 dichloroethylene, and lesser concentrations of trichlorofluoromethane. The area of highest concentrations of the volatile organic compounds was near the Neutralization Pond and Rocket Test Cell area. The Zone 1 plume was noted to extend past the southern and eastern site boundaries generally in the direction of groundwater flow. To the south the plume apparently passes beneath Bergholtz Creek with measured concentrations of 2.8 mg/L of trichloroethylene and 2.4 mg/L of trans-1,2 dichloroethylene in wells 87-20(1) and 87-21(1). The full southern and southeastern extent of the dissolved phase plume was not identified by the Phase III investigation.

Dense non-aqueous phase liquid (DNAPL) was detected in Zone 1 extending about 550 feet southeast of the Pond to Walmore Road with an apparent width of about 100 feet. The DNAPL primarily consisted of trichloroethylene.

Volatile organic compounds were detected in the Zone 3 wells, but appeared to be restricted to the area around the Neutralization Pond. The highest detected concentration of methylene chloride was 1.2 mg/L and for trichloroethylene was 6.2 mg/L, both in a location directly beneath the DNAPL plume in the Zone 1 bedrock. These data indicate the effectiveness of the massive Zone 2 bedrock at restricting the downward migration of the volatile organic compounds from Zone 1.

3.4 Phase IV Investigation

The Phase IV investigation program was developed to define the full extent of groundwater contamination which was not completely determined by the Phase III investigation. The Phase III investigation could not be simply extended because many of the investigation locations were off-site on private properties. Obtaining permission to enter the these properties essentially dictated the break between Phases III and IV. All details regarding the investigation, the methods and procedures, and the results are included in Golder Associates report of August 1989 (Reference 26).

The Phase IV investigation included installation of ten off-site Zone 1 wells, one off-site Zone 3 well, and two off-site wells along the Cayuga Drive Extension sewer line.

These installations are denoted as the 89 series wells on Figures 3-1 and 3-2. All wells were completed with 2-inch diameter stainless steel screen and riser pipes, with the screen sections sealed in a specific hydrostratigraphic unit. Analyses of volatile organic compounds in the groundwater samples from the wells during the Phase IV investigation were performed using EPA Method 624.

Specific well screen installations indicated that there is a downward vertical gradient south of Bergholtz Creek within the Zone 1 bedrock. Organic compounds were not detected in the soil overburden outside the BAT property.

Analyses of the DNAPL plume in the Zone 1 bedrock indicated that it is predominantly composed of trichloroethylene (94.1 percent to 99.7 percent). It is estimated to have a specific gravity about 1.5 times that of water so it has the potential to sink rapidly through the permeable Zone 1 bedrock. The location of the DNAPL plume is controlled by gravity flow along the top of the Zone 2 bedrock. The plume may extend beneath Walmore Road, but was not detected as a DNAPL plume in well 89-2(1). The DNAPL plume was not considered to be migrating at a significant rate since the former driving head, caused by solvents in the base of the Neutralization Pond, was eliminated when the Pond was closed.

The extent of the Zone 1 dissolved phase plume was defined along its northern, western and southern boundaries. The eastern boundary of the plume was not defined because of limited access to private property. The Phase IV investigation indicated that overall, the plume is approximately 4,000 feet long, and about 3,500 feet wide, extending south from the closed Neutralization Pond. It is apparently situated in the lower half of Zone 1 in the area south of Bergholtz Creek and may be confined to the lower half of Zone 1 north of Bergholtz Creek in areas closer to the BAT site. If this is the case, it was considered that the plume may be passing, unaffected, beneath Bergholtz Creek. Results of analyses of samples from the wells along the Cayuga Drive Extension sewer (SW89-1 and SW89-2) reported methylene chloride in one sample (SW89-1) at a concentration of 14.7 ug/l. This low concentration for methylene chloride was considered to possibly be a laboratory induced artifact.

A sample of groundwater from well 87-13(1) in the Zone 1 dissolved phase plume was analyzed for the 40 CFR Part 264 Appendix IX list of constituents. These results indicate the primary constituents in the plume are methylene chloride, trichloroethylene, 1,1,1-trichloroethane, acetone, and trichlorofluoromethane. In addition, about 200 ug/l of polyaromatic hydrocarbons (PAHs) were detected as well as PCB Arochlor 1260. Pentachlorodibenzofuran (PCDF) and tetrachlorodibenzofuran (TCDF) were reported at concentrations of 3.9 ng/L (ppt) and 10.31 ng/L (ppt), but the laboratory also indicated that the compound detected could have been polychlorinated diphenyl ether (PCDE). The PCDE ions and the PCDF and TCDF ions have the same retention time but the EPA requires they be reported as furans.

The Zone 3 plume was investigated by well 89-2(3) installed east of Walmore Road. No volatile organic compounds were detected in this well. Thus, the Zone 3 plume was considered to be confined to an area just downgradient of the Neutralization Pond and beneath the DNAPL plume in the Zone 1 bedrock.

Based on the results of the Phase IV investigation additional work was recommended to complete the groundwater assessment at the BAT site. The primary items were definition of the extent of the eastern boundary of the Zone 1 plume with additional off-site wells, extend the private well survey east of the site, provide a better definition of the downgradient edge of the Zone 1 DNAPL plume with additional wells, additional sampling and analyses to confirm the presence of furans in the plume, and Bergholtz Creek bottom elevation measurements to determine flood and low flow water levels. These additional items are included in this report which presents the details of the Phase V investigation (see Section 4)

3.5 Pump Test Study

A program of pump testing the Zone 1 bedrock was performed in 1989 to provide information on the hydrogeologic system for design of a groundwater remediation system. Details of the study are included in the report by Golder Associates of February 1990 (Reference 33). The testing included a series of pump-in tests and a 12,000 gallon extraction (pump-out) test.

Five wells (87-1(1), 87-12(1), 87-17(1), 87-18(1), and 87-22(1)) located in the dissolved phase plume in the Zone 1 bedrock were subjected to pump-in testing using a constant pressure injection technique with both variable and constant flow rates. Potentiometric head recovery data were also collected and analyzed for each pump-in test. The pump-in data indicate the Zone 1 bedrock aquifer to be somewhat heterogeneous. The mean transmissivity from the pump-in tests was calculated to be $3.2x10^{-4}$ m^2/s (297.7 ft^2/day), but the standard deviation was of the same order of magnitude. It should be noted, however, that this apparent wide variation in transmissivities is primarily influenced by the recovery analysis of well 87-1(1). When the recovery analysis for this well is excluded, all other results are within about one order of magnitude, indicating areas of hydraulic consistency. Some heterogeneity of the unit was demonstrated by the presence of boundary effects. Additionally, indications of transmissivity changes were noted as areas of bedrock more remote from the injection holes became influenced by the pump-in testing. Storativity values from the injection data from single hole tests were also highly variable. The most reliable storativity value of 5.9×10^{-4} was obtained from the cross hole test between holes 87-17(1) and 87-15(1). This result was later found to be in good general agreement with the extraction pump test estimates.

The extraction pump test was designed to measure hydrogeologic characteristics of the Zone 1 bedrock in the vicinity of the DNAPL plume and to determine the response, if any, in the Zone 3 and overburden aquifers to the Zone 1 pumping. Well 87-14(1) was selected as the pumping well based on its adequate yield, position relative to other suitable monitoring wells, and its location along the edge of the DNAPL plume. A jet pump was used to pump the well and the water was directed through a metered manifold to a holding tank for later on-site treatment prior to discharge via the sanitary sewer system to the Niagara Sewer District POTW. Water levels in the monitoring wells were measured with pressure transducers and manually.

Estimates of transmissivity and hydraulic conductivity derived from the pump test results were generally consistent from well to well and as determined from various analysis techniques. Some heterogeneities were noted within the Zone 1 system as evidenced by boundary effects in the drawdown plots of the test wells. In all but one case, a single low permeability boundary was noted late in the data, which is believed to have been caused by the DNAPL plume. There was no evidence of leakage or recharge to the Zone 1 aquifer from the soil overburden or from the underlying Zone 3 aquifer through the Zone 2 aquitard. The drawdown plots indicate there may be some minor horizontal anisotropy in Zone 1, as evidenced by the distribution of the cone of depression. This indicates that the overall bulk estimates of hydraulic properties are appropriate and adequate for use in the design of a remedial program. The geometric mean of the hydraulic conductivities for all tests performed (i.e. pump-in, pump-out, and slug tests) ranged from about 1×10^{-4} cm/s to 2×10^{-2} cm/s with an overall geometric mean of about 2×10^{-3} cm/s. This result is consistent with the packer test results performed during the previous phases of investigation. Overall storativity values were generally consistent ranging from about 1×10^{-4} to 6×10^{-3}.

During the test a sudden rise in water levels was initially noticed in wells 87-4(1) and 87-11(1) after about 16 hours of pumping. The rise in the depressed water table gradually moved to the west across the monitoring well field until water level increases had been noticed in each of the wells being monitored. After the pump test was completed, transducers were reinstalled in five locations for the purpose of the making passive measurements of long-term head changes in Zone 1 aquifer. The results indicated three successive increases and subsequent decreases in water levels measured in all of the monitored wells. These rapid and pronounced increases in water levels corresponded to tests being conducted in the Altitude Research Building at the ARC facility at the site. During these tests, large volumes of condensed steam and non-contact cooling water are discharged into a surface ditch which leads along the north property boundary to the drainage ditch along the west side of Walmore Road, and thence southwards, to a drop culvert and into the storm sewer system, along Walmore Road. The data suggest that the water flowing along the Walmore Road ditch infiltrates into Zone 1, perhaps via the coarse granular backfill around the adjacent Walmore Road sanitary sewer line which was constructed near the top of rock. This pressure pulsing of the Zone 1 system may have had an influence on the spreading of the contaminant plume in Zone 1.

4.0 PHASE V SITE INVESTIGATION

4.1 General

The Phase V investigation approved by NYSDEC included the following major components:

- Installation of two overburden wells in the northeast corner of the site to investigate the groundwater conditions in this area. Groundwater contours determined from water level measurements in previously installed wells in this area indicated a slightly northeastwards flow direction away from the Neutralization Pond.
- Installation of four Zone 1 monitoring wells to define the northeast and eastern boundaries of the dissolved phase plume.
- Installation of four Zone 1 monitoring wells and one Zone 3 monitoring well to define the southeastwards extent of the Zone 1 DNAPL plume and the extent of the Zone 3 dissolved phase plume.
- Measurement of the channel invert elevations of Bergholtz Creek to determine the potential for discharge to the stream from the overburden and bedrock.
- Preparation of a Sampling and Analysis Plan for completing a sampling event including all site wells.
- Sampling of all the wells installed at the site in accordance with the NYSDEC approved Sampling and Analysis Plan. Analysis of samples using Contract Laboratory Program (CLP) protocols with Data Validation.
- Analysis of DNAPL samples and associated dissolved phase groundwater samples for Appendix IX parameters and specific tests for furans.
- Complete an extension to the survey of private wells to include those on the eastern side of the plume (see Section 2.7).

Samples of groundwater were taken from piezometers along Walmore Road and analyzed for volatile organic compounds (EPA Method 624) to guide the location of the DNAPL definition wells. Samples of groundwater were taken from wells 87-18(1) and 87-20(1) and analyzed for VOAs, Semi VOAs, and PCBs to provide information for treatability studies. A sample of water was taken from the overburden piezometer 86-21C in the northeast section of the site to guide the location of the overburden monitoring well in this section of the site.

In addition to the above, four sediment and four stream water samples were obtained from Bergholtz Creek and analyzed for Target Compound List Volatile Organic compounds, pesticides and PCBs, and PAH compounds. All monitoring well and piezometer installations were resurveyed by Wendell Engineering of Lockport, New York to Geodetic datum and the New York grid. This company also completed a photogrammetric map of the area surrounding the site.

To provide additional information regarding the occurrence of volatile organic compounds, PAH compounds and PCBs in the shallow overburden soil a series of auger holes were completed as shown on Figure 7-6A. Soil samples were taken at 2 feet and 4 feet depths and analyzed for VOAs, semi-VOAs,and PCBs. The results of this work were compared to the Phase II investigation results and are discussed in Section 7 of this report.

Table 4-1 provides survey data for all wells and piezometers completed at the site. Table 4-2 provides well construction data for all wells completed at the site.

Two temporary piezometers were installed in the overburden and Zone 1 bedrock to the north of the Boiler House building in the north central portion of the BAT Plant to determine groundwater levels and pressures in this area. Information on groundwater levels was also obtained from a series of monitoring wells installed by Carborundum on their property to the north of the BAT site.

Construction Drilling Services (CDS) of Chelmsford, Massachusetts, provided drilling and monitoring well installation services. All work was monitored by a Golder Associates geologist. Alpha Analytical of Niagara Falls, New York provided analytical laboratory services for water samples taken during the drilling program of the site investigation.

The following sections describe the procedures and methods employed for this work which was started in late 1989. Analyses of the groundwater samples using CLP methods were completed in September 1990 by Enseco Rocky Mountain Analytic Laboratory (RMAL). Analyses of the Bergholtz Creek samples were completed in mid-October 1990 by RMAL. These samples were analyzed using CLP procedures.

4.2 Overburden Monitoring Well Installation

Prior to installing the two overburden monitoring wells in the northeast section of the site, a groundwater sample was taken from piezometer 86-21(c) and analyzed for volatile organic compounds by EPA Method 624 by Alpha Analytic (see Table 7-10). Since VOAs were detected in the sample taken from this piezometer, the planned overburden monitoring wells were installed.

Two overburden monitoring wells, 89-13(0) and 89-14(0), were installed in the northeast area of the site (see Figures 3-1 3-3 for locations). The boreholes were advanced using a 6.25-inch ID hollow stem auger drill. Soil samples were taken using a 2-inch diameter split spoon sampler. The split spoons were washed with Alconox detergent and rinsed with distilled water between each sample. Detailed procedures were provided in the Phase V Investigation Monitoring Well Installation specifications (Reference 28), and the logs are included in Appendix A.

The 2-inch stainless steel screens and riser pipes were installed in each well. The screens were 5 feet long and packed with coarse sand. A cement bentonite grout was used to seal the annular space above the sand pack. Both wells were completed with lockable steel well covers.

Well 89-13(0) was drilled and installed first. It was developed using nitrogen until the pH and specific conductivity of the water from the well had stabilized. The well was then purged and a water sample taken and analyzed by Alpha Analytics for volatile organic compounds by EPA Method 624. Because this analysis detected volatile organic compounds, well 89-14(0) was installed on the east side of Walmore Road to determine if volatile organic compounds had migrated beneath Walmore Road in this direction. Details of the sampling procedures were presented in the Phase V Work Plan (Reference 31). Analysis of water samples from well 89-14(0) (1990 CLP Sampling) did not indicate the presence of volatile organic compounds (see Section 7). The results of the 1990 CLP sampling event are included in Appendix D. Tables 7-6A and 7-6B summarize the results of the 1990 CLP sampling event.

4.3 Zone 1 Monitoring Well Installation

A total of eight Zone 1 monitoring wells were installed in January 1990 through March 1990. These wells were numbered 89-10(1) through 89-12(1) and 89-14(1) through 89-18(1). Wells 89-14(1), 89-16(1), 89-17(1), and 89-18(1) were installed to define the northern and eastern perimeter of the Zone 1 dissolved phase plume (see Figures 3-2 and 3-3 for location). Wells 89-10(1), 89-11(1), 89-12(1), and 89-15(1) were installed to further define the width and southeasterly (down gravity gradient) extent of the DNAPL plume. To guide the positioning of these holes, groundwater samples were taken from piezometers 86-23(c) and analyzed for volatile organic compounds using EPA Method 624 (see Table 7-10). All the wells were completed in the same manner (see Appendix A for boring records and monitoring well installation details).

The Zone 1 monitoring wells were advanced to bedrock using a 6.25-inch ID hollow stem auger drill. Continuous split spoon samples were taken in the overburden. A 4-inch diameter HW steel casing was drilled into the bedrock surface. The bedrock was then air rotary core drilled to the base of Zone 1 (the A Marker Bed, see Section 5.2.1). The 2-inch diameter stainless steel screen and riser pipe were then installed in the hole. Screen lengths of 10 feet were used in all holes except 89-10(1) and 89-17(1) (see below). Sand packs were installed around each screen, a bentonite pellet seal placed over each sand pack up to the bedrock surface, and the annular space between the overburden and riser pipe grouted using a tremie pipe and bentonite cement grout.

Normal Zone 1 well installation procedures require the HW casing to be removed as the bentonite pellet seal is placed. During installation of well 89-17(1), the HW casing jammed in the bedrock so the casing was grouted in place to ensure an adequate seal. A 5-foot screen was used in well 89-10(1) since the upper section of the bedrock was highly fractured. A five foot screen was also installed in 89-17(1) since the Zone 1 bedrock was too thin to allow a 10-foot screen to be installed.

4.4 Zone 3 Monitoring Well Installations

Well 87-10(1) was the most southerly well installed during the Phase III program to indicate the presence of DNAPL. Water samples from 89-11(1), which was installed to determine the downgradient extent of the DNAPL plume, did not indicate the presence or immediate proximity of DNAPL on the east side of Walmore Road about 600 feet southeast of well 87-13(1). As agreed with NYSDEC, a Zone 3 monitoring well 89-20(3) was installed adjacent to 89-11(1) to determine groundwater quality (see Figure 3-1 for location).

This well was installed in accordance with the normal Zone 3 monitoring well procedures described in the Phase V Work Plan (Reference 31). The installation of the well involved drilling a 10-inch diameter hollow stem auger hole to refusal at the bedrock surface and the installation of a temporary 8-inch diameter steel casing. An HQ sized borehole was then advanced, by air coring through Zone 1 bedrock, to approximately 1.5 feet into the Zone 2 aquitard. The hole was then reamed to 7.88-inch diameter by air flush triconing. In order to reduce the potential for cross contamination between the Zone 1 and Zone 3 aquifers, a centralized 4-inch diameter steel casing was sealed in the Zone 2 aquitard by backfilling the annular space between the 4-inch casing and the borehole with bentonite pellets up to the bedrock surface. The 7.88-inch temporary casing was then removed and the annular space between the 4-inch casing and the overburden backfilled with bentonite/cement grout. The casing was left overnight for the grout to harden. The hole was then advanced into the underlying Zone 3 aquifer using air flush HQ coring equipment. A 2-inch diameter, 10-foot stainless steel screen was set within the Zone 3 aquifer and a silica sand pack installed around the screen. The sand pack was extended upward to the B Marker Bed which is located at the top of Zone 3. Approximately 10 feet of bentonite pellets were placed in the annular space between the stainless steel riser pipe and the well casing. The remainder of the hole was then grouted to surface via a tremie pipe using bentonite/cement grout. The well was completed with a lockable security cap.

4.5 DNAPL Sampling

Attempts were made to obtain DNAPL samples from three wells 87-6(1), 87-13(1), and 87-16(1); to determine the constituents and composition of the DNAPL. DNAPL had previously been identified at these wells (see Figure 3-2 for locations).

The procedure used to collect DNAPL commenced with purging the wells with a high pressure nitrogen line to induce DNAPL to flow to the well and then sucking DNAPL from the base of the hole using a peristaltic pump and suction line discharging into a laboratory cleaned glass container. If DNAPL was observed in the container, the dissolved phase liquid was decanted into sample containers and the DNAPL sealed into another sample container.

Only trace amounts of DNAPL could be extracted from well 87-16(1). Only a faint trace of DNAPL was visible in the water samples extracted from well 87-6(1). Well 87-13(1) was nitrogen purged for 2 hours. Scavenging the base of this well with a peristaltic pump yielded about 300 ml of DNAPL for analytical testing.

The DNAPL and water samples were analyzed by Alpha Analytical and ETC of Edison, New Jersey using EPA Methods 624, 625, and 608. In addition, ETC completed specific analyses for furans by SW 846 3rd Edition Method 8280. This is a GC/MS method using a capillary DB-5 column and selective ion monitoring. If collating ions resembling furans are detected, this method requires additional analysis by GC/MS equipment using a CP-SIL88 capillary column with tandem mass spectrometers. This technique allows detailed identification in the mass spectral library for several things such as collating compounds as well as interferences. Since ETC did not have this capability, this work was subcontracted to Oneida laboratory, Syracuse, New York. No furans were detected in the DNAPL by this work.

Table 4-3 lists the samples, analytical methods, and laboratory used for this testing.

4.6 Groundwater Sampling

A detailed Sampling and Analysis Work Plan and Quality Assurance Project Plan (Reference 32) was completed and submitted to NYSDEC for approval. Subsequent to approval of these Plans, sampling was performed on all the existing wells completed during all the investigations at the site. As outlined in the 1990 Sampling and Analysis Plan, the sampling objectives were to define the nature and extent of contamination of volatile organic compounds, semivolatile compounds, and PCB compounds in one specific time frame.

Frontier Technical completed the sampling during May and June 1990. An on-site audit of the sampling procedures used by Frontier was completed by Golder Associates in May 1990. All samples were taken in accordance with the Sampling and Analysis Plan. All samples were successfully transferred from the site to the laboratory under chain-of-custody procedures.

ENSECO Rocky Mountain Analytic Laboratory (RMAL) was contracted by BAT to provide CLP analytical services in accordance with the Sampling and Analysis Plan.

Chemical analyses of samples from selected wells were performed by RMAL using Contract Laboratory Procedures for:

- o Target Compound List - Volatile Organic Compounds
- o Target Compound List - Semivolatiles Compounds
- o Target Compound List - Pesticides and PCBs

Since the holding time for several samples taken for semivolatile analysis was exceeded, prior to analysis. these wells were resampled for semi volatile analysis in August 1990 by Frontier Technical using the approved sampling procedures. These samples were analyzed successfully by RMAL.

Tables 4-4, 4-5, and 4-6 include the list of the sampled wells and the analysis methods used for volatiles, semivolatiles, pesticides, and PCBs.

The results of these analysis were reported between July and September 1990 in EPA paper format and on computer disks. To provide a check on the data validation completed by RMAL as part of the CLP protocol, Golder Associates completed independent data validation on 10 percent of the data reported by RMAL. A report regarding the QA/QC data validation is included in Appendix D.

In addition to the full CLP data validation procedure completed by Golder on 10 percent of the samples, a qualitative comparison were made between the CLP data and the data from previous sampling events. The main focus of this qualitative comparison was the volatile organic compounds historically detected in the aquifers of the study area consisting of: trichloroethylene, methylene chloride, 1,2-trans-dichloroethylene and vinyl chloride. No significant qualitative differences were found between the 1990 CLP sampling results and the historic data. Section 7.2 discusses the data analysis procedures, results and the interpretation of the results.

4.7 Bergholtz Creek Sampling

Comparison of the overburden phreatic surface levels and the Zone 1 aquifer potentiometric levels with the possible range of water surface elevations in Bergholtz Creek indicated the potential for groundwater to flow into the creek. To determine if compounds associated with the Neutralization Pond were impacting Bergholtz Creek, a sampling program was developed. A Sampling and Analysis Plan for sampling water and stream sediments from Bergholtz Creek was submitted to NYSDEC. Subsequent to revisions requested by NYSDEC, this Sampling and Analysis Plan was modified and approved by NYSDEC (Reference 32). Four stream sediments samples and four surface water samples were collected (see Figures 3-2 and 6-1 for sample locations). The Bergholtz Creek surface water and stream sediments were sampled on August 28, 1990. The samples were analyzed using CLP methods as specified in the Sampling and Analysis Plan.

Since the water samples were being taken in conjunction with the sediment samples, the water samples were taken first. This was done in order to obtain an undisturbed water sample. Each sampling location was approached from the downstream direction with the sample container provided by RMAL pointed upstream to ensure collection of an undisturbed sample. The lower portion of the stream flow was sampled. The sample location sequence started at the most downstream point, location 4, and progressed upstream to sample location 1, the sampling point located upgradient from the Zone 1 plume.

A hand auger was used to collect the sediment samples. The hand auger was thoroughly rinsed with distilled water between each location. The locations were marked with a numbered stake.

The sediment samples to be analyzed for PCBs and semivolatiles were composited from three equal size samples taken at points spaced at 10 feet apart on the creek bed. The samples were deposited in a clean pyrex dish and the portions were then quickly mixed using a stainless steel spoon into one composite sample. This sample was then transferred from the pyrex dish to the appropriate sample bottle which was filled completely. The samples for volatile organics compounds were not composited, as this would potentially allow volatilization of these compounds. The volatile sample jars were completely filled with sediment from each of the sampling locations prior to sealing.

All samples were shipped, the day they were obtained, to RMAL in sealed coolers with ice packs under chain-of-custody procedures.

The methods used by RMAL to analyze these samples are listed below:

SURFACE WATER SAMPLES (BERGHOLTZ CREEK)

	TCL VOLATILES	TCL SEMI VOLATILES	TCL PEST/PCBS
Location 1	X	X	X
Location 2	X	X	
Location 3	X	X	X
Location 4	X	X	

SURFACE SEDIMENT SAMPLES (BERGHOLTZ CREEK)

	VOLATILES	SEMI VOLATILES	PEST/PCBS
Location 1	X	X	X
Location 2	X	X	
Location 3	X	X	X
Location 4	X	X	

The results of these analysis are discussed in Section 7.2.6 and provided in Tables 7-11 and 7-12.

4.8 Surveying and Map Preparation

All wells completed prior to the Phase IV investigation were surveyed to a datum on well B-1 (installed by GZA) which was understood to be referenced to a geodetic datum located at the Carborundum Plant (located to the north of the BAT Plant). The Phase IV wells were surveyed by Wendell Engineering to a geodetic datum monument at the U.S. Air Force Base north of BAT. Wendell attempted to establish a relationship between the Phase IV geodetic elevations and the previously determined elevations for Phase I, II, and III wells and piezometers by resurveying wells 87-19(0), 87-19(1), B-13, and B-18. The results of this resurveying indicated that the pre-Phase IV elevations were within approximately 1 foot of the true geodetic datum, however, the differences at each of the resurveyed points were variable. To determine the correct elevations of all the wells and piezometers completed at the site, Wendell

Engineering surveyed the locations and elevations of all the wells installed during the previous investigations. The horizontal location of the wells were tied into the New York coordinate system west zone (Transverse Mercator Grid System). The geodetic elevation datum was obtained from the same monument that was used for the Phase IV wells. This monument is on the nearby U.S. Air Force Base located to the north of the BAT Plant.

In addition, Wendell Engineering was retained to produce one topographic map (scale 1 inch=50 feet) with 2-foot elevation contours for the area that covers the BAT property. A map of a second contiguous area at a map scale of 1 inch=200 feet was also completed by Wendell. This map was not contoured (planimetric control only) and covered the investigation area south of the Plant to Jagow Road. These maps are incorporated as the base maps for drawings included in this report.

4.9 Aquifer Testing and Water Level Measurements

To determine static water level in the wells at the site at one interval in time, water levels were measured on August 28, 1990. The water levels were measured using a Solinst electric water level finder. The cable and probe were rinsed with deionized water between wells. Table 7-1 presents the water level elevations determined by this work. Transducers were installed in wells 87-11(1) and 87-14(1) in order to correct the field data for the influence of the water discharged from the rocket test cells via the drainage ditch (see Section 3.5). Figure 4-1 presents the results of this monitoring. Groundwater potentiometric level contours are presented in Figures 7-1, 7-2, and 7-3.

A rising head test was completed in each well installed during the Phase V investigation. The tests were completed by evacuating the water from the well using nitrogen line lowered to the base of the well. The water evacuated from the well was collected and disposed by BAT in accordance with their standard operation procedures. The water level recovery was monitored using a Geocon datalogger connected to a calibrated vibrating wire pressure transducer located near the bottom of the well.

The water level recovery data was analyzed using the Hvorslev Method (1951). This analysis requires the plotting of the head ratio (percentage of head yet to recover) on the vertical scale of semi-log paper vs. time on the linear horizontal scale. The plotted data should produce a straight line between 90 and 50 percent recovery. Early and late time data may result in a curved plot due to wellbore storage, skin, or boundary effects.

The required data point from the graph for the Hvorslev analysis is the projected time for the 37 percent head ratio (63 percent recovery). This point (T) can be extrapolated from the straight line portion of the curve. Once T has been established a hydraulic conductivity estimate can be obtained from the equation:

$$K_h = \frac{\ln(L/R)r^2}{2LT}$$

where: K_h = horizontal hydraulic conductivity in cm/sec
r = inside radius of the well in cm
R = borehole radius in cm
L = test interval length in cm
T = time of 37 percent head ratio recovery in sec
ln = natural log

To provide additional information regarding ground water levels to the far west of the Neutralization Pond, two temporary piezometers were installed immediately north of the Boiler House in March 1990 (see Figures 7-1 and 7-2 for location).

One standpipe piezometer was installed in an overburden hole, the bedrock piezometer was installed in a core hole drilled into the Zone 1 bedrock. A sand pack was placed around the screen section of this piezometer. A bentonite pellet seal was completed to the bedrock surface. Water level measurements were taken and the holes decommissioned since this area of the site was being regraded.

4.10 Health and Safety

All work undertaken for the Phase V studies was completed in accordance with the Health and Safety Plan developed for the Phase I, II, and III studies and revised for the Phase IV studies.

4.11 Summary of Phase V Investigation Results

To allow definition of the nature and extent of the groundwater contamination related to the Neutralization Pond and associated SWMUs, all of the data from the preceding studies have been compiled with the results of the Phase V investigations. This data and the analysis of this data is described in the following sections:

Section 5	Site Area Geology
Section 6	Site Area Surface Water
Section 7	Site Area Hydrogeology and Groundwater Conditions

In general the Phase V studies confirmed the previous geologic and hydrogeologic evaluations of the site conditions and allowed for definition of the extent of the groundwater contaminant plumes. Specific points identified by the Phase V studies are listed below:

- The two overburden wells installed in the northeast corner of the site indicate that groundwater containing volatile organics extends to the northeast boundary of the site (possibly to the Walmore Road Sanitary Sewer trench) but does not extend beneath Walmore Road. This is possibly due to the sewer trench acting as a boundary to overburden groundwater flow.
- For the most part, the northeastern and eastern boundaries of the plume are in essentially the same position as those interpreted by the Phase IV studies. However, in the vicinity of well 89-16(1) the plume in the Zone 1 hydrostratigraphic unit extends about 200 feet to 300 feet further east than previously predicted.
- No DNAPL was detected on the east side of Walmore Road.
- No furans have been detected in the DNAPL or intimately associated groundwater.
- DNAPL was detected in well 89-15(1) located on the west side of Walmore Road adjacent to the entrance to ARC.
- The occurrence of DNAPL at the base of Zone 1 in the A Marker Bed appears to be limited to two shallow depressions in the top of the Zone 2 aquitard. These depressions extend from the Neutralization Pond southeastwards towards wells 87-10(1) and 89-15(1).
- The relative elevations of the overburden groundwater table and the Zone 1 potentiometric surface and the level of Bergholtz Creek indicate the potential for groundwater flow from the overburden and Zone 1 bedrock unit to the creek.

- Analysis of water samples taken from Bergholtz Creek indicate the presence of very low levels of 1,2 dichloroethylene at sampling points 3 and 4. This suggests that either water from the sanitary sewer trench backfill, or the Zone 1 bedrock, may be entering the creek. Since this compound was only detected in the sampling points downstream from the point where the Cayuga Drive Extension Sanitary Sewer crosses beneath the creek, the sewer trench may be the most likely pathway for this compound to reach the creek.

- The results of the 1990 CLP sampling event confirm the results of previous sampling events in terms of compounds detected and concentrations.

- One private well, which was previously unused (Survey No. 38), was found to contain volatile organic compounds. This well extends into the lower section of the Zone 1 dolomite strata unlike most of the other wells for which depth information is available. The concentrations of volatile organic compounds in the well were in agreement with predicted levels in this area of the Zone 1 dissolved phase plume.

- The results of the analyses of the samples taken from the eleven shallow soil borings completed in the vicinity of the Neutralization Pond are in general agreement with previous results. It should be noted that PCBs were detected in some of these samples (see Section 7.0).

As discussed above, the compilation of all data obtained at the site in the various phases of investigation is discussed in the following section of this report.

5.0 SITE AREA GEOLOGY

5.1 Overburden Geology

As discussed in Section 2.5.2, the site area is underlain by glacio-lacustrine silts and clays and glacial till. These materials were developed during the Wisconsinan stage of the Pleistocene glaciation. Since glaciation, weathering of the surface of these materials developed a thin layer of silty clay loam. Fill materials have been used to modify the grade of sections of the BAT Plant area and for constructing the rocket blast deflection berms in the Rocket Test Cell area.

The overburden soils and other surficial material are described below:

Surficial Fill

Much of the Rocket Test Cell area is underlain by fill related to surface grading and road construction. The fill varies in thickness from 1 foot to 6.5 feet across the Rocket Test Cell area, but averages 1.5 feet to 2.5 feet thick. The fill is composed of silty sand and sandy silt, clay, crushed gravel, and slag (possibly ashes and clinker from the boiler house). Fill material was not noted in off-site areas. The parking lot to the east of the Helicopter Blade Bonding Building and south of the main Plant building was regraded and paved with asphalt during 1989 and 1990.

Lacustrine Clay

Lacustrine clay underlies the surficial fill and/or the topsoil. It is composed of moist, stiff to hard, laminated to varved, reddish brown to gray, silty-clay, with silt laminations and occasional gravel sized dropstones. The clay varies in thickness from 2.5 feet to 11.5 feet. The thickest sections were encountered in the southeastern portion of the study area {wells 89-18(1) and 89-8(1)}.

Within the area covered by fill, remnant topsoil layers were encountered between the top of the clay section and the fill. The top soil represents the original ground surface prior to construction of the Plant. Some light gray, bleached root zones and fractures were noted in the clay.

Lacustrine Till

Lacustrine till (meltout till) underlies the lacustrine clay. This till is composed of a distinct reddish brown, hard to dense, sandy-silt to silty-sand with trace to some clay gravel. The unit varies in thickness from 1.25 feet to 4.75 feet. The soil was generally moist and has a massive texture. Lacustrine till is a transitional facies between underlying basal till and the overlying lacustrine clay. Some thin layers of laminated clay and moist to wet silty-sand layers were noted within the lacustrine till. In the vicinity of the Neutralization Pond, thin discontinuous layers of wet sand to silty sand varying in thickness from 0.25 feet to 4 feet were encountered between the lacustrine till and the basal till at depths of 8 feet to 12 feet below ground surface. The extent of these materials is shown on Figure 3-1. This deposit may represent an isolated near shore sand bar developed during the early shallow stages of the lacustrine event which deposited the overlying lacustrine clays.

Basal Till

The basal till is a dense to very dense, light to medium brown, silty-sand with gravel and boulders. The soil samples appeared moist to dry. The basal till varies in thickness from 0 feet to 10 feet; it is not present in the southeast corner of the site and is thickest in the northwest half of the site. The till directly overlies the bedrock and it has both transitional and sharp contacts with the overlying lacustrine till.

5.2 Bedrock Geology

Previous studies have shown that the bedrock beneath the study area is made up of approximately 160 feet to 170 feet of dolomitic strata of the Middle Silurian Lockport Group (U.S. Geological Survey, 1990) underlain by the Rochester Shale Formation of the Clinton Group (see Figure 2-6A, 2-6B, and 2-7).

The hydrogeological investigations of the site have been concentrated within the upper half of the Lockport Dolomite which includes the Guelph Formation dolomite and the underlying Eramosa Dolomite. As discussed in Section 2.5.2 and Section 3 for the purposes of this study, this sequence has been subdivided into four hydrostratigraphic zones based on detailed borehole core logging and hydraulic conductivity packer testing. These zones are considered to be the principal areas of concern with regard to groundwater quality beneath the study area. The various aspects of the bedrock geology, including the configuration of the bedrock surface, stratigraphy of Zones 1 to 4 and the structural dip of the bedrock, are discussed in the following sections. Figures 2-7 and 5-1 provide a hydrostratigraphic column for the site and relative elevations of geologic and hydrogeologic units at the site. The upper four hydrostratigraphic units, Zones 1 through Zone 4 are discussed below. The composite section shown on Figure 5-1 is not to scale. This figure was developed to indicate general lithologic conditions. Figures 7-4 and 7-5 indicate the relative thicknesses of the units.

Surface elevation contours for the top of bedrock are shown on Figure 5-2. This surface dips gently southwards at about 30 feet per mile. In areas of increased data density (Neutralization Pond area) undulations of between 1 foot and

2 feet are evident. These undulations possibly reflect scouring and plucking of the tabular bedrock slabs by ice action during the Pleistocene glaciation.

5.2.1 Zone 1 Dolomite

Zone 1 includes the bedrock surface and the upper 10 feet to 20 feet of bedrock and is stratigraphically equivalent to lower units within the Guelph Formation dolomite (see Figures 2-7 and 5-4). The elevation of the top of this zone varies from approximately 570 feet MSL near the northern edge of the study area (well 86-22c), to approximately 542 feet MSL near the southern edge (well 89-7(1)) (see Figures 7-4 and 7-5). This hydrostratigraphic unit is composed of fine grained, thinly bedded, light brownish gray dolomite with numerous open bedding partings (bedding fractures) that have formed by the weathering of gypsum from the bedding planes due to the dissolving action of moving groundwater. The influence of weathering is most pronounced in the upper 1 foot to 5 feet of rock beneath the bedrock surface and in the lower 1 foot to 2 feet of the zone. This lower zone has been termed the A Marker Bed and is recognized as a bed of dolomite with abundant intergranular gypsum. The A Marker Bed frequently contains open bedding planes and is usually the most permeable section of the bedrock drilled on site. During the Phase II investigations core drilling was completed using potable water as a flushing medium. Drill water losses of up to 20 gpm to 30 gpm were noted in the A Marker Bed. This bed was intersected by nearly all the boreholes completed to the top of the underlying Zone 2 unit.

Previous reports (Phase III report, Golder 1988) have included the A Marker Bed within the Zone 2 dolomite unit. However, since the A Marker Bed is relatively permeable, it has now been included within the Zone 1 unit which is classed as the upper aquifer of the site (see Figure 2-7).

The A Marker Bed is the formational contact of the Guelph Formation with the underlying Eramosa Dolomite. Elevation contours for the base of the A Marker Bed are shown on Figure 5-3. As with the top of bedrock contours in the vicinity of the Plant, the increased availability of data points has allowed undulations of this surface to be better defined in this area. These undulations may reflect an erosional surface at the top of the Eramosa Dolomite.

5.2.2 Zone 2 Dolomite

Zone 1 is underlain by the massive dolomite of Zone 2. This zone is approximately 8 feet thick and is equivalent to the upper member of the Eramosa Dolomite. The underlying 6 feet to 7 feet of dolomite is relatively unfractured. Structural contours of the top of Zone 2 are shown on Figure 5-3. As shown, the elevation of the top of this zone varies from approximately 560 feet MSL to approximately 522 feet MSL from north to south across the study area. The rock of Zone 2 is fresh (unweathered) medium to thickly bedded, massive dolomite with a light brown to medium gray coloration and fine to medium granularity. Well developed, serrated stylolites form subhorizontal features between rare bedding planes. Some beds within Zone 2 have a distinct white speckled appearance due to intergranular gypsum. The rock has a generally non-porous appearance; however, some beds do have the appearance of a faint porosity associated with fine pitting. Due to the massive nature of the bedding this stratum has very few discontinuities and tends to core in continuous pieces several feet long.

The lower 1 foot to 1.5 feet stratum of Zone 2 is a distinct light to medium brownish grey thinly bedded laminar textured dolomite with soft sediment slump structures. This bed is referred to as the B Marker Bed (see Figure 2-7).

5.2.3 Zone 3 Dolomite

Zone 3 is a notably porous, vuggy dolomite. It is medium brownish grey, medium grained with saccharoidal textured sections, moderately porous, and medium to thickly bedded. Occasional stylolites and argillaceous laminations form subhorizontal features and bedding partings. The thickness of Zone 3 is irregular, varying from 18 feet to 29 feet, due to a transitional contact with the underlying Zone 4 dolomite. The elevation of the top of the Zone 3 dolomite is interpreted to vary from approximately 545 feet MSL in the northern part of the study area to approximately 497 feet MSL in the southern portion.

The vugs, which characterize Zone 3, form open holes in the rock that vary in diameter from 0.25 inches to 1.5 inches. The vugs have apparently formed from the dissolution of gypsum nodules and some of the cavities show distinct signs of weathering. The vugs are mineralized to varying degrees with well formed crystals of clear dolomite, gypsum and yellowish brown sphalerite (zinc sulfide). Small veins within the rock are similarly mineralized including traces of galena (lead sulfide) and have a weathered appearance. The majority of the discontinuities within Zone 3 are related to vugs and small veins.

5.2.4 Zone 4 Dolomite

Zone 4 **is** the lowest unit cored by the deep boreholes in the Phase II study. It is a fresh, light to medium brownish grey, fine to medium grained dolomite with medium to very thick bedding. The beds are massive textured. Stylolites form most of the subhorizontal discontinuities. The rock is transitional from Zone 3 and contains occasional patches of brown saccharoidal dolomite, and a few unweathered gypsum nodules, but it is characteristically not vuggy. Only the lowest section has some faintly to moderately porous sections. The section has very few discontinuities although an argillaceous bedding parting was encountered at depths of approximately 75 feet to 77 feet in boreholes 86-21 and 86-22. The parting was not encountered in the other two holes drilled during the Phase II investigation (86-23 and 86-24).

Since the contact between Zones 3 and 4 is transitional, the thickness of each zone is corresponding variable. However, the combined thickness of Zones 3 and 4 is fairly consistent, varying from 60 feet to 65 feet based on correlations with the Navy Island NI-2 borehole.

Zone 4 directly overlies the Vinemount Member of the Goat Island Dolomite. This strata is estimated to occur at depths of approximately 100 feet to 105 feet below ground surface.

5.3 Structural Features

The structural dip of the bedrock sequence, as reflected by the elevation contours of the base of the A Marker Bed, is shown on Figure 5-3. The dip is approximately 0.7 percent southeast-ward from the Neutralization Pond area at BAT, sloping from about 558 feet MSL beneath the Pond to 547 feet MSL beneath Bergholtz Creek. This slope is similar to that of the bedrock surface. The top of Zone 2 is quite uniform but locally undulates within a range of approximately 1 foot to 2 feet.

The structural dip of the rock directly reflects the dip of the bedding-parallel fractures which are the principal water bearing features within the bedrock aquifers. The dip of these fractures provides the gravitational gradient which controls the migration of the DNAPL plume at the base of the Zone 1 bedrock. In the vicinity of the Neutralization Pond it appears that two of the undulations discussed above have controlled the movement of DNAPL (see Section 7.2.3 and Figure 5-3).

Vertical and subvertical fracturing in the bedrock is oriented roughly northeast-southwest and southwest-northeast (Reference 51).

Vertical and subvertical fractures were intersected in some of the coreholes indicating the potential for movement of groundwater through these features. Since the DNAPL plume is usually detected at the base of Zone 1 these fractures probably formed the pathway for downward migration of DNAPL. The relatively low concentration of chlorinated solvents in the Zone 3 plume (see Section 7) in comparison to the concentrations in the overlying Zone 1 plume suggests that any vertical fracturing in the massively bedded Zone 2 aquitard is of sufficiently low frequency and apperture to have effectively restricted downward movement of DNAPL from Zone 1 to Zone 3.

Figure 5-4 provides a cross-section showing the geologic and hydrogeologic strata beneath the site. In addition, the sections of bedrock with increased frequency of fractures are also shown. The Zone 1 unit exhibits significantly more fractures per foot (0-12) than the underlying units which show generally less fractures per foot. The hydraulic conductivity values determined from packer testing and rising head testing are also shown in Figure 5-4.

Estimated effective transport porosities for the Zone 1 bedrock, based on visual examination of rock core recovered from the borings, are in the range of 1 percent to 5 percent with an overall value of 3 percent. This estimate includes bedding plane and vertical joint apertures, and also allows for well connected larger sized vugs.

6.0 SITE AREA SURFACE WATER

6.1 Surface Water Drainage

The surface water drainage system is dominated in the study area by the Niagara River, located approximately 2.5 miles south of the BAT Plant. Cayuga Creek is the main tributary to the Niagara River and is located to the north of the study area (Figure 2-3). The main creek crossing the study area is Bergholtz Creek which is a tributary to Cayuga Creek. Bergholtz Creek and Cayuga Creek have a general east-west orientation in this area but trend southwards to the west of the study area. The construction of the Niagara Falls International Airport required the relocation of Cayuga Creek northward from its original location, which was across the central portion of the airfield.

Sawyer Creek is minor tributary to Bergholtz Creek and crosses the site from east to west just to the south of Bergholtz Creek. The confluence of these creeks is located towards the west site of the study area (see Figure 2-3).

Flow rates for these creeks were not measured as a part of this investigation. Drainage of precipitation from the relatively flat topography to the slightly incised creeks is poor. During spring runoff, areas of standing water develop in some of the agricultural land.

Bergholtz Creek has almost incised down to bedrock. The base of the creek may be formed of intermittent overburden soil material (Basal Till) although no bedrock outcrops were located in the creek bed during field reconnaissance studies. The creek bed slopes from an elevation of about 567 feet MSL on the east side of the study area to about 562 feet MSL on the west side. Table 6-1 provides the surveyed elevations of four locations on Bergholtz Creek and one on

Sawyer Creek. The positions of these survey points is shown on Figure 6-1.

Sawyer Creek is less incised than Bergholtz Creek and appears to be almost stagnant or dry during periods of low rainfall.

Natural runoff from the surrounding area is augmented by drainage ditches adjacent to the main roads. These drainage ditches run into drop culverts to storm water sewer lines. Such a system runs along the eastern boundary of the BAT Plant site along Walmore Road.

The study area is crossed by drainage ditches, storm drains, and sanitary sewer systems. Figure 6-1 presents the locations of the municipal sanitary sewer and storm sewers provided by the Townships of Niagara and Wheatfield. A complex system of storm drains and sewer lines is also maintained within the BAT property. The locations of these structures are discussed below.

Municipal Sanitary Sewers

Several main municipal sanitary sewer lines service the BAT Plant and surrounding area and are considered to influence the hydrogeological conditions beneath the site. The locations of these sewers, the 36-inch Walmore Road Sanitary Sewer, the 48-inch Niagara Falls Boulevard Sanitary Sewer, the 48-inch Cayuga Drive Extension Sanitary Sewer, and the main 48-inch trunk sewer link, which flows southwards along the Niagara Mowhawk Right-of-Way, are shown on Figure 6-1, which also shows the sewer manholes with invert elevations. This information was obtained from the "as built" construction plans provided by the engineering department of the Niagara County Sanitary Sewer District No. 1.

The sewers were constructed with concrete pipe in trenches backfilled with coarse granular material. The southward flowing 36-inch Walmore Road Sanitary Sewer was constructed along the eastern side of the BAT Plant in an overburden trench dug into, or very near to, the bedrock surface. Adjacent to the BAT Plant, the depth of this trench is about 16 feet below ground surface. At Niagara Falls Boulevard the line turns westwards and enters the 48-inch Niagara Falls Boulevard Sanitary Sewer at a manhole located approximately 500 feet west of the Walmore Road/Niagara Falls Boulevard intersection.

The Niagara Falls Boulevard 48-inch Sanitary Sewer, which flows eastwards, is situated approximately 10 feet below the Walmore Road Sanitary Sewer. The sewer trench was blasted approximately 5 feet to 10 feet into the surface of the bedrock. The Niagara Falls Boulevard Sanitary Sewer enters the southward flowing Cayuga Drive Extension Sanitary Sewer at the intersection point with the Walmore Road Sanitary Sewer. The 48-inch diameter Cayuga Drive Extension Sanitary Sewer passes beneath Bergholtz Creek in a bedrock trench and eventually discharges to the Niagara County Sewer District No. 1 waste water treatment plant which is located about 2 miles south of the BAT Plant.

Storm Sewers

Surface water runoff in the Plant area is by surficial flow to drainage ditches along the north, east, and south sides of the Plant and to catch basins and storm drains which feed into the municipal storm sewers. Figure 6-1 provides the locations of these relatively shallow drains. These storm sewers discharge to Bergholtz Creek.

BAT Sanitary Sewers

It is understood that the major components of the BAT sanitary sewer system are developed around a main sanitary sewer line which runs southwards from the Carborundum Abrasives Company Plant (located north of the BAT Plant) to a main 30-foot deep pumping station located adjacent to borehole B-9 (see Figure 6-1). Sanitary sewers from the Rocket Test Cell Facility enter this pumping station which is concrete lined. It is understood that groundwater leaks into this lift station. Sewage from these lines is pumped to the BAT Plant sanitary sewer system which is located within the overburden. This system runs southwards beneath the plant building and discharges to the Niagara Falls Boulevard Sanitary Sewer line as shown on Figure 6-1. The section of the sanitary sewer from the Carborundum Plant to the pumping station has been plugged and abandoned.

6.3 Surface Water/Groundwater Relationships

The sanitary sewers were generally constructed without clay stops which would normally serve to prevent the flow of water within the granular sewer trench backfill. Consequently, these trenches have the potential to transmit significant amounts of water. No as-built drawings are available for the manholes; however, Mr. Frank Nerone of Niagara County Sewer District No. 1 has indicated that the manholes, constructed for the sewers in the rock trenches, were cast in place. These manholes could, therefore, act as partial water flow stops within the trenches. The potential for this water to bypass these "stops" by flowing through the adjacent fractured bedrock, should not be neglected.

During drilling for monitoring well 87-10(1) (Phase III Investigations 1988-1989), the augers drilled through the top of the Walmore Road Sanitary Sewer. During excavation of the sanitary sewer pipe for repair, an estimated 100 gpm to 200 gpm of water were flowing from the granular backfill of the trench into the sewer pipe. Analysis of a sample of this water did not detect any volatile compounds using EPA Method 624 (see Appendix D). Well 87-10(0) was constructed in the Walmore Road Sanitary Sewer trench backfill. The 1990 CLP Sampling Event detected 8 ug/l total volatile organics in this well.

The Cayuga Drive Extension Sanitary Sewer was constructed in a bedrock trench which crossed Bergholtz Creek. Mr. Nerone indicated that subsequent to construction of the sewer a fire hose was discharged into the trench backfill some distance to the north of the Creek. The firehose discharge was observed to be seeping into the base of the Creek, indicating that flow of water along the trench to the Creek is possible. However, such seepage was not noted during the Phase V investigation.

As discussed in Section 3.5, the surface drainage ditch along the west side of Walmore Road is considered to discharge water to the Walmore Road Sanitary Sewer trench which in turn causes pressure fluctuations in the Zone 1 aquifer. It was subsequently observed that between 5 gpm and 10 gpm of surface water flow infiltrated into the coarse granular backfill of the Walmore Road Sanitary Sewer trench from this section of the drainage ditch.

To further investigate this phenomenon, pressure transducers were installed in monitoring wells 87-11(1), 87-14(1), and 87-15(1) during February 1990 and March 1990; these wells are located about 50 feet, 250 feet, and 400 feet, respectively, to the west of Walmore Road.

Data obtained from these transducers was collected on a Geokon datalogger and subsequently downloaded as a series of head changes for each of the monitored wells. This data was plotted against time to produce the graphs shown on Figure 6-2. During this time period water levels fluctuated by as much as 3 feet over the course of one or two days. More significantly, there is a direct correlation of rocket testing and increases in potentiometric pressure in the Zone 1 aquifer. The peaks on the graphs shown on Figure 6-2 correspond to a period of discharge from the Rocket Test Facility. Though not readily discernible on the graphs, it takes about one to two hours for the pressure pulse, which is considered to originate in the Walmore Road Sanitary Sewer trench, to move to monitoring well 87-15(1) which is located 400 feet to the west of Walmore Road. This pressure pulse also probably occurs within the Zone 1 bedrock to the east of Walmore Road. Since the discharge from rocket testing is transient the maximum amplitude of this pressure pulse tends to decrease with distance from the sanitary sewer trench.

It is considered, therefore, that water flow in this section of the Walmore Road drainage ditch and in the Walmore Road Sanitary Sewer trench backfill can radically change the Zone 1 potentiometric head conditions in the vicinity of the Neutralization Pond. Flow of water caused by these pressure changes has most likely influenced the movement and the development of the dissolved phase groundwater plume in Zone 1 and may well have caused the plume to spread laterally more that it would have without this process.

The impact of the sewage pumping station is discussed in Section 7.

7.0 SITE AREA HYDROGEOLOGY

The hydrogeologic conditions beneath the BAT site have been assessed with a network of groundwater monitoring wells within each of the primary hydrostratigraphic units described in Section 5.0 and by hydrologic testing of these various units. This information has been used to assess the spatial and vertical distribution of hydraulic conductivities and hydraulic heads, within and between each of these units. In addition, the analytical data from groundwater samples collected from wells within the overburden, Zone 1 dolomite, and Zone 3 dolomite, have been used to determine the nature and extent of organic compounds in the flow regime within the hydrostratigraphic units. The migration rates of the plumes (assuming a migration period of about 40 years) have also been estimated.

A discussion of the findings of the hydrogeologic investigations for the BAT site study area is presented in the following sections.

7.1 Site Hydrogeology

This section contains a discussion of the hydraulic characteristics of the soil overburden, and bedrock Zones 1, 2, 3, and 4. These hydraulic characteristics were determined from the packer, pump-in, pump-out, slug, and rising head testing of wells and coreholes, as well as from the long-term collection of water level elevation data from the on-site and off-site monitoring well/piezometer network.

To illustrate the phreatic and potentiometric pressures in the study area, three cross-sections have been drawn. Section A-A' (Figure 7-4), which also illustrates the geologic units of the site, is located north-south along Walmore Road. Section B-B' (Figure 7-5) is located north-south along the Niagara Mowhawk Right-of-Way, and Section C-

C′ (Figure 7-5) is located east-west slightly north of Niagara Falls Boulevard.

7.1.1 Overburden Aquifer

The fine-grained glacio-lacustrine and glacial till soils comprising the bulk of the overburden at the BAT site was found to yield relatively little water. The majority of wells completed in the soil overburden are easily bailed dry and full recovery to static conditions generally requires several hours or more. Slug tests were completed in some of the overburden wells, and estimates of hydraulic conductivity calculated from these tests was on the order of $1x10^{-5}$ cm/sec or less in most cases. Many wells, once bailed dry during development, recovered too slowly to be practicably monitored by hand.

The field data indicate that secondary permeability exists within the soil overburden because of near vertical discontinuities. The nature and extent of such discontinuities was evident during the air coring of borehole 89-2(1) (Reference 26). As the core barrel was advanced into the underlying bedrock, air bubbling of the wet ground surface was observed approximately 10 feet from the drilling rig. This observation suggests that discontinuity communication between the soil overburden and the Zone 1 bedrocks exists in at least some locations. Such secondary permeability features may provide a pathway for recharge to the underlying Zone 1 bedrock. It should be noted, however, that comparisons of water level data between adjacent overburden and Zone 1 wells (see Figures 7-1 and 7-2) indicate the water level in the soil to be about 2 feet to 8 feet above that in the Zone 1 bedrock. In addition, the extraction pump test at well 87-14(1) (Reference 26) failed to produce any notable response in the adjacent overburden wells. This evidence suggests that the occurrence of these secondary permeability features is likely to be spatially variable.

The phreatic surface interpreted from water level measurements taken during August 1990 from overburden wells on, and adjacent to, the BAT property (see Table 7-1), is depicted in Figure 7-1. In general, groundwater flow is in a south to southeasterly direction in the overburden. The high density of overburden wells on the BAT site has revealed the presence of a local groundwater phreatic surface high in the vicinity of well 87-13(0), and a groundwater table "trough" located roughly between wells B-01(0) and B-17(0). While the origin of the local groundwater mound is not clear at this time, the trough is believed to have been caused by a leaky sanitary sewer pumping station located near borehole B-9 (Figures 6-3, 7-1, and 7-2). The pumping station is believed to have been completed several feet into Zone 1, and serves as the junction point for two sanitary sewer lines, one from the Carborundum Plant located north of BAT (now plugged) and one from the buildings currently used by ARC. ARC currently pumps accumulated water out of this shaft into the BAT sanitary sewer line which flows to a discharge at the Niagara Falls Boulevard Sanitary Sewer line (see Figure 6-2). This pumping station is believed to accept groundwater leakage from the overburden and the Zone 1 aquifer. Pumping of this water, out of the station, is considered to be the cause of the trough-like depression observed in the overburden phreatic surface shown in Figure 7-1.

Water level data was obtained from NYSDEC files from a series of four overburden wells installed on the Carborundum Abrasives Plant property, to the north of the BAT property. This data suggests a gradient reversal to the north of the BAT site and implies that a local subdued groundwater divide may exist immediately to the north of the BAT facility, in the southern portion of the Carborundum property.

Water level data collected from wells located near Bergholtz Creek, suggest that the phreatic surface gradient steepens towards the creek, and that Bergholtz Creek accepts at least some groundwater discharge from the overburden system. It should be noted, however, that the 1990 CLP groundwater samples collected from overburden wells 87-19(0) and 87-20(0) which are located immediately north of Bergholtz Creek, did not yield detectable concentrations of organic compounds.

The lacustrine clay, and to a lesser extent, the basal till, act hydraulically as semi-confining units to the underlying Zone 1 aquifer. This is evidenced by the relatively low hydraulic conductivities obtained from slug testing in the wells completed in the soil overburden (Reference 16), the fine grain size characteristics of these soils, the difference in hydraulic head between the soil overburden and bedrock, and the absence of drawdown within nearby overburden wells during the pump test performed on Zone 1 well 87-14(1) (Reference 33). However, the presence of secondary permeability features, observed during drilling (particularly in the lacustrine clay), may provide a localized means for more rapid recharge and greater hydraulic communication between the overburden and Zone 1 aquifers than these data would imply.

The difference in the hydraulic conductivities between the overburden and the Zone 1 dolomite results in the downward vertical gradient between the units. Zone 1 has the potential, therefore, to underdrain the overburden.

7.1.2 Zone 1 Aquifer

The permeability and porosity of the Zone 1 aquifer is provided by the presence of numerous bedding plane partings created by the dissolution of gypsum within the interconnected fracture system of the rock. Therefore, this unit is referred to as the Zone 1 aquifer. The A Marker Bed is considered to be the dominant hydrogeologic feature in the Zone 1 aquifer.

The hydraulic properties of the Zone 1 aquifer have been tested during the various phases of the investigation using a wide variety of techniques, including pump-out, pump-in, packer, and rising head testing. **Table 7-5 presents** a summary of all of the hydraulic conductivity values obtained for the Zone 1 aquifer by each of the methods mentioned. The hydraulic conductivity, as obtained from tests of the Zone 1 aquifer alone, range in magnitude from approximately $1x10^{-4}$ cm/sec to $2x10^{-2}$ cm/sec, with an overall mean for all methods of about $2x10^{-3}$ cm/sec. In general, rising head (or slug) test results were about one order of magnitude less than results obtained by pump-in or pump-out testing techniques. Results of the pump-in and pump-out testing were generally in good agreement with one another. These results are considered to be the more reliable because of their sustained nature, thus allowing for greater hydraulic impact on the surrounding rock mass, and because slug tests are generally highly susceptible to near borehole effects such as borehole skin friction and wellbore storage.

Storativity was estimated for the Zone 1 aquifer from both the pump-out and pump-in tests (Reference 33). Storativity estimates from pump-out test results ranged from about $1x10^{-4}$ to $6x10^{-3}$ with a mean value of about $7x10^{-4}$ (dimensionless). The storativity value obtained from the multiple well pump-in test was estimated at $6x10^{-4}$ which is in good general agreement with results obtained from the pump-out testing.

Figure 7-2 depicts the interpolated potentiometric surface of the Zone 1 aquifer based on August 1990 water level measurements. Table 7-1 provides the water levels used to define the surface. In general, flow in the Zone 1 aquifer is in a southeasterly then southwesterly direction across the study area. The equipotential surface appears to change to a more southwesterly flow direction immediately south of Bergholtz Creek as the gradient flattens towards the Niagara River. The slope of this surface in the vicinity of the BAT property suggests the presence of a localized groundwater high around the Neutralization Pond, with a slight northeasterly component to groundwater flow on the northern side of this mound. Additionally, a subdued reflection of the groundwater trough observed in the overburden phreatic surface (Figure 7-1) is also evident in the Zone 1 potentiometric surface. As discussed in Section 7.1.1, it is believed that leakage of Zone 1 water to the sanitary sewer pumping station, adjacent to borehole B-09, is the most likely cause for this depression in the potentiometric surface.

As discussed previously, the flow of water in the Walmore Road Sanitary Sewer has an impact on the potentiometric pressure in the Zone 1 aquifer which fluctuates simpathetically with the discharge of rocket test cooling water. It is considered likely that the sewer trench acts as a recharge boundary and at times as a discharge boundary, depending on the flow of water in the surface runoff ditch (either precipitation runoff or rocket test discharge water) next to the Walmore Road Sanitary Sewer trench and, the distance, south along Walmore Road, from the ARC property.

Additionally, the Niagara Falls Boulevard and Cayuga Drive Extension Sanitary Sewer trenches have the potential to act as discharge boundaries from the upper portions of the Zone 1 aquifer.

Groundwater flow in the Zone 1 aquifer is likely influenced to some degree by Bergholtz Creek. The shape of the potentiometric surface in the vicinity of Bergholtz Creek suggest a slight interaction between the creek and Zone 1 immediately south of the BAT site. However, it should be noted that volatile organic compounds have been detected south of the Creek. Golder Associates personnel have walked both Bergholtz and Sawyer Creeks in the vicinity of the BAT property. Based on these observations and the data from borings there is generally anywhere from 1 foot to 3 feet of sediment or overburden soil between the base of Bergholtz Creek and the top of bedrock. The composition of this sediment/soil varies widely, from thin sands and gravels, to organic rich silts and clays.

Sawyer Creek is less incised than Bergholtz Creek. The thickness of overburden along this creek alignment is probably on the order of 10 feet or more. Thus, the level of hydraulic interconnection between Zone 1 and Sawyer Creek is believed to be considerably less than Bergholtz Creek.

In order to assess the migration potential of organic compounds in the Zone 1 aquifer system, it is necessary to obtain an understanding of groundwater seepage velocities within this unit. While it is recognized that flow takes place in the fracture systems which dissects the rock mass, the seepage velocity of groundwater may be estimated by the equation:

$$Vs = \frac{K(dh/dl)}{ne}$$

where:
Vs = seepage velocity
K = hydraulic conductivity
dh = change in hydraulic head
dl = distance over which head change dh occurs
ne = effective porosity

The mean hydraulic conductivity of the Zone 1 aquifer, obtained from the extensive aquifer testing, is 2×10^{-3} cm/sec (Reference 33). The effective porosity (ne) has been estimated to be about 3 percent from fracture log records of coreholes completed during the Phase I through V investigations (this includes an allowance for bedding plane and vertical fracture apertures). The hydraulic gradient (dh/dl) however, varies significantly between the vicinity of the BAT site and the area south of Bergholtz Creek. This has a significant impact on the magnitude of the estimated groundwater seepage velocities in different sections of the study area. The change of hydraulic gradient is considered to be influenced primarily by the change of topographic gradient, to the impact of Bergholtz Creek as a discharge boundary and to a lesser extent possibly due to the presence of the sewer trenches. It should be noted that these gradient changes appear to reflect the regional gradient changes (see Figure 2-8).

The gradient at the BAT site, north of Bergholtz Creek, is about 0.01 ft/ft from the Rocket Test Cell area to the creek. Therefore, the groundwater seepage velocity across this area is estimated to be approximately 1.9 ft/day to 2.8 ft/day. The gradient from the area around Jagow Road to Bergholtz Creek, has been estimated to be between 2×10^{-3} ft/ft to 7.5×10^{-4} ft/ft which corresponds to a seepage velocity, in this area south of the creek, of about 0.3 ft/day to 0.4 ft/day.

7.1.3 Zone 2 Aquitard

The Zone 2 unit possesses few bedding plane partings or open fractures. Wells screened below Zone 2 (in Zone 3) were monitored during the pump-out test conducted at Zone 1 well 87-14(1) (Reference 33). No notable response was observed in these wells during pumping, suggesting that hydraulic communication between Zones 1 and 3 was being occluded by Zone 2. Several packer tests were completed across Zone 2 (Table 7-5), during the Phase II investigation (Reference 19) and indicated a hydraulic conductivity in the order of $1x10^{-5}$ cm/sec to $1x10^{-6}$ cm/sec.

Because of the massive nature of Zone 2 dolomite observed in the rock core, the lack of communication between adjacent Zone 1 and 3 wells during the pump-out test, and the relatively low concentrations of volatile organic constituents detected in groundwater samples collected from Zone 3 (see Section 7.2), Zone 2 is considered to be an aquitard between the Zone 1 and Zone 3 aquifers.

7.1.4 Zone 3 Aquifer

Figure 7-3 illustrates the interpolated potentiometric surface of the Zone 3 aquifer based on August 1990 water level measurements. In general, groundwater flow in Zone 3 is to the south, with a small groundwater high corresponding to that seen in water level elevation maps for the overburden and Zone 1 (Figures 7-1 and 7-2). It is likely, that whatever the cause of this local high, its origin begins in the overburden, since the phreatic surface exhibits the most pronounced effect.

The horizontal gradients within the Zone 3 aquifer are much more uniform than the horizontal gradients in the overburden and Zone 1 aquifer. The horizontal gradient ranges in value from 3.7×10^{-3} ft/ft to 8.3×10^{-3} ft/ft. Table 7-4 presents the vertical gradients between Zone 1 and Zone 3 calculated from data collected on August 28, 1990. These data indicate that during a period during which no water was being discharged from the Rocket Testing Facility and groundwater pressures were relatively stable (see Figure 4-1) gradients between Zone 1 and Zone 3 were small and generally downwards. During periods of rocket test discharge Zone 2 water pressures increase above those measured on August 28, 1990 and probably result in increased downward hydraulic gradients between Zone 1 and Zone 3.

Zone 3 is thought to be an aquifer of very modest permeability, due to its weathered porous to vuggy nature and the fact that bedding plane partings and fractures, while present, are rare. Packer testing has been performed (Reference 19) to estimate the hydraulic conductivity of this unit. Estimates range from about 9×10^{-6} cm/sec to about 2×10^{-4} cm/sec, with a mean value of approximately 3×10^{-5} cm/sec (**Table 7-5**). Well yields, determined during development, range from 1 gpm to 10 gpm for Zone 3.

7.1.5 Zone 4 Aquifer

Like the Zone 1 and 3 potentiometric surfaces, the Zone 4 water levels suggest a surface which slopes southward toward the Niagara River. Packer tests were used to estimate the hydraulic conductivity of Zone 4. The range of values obtained from packer testing varied from about 3×10^{-6} cm/sec to about 5×10^{-4} cm/sec, with a mean value of approximately 1×10^{-5} cm/sec (**Table 7-5**). Like Zone 3, Zone 4 is considered to represent an aquifer of very modest permeability and potential yield capacity.

7.1.6 Conceptual Groundwater Flow Model

The hydrogeologic model of the site area consists of the following components:

- An overburden layer of low permeability.
- The Zone 1 aquifer, which is the dominant groundwater flow system beneath the site.
- The Zone 2 aquitard which restricts flow between the Zone 1 aquifer and the underlying Zone 3 aquifer.
- The Zone 3 aquifer which has a lower hydraulic conductivity than the Zone 1 aquifer.
- The Zone 4 aquifer, a stratum of bedrock beneath Zone 3 which has limited permeability.

Groundwater flow directions in all these components is predominantly southwards and reflects the regional flow direction towards the Niagara River.

Locally, groundwater flow directions in the overburden and Zone 1 components of the groundwater model may vary as a result of manmade structures, the variability of hydraulic conductivity, or surficial streams. Downward hydraulic gradients generally exist between the overburden and the Zone 1 aquifer. This may vary locally due to the influence of sanitary sewer lines.

Within Zone 1 gradients are generally downwards towards the A Marker Bed (**Table 7-4**).

Both downward and upward gradients have been measured between the Zone 1 and Zone 3 aquifers which are separated by the Zone 2 aquitard. On August 28, 1990, most gradients were downward. Variation in the magnitude and direction of this gradient may occur due to the pressure pulse phenomenon caused by the infiltration of rocket test discharge water and/or surface water runoff to the Walmore Road Sanitary Sewer trench. During such events, downward vertical gradients between Zone 1 and Zone 3 probably increase.

The dominant flow path in the Zone 1 aquifer, the uppermost aquifer of the site, is the A Marker Bed at the base of this unit. It is considered that flow of water in this unit, beneath Bergholtz Creek, has been the prime factor in the development of a dissolved phase plume south of this creek. Discharge of groundwater to Bergholtz Creek is considered to be limited.

7.2. Nature, Extent, and Rate of Contamination

7.2.1 Data Analysis Procedures

The hydrogeology studies completed at BAT's Wheatfield Plant have provided information regarding the nature and extent of chlorinated solvent contamination in groundwater and the overburden.

The analytical chemistry data utilized is primarily from the May and June 1990 CLP sampling event and the September 1989 DNAPL sampling event (results provided in Appendix D), however, the entire historical database was evaluated.

Although interconnected, the groundwater contamination plume is discussed herein as four plumes for convenience:

1. A plume containing organic solvents within an area of overburden around the Neutralization Pond and Blade Bonding Building (see Figure 7-6);
2. A Dense Non-Aqueous Phase Liquid (DNAPL) plume in the Zone 1 aquifer (uppermost bedrock strata) stretching about 750 feet to the southeast of the Neutralization Pond (see Figure 7-7);

3. A plume containing dissolved solvents extending about 4,000 feet to the southeast of the Pond, roughly pear shaped, spreading to about 3,000 feet to 4,000 feet wide, also in the Zone 1 bedrock stratum (see Figures 7-7, 7-8, 7-9, 7-10, 7-11); and,

4. A dissolved phase plume of limited extent in the Zone 3 bedrock stratum, beneath the DNAPL plume (see Figure 7-12).

The results of the chemical analyses of the May and June 1990 CLP sampling event (provided in Appendix D) were used to determine the isoconcentration contours as follows:

- o Overburden aquifer
  - total volatile organic compounds (Figure 7-6)
- o Zone 1 aquifer
  - total volatile organic compounds (Figure 7-7)
  - trichloroethylene (Figure 7-8)
  - methylene chloride (Figure 7-9)
  - 1,2 dichloroethylene total (Figure 7-10)
  - vinyl chloride (Figure 7-11)
- o Zone 3 aquifer
  - total volatile organic compounds (Figure 7-12)

In contouring the analytical chemistry data the following techniques were used:

- o If field or laboratory duplicate values were available, the highest concentration value was used as a conservative approach.
- o In contouring the concentration of individual compounds or the total of a class of compounds the estimated concentrations below the quantitation limit (qualifier J) were also taken into consideration.
- o The position of the 1 ug/l concentration contour has been interpreted as lying between the sampling points reported as non-detect (qualifier U) and the adjacent sampling points with a reported quantitation value or estimated concentration (qualifier J).

- The high concentrations of the main compounds (i.e. trichloroethylene and methylene chloride) in the DNAPL plume area tend to make the detection of the minor compounds difficult (i.e. 1,2 dichloroethylene and vinyl chloride). The quantitation limits for the minor compounds are very high in these cases and in some cases they are qualified as undetected (U). These results were excluded from the interpolated values, and the sampling points were included within the limits determined by the interpolation of the concentrations of the compound detected at adjacent sampling points.

  Also excluded from the interpolated values were the results reported below the reported quantitation limit for the sampling points located towards the edge of the dissolved phase plume. This criteria was applied to only one analysis collected from well 87-16(1), which indicated an estimated concentration of 3 ug/l for carbon disulfide (Figure 7-7).

The following sections present discussions regarding the results of the groundwater analytical chemistry data from the site.

7.2.2 Overburden Plume

Previous phases of the investigation at the BAT plant have examined the soil overburden on the site and in the area between the plant site and Cayuga Drive. The potential presence of organic compounds within the soil in this area was investigated by the use of organic vapor analysis (OVA) of soil samples, using head space analysis, and by laboratory analysis of soil samples from a network of overburden wells (Phase I and II Report, and Section 4 of this report). The investigation indicates an area of overburden soil, in the vicinity of the Neutralization Pond, which contains organic solvents.

The groundwater samples collected during the 1990 CLP sampling event allowed for additional chemical characterization of the overburden plume and the definition of the extent of various classes of chemical compounds.

Volatile Organic Compounds

These compounds are the most common constituents within the dissolved phase overburden plume. Figure 7-6 presents the areal distribution of total volatile organic compounds in this plume based on the 1990 CLP data. **Tables 7-6A and 7-6B summarize** the detected volatile organic compounds of the groundwater samples collected from the overburden wells. The detected volatile organic compounds and their maximum concentrations for the 1990 CLP sampling event are listed below.

PARAMETER	CONCENTRATION (ug/l)	SAMPLING POINT	QUALIFIER
Methylene chloride	1,500,000	B-11(0)	
Trichloroethylene	200,000	B-6(0)	
1,2-Dichloroethylene (total)	28,000	87-8(0)	
Acetone	16,000	87-17(0)	BJ
Chloroform	580	B-10S(0)	J
Vinyl chloride	120	B-1(0)	J
1,1,1-Trichloroethane	20	87-1(0)	J
Xylene (total)	3	B-9(0)	J
Benzene	2	B-9(0)	J
Toluene	1	87-22(0)	J

J Estimated concentration below the quantitation limit.
B Parameter detected in the associated blank.

The distribution of the concentration contours for the overburden volatile organic plume (Figure 7-6) shows two relative maximum areas. One delineated by wells B-11, 87-17(1), B-3 and B-6, with concentrations of total volatile organics above 100,000 ug/l and another one to the south delineated by wells B-18 and 87-2(0) with concentrations of total volatile organics above 10,000 ug/l. This area is in the vicinity of the Helicopter Blade Bonding Building.

A factor that may have contributed to the distribution of the plume may be that recharge is occurring in the vicinity of well 87-13(0). A groundwater mound has developed around this well, as shown on Figure 7-1. Historically, the concentrations recorded for this well have dropped significantly as illustrated by the following table:

PARAMETER	CONCENTRATION (ug/l)	DATE (yymmdd)
1,1,1-Trichloroethane	60500.00	880804
1,1,1-Trichloroethane	ND	881102
1,1,1-Trichloroethane	ND	890104
1,1,1-Trichloroethane	ND	890418
Methylene chloride	1140000.00	880804
Methylene chloride	<DL	881102
Methylene chloride	<DL	890104
Methylene chloride	<DL	890418
Methylene chloride	ND	890719
Trichloroethylene	877000.00	880804
Trichloroethylene	<DL	881102
Trichloroethylene	<DL	890104
Trichloroethylene	<DL	890418
Trichloroethylene	<DL	890719

ND: Not detected;
<DL: Less than detection limit.

This reduction may indicate that this well is not functioning correctly and may require redevelopment or replacement. Alternatively, some form of clean water recharge may be occurring in the vicinity of the well causing the local groundwater mound and flushing of contaminants.

The shallow soil samples taken as part of the Phase V investigation also indicate the presence of volatile organic compounds in the shallow soil within the area defined by the overburden plume. Table 7-13A and 7-13B presents the results of the analysis of these soil samples. Figure 7-6A and 7-6B indicate the location of the samples and the results of the analyses.

Semivolatile Organic Compounds

The results of the 1990 CLP sampling event indicate that these compounds have a very limited areal distribution (Table 7-7A and 7-7B). The only semivolatile organic compound detected in the overburden wells is bis(2-ethylhexyl)phtalate, commonly found in the associated blanks. The concentration levels of bis(2-ethylhexyl)phtalate are below the quantitation limit for the two samples with detectable values (B-17 and B-8; Table 7-7A and 7-7B). No isoconcentration contours were prepared for these compounds as the results are considered to be false positives. Table 7-13A and 7-13B presents the results of the shallow soil sampling. Figure 7-6B provides the totalized PAH concentrations at the sample locations.

Pesticides and PCBs

These compounds have not been detected in the overburden aquifer samples, however three shallow soil samples indicated the presence of PCBs in the vicinity of the Pond (see Figure 7-6B).

7.3 DNAPL Plume Results

A DNAPL plume at BAT occurs within the fractured, dolomite bedrock of the Zone 1 aquifer. The DNAPL is a dark amber brown to black colored fluid with a density approximately 1.5 times that of water and, accordingly, has the potential to sink rapidly in water.

During the Phase V investigation a total of four wells were drilled [89-10(1), 89-(1), 89-(1) and 89-(1); (see Figure 3-2 for location)] in order to define the down gravity gradient extent of the DNAPL plume. Wells 89-10(1), 89-11(1) and 89-12(1) did not indicate the presence of DNAPL. Well 89-15(1) did indicate DNAPL in the groundwater at the base of Zone 1. Figure 5-3 shows the elevation contours for the base of the A Marker Bed (the top of Zone 2). This shows two depressions in the surface stretching southwest from the Neutralization Pond to wells 87-10(1) and 89-15(1). All occurrences of DNAPL have been within these topographic depressions. These dense products tend to migrate gravitationally and to accumulate on the topographic lows of an aquifer base. It is considered that the more elevated sections of the top of Zone 2 on either side of these depressions and in the vicinity of well 89-11(1), have tended to trap the DNAPL in these depressions.

Zone 1 is underlain by the 8 foot thick massive dolomite of Zone 2 which has apparently restricted the downward movement of DNAPL into the deeper Zone 3 aquifer.

The DNAPL is believed to occur within the lower half of Zone 1, predominantly within the A Marker Bed. The DNAPL plume is not considered to be presently migrating at a significant rate considering that the former DNAPL driving head, within the Pond, was eliminated when the Pond was closed. In addition, the undulations in the base of the A Marker Bed probably restrict the movement of DNAPL.

During the Phase IV investigation (Reference 26), DNAPL was recovered from monitoring wells 87-6(1) and 87-10(1), for chemical analysis. The samples were analyzed for volatile organic compounds and the analyses indicated that the DNAPL was comprised of 94.1 percent to 99.7 percent trichloroethylene (TCE). Additional organic compounds within the DNAPL included methylene chloride, 1,2-trans-dichloroethylene and 1,1,1-trichloroethane, varying from <1 to 3.3 percent. These latter compounds are likely dissolved within the TCE DNAPL and do not occur as separate phases.

As part of the Phase IV investigation, one sample of water (dissolved phase) from well 87-13(1) was tested for the 40 CFR Part 264 Appendix IX list of chemicals. Table 2 of the Phase IV Report (Reference 26) presents the list of compounds detected by this analysis. This analysis indicated that the major portion of the dissolved phase is composed of the following solvents:

Methylene chloride;
Trichloroethylene;
1,1,1-Trichloroethane;
Acetone; and
Trichlorofluoromethane.

A total of about 200 ppb of polyaromatic hydrocarbons (PAHs) were also detected, as was Arochlor 1260, a polychlorinated biphenol (PCB). Of potentially greater significance was the possible detection of pentachlorodibenzofuran (PCDF) and tetrachlorodibenzofuran (TCDF) at 3.90 ppt and 10.31 ng/l (ppt), respectively. These compounds are within a RCRA hazardous waste group collectively known as dioxins and can be classified as F020-F023, or F026-F028 wastes. Though the report from ETC, the analytical lab, indicated that these compounds were detected, the lab report indicates that the compound detected may have been polychlorinated diphenyl ether (PCDE) or PCDF and TCDF. The PCDE confirmation ions have the same retention time as PCDF and TCDF confirmation ions. EPA requires the laboratory to report the detection of these ions as furans.

Special analysis was completed as part of the Phase V investigation to determine if furans are actually present in the DNAPL and closely associated groundwater (September 1989 Sampling Event). Samples of groundwater were collected from wells 87-6(1), 87-13(1) and 87-16(1). Groundwater samples from these wells were analyzed by Alpha Analytical and ETC. Table 7-12 includes the list of the sampling points and the analyses performed. The results of these analyses are included in Appendix D of this report and a summary of the detected compounds is presented in Table 7-12. None of the analyses completed on these samples indicated the presence of furans.

A DNAPL sample was collected from well 87-13(1) and analyzed by Alpha Analytical for furans using SW846 Method 8280. This was the only well from which DNAPL could be extracted in sufficient quantities for analysis. Additionally, a duplicate sample of DNAPL from 87-13(1) was analyzed by ETC using SW846 method 8280 and special GC/MS techniques (see Section 4.5). The results of these analyses did not indicate the presence of furans (see Appendix D).

Volatile Organic Compounds

The analyses collected during the September 1989 sampling event indicated that the main volatile organic compounds in the DNAPL are:

PARAMETER	CONCENTRATION (ug/l)	PERCENT RELATIVE TO TOTAL VOC
Trichloroethylene	668,000,000	67.43 %
Methylene chloride	162,000,000	16.35 %
1,1,1-Trichloroethane	106,000,000	10.70 %
Acetone	45,100,000	4.55 %
1,1-Dichloroethylene	3,260,000	0.33 %
Toluene	2,080,000	0.21 %
Trichlorofluoromethane	1,900,000	0.19 %
Xylene (total)	686,000	0.07 %
Ethylbenzene	640,000	0.06 %

PARAMETER	CONCENTRATION (ug/l)	PERCENT RELATIVE TO TOTAL VOC
1,2-Trans-dichloroethylene	580,000	0.06 %
Tetrachloroethylene	315,000	0.03 %
Vinyl Chloride	80,000	0.01 %
Chloroform	74,100	0.01 %

Table 7-12 illustrates the concentration of the detected compounds in the DNAPL sample and the aqueous samples collected for the September 1989 sampling event. The same table indicates the percent of each compound relative to the total concentration of volatile organic compounds detected in each sample. It should be noted that there is a relative increase of 1,2-trans dichloroethylene in the samples located farther from the DNAPL. 1,2-trans dichloroethylene forms 0.06 percent of the total volatile organic compounds in the DNAPL sample from well 87-13(1). In the aqueous samples obtained from the 1990 CLP sampling event from wells 87-18(1) and 81-22(1), located approximately 1200 feet downgradient from the Neutralization Pond, 1,2-trans dichloroethylene forms 73.1 percent and 29.2 percent of the total volatile organic compounds, respectively. This is considered to be result of anaerobic biologic degradation of the trichloroethylene to 1,2-trans dichloroethylene.

Semivolatile Organic Compounds

The analysis of this class of organic compounds indicated the following concentrations in the DNAPL sample (September 1989 Sampling Event):

PARAMETER	CONCENTRATION (ug/l)	PERCENT RELATIVE TO TOTAL SEMI VOC
1,2,4,5-Tetrachlorobenzene	7,410.0	66.92%
Napthalene	2,180.0	19.68%
Di-n-octylphtalate	652.0	5.88%
o-Dichlorobenzene	406.0	3.67%
p-Dichlorobenzene	212.0	1.91%
Anthracene	120.0	1.08%

PARAMETER	CONCENTRATION (ug/l)	PERCENT RELATIVE TO TOTAL SEMI VOC
2,3,4,6-Tetrachlorophenol	52.1	0.47%
2,4-Dimethylphenol	23.7	0.21%
2-Chlorophenol	17.2	0.16%

In the aqueous samples p-dichlorobenzene, 2,3,4,6-tetrachlorophenol, 2,4-dimethylphenol 2-chlorophenol were not detected. The remaining compounds were detected in the dissolved phase at much lower concentrations (Table 7-12), the maximum concentration being reported for di-n-octyl phtalate with 80 ug/l in the sample from well 87-16(1).

Pesticides, PCBs and Herbicides

Herbicides were not detected in the DNAPL sample from well 87-13(1) and aqueous phase sample from well 87-16(1) taken during the September 1989 sampling event (Table 7-12). Similarly, pesticides were not been detected in the samples taken by the 1990 CLP sampling event (Appendix D).

PCBs were detected in the DNAPL in following concentrations:

PARAMETER	CONCENTRATION (ug/l)	ANALYTICAL LAB
PCB-1254	352,000	ETC
PCB-1254	186,000	ALPHA ANALYTICAL
PCB-1260	102,000	ALPHA ANALYTICAL

Additionally PCB-1242 was detected at concentrations below the detection limit (detection limit = 2,400 ug/l).

In the aqueous samples the PCBs were detected at much lower concentration levels (Table 7-12). The ranges of concentrations for PCB-1254 are from 4.4 ug/l to 101.0 ug/l and for PCB-1260 from 4.1 ug/l to 90.3 ug/l.

Inorganic Constituents

The inorganic substances present in the DNAPL (September 1989 Sampling Event) are: lead (13,000 ug/l), zinc (4,000 ug/l), barium (2,670 ug/l) and selenium (768 ug/l). Copper, thallium, antimony, tin and sulfide (as sulfur) were also detected at levels below the detection limit. In the aqueous samples these inorganic compounds occur at concentrations generally two orders of magnitude less than in the DNAPL sample (Table 7-12). Because of these differences in concentrations, it is considered that at least part of the inorganic constituents detected in the aqueous samples may have originated from the Neutralization Pond area. It should be noted that galena and sphalerite are present in the bedrock, consequently the lead and zinc concentrations may be due to these naturally occurring minerals.

7.4 Zone 1 Plume Results

The major impact of the former Neutralization Pond on groundwater is within the Zone 1 aquifer. The analyses completed to date indicate that the volatile organic compound plume within this aquifer extends approximately 4,000 feet south of the Neutralization Pond. Based on the results of previous sampling events of wells 89-5(1A) and 89-5(1B) (Reference 26), the plume appears to be predominantly situated within the lower half of Zone 1 in the area south of Bergholtz Creek. Well 89-5(1B) located in the upper half of Zone 1 contained no detectable chlorinated solvents, whereas well 89-5(1A) in the lower half of Zone 1 showed concentrations of volatile organic compounds. The 1990 CLP sampling event indicated a total volatile organic concentration of 475 ug/l in well 89-5(1A) with 56 ug/l total volatile organics being detected in well 89-5(1B).

Given the downward gradients measured in Zone 1, the dissolved plume may be located predominantly within the lower half of Zone 1 in areas closer to the BAT site. If this is the case, the plume may be passing, relatively unaffected, beneath Bergholtz Creek. The very low concentrations of volatile organic compounds detected by the analyses of stream and sediment samples from this creek (see Section 7.2.6) seems to support this hypothesis.

Volatile Organic Compounds.

The 1990 CLP sampling event, generally confirmed the results of the previous investigations regarding the distribution of volatile organic compounds.

The results of the 1990 CLP sampling event indicate that the maximum concentration of detected volatile organic compounds in the Zone 1 wells are:

PARAMETER	CONCENTRATION (ug/l)	SAMPLING POINT	QUALIFIER
Methylene chloride	1,400,000	87-13(1)	
Trichloroethylene	1,100,000	87-13(1)	
1,1,1-Trichloroethane	51,000	87-13(1)	
Acetone	17,000	87-10(1)	J
1,2-Dichloroethylene (total)	12,000	87-18(1)	
Chloromethane	4,800	89-10(1)	J
Vinyl chloride	420	87-22(1)	J
Carbon disulfide	110	B-14(1)	
1,1-Dichloroethylene	47	87-22(1)	J
1,1-Dichloroethane	17	B-15(1)	
Xylene (total)	9	89-5(1B)	
Chloroform	3	87-2(1)	J
Toluene	2	89-5(1A)	J
Benzene	1	89-5(1A)	J
Ethylbenzene	1	89-5(1B)	J

J = Estimated concentration below the quantitation limit

Taking into consideration the frequency of detection and the concentration levels, the main compounds of the dissolved phase plume are: methylene chloride, trichloroethylene, 1,2-dichloroethylene (total), and vinyl chloride. Figures 7-6 to 7-11 show the interpreted isoconcentration contours for total volatile organic compounds and for the main individual constituents (trichloroethane, methylene chloride, total 1,2 dichloroethylene (trans and cis isomers), and vinyl chloride).

Trichloroethylene concentrations reach the saturation levels (800,000 ug/l) in the aqueous phase adjacent to the DNAPL area. The extent of the trichloroethylene plume is shown on Figure 7-8.

The main difference between the results from the 1990 CLP sampling event and the earlier phases of investigation are the decreases in concentration levels for well 87-1(1). The table below illustrates these changes in the concentrations of the main volatile organic compounds detected at this sampling point. As can be seen, a gradual decrease in concentrations has been reported for this sampling point since 1987. The reasons for this reduction are not apparent but may be related to a change in infiltration rates around the perimeter of the Blade Bonding Building due to paving the parking lot or roadway or the impact of the sanitary sewer lift station, located upgradient of this point.

PARAMETER	CONCENTRATION (ug/l)	DATE (yymmdd)
1,1,1-Trichloroethane	206.00	871105
1,1,1-Trichloroethane	384.00	880516
1,1,1-Trichloroethane	<DL	881103
1,1,1-Trichloroethane	45.00	890105
1,1,1-Trichloroethane	0.31	890418
1,1,1-Trichloroethane	0.06	890719
1,2-Trans-dichloroethylene	0.80<DL	871105
1,2-Trans-dichloroethylene	9220.00	880516

PARAMETER	CONCENTRATION (ug/l)	DATE (yymmdd)
1,2-Trans-dichloroethylene	3460.00	881103
1,2-Trans-dichloroethylene	1800.00	890105
1,2-Trans-dichloroethylene	5.00	890418
1,2-Trans-dichloroethylene	1.20	890719
Methylene chloride	892.00	871105
Methylene chloride	31900.00	880516
Methylene chloride	5420.00	881103
Methylene chloride	1400.00	890105
Methylene chloride	23.00	890418
Methylene chloride	2.50<DL	890719
Trichloroethylene	755.00	871105
Trichloroethylene	28200.00	880518
Trichloroethylene	1620.00	881103
Trichloroethylene	800.00	890105
Trichloroethylene	13.00	890418
Trichloroethylene	0.96	890719
Trichlorofluoromethane	470.00	871105
Trichlorofluoromethane	631.00	880516
Trichlorofluoromethane	ND	881103
Trichlorofluoromethane	ND	890105
Trichlorofluoromethane	ND	890418
Trichlorofluoromethane	ND	890719

ND: Not detected;
<DL: Less than detection limit.

The areal distribution of methylene chloride (shown on Figure 7-9) is small in relation to the areal distribution of trichloroethylene. This may be the result of a higher retardation factor of methylene chloride versus the retardation factor of trichloroethylene for the site specific conditions. Another factor that may influence the methylene chloride areal distribution may be the lower methylene chloride concentration in the DNAPL area (16.24 percent of the total volatile organics) relative to the trichloroethylene concentration (67.43 percent of the total volatile organics). It is understood that both methylene chloride and TCE were used at the facility during the time the Neutralization Pond was in use.

The 1,2-dichloroethylene (total) plume is shown on Figure 7-10. 1,2-dichloroethylene (total) in the Zone 1 aquifer tends to have an increased relative concentration to the total volatile organic compounds downgradient from the DNAPL plume. This is considered to be the result of degradation of the trichloroethylene to 1,2-dichloroethylene probably by the action of anaerobic bacterial action.

The vinyl chloride plume in the Zone 1 aquifer (see Figure 7-11) has developed partly from the DNAPL and partly from the trichloroethylene which degrades to 1,2-dichloroethylene and then to vinyl chloride. As in the case of 1,2-dichloroethylene, the percentage of vinyl chloride relative to the total volatile organic compounds increases towards the downgradient end of the plume (this trend is discussed further in Section 7.7).

The maximum vinyl chloride concentration (420 ug/l) was recorded for the sample collected from well 87-22(1) during the 1990 CLP sampling event.

Semivolatile Organic Compounds

The detection of semivolatile organic constituents in the groundwater samples collected for the 1990 CLP sampling event is very limited (see Appendix D). The majority of the samples indicated semivolatile compounds with concentrations below the quantitation limit (qualifier J; Table 7-7A and 7-7B). Many of the detected semivolatile compounds have concentrations associated with detectable analytes in the associated blanks (qualifier B; Table 7-7A and 7-7B). The only two parameters with concentrations not qualified with J and B are:

PARAMETER	CONCENTRATION (ug/l)	SAMPLING POINT
4-Methylphenol	25	97-6(1)
di-n-octylphtalate	17	87-15(1)

The relatively low concentration of the semivolatile organic compounds in the DNAPL plume and the lower solubility of these substances in water is considered to result in these low concentrations in the aqueous phase.

Pesticides and PCBs

Out of thirty wells sampled during the 1990 CLP sampling event for analysis of TCL pesticides and PCBs, only six samples indicated detectable concentrations above or equal with the quantitation limit (see Appendix D). These samples are from wells 87-6(1), 87-13(1), 87-14(1), 87-23(1), 89-10(1) and B-10A(1). The main compound identified by these analyses was Arochlor-1254 with a maximum concentration in well B-10A(1) of 38 ug/l (Table 7-8A and 7-8B). Additionally three other samples from wells 87-5(1), 89-10(1) and 89-15(1) indicated detectable concentrations of Arochlor-1254 at levels below the detection limit. Very low levels of gamma-BHC(Lindane) were detected in the wells B-10A(1) (3.5 ug/l) and 87-14(1) (0.14 ug/l).

7.5 Zone 3 Plume Results

In order to determine the groundwater quality in the Zone 3 aquifer, the nine existing wells screened in this unit were sampled for TCL volatile organic compounds in the 1990 CLP sampling event (see Table 4-4). The wells close to the corresponding Zone 1 DNAPL plume (five wells, see Table 4-4) were sampled for TCL semivolatile organic compounds and TCL pesticides and PCBs. The results of these analyses are provided in Appendix D.

Volatile Organic Compounds

The volatile organic compounds detected in Zone 3 aquifer are at much lower concentrations than their corresponding concentrations in Zone 1 aquifer. A list of the detected volatile organic compounds in the Zone 3 aquifer and their maximum concentrations is presented below.

PARAMETER	CONCENTRATION (ug/l)	SAMPLING POINT	QUALIFIER
Trichloroethylene	11,000	87-20(3)	
Methylene chloride	3,300	87-20(3)	
1,2-Dichloroethylene (total)	880	87-13(3)	
Carbon disulfide	250	87-20(3)	J
Vinyl chloride	160	87-26(3)	
1,1,1-Trichloroethane	34	87-16(3)	
1,1-Dichloroethane	16	87-16(3)	
4-Methyl-2-Pentanone	16	87-5(3)	
2-Hexanone	15	87-5(3)	
1,1,2-Trichloroethane	2	87-5(3)	J

J = Estimated concentration below the quantitation limit

Based on the 1990 CLP data, the interpreted concentration contours for total volatile organic compounds indicate a maximum concentration in the vicinity of the well 89-20(3), located southeast of the extremity of the Zone 1 DNAPL plume (Figure 7-12).

The Zone 2 aquitard, formed by a massive dolomite strata, has a very low fracture frequency and permeability. However, some vertical fractures may occur within this massive dolomite strata, and may form very limited pathways for migration of contaminants from Zone 1 to Zone 3. This potentially explains the detection of volatile organic compounds in the Zone 3 aquifer with the highest concentrations located downgradient from the Zone 1 DNAPL plume.

This distribution may be the result of the migration of the Zone 3 volatile organics plume from the Neutralization Pond area down gradient towards the location of well 89-20(3).

Semivolatile Organic Compounds

The analysis of the samples collected from the Zone 3 wells indicated only two compounds detected above the quantitation limit for phthalates in the wells 87-5(3) and 87-15(3). No isoconcentration contours were prepared for these compounds.

PARAMETER	CONCENTRATION (ug/l)	SAMPLING POINT
bis(2-Ethylhexyl)phtalate	10	87-5(3)
di-n-octylphtalate	53	87-15(3)

Two other results indicated phthalates concentrations associated with blank samples, but below the quantitation limit (Table 7-7A and 7-7B). This may indicate that the above values are false positives.

It appears that the semivolatile organic compounds have not migrated in significant quantities into the Zone 3 aquifer because of the lower mobility of these compounds and relatively low concentration of these compounds in the DNAPL area.

Pesticides and PCBs

These compounds were not detected in the samples collected from the Zone 3 aquifer in the 1990 CLP sampling event.

7.6 Bergholtz Creek Sampling Results

Stream Water Sample Results

The results of the water samples collected from Bergholtz Creek (see Table 7-11) indicated two concentrations of 1,2-dichloroethylene (total) above the detection limit: 7 ug/l from sample WS-3 and 6 ug/l for sample WS-4 (see Figure 6-1 for sampling point locations).

Other parameters with concentrations below the quantitation limit detected in the stream water samples are: acetone 62 ug/l (qualifier J), in sample WS-3; xylene(total) 2 ug/l (qualifier J), in sample WS-2; chloroform 1 ug/l (qualifier J), in samples WS-3 and WS-4; trichloroethylene 1 ug/l (qualifier J), in sample WS-4.

The groundwater samples collected from the wells adjacent to Bergholtz Creek by the 1990 CLP sampling event did not indicate the presence of acetone. The Zone 1 wells with detectable concentrations of acetone are: 87-10(1), B-10A, B-13, B-15 and 87-17(1). All these wells are located in the vicinity of the former Neutralization Pond. The samples collected from the overburden wells at the site indicated only three reported detections of acetone, all related with associated blank contamination (qualifier B, Table 7-11). Based on these observations, it is considered that the acetone concentrations detected in the creek are not related to the site groundwater chemistry.

The semivolatile organic constituents detected in the water samples collected from Bergholtz Creek are all at concentrations below the quantitation limit (Table 7-11). They are not considered to be related to the BAT site as they were also detected in the upgradient stream water sample.

Pesticides and PCBs were not detected in the stream water samples.

Stream Sediment Samples

The volatile organic compound analyses completed on the four sediment samples taken from Bergholtz Creek by the Phase V investigation indicate only acetone with concentrations above the quantitation limit of 55 ug/kg, sample S-4. Acetone was also reported at a concentrations below the quantitation limit in the upgradient sample S-1 at 21 ug/kg, (qualifier J).

As discussed previously, the acetone in the groundwater aquifers occurs only in the immediate vicinity of the former Neutralization Pond and has not reached Bergholtz Creek in any of the groundwater plumes. This observation, together with the presence of acetone at levels below the quantitation limit in the upgradient sample indicates that the acetone in stream sediments is not related to the BAT site.

Other parameters with concentrations below the quantitation limit are: methylene chloride 4 ug/kg to 7 ug/kg (qualifier J), in samples S-3, S-2, and S-4; toluene 2 ug/kg to 3 ug/kg (qualifier J), in samples S-4 and S-3; and xylene(total) 5 ug/kg (qualifier J), in sample S-4.

Of these compounds only methylene chloride is a significant constituent of the groundwater plumes. Both xylene and toluene are common components of vehicular fuel. The proximity of this portion of the Creek to several roads is considered to be the cause of the detection of these compounds. Methylene chloride is a common laboratory contaminant.

The semivolatile organic constituents detected at levels above the quantitation limit are: benzo(a)anthracene 3400 ug/kg, in sample S-4; benzo(a)pyrene 1600 ug/kg, in sample S-4; benzo(b)fluoranthene 2900 ug/kg, in sample S-4; benzo(k)fluoranthene 2200 ug/kg, in sample S-4: chrysene 3400 ug/kg, in sample S-4; fluoranthene 7900 ug/kg to 2000 ug/l, in samples S-4 and S-3; indeno(1,2,3-cd)pyrene 1100 ug/kg, in sample S-4; phenanthrene 4600 ug/kg, in sample S-4; pyrene 4800 ug/kg in sample S-4.

The samples collected from the overburden Zone 1 and Zone 3 wells, by the 1990 CLP sampling event, did not indicate the presence of these compounds with the exception of: fluoranthene, detected in only one sample at levels below the quantitation limit [5 ug/l, qualifier J, sample 87-13(1)]; phenanthrene detected in only one sample at levels below the quantitation limit [2;7 ug/l, qualifier J, sample 87-6(1)]; pyrene detected in only one sample at levels below the quantitation limit [25 ug/l, qualifier J, sample 87-6(1)].

Base on these observations it is considered that the semivolatile organic constituents detected in stream sediments are not related to the site groundwater chemistry. These compounds are related to coaltar, and asphaltic compounds and are probably derived from the nearby roadways.

The pesticides and PCB analyses completed on the Phase V investigation samples indicated only one reported detection below the quantitation limit for Arochlor 1254 (200 ug/kg) in the S-3 sample. All the groundwater samples for wells in the overburden, and the Zone 1 and Zone 3 aquifers indicated the presence of PCBs only in Zone 1 in the immediate vicinity of the former Neutralization Pond. This detection is not considered to be related to the BAT site.

7.7 Rate of Migration

The Neutralization Pond was in operation for a period of about 35 years from 1949 to 1984. Given this, the time for plume development and migration, between 1949 and 1990, is approximately 40 years.

The nature, extent, and rate of migration of the plumes in the overburden, Zone 1 and Zone 3 aquifers, have been and will continue to be influenced by the following processes:

- Groundwater flow (advection) and flow velocity;
- Dissolution of the DNAPL into the groundwater supplies, the dissolved phase plumes in the overburden, Zone 1 aquifer and to a lesser extent the Zone 3 aquifer;
- Dilution of the dissolved phase plumes by percolating groundwater either by infiltration of precipitation in the case of the overburden plume or by percolation of groundwater from the overburden to the Zone 1 dissolved phase plume;
- Dispersion of the plume due to the tortuous movement of the groundwater through the surrounding medium and intermingling of the edges of the plume with water adjacent to the plume;
- Sorption of the compounds in the plume to particles of the medium through which it is moving;
- Diffusion of the compounds into the matrix of the surrounding material; and,
- Reaction with the natural groundwater or by biologic bacterial activity changing the parent compounds to daughter compounds.

In addition to these natural processes, it is considered that the pressure pulse phenomenon in the Zone 1 aquifer discussed in Section 6.3 may well have had a considerable influence on the lateral (east-west) migration of the Zone 1 plume. It has also become apparent that groundwater leakage into the sanitary sewer lift pump station, near borehole B-09 is occurring (see Section 7.1.2). The seepage may have locally modified the shape of the plume in Zone 1.

The DNAPL plume is the only plume at the site which is influenced by dissolution; all the other plumes are already dissolved. As discussed in Section 7.3, the DNAPL plume is considered to be trapped within depressions in the base of the A Marker Bed. Since the Neutralization Pond has been closed, the original driving force (the DNAPL in the base of the Pond) has been removed. It is considered that the DNAPL plume has probably stopped migrating and will maintain its current position unless the present equilibrium is disturbed.

The amount of DNAPL in the plume is very difficult to determine. Calculations based on observations in the boreholes during monitoring well installations, yield of DNAPL to the wells (which is low), and the secondary porosity of the Zone 1 dolomite are considered to result in essentially speculative numbers. It is considered that the DNAPL may be viewed as a plume which has the potential to maintain the dissolved phase plumes, by the process of dissolution and advection, for a considerable period of time unless the dissolution rate and direction of advection is controlled.

The migration rates of the dissolved phase plumes have been, and will continue to be, influenced by all the processes listed above except for dissolution. These processes cause movement, retardation and transformation effects on the plumes.

Rather than attempt to determine the magnitude of the various components of the overall effect and thereby determine the eventual fate of the plumes, the extent of the plumes coupled with the known hydrogeologic data and chemistry data have been assessed to provide a mechanism for the assessment of migration rates. The following assumptions form the basis of these assessments:

- Current hydrogeologic conditions will be maintained.
- The DNAPL will maintain a steady state supply of dissolved phase components to the dissolved phase plumes.

The overburden plume has moved roughly southeastwards from the Neutralization Pond to the edge of the BAT property along Walmore Road. No contamination of overburden has been detected on the east side of Walmore Road. This suggests that the Walmore Road Sanitary Sewer trench is intercepting the plume. Since a naturally developed edge of the plume cannot be defined, the average rate of movement cannot be calculated on a simple time distance basis. The more conservative approach in this case is to assume that the plume moved with the groundwater. GZA calculated the range of flow velocities in the overburden at 1.4×10^{-3} feet per day to 5.5×10^{-2} feet per day in the coarser soil units to 2.7×10^{-6} feet per day to 2.7×10^{-4} feet per day in the silty clays. Given a 40 year time frame for migration and a retardation factor of 2, it would appear that except for flow in the coarser soil units, there has been insufficient time for the volatile organics to migrate to the sewer trench through the finer grain soils. This suggests that the main area of overburden contamination is in the lower basal till unit or the sandy lens discussed in Section 5.1.

The groundwater flow rates in the Zone 1 aquifer vary due to changes in hydraulic gradient. As discussed in Section 7, based on the average hydraulic conductivity of $2x10^{-3}$ cm/s, a 3 percent porosity in the Zone 1 bedrock and the average hydraulic gradient north of the creek, the flow rates between the Neutralization Pond and Bergholtz Creek are about 1.9 feet per day. In the southern section of the plume these velocities have been assessed at 0.4 feet per day. This lower velocity is due to the much lower gradient in this southern area of the site. Using the velocity north of the creek and the velocity south of the creek and an overall retardation factor of 2, the current length of the plume (about 4,000 feet) is commensurate with a calculated plume length for a 40 year migration period of 3,750 feet.

In order to show the variation of groundwater components with time within the plume, a triangular plot of the ratios of trichloroethylene (TCE) and the degradation products 1,2 dichlorotheylene (total)(DCE), and vinyl chloride (VC) was prepared (see Figure 7-13). This figure clearly illustrates that the relative percentages of the components varies systematically. Four groups of wells are defined in this figure and are listed below:

- o Group 1 wells contain predominantly TCE;
- o Group 2 wells show DCE up to 50 percent and VC up to 10 percent;
- o Group 3 wells show DCE greater than 80 percent and generally less than 15 percent TCE; VC is still less than 10 percent; and,
- o Group 4 wells show a gradually increasing VC percentage with virtually no TCE.

These wells are plotted on Figure 7-14 and the area around the wells is classified according to their group. This figure illustrates the transformation of the plume from a core area plume of TCE (Group 1 wells) to a long sinuous plume with gradually increasing DCE content (Group 2 wells) flanked successively by areas containing Group 3 and Group 4 wells. This figure illustrates that the trichloroethylene is being converted to vinyl chloride within the plume.

To determine the rate of change and the distance to a 1 ug/l detection boundary for each of the main compounds, the relative concentration of each compound with respect to the concentration in the DNAPL area was plotted against distance from the Neutralization Pond (see Figures 7-15 and 7-16). A 1 ug/l relative concentration line is also shown on these figures. The distance at which the graph line crosses the detection limit line is the projected maximum length of the detectable plume (1 ug/l detection limit) for that compound.

Assuming a detection limit of 1 ug/l, these maximum detectable plume lengths are:

Trichloroethylene	3,800 feet
1,2 Dichloroethylene	5,500 feet
Vinyl Chloride	8,000 feet

This indicates that the maximum detectable plume length at the site is 8,000 feet. Assuming migration rates remain similar to the assessed values which appear to have occurred between 1949 and 1990. Preliminary estimates indicate that the plume will reach a position 8,000 feet south of the Neutralization Pond in about 154 years time.

The estimation of the time in which the plume will reach a total length of 8,000 feet was completed as follows:

- Distance from the present plume boundary to the maximum predicted length; - 4,000 feet;
- Calculated groundwater velocity for the southern section of the plume based on:
  - hydraulic conductivity $2x10^{-3}$ cm/s.
  - effective porosity 3 percent
  - hydraulic gradient south of Sawyer Creek $7.5x10^{-4}$ ft/ft
  - groundwater velocity 0.14 ft/day (52 ft/yr);
- Contaminant retardation factor = 2

Estimated travel time 4,000 divided by 26 = 154 years.

An estimate of the contaminant migration rate within the Zone 3 plume was completed using the following:

- Average Zone 3 hydraulic conductivity equals $1x10^{-4}$ cm/s, as indicated by packer test results;
- Average hydraulic gradient equals $6x10^{-3}$, as indicated by the potentiometric surface map for the Zone 3 aquifer (Figure 7-3);
- An average effective porosity of 1 percent (based on examination of rock core recovered from Zone 3) and,
- A retardation factor of 2.

The results of these calculations indicated a groundwater velocity of 61 feet/year, with a corresponding contaminant migration rate of 30.5 feet per year. The travel time of contaminants is estimated at about 40 years which, coupled with the above velocity, predicts a plume length of 1,200 feet. Figure 7-12 shows the interpreted concentration contours for total volatile organic constituents in the Zone 3 aquifer. The measured length of the plume from the

Neutralization Pond is 1,100 feet. The predicted plume length is considered to be in good agreement with the actual plume length.

8.0 SUMMARY

Geologic, hydrogeologic, and groundwater chemistry analyses have been completed at the BAT Wheatfield Plant in support of a RCRA Facility Investigation for the Neutralization Pond and associated SWMUs. These investigations were completed by September 1990. The findings of these studies have been provided in this report.

Release of predominantly chlorinated solvents occurred during operation of the now closed Neutralization Pond between 1949 and 1987, and to a limited extent from an apparent spill in the vicinity of the Helicopter Blade Bonding Building. These releases resulted in the development of a DNAPL plume and three associated groundwater plumes and a groundwater plume within the overburden around the east side of the Helicopter Blade Bonding building.

The overburden plume next to the east side of the Helicopter Blade Bonding building is relatively limited and appears to have migrated downgradient and towards the Walmore Road Sanitary Sewer trench. A groundwater plume containing organic solvents exists within an area of overburden around the Neutralization Pond. This plume which surrounds the Pond appears to have migrated in the basal till to the eastern boundary of the BAT property. The migration rate of this plume is considered to be slow. This plume appears to end at the Walmore Road Sanitary Sewer trench.

A zone of unsaturated overburden in the vicinity of the Pond also contains volatile organic compounds, PAH compounds, and in a smaller area PCB compounds. This area appears to be located within the area defined by the overburden groundwater plume.

A Dense Non-Aqueous Phase Liquid (DNAPL) plume has been defined in the Zone 1 aquifer (uppermost bedrock strata). The DNAPL in the plume is located in two slight depressions in the base of the A Marker Bed which is located at the base of the Zone 1 aquifer. The DNAPL plume stretches about 750 feet to the southeast of the Neutralization Pond and eastwards from the Pond to Walmore Road. The plume may go partway under Walmore Road.

The solvents which collected in the base of the Neutralization Pond were the driving force for this plume. Since this driving force was removed when the Pond was closed and the plume is surrounded by ridges in the topography of the top of the Zone 2 aquitard, this plume is considered to have effectively stopped moving.

The Zone 1 dissolved phase plume, which is roughly elliptical and predominantly located in the base of this aquifer, has migrated a distance of about 4,000 feet southwards from the Pond. During this migration the plume passed beneath Bergholtz Creek. The plume is relatively wide (about 3,600 feet) in relation to its length which may be due to an interaction between the surface drainage system along Walmore Road and the adjacent Walmore Road Sanitary Sewer trench which was excavated almost to the bedrock surface. Water infiltrating this trench may cause an east-west flow component that has spread the plume.

The main components of the dissolved phase plume in the groundwater are trichloroethylene, methylene chloride, 1,2 dichloroethylene, and vinyl chloride. The disposition of these components in the plume and the ratios between them indicates that the trichloroethylene is undergoing a transformation to 1,2 dichloroethylene and this in turn to vinyl chloride, possibly as a result of anaerobic bacterial activity.

The average migration rate of the southern end of the plume has been assessed at about 26 feet per year. Trichloroethylene is not detected in the extremities of the plume since it has apparently degraded to 1,2 dichloroethylene. Vinyl chloride is the dominant compound at the edge of the plume.

A relatively small plume of volatile organic compounds has been detected in the Zone 3 aquifer. This plume is located predominantly below the DNAPL plume; the present rate of migration of this plume has been estimated at 30 feet per year.

It is considered that the studies completed to date at the site have allowed the nature, extent and rate of migration of the groundwater degradation caused by the Neutralization Pond and associated SWMUs to be defined in accordance with the requirements of RCRA.

We trust that this report is satisfactory for your current requirements and look forward to discussing your comments. If you have any questions prior to these discussions, please call.

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TABLE 2-1

BELL AEROSPACE TEXTRON

SOLID WASTE MANAGEMENT UNITS

Unit No.	Description	Location	Status
1.	Neutralization Pond	E of Building 63	RR
2.	Former Drum Storage Yard	W of Building 9	RR
3.	Drum Accumulation	Building 19	NFAR
4.	Drum Accumulation	Building 54	NFAR
5.	Drum Accumulation	Building 62	NFAR
6.	Drum Accumulation	Building 8	NFAR
7.	Lab Pack Accumulation	Building 18	RR
8.	Rock Engine Test Cells W,X,Y,Z	Building 62	NFAR
9.	Helicopter Blade Bonding Building	Building 2E	RR
10.	Underground Transfer Lines	NE Property Corner	NFAR
11.	Underground Tanks for Aviation Gas	Building 2A	NFAR
12.	Incinerator	Building 12	NFAR
13.	Rocket Tank Test Building	Building 63	RR
14.	Chemistry Laboratory	Building 75	NFAR
15.	Foundry	Building 2B	NFAR
16.	H Test Cells	Building 31	NFAR
17.	Drum Storage Shed	NE Property Corner	NFAR
18.	Fuel Area Shed	NE Property Corner	NFAR
19.	Peroxide Catalyst Bed	NE Property Corner	NFAR
20.	Peroxide Drum Storage Area	NE Property Corner	NFAR
21.	Caustic Storage	NE Property Corner	NFAR
22.	Liquid Caustic Storage Tank	NE Property Corner	NFAR
23.	Acid Drum Storage Area	NW of Building 52	NFAR
24.	Acid Storage Tanks	NW of Building 52	NFAR
25.	Slag	N of Building 62	NFAR
26.	Drum Storage	NE Property Corner	NFAR
27.	Drum Accumulation Boiler Houses	N of Building 22	RR

NOTE: RR - Remediation Required
NFAR - No Further Action Required

TABLE 4-1
TOPOGRAPHIC SURVEY DATA

DESIG	CONSTRUCTION DATE (MM/DD/YY)	NORTHING	EASTING	GROUND SURFACE ELEVATION (FT MSL)	TOP OF CASING ELEVATION (FT MSL)	TOP OF RISER ELEVATION (FT MSL)
OVERBURDEN WELLS / PIEZOMETERS						
86-21C	12/21/86	1130861.24	407950.53	586.60	589.57	589.51
86-22C	01/07/87	1130913.94	407262.07	586.90	589.55	589.52
86-23C	01/22/87	1129837.81	408070.04	582.50	585.47	585.42
86-24C	01/30/87	1130244.76	407595.34	586.20	589.11	589.10
87-01(0)	09/16/87	1129942.85	407807.28	585.60	588.26	588.10
87-02(0)	10/02/87	1130112.27	407905.04	586.30	588.87	588.81
87-04(0)	10/08/87	1130546.50	408053.43	586.40	589.38	589.32
87-08(0)	09/23/87	1130769.14	407881.96	587.10	589.87	589.81
87-10(0)	12/09/87	1130157.53	408074.64	584.70	587.36	587.30
87-13(0)	10/29/87	1130539.17	407842.36	587.00	589.82	589.77
87-14(0)	11/04/87	1130661.74	407865.63	587.10	589.69	589.56
87-15(0)	11/12/87	1130745.36	407660.24	587.60	590.88	590.70
87-17(0)	12/07/87	1130569.86	407613.81	587.00	589.58	589.50
87-18(0)	04/05/88	1129530.51	407429.81	583.80	586.04	585.95
87-19(0)	04/08/88	1128811.35	406866.96	579.20	581.60	581.57
87-20(0)	04/11/88	1129145.54	408314.10	576.40	578.88	578.77
87-21(0)	04/13/88	1128756.16	408568.24	574.60	577.37	577.23
87-22(0)	04/21/88	1129632.74	408539.23	581.00	583.82	583.80
87-23(0)	04/26/88	1130214.09	408566.38	584.40	587.28	587.27
89-13(0)	01/10/90	1130868.69	408007.32	585.64	588.24	588.18
89-14(0)	02/14/90	1130961.25	408187.93	584.99	587.70	587.45
B-01	08/11/82	1130761.37	407821.89	586.20	589.39	588.94
B-03	08/12/82	1130585.18	407725.78	587.50	591.55	591.50
B-06	08/16/82	1130653.31	407722.29	587.40	590.56	590.25
B-07	06/07/83	1130622.62	408012.03	587.00	590.12	589.87
B-08	06/08/83	1130832.45	407604.35	586.90	590.76	590.26
B-09	06/07/83	1130491.29	407615.21	587.00	590.28	590.17
B-10(S)	06/10/83	1130680.93	407716.96	587.60	591.05	590.78
B-11	06/09/83	1130651.88	407900.31	587.20	589.77	589.74
B-12	06/10/83	1130379.26	407819.84	586.40	589.55	589.48
B-17	02/15/84	1130434.48	408054.37	585.70	589.67	589.42
B-18	02/16/84	1130189.06	407934.67	585.00	589.30	589.18
SEWER TRENCH WELLS						
SW89-1	06/12/89	1129362.44	407644.72	580.30	581.39	581.18
SW89-2	06/13/89	1128767.99	408569.13	574.30	577.64	577.54

TABLE 4-1 (CONTINUED)
TOPOGRAPHIC SURVEY DATA

DESIG	CONSTRUCTION DATE (MM/DD/YY)	NORTHING	EASTING	GROUND SURFACE ELEVATION (FT MSL)	TOP OF CASING ELEVATION (FT MSL)	TOP OF RISER ELEVATION (FT MSL)
ZONE 1 WELLS / PIEZOMETERS						
86-21B	12/21/86	1130854.88	407960.00	586.20	588.64	588.59
86-22B	01/07/87	1130914.02	407257.71	586.90	589.53	589.47
86-23B	01/22/87	1129832.48	408070.77	582.50	585.40	585.24
86-24B	01/30/87	1130250.59	407596.49	586.00	589.06	589.00
87-01(1)	09/15/87	1129944.69	407813.00	585.60	588.20	587.99
87-02(1)	10/01/87	1130118.17	407905.86	586.20	589.45	589.21
87-04(1)	10/09/87	1130534.76	408053.97	586.40	589.29	589.08
87-05(1)	10/14/87	1130382.74	407814.33	586.40	589.62	589.37
87-06(1)	09/25/87	1130385.16	407946.77	586.00	588.49	588.27
87-08(1)	09/23/87	1130764.95	407882.27	587.20	589.69	589.48
87-09(1)	09/17/87	1130374.92	407652.89	586.50	588.87	588.70
87-10(1)	12/09/87	1130157.78	408078.17	584.50	587.53	587.52
87-11(1)	09/24/87	1130658.19	408008.08	587.10	589.75	589.55
87-12(1)	10/20/87	1129499.44	407988.76	581.40	583.91	583.84
87-13(1)	10/26/87	1130537.64	407850.38	587.00	590.31	590.06
87-14(1)	11/05/87	1130662.14	407853.96	587.00	589.14	589.06
87-15(1)	11/17/87	1130746.37	407653.74	587.50	590.47	590.27
87-16(1)	12/03/87	1130585.57	407729.83	587.50	590.54	590.45
87-17(1)	12/08/87	1130574.28	407613.95	587.00	589.75	589.62
87-18(1)	04/06/88	1129530.45	407425.54	583.80	586.25	586.02
87-19(1)	04/07/88	1128811.96	406862.06	579.00	581.55	581.47
87-20(1)	04/11/88	1129145.92	408317.17	576.40	579.08	579.01
87-21(1)	04/13/88	1128751.66	408568.18	574.60	577.38	577.33
87-22(1)	04/20/88	1129628.88	408543.25	581.00	584.04	583.97
87-23(1)	04/25/88	1130214.73	408559.86	584.30	587.15	587.13
89-01(1)	03/22/89	1130284.83	409027.23	583.00	586.27	586.12
89-02(1)	04/17/89	1129771.96	408312.47	581.70	584.71	584.63
89-03(1)	03/16/89	1128603.74	405966.62	578.10	581.34	581.30
89-04(1)	04/03/89	1129475.05	409586.54	575.10	577.95	577.92
89-05(1A)	04/06/89	1127323.30	408575.64	574.70	577.72	577.56
89-05(1B)	04/11/89	1127325.49	408576.94	574.70	577.81	577.77
89-06(1)	05/01/89	1125632.29	407067.80	573.00	576.08	575.93
89-07(1A)	06/21/89	1125344.31	408479.98	574.50	577.66	577.50
89-07(1B)	04/27/89	1125348.74	408480.79	574.60	577.64	577.48
89-08(1)	05/03/89	1125371.03	409675.86	575.50	578.80	578.63

TABLE 4-1 (CONTINUED)
TOPOGRAPHIC SURVEY DATA

DESIG	CONSTRUCTION DATE (MM/DD/YY)	NORTHING	EASTING	GROUND SURFACE ELEVATION (FT MSL)	TOP OF CASING ELEVATION (FT MSL)	TOP OF RISER ELEVATION (FT MSL)
89-10(1)	01/16/90	1130282.12	408070.59	584.79	587.63	587.50
89-11(1)	02/08/90	1130016.33	408228.75	583.97	584.89	584.76
89-12(1)	01/14/90	1130016.10	408073.96	583.73	586.69	586.60
89-14(1)	02/13/90	1130965.48	408185.88	584.54	587.71	587.59
89-15(1)	03/20/90	1130434.44	408046.60	585.86	588.89	588.76
89-16(1)	03/13/90	1129830.14	410222.09	573.83	576.84	576.76
89-17(1)	01/28/90	1127824.38	410900.24	574.65	577.74	577.59
89-18(1)	03/09/90	1126499.89	410432.40	573.96	576.89	576.75
B-10A	02/20/84	1130677.88	407724.79	587.40	589.89	589.66
B-13	02/16/85	1130381.90	408045.88	585.80	588.56	588.41
B-14	02/17/84	1130302.70	407655.71	586.00	589.72	589.54
B-15	02/17/84	1130632.52	407469.17	587.40	589.21	589.03
B-16	02/20/84	1130861.94	407914.64	586.50	588.55	588.41
89-09(1)		1130538.32	407846.45	587.10	588.43	588.25

TABLE 4-1 (CONTINUED)
TOPOGRAPHIC SURVEY DATA

DESIG	CONSTRUCTION DATE (MM/DD/YY)	NORTHING	EASTING	GROUND SURFACE ELEVATION (FT MSL)	TOP OF CASING ELEVATION (FT MSL)	TOP OF RISER ELEVATION (FT MSL)
ZONE 3 WELLS / PIEZOMETERS						
86-21A2	12/21/86	1130862.29	407960.28	586.50	588.75	588.64
86-22A2	01/07/87	1130913.67	407253.09	587.00	589.47	589.37
86-23A2	01/22/87	1129827.33	408071.25	582.50	585.32	585.28
86-24A2	01/30/87	1130257.34	407596.96	586.00	588.86	588.77
87-02(3)	10/05/87	1130124.33	407905.91	586.00	588.78	588.63
87-04(3)	10/09/87	1130539.71	408053.38	586.40	589.77	589.49
87-05(3)	10/16/87	1130378.68	407816.16	586.40	589.63	589.46
87-13(3)	10/28/87	1130540.81	407846.40	587.00	590.18	589.91
87-14(3)	11/04/87	1130661.81	407859.07	587.20	590.53	590.35
87-15(3)	11/17/87	1130746.22	407646.09	587.40	590.03	589.87
87-16(3B)	08/03/88	1130591.31	407725.30	587.50	590.60	590.51
89-02(3)	03/28/89	1129776.13	408313.14	581.80	584.97	584.80
89-20(3)	02/10/90	1130016.09	408233.72	584.04	585.04	584.88
ZONE 4 PIEZOMETERS						
86-21A1	12/21/86	1130862.29	407960.28	586.50	588.75	588.64
86-22A1	01/07/87	1130913.67	407253.09	587.00	589.47	589.37
86-23A1	01/22/87	1129827.33	408071.25	582.50	585.32	585.28
86-24A1	01/30/87	1130257.34	407596.96	586.00	588.86	588.77
TEMPORARY PIEZOMETERS *						
P1 (ZONE1)	03/22/90	1130647.95	406920.69	586.72	NA	NA
P2 (OB)	03/22/90	1130647.95	406920.69	586.72	NA	NA

NOTE: AN INTERMEDIATE DATUM POINT WAS SURVEYED FOR THE LOCATION OF THE TEMPORARY PIEZOMETERS

TABLE 4-2
WELL CONSTRUCTION DATA

DESIG	WELL DEPTH (FT BGS)	BOTTOM OF WELL ELEVATION (FT MSL)	TOP OF SCREEN DEPTH (FT BGS)	TOP OF SCREEN ELEVATION (FT MSL)	BOTTOM OF SCREEN DEPTH (FT BGS)	BOTTOM OF SCREEN ELEVATION (FT MSL)	SCREEN LENGTH (FT)	TOP OF SAND PACK DEPTH (FT BGS)	TOP OF SAND PACK ELEVATION (FT MSL)	BOTTOM OF SAND PACK DEPTH (FT BGS)	BOTTOM OF SAND PACK ELEVATION (FT MSL)	SAND PACK LENGTH (FT)
OVERBURDEN WELLS / PIEZOMETERS												
86-21C	12.50	574.10	2.50	584.10	12.50	574.10	10.00	2.00	584.60	12.50	574.10	10.50
86-22C	13.00	573.90	2.50	584.40	13.00	573.90	10.50	2.00	584.90	13.00	573.90	11.00
86-23C	12.00	570.50	1.00	581.50	12.00	570.50	11.00	1.00	581.50	12.00	570.50	11.00
86-24C	7.00	579.20	1.00	585.20	7.00	579.20	6.00	1.00	585.20	7.00	579.20	6.00
87-01(0)	14.00	571.60	3.70	581.90	14.00	571.60	10.30	3.00	582.60	14.00	571.60	11.00
87-02(0)	14.30	572.00	3.70	582.60	14.00	572.30	10.30	2.80	583.50	14.30	572.00	11.50
87-04(0)	12.50	573.90	2.20	584.20	12.50	573.90	10.30	2.00	584.40	12.50	573.90	10.50
87-08(0)	14.20	572.90	3.90	583.20	14.20	572.90	10.30	3.00	584.10	14.20	572.90	11.20
87-10(0)	15.50	569.20	5.20	579.50	15.50	569.20	10.30	4.00	580.70	15.50	569.20	11.50
87-13(0)	13.70	573.30	3.40	583.60	13.70	573.30	10.30	2.40	584.60	13.70	573.30	11.30
87-14(0)	14.00	573.10	3.70	583.40	14.00	573.10	10.30	2.60	584.50	14.00	573.10	11.40
87-15(0)	14.50	573.10	4.20	583.40	14.50	573.10	10.30	3.00	584.60	14.50	573.10	11.50
87-17(0)	13.65	573.35	3.20	583.80	13.50	573.50	10.30	3.00	584.00	13.65	573.35	10.65
87-18(0)	10.90	572.90	5.90	577.90	10.90	572.90	5.00	4.50	579.30	10.90	572.90	6.40
87-19(0)	10.50	568.70	5.40	573.80	10.40	568.80	5.00	3.90	575.30	10.50	568.70	6.60
87-20(0)	8.00	568.40	3.00	573.40	8.00	568.40	5.00	2.00	574.40	8.00	568.40	6.00
87-21(0)	8.50	566.10	3.50	571.10	8.50	566.10	5.00	2.00	572.60	8.50	566.10	6.50
87-22(0)	9.00	572.00	4.00	577.00	9.00	572.00	5.00	3.00	578.00	9.00	572.00	6.00
87-23(0)	14.00	570.40	3.70	580.70	14.00	570.40	10.30	3.00	581.40	14.00	570.40	11.00
89-13(0)	13.00	572.64	7.50	578.14	17.50	568.14	10.00	5.60	580.04	13.00	572.64	7.40
89-14(0)	9.45	575.54	3.95	581.04	8.95	576.04	5.00	3.95	581.04	9.45	575.54	5.50
B-01	18.50	567.70	9.00	577.20	14.00	572.20	5.00	8.00	578.20	14.50	571.70	6.50
B-03	14.00	573.50	9.00	578.50	14.00	573.50	5.00	8.00	579.50	14.00	573.50	6.00
B-06	14.00	573.40	9.00	578.40	14.00	573.40	5.00	7.95	579.45	14.00	573.40	6.05
B-07	14.50	572.50	9.50	577.50	14.50	572.50	5.00	7.40	579.60	14.50	572.50	7.10
B-08	16.00	570.90	10.00	576.90	15.00	571.90	5.00	9.00	577.90	16.00	570.90	7.00

TABLE 4-2 (CONTINUED)
WELL CONSTRUCTION DATA

DESIG	WELL DEPTH (FT BGS)	BOTTOM OF WELL ELEVATION (FT MSL)	TOP OF SCREEN DEPTH (FT BGS)	TOP OF SCREEN ELEVATION (FT MSL)	BOTTOM OF SCREEN DEPTH (FT BGS)	BOTTOM OF SCREEN ELEVATION (FT MSL)	SCREEN LENGTH (FT)	TOP OF SAND PACK DEPTH (FT BGS)	TOP OF SAND PACK ELEVATION (FT MSL)	BOTTOM OF SAND PACK DEPTH (FT BGS)	BOTTOM OF SAND PACK ELEVATION (FT MSL)	SAND PACK LENGTH (FT)
B-09	16.50	570.50	10.80	576.20	15.80	571.20	5.00	10.00	577.00	16.50	570.50	6.50
B-10(S)	15.50	572.10	10.00	577.60	15.00	572.60	5.00	9.00	578.60	15.50	572.10	6.50
B-11	27.50	559.70	9.80	577.40	14.80	572.40	5.00	18.00	569.20	27.50	559.70	9.50
B-12	15.40	571.00	10.00	576.40	15.00	571.40	5.00	9.00	577.40	15.40	571.00	6.40
B-17	15.00	570.70	8.00	577.70	13.00	572.70	5.00	7.00	578.70	15.00	570.70	8.00
B-18	15.00	570.00	8.00	577.00	13.00	572.00	5.00	7.00	578.00	15.00	570.00	8.00

TABLE 4-2 (CONTINUED)
WELL CONSTRUCTION DATA

DESIG	WELL DEPTH (FT BGS)	BOTTOM OF WELL ELEVATION (FT MSL)	TOP OF SCREEN DEPTH (FT BGS)	TOP OF SCREEN ELEVATION (FT MSL)	BOTTOM OF SCREEN DEPTH (FT BGS)	BOTTOM OF SCREEN ELEVATION (FT MSL)	SCREEN LENGTH (FT)	TOP OF SAND PACK DEPTH (FT BGS)	TOP OF SAND PACK ELEVATION (FT MSL)	BOTTOM OF SAND PACK DEPTH (FT BGS)	BOTTOM OF SAND PACK ELEVATION (FT MSL)	SAND PACK LENGTH (FT)
SEWER TRENCH WELLS												
SW89-1	15.10	565.20	9.60	570.70	14.60	565.70	5.00	9.00	571.30	15.10	565.20	6.10
SW89-2	17.00	557.30	12.00	562.30	17.00	557.30	5.00	9.50	564.80	17.00	557.30	7.50
ZONE 1 WELLS / PIEZOMETERS												
86-21B	27.50	558.70	16.00	570.20	26.00	560.20	10.00	15.80	570.40	27.50	558.70	11.70
86-22B	30.00	556.90	20.00	566.90	30.00	556.90	10.00	18.50	568.40	30.00	556.90	11.50
86-23B	29.50	553.00	19.00	563.50	29.50	553.00	10.50	16.00	566.50	29.50	553.00	13.50
86-24B	28.00	558.00	17.50	568.50	28.00	558.00	10.50	17.50	568.50	28.00	558.00	10.50
87-01(1)	30.60	555.00	20.30	565.30	30.60	555.00	10.30	19.20	566.40	30.50	555.10	11.30
87-02(1)	30.75	555.45	20.45	565.75	30.75	555.45	10.30	19.00	567.20	30.75	555.45	11.75
87-04(1)	29.50	556.90	22.20	564.20	32.50	553.90	10.30	17.50	568.90	29.50	556.90	12.00
87-05(1)	30.10	556.30	19.80	566.60	30.10	556.30	10.30	17.20	569.20	30.10	556.30	12.90
87-06(1)	30.15	555.85	19.90	566.10	30.20	555.80	10.30	18.50	567.50	30.15	555.85	11.65
87-08(1)	30.40	556.80	20.10	567.10	30.40	556.80	10.30	19.20	568.00	30.40	556.80	11.20
87-09(1)	31.90	554.60	21.60	564.90	31.90	554.60	10.30	18.80	567.70	31.90	554.60	13.10
87-10(1)	30.10	554.40	19.80	564.70	30.10	554.40	10.30	17.70	566.80	30.10	554.40	12.40
87-11(1)	30.00	557.10	19.70	567.40	30.00	557.10	10.30	18.50	568.60	30.00	557.10	11.50
87-12(1)	30.20	551.20	19.90	561.50	30.20	551.20	10.30	17.80	563.60	30.20	551.20	12.40
87-13(1)	30.00	557.00	19.70	567.30	30.00	557.00	10.30	18.70	568.30	30.00	557.00	11.30
87-14(1)	30.00	557.00	20.00	567.00	30.30	556.70	10.30	19.50	567.50	30.00	557.00	10.50
87-15(1)	30.00	557.50	19.70	567.80	30.00	557.50	10.30	19.50	568.00	30.00	557.50	10.50
87-16(1)	30.33	557.17										
87-17(1)	29.00	558.00	19.50	567.50	29.80	557.20	10.30	20.00	567.00	29.00	558.00	9.00
87-18(1)	30.20	553.60	19.90	563.90	30.20	553.60	10.30	17.00	566.80	30.20	553.60	13.20
87-19(1)	31.80	547.20	21.50	557.50	31.80	547.20	10.30	16.30	562.70	31.80	547.20	15.50
87-20(1)	28.40	548.00	18.10	558.30	28.40	548.00	10.30	12.80	563.60	28.40	548.00	15.60
87-21(1)	31.00	543.60	20.70	553.90	31.00	543.60	10.30	13.00	561.60	31.00	543.60	18.00

TABLE 4-2 (CONTINUED)
WELL CONSTRUCTION DATA

DESIG	WELL DEPTH (FT BGS)	BOTTOM OF WELL ELEVATION (FT MSL)	TOP OF SCREEN DEPTH (FT BGS)	TOP OF SCREEN ELEVATION (FT MSL)	BOTTOM OF SCREEN DEPTH (FT BGS)	BOTTOM OF SCREEN ELEVATION (FT MSL)	SCREEN LENGTH (FT)	TOP OF SAND PACK DEPTH (FT BGS)	TOP OF SAND PACK ELEVATION (FT MSL)	BOTTOM OF SAND PACK DEPTH (FT BGS)	BOTTOM OF SAND PACK ELEVATION (FT MSL)	SAND PACK LENGTH (FT)
87-22(1)	30.00	551.00	19.70	561.30	30.00	551.00	10.30	12.30	568.70	30.00	551.00	20.00
87-23(1)	32.00	552.30	21.70	562.60	32.00	552.30	10.30	14.50	569.80	32.00	552.30	17.50
89-01(1)	32.00	551.00	22.00	561.00	32.00	551.00	10.00	15.60	567.40	32.00	551.00	16.40
89-02(1)	31.90	549.80	21.90	559.80	31.90	549.80	10.00	14.30	567.40	31.90	549.80	17.60
89-03(1)	32.60	545.50	22.60	555.50	32.60	545.50	10.00	21.60	556.50	32.60	545.50	11.00
89-04(1)	28.90	546.20	18.90	556.20	28.90	546.20	10.00	14.30	560.80	28.90	546.20	14.60
89-05(1A)	39.33	535.37	29.33	545.37	39.33	535.37	10.00	28.00	546.70	39.33	535.37	11.33
89-05(1B)	26.00	548.70	21.00	553.70	26.00	548.70	5.00	17.80	556.90	26.00	548.70	8.20
89-06(1)	48.20	524.80	38.20	534.80	48.20	524.80	10.00	21.00	552.00	48.20	524.80	27.20
89-07(1A)	52.90	521.60	42.90	531.60	52.90	521.60	10.00	42.00	532.50	52.90	521.60	10.90
89-07(1B)	40.20	534.40	35.20	539.40	40.20	534.40	5.00	34.20	540.40	40.20	534.40	11.20
89-08(1)	49.60	525.90	39.60	535.90	49.60	525.90	10.00	25.50	550.00	49.60	525.90	24.10
89-10(1)	29.80	554.99	24.80	559.99	29.80	554.99	5.00	22.90	561.89	29.80	554.99	6.90
89-11(1)	31.95	552.02	21.95	562.02	31.95	552.02	10.00	19.60	564.37	31.95	552.02	12.35
89-12(1)	30.00	553.73	19.50	564.23	29.50	554.23	10.00	17.90	565.83	30.00	553.73	12.10
89-14(1)	28.60	555.94	18.60	565.94	28.60	555.94	10.00	16.40	568.14	28.60	555.94	12.20
89-15(1)	32.20	553.66	22.20	563.66	32.20	553.66	10.00	20.00	565.86	32.20	553.66	12.20
89-16(1)	28.80	545.03	18.80	555.03	28.80	545.03	10.00	16.00	557.83	28.80	545.03	12.80
89-17(1)	34.56	540.09	29.56	545.09	34.56	540.09	5.00	29.10	545.55	34.56	540.09	5.46
89-18(1)	42.55	531.41	32.55	541.41	42.55	531.41	10.00	32.00	541.96	42.55	531.41	10.55
B-10A	26.90	560.50	19.60	567.80	24.60	562.80	5.00	19.00	568.40	26.90	560.50	7.90
B-13	25.30	560.50	18.50	567.30	23.50	562.30	5.00	18.50	567.30	25.30	560.50	6.80
B-14	25.60	560.40	18.00	568.00	23.00	563.00	5.00	17.00	569.00	25.60	560.40	8.60
B-15	26.70	560.70	19.00	568.40	24.00	563.40	5.00	18.00	569.40	26.70	560.70	8.70
B-16	26.00	560.50	19.00	567.50	24.00	562.50	5.00	17.50	569.00	26.00	560.50	8.50
89-09(1)												

TABLE 4-2 (CONTINUED)
WELL CONSTRUCTION DATA

DESIG	WELL DEPTH (FT BGS)	BOTTOM OF WELL ELEVATION (FT MSL)	TOP OF SCREEN DEPTH (FT BGS)	TOP OF SCREEN ELEVATION (FT MSL)	BOTTOM OF SCREEN DEPTH (FT BGS)	BOTTOM OF SCREEN ELEVATION (FT MSL)	SCREEN LENGTH (FT)	TOP OF SAND PACK DEPTH (FT BGS)	TOP OF SAND PACK ELEVATION (FT MSL)	BOTTOM OF SAND PACK DEPTH (FT BGS)	BOTTOM OF SAND PACK ELEVATION (FT MSL)	SAND PACK LENGTH (FT)
ZONE 3 WELLS / PIEZOMETERS												
86-21A2	52.00	534.50	40.00	546.50	51.00	535.50	11.00	39.00	547.50	52.00	534.50	13.00
86-22A2	47.00	540.00	40.00	547.00	46.00	541.00	6.00	35.70	551.30	47.00	540.00	11.30
86-23A2	52.00	530.50	40.00	542.50	51.00	531.50	11.00	38.00	544.50	52.00	530.50	14.00
86-24A2	54.00	532.00	41.00	545.00	54.00	532.00	13.00	40.00	546.00	55.00	531.00	15.00
87-02(3)	55.00	531.00	44.70	541.30	55.00	531.00	10.30	40.00	546.00	55.00	531.00	15.00
87-04(3)	55.70	530.70	45.40	541.00	55.70	530.70	10.30	36.50	549.90	55.70	530.70	19.20
87-05(3)	55.00	531.40	44.70	541.70	55.00	531.40	10.30	37.00	549.40	55.00	531.40	18.00
87-13(3)	54.70	532.30	44.40	542.60	54.70	532.30	10.30	37.00	550.00	54.70	532.30	17.70
87-14(3)	55.00	532.20	44.70	542.50	55.00	532.20	10.30	36.50	550.70	55.00	532.20	18.50
87-15(3)	54.50	532.90	44.20	543.20	54.50	532.90	10.30	36.00	551.40	54.50	532.90	18.50
87-16(3B)	55.00	532.50	45.00	542.50	55.00	532.50	10.00	36.50	551.00	55.00	532.50	18.50
89-02(3)	55.15	526.65	45.15	536.65	55.15	526.65	10.00	37.00	544.80	51.15	530.65	14.15
89-20(3)	54.95	529.09	44.95	539.09	54.95	529.09	10.00	37.30	546.74	54.95	529.09	17.65
ZONE 4 PIEZOMETERS												
86-21A1	89.90	496.60	67.00	519.50	87.00	499.50	20.00	66.00	520.50	89.90	496.60	23.90
86-22A1	90.50	496.50	70.00	517.00	90.50	496.50	20.50	68.00	519.00	90.50	496.50	22.50
86-23A1	90.00	492.50	80.00	502.50	90.00	492.50	10.00	68.00	514.50	90.00	492.50	22.00
86-24A1	89.90	496.10	70.00	516.00	89.90	496.10	19.90	69.00	517.00	89.90	496.10	20.90
TEMPORARY PIEZOMETERS												
P1 (ZONE1)	21.10	565.62	19.10	567.62	21.10	565.62	2.00	18.00	568.72	21.10	565.62	3.10
P2 (OB)	12.75	573.97	7.25	579.47	12.25	574.47	5.00	5.00	581.72	12.75	573.97	7.75

TABLE 4-3
LIST OF THE SAMPLING POINTS AND ANALYTICAL METHODS
SEPTEMBER 1989 SAMPLING EVENT

SAMPLING POINT	ANALYTYCAL METHOD	COMPOUNDS	ANALYTYCAL LABORATORY	TYPE OF SAMPLE
87-13(1)DNAPL	EPA 524.2	VOLATILE ORGANICS	ALPHA ANALYTICAL	DNAPL
87-13(1)DNAPL	EPA 625	SEMIVOLATILE ORGANICS	ALPHA ANALYTICAL	DNAPL
87-13(1)DNAPL	EPA SW-846 (8280)	FURANS	ALPHA ANALYTICAL	DNAPL
87-13(1)DNAPL	EPA SW-846 (8080, 8150)	PESTCIDES, PCB's, HERBICIDES	ALPHA ANALYTICAL	DNAPL
87-13(1)DNAPL	APPENDIX IX-INORGANICS	METALS, CYANIDES & SULFIDES	ALPHA ANALYTICAL	DNAPL
87-13(1)DNAPL	EPA-608 (8080), SW846-8280	PCB's and FURANS	ETC	DNAPL
87-13(1)	EPA SW-846 (8280)	FURANS	ALPHA ANALYTICAL	AQUEOUS
87-13(1)	EPA SW-846 (8080)	PCB's	ALPHA ANALYTICAL	AQUEOUS
87-13(1)	EPA-608 (8080), SW846-8280	PCB's and FURANS	ETC	AQUEOUS
87-13(1)dup	EPA SW-846 (8280)	FURANS	ALPHA ANALYTICAL	AQUEOUS
87-13(1)dup	EPA SW-846 (8080)	PCB's	ALPHA ANALYTICAL	AQUEOUS
87-16(1)	EPA 524.2	VOLATILE ORGANICS	ALPHA ANALYTICAL	AQUEOUS
87-16(1)	EPA 625	SEMIVOLATILE ORGANICS	ALPHA ANALYTICAL	AQUEOUS
87-16(1)	EPA SW-846 (8280)	FURANS	ALPHA ANALYTICAL	AQUEOUS
87-16(1)	EPA SW-846 (8080, 8150)	PESTCIDES, PCB's, HERBICIDES	ALPHA ANALYTICAL	AQUEOUS
87-16(1)	APPENDIX IX-INORGANICS	METALS, CYANIDES & SULFIDES	ALPHA ANALYTICAL	AQUEOUS
87-16(1)dup	EPA 625	SEMIVOLATILE ORGANICS	ALPHA ANALYTICAL	AQUEOUS
87-16(1)dup	APPENDIX IX-INORGANICS	METALS, CYANIDES & SULFIDES	ALPHA ANALYTICAL	AQUEOUS
87-6(1)	EPA SW-846 (8280)	FURANS	ALPHA ANALYTICAL	AQUEOUS
87-6(1)	EPA SW-846 (8080)	PCB's	ALPHA ANALYTICAL	AQUEOUS
87-10(1)	EPA 524.2	VOLATILE ORGANICS	ALPHA ANALYTICAL	AQUEOUS
86-23(1)	EPA 524.2	VOLATILE ORGANICS	ALPHA ANALYTICAL	AQUEOUS

TABLE 4-3
LIST OF THE SAMPLING POINTS AND ANALYTICAL METHODS
SEPTEMBER 1989 SAMPLING EVENT

SAMPLING POINT	ANALYTYCAL METHOD	COMPOUNDS	ANALYTYCAL LABORATORY	TYPE OF SAMPLE
87-18(1)	EPA 524.2	VOLATILE ORGANICS	ALPHA ANALYTICAL	AQUEOUS
87-18(1)	EPA 625	SEMIVOLATILE ORGANICS	ALPHA ANALYTICAL	AQUEOUS
87-18(1)	EPA 608	PCB's	ALPHA ANALYTICAL	AQUEOUS
87-22(1)	EPA 524.2	VOLATILE ORGANICS	ALPHA ANALYTICAL	AQUEOUS
87-22(1)	EPA 625	SEMIVOLATILE ORGANICS	ALPHA ANALYTICAL	AQUEOUS
87-22(1)	EPA 608	PCB's	ALPHA ANALYTICAL	AQUEOUS
86-21(1)	EPA 524.2	VOLATILE ORGANICS	ALPHA ANALYTICAL	AQUEOUS

TABLE 4-4
LIST OF THE WELLS SAMPLED FOR VOLATILE ORGANIC COMPOUNDS
(CLP DATA - 1990)

ZONE 1 WELLS

- 87-01(1)
- 87-02(1)
- 87-04(1)
- 87-05(1)
- 87-06(1)
- 87-08(1)
- 87-09(1)
- 87-10(1)
- 87-11(1)
- 87-12(1)
- 87-13(1)
- 87-14(1)
- 87-15(1)
- 87-17(1)
- 87-18(1)
- 87-19(1)
- 87-20(1)
- 87-21(1)
- 87-22(1)
- 87-23(1)
- 89-01(1)
- 89-2(1)
- 89-03(1)
- 89-04(1)
- 89-05(1A)
- 89-05(1B)
- 89-06(1)
- 89-07(1A)
- 89-07(1B)
- 89-08(1)
- 89-10(1)
- 89-11(1)
- 89-12(1)
- 89-14(1)
- 89-15(1)
- 89-16(1)
- 89-17(1)
- 89-18(1)
- B-10A(1)
- B-13(1)
- B-14(1)
- B-15(1)
- B-16(1)

OVERBURDEN WELLS

- 87-01(0)
- 87-02(0)
- 87-04(0)
- 87-08(0)
- 87-10(0)
- 87-13(0)
- 87-14(0)
- 87-15(0)
- 87-17(0)
- 87-18(0)
- 87-19(0)
- 87-20(0)
- 87-21(0)
- 87-22(0)
- 87-23(0)
- 89-13(0)
- 89-14(0)
- B-01(0)
- B-10S(0)
- B-11(0)
- B-12(0)
- B-17(0)
- B-18(0)
- B-3(0)
- B-6(0)
- B-7(0)
- B-8(0)
- B-9(0)

ZONE 3 WELLS

- 87-02(3)
- 87-04(3)
- 87-05(3)
- 87-13(3)
- 87-14(3)
- 87-15(3)
- 87-16(3)
- 89-02(3)
- 89-20(3)

TABLE 4-5
LIST OF THE WELLS SAMPLED FOR SEMIVOLATILE ORGANIC COMPOUNDS
(CLP DATA - 1990)

ZONE 1 WELLS

87-01(1)
87-02(1)
87-04(1)
87-05(1)
87-06(1)
87-08(1)
87-09(1)
87-10(1)
87-11(1)
87-12(1)
87-13(1)
87-14(1)
87-15(1)
87-17(1)
87-18(1)
87-19(1)
87-20(1)
87-21(1)
87-22(1)
87-23(1)
89-01(1)
89-02(1)
89-04(1)
89-10(1)
89-11(1)
89-12(1)
89-14(1)
89-15(1)
B-10A(1)
B-13(1)
B-14(1)
B-15(1)
B-16(1)

OVERBURDEN WELLS

87-13(0)
B-08(0)
B-12(0)
B-17(0)

ZONE 3 WELLS

87-04(3)
87-05(3)
87-13(3)
87-15(3)
89-20(3)

TABLE 4-6
LIST OF THE WELLS SAMPLED FOR PESTICIDES AND PCB's
(CLP DATA - 1990)

ZONE 1 WELLS

87-01(1)
87-02(1)
87-04(1)
87-05(1)
87-06(1)
87-08(1)
87-09(1)
87-10(1)
87-11(1)
87-12(1)
87-13(1)
87-14(1)
87-15(1)
87-17(1)
87-18(1)
87-20(1)
87-22(1)
87-23(1)
89-01(1)
89-02(1)
89-10(1)
89-11(1)
89-12(1)
89-14(1)
89-15(1)
B-10A(1)
B-13(1)
B-14(1)
B-15(1)
B-16(1)

OVERBURDEN WELLS

87-13(0)
B-08(0)
B-12(0)
B-17(0)

ZONE 3 WELLS

87-04(3)
87-05(3)
87-13(3)
87-15(3)
89-20(3)

TABLE 5-1
ELEVATION OF THE GEOLOGIC / HYDROGEOLOGIC UNITS

DESIG	GROUND SURFACE ELEVATION (FT MSL)	DEPTH TO BEDROCK (FT BGS)	TOP OF BEDROCK ELEVATION (FT MSL)	DEPTH TO TOP OF A MARKER BED (FT BGS)	TOP OF A MARKER BED ELEVATION (FT MSL)	DEPTH TO BASE OF A MARKER BED (FT BGS)	BASE OF A MARKER BED ELEVATION (FT MSL)
WELLS DRILLED THROUGH OVERBURDEN / BEDROCK CONTACT							
87-22(1)	581.00	12.30	568.70				
89-05(1B)	574.70	16.80	557.90				
89-07(1B)	574.60	32.30	542.30				
B-10A	587.40	17.70	569.70				
B-13	585.80	15.30	570.50				
B-14	586.00	15.70	570.30				
B-15	587.40	16.70	570.70				
B-16	586.50	16.00	570.50				
SW89-1	580.30	15.10	565.20				
SW89-2	574.30	12.00	562.30				
P1	586.72	15.80	570.92				
WELLS DRILLED THROUGH THE TOP OF A MARKER BED							
87-11(1)	587.10	16.60	570.50	29.50	557.60		
89-03(1)	578.10	19.80	558.30	31.60	546.50		

TABLE 5-1 (CONTINUED)
ELEVATION OF THE GEOLOGIC / HYDROGEOLOGIC UNITS

DESIG	GROUND SURFACE ELEVATION (FT MSL)	DEPTH TO BEDROCK (FT BGS)	TOP OF BEDROCK ELEVATION (FT MSL)	DEPTH TO TOP OF A MARKER BED (FT BGS)	TOP OF A MARKER BED ELEVATION (FT MSL)	DEPTH TO BASE OF A MARKER BED (FT BGS)	BASE OF A MARKER BED ELEVATION (FT MSL)
WELLS DRILLED THROUGH THE BASE OF A MARKER BED							
86-21B	586.20	16.30	569.90	25.80	560.40	27.80	558.40
86-22B	586.90	17.50	569.40	24.70	562.20	26.30	560.60
86-23B	582.50	14.50	568.00	27.30	555.20	29.20	553.30
86-24B	586.00	16.10	569.90	28.70	557.30	30.50	555.50
87-01(1)	585.60	17.20	568.40	29.10	556.50	30.25	555.35
87-02(3)	586.00	17.00	569.00	29.70	556.30	32.00	554.00
87-04(3)	586.40	15.50	570.90	28.00	558.40	30.50	555.90
87-05(3)	586.40	15.70	570.70	27.30	559.10	29.50	556.90
87-06(1)	586.00	15.50	570.50	28.10	557.90	29.50	556.50
87-08(1)	587.20	17.00	570.20	27.00	560.20	29.00	558.20
87-09(1)	586.50	17.00	569.50	29.10	557.40	31.50	555.00
87-10(1)	584.50	15.70	568.80	28.20	556.30	30.10	554.40
87-12(1)	581.40	15.70	565.70	28.20	553.20	29.80	551.60
87-13(1)	587.00	17.20	569.80	28.50	558.50	29.90	557.10
87-14(3)	587.20	17.00	570.20	27.50	559.70	30.00	557.20
87-15(1)	587.50	18.00	569.50	28.00	559.50	30.00	557.50
87-16(1)	587.50	18.00	569.50	27.87	559.63	30.00	557.50
87-17(1)	587.00	17.50	569.50	27.20	559.80	29.20	557.80
87-18(1)	583.80	14.10	569.70	28.80	555.00	30.20	553.60
87-19(1)	579.00	13.50	565.50	29.80	549.20	31.70	547.30
87-20(1)	576.40	9.80	566.60	26.50	549.90	28.20	548.20

TABLE 5-1 (CONTINUED)
ELEVATION OF THE GEOLOGIC / HYDROGEOLOGIC UNITS

DESIG	GROUND SURFACE ELEVATION (FT MSL)	DEPTH TO BEDROCK (FT BGS)	TOP OF BEDROCK ELEVATION (FT MSL)	DEPTH TO TOP OF A MARKER BED (FT BGS)	TOP OF A MARKER BED ELEVATION (FT MSL)	DEPTH TO BASE OF A MARKER BED (FT BGS)	BASE OF A MARKER BED ELEVATION (FT MSL)
87-21(1)	574.60	11.00	563.60	29.25	545.35	31.00	543.60
87-23(1)	584.30	17.00	567.30	30.00	554.30	32.00	552.30
89-01(1)	583.00	11.90	571.10	27.30	555.70	29.30	553.70
89-02(3)	581.80	11.75	570.05	29.90	551.90	32.50	549.30
89-04(1)	575.10	12.40	562.70	26.70	548.40	28.90	546.20
89-05(1A)	574.70	17.50	557.20	36.40	538.30	38.50	536.20
89-06(1)	573.00	26.40	546.60	45.20	527.80	47.50	525.50
89-07(1A)	574.50	32.30	542.20	49.70	524.80	52.60	521.90
89-08(1)	575.50	29.40	546.10	47.25	528.25	49.60	525.90
89-10(1)	584.79	14.50	570.29	27.50	557.29	29.80	554.99
89-11(1)	583.97	16.25	567.72	28.60	555.37	30.57	553.40
89-12(1)	583.73	14.50	569.23	28.15	555.58	30.00	553.73
89-14(1)	584.54	12.60	571.94	23.55	560.99	26.78	557.76
89-15(1)	585.86	15.20	570.66	28.20	557.66	30.80	555.06
89-16(1)	573.83	12.40	561.43	24.80	549.03	26.70	547.13
89-17(1)	574.65	24.90	549.75	31.25	543.40	33.15	541.50
89-18(1)	573.96	28.80	545.16	36.15	537.81	38.75	535.21
89-20(3)	584.04	14.90	569.14	28.80	555.24	31.60	552.44

TABLE 6-1
BERGHOLTZ CREEK AND SAWYER CREEK SURVEY POINTS

POINT NO.	DATUM POINT ELEVATION (FT MSL)	DEPTH TO BASE OF CREEK (FT)	BASE OF CREEK ELEVATION (FT MSL)	DEPTH TO SURFACE WATER (FT)	SURFACE WATER ELEVATION (FT MSL)	DATE OF WATER LEVEL MEASUREMENT
#1 BERGHOLTZ CREEK AND NIAGARA FALLS BOULEVARD	582.23	15.12	567.11	13.25	568.98	APRIL 1990
#2 BERGHOLTZ CREEK AND WALMORE ROAD	576.79	9.47	567.32	8.00	568.79	APRIL 1990
#3 BERGHOLTZ CREEK AND CAYUGA DRIVE	574.11	6.68	567.43	5.80	568.31	APRIL 1990
#4 BERGHOLTZ CREEK AND PLAZA DRIVE	571.83	NA	NA	4.95	566.88	APRIL 1990
#5 SAWYER CREEK AND WALMORE ROAD	574.39	5.10	569.29	NA	NA	

NOTE: SEE FIGURE 6-1 FOR SURVEY POINT LOCATIONS

TABLE 7-1
WATER LEVEL DATA - AUGUST 28, 1990

DESIG	TOP OF RISER ELEVATION (FT MSL)	DEPTH TO WATER LEVEL (FT BTOR)	GROUNDWATER ELEVATION (FT MSL)
OVERBURDEN WELLS / PIEZOMETERS			
86-21C	589.51	7.51	582.00
86-23C	585.42	6.56	578.86
87-01(0)	588.10	11.11	576.99
87-02(0)	588.81	9.64	579.17
87-04(0)	589.32	7.53	581.79
87-08(0)	589.81	8.43	581.38
87-10(0)	587.30	7.35	579.95
87-13(0)	589.77	6.23	583.54
87-14(0)	589.56	8.07	581.49
87-15(0)	590.70	9.70	581.00
87-17(0)	589.50	11.16	578.34
87-18(0)	585.95	12.30	573.65
87-19(0)	581.57	9.67	571.90
87-20(0)	578.77	5.21	573.56
87-21(0)	577.23	10.90	566.33
87-22(0)	583.80	DRY	
87-23(0)	587.27	8.89	578.38
89-13(0)	588.18	6.08	582.10
89-14(0)	587.45	5.93	581.52
B-01	588.94	7.71	581.23
B-03	591.50	12.02	579.48
B-06	590.25	11.15	579.10
B-07	589.87	8.27	581.60
B-08	590.26	7.42	582.84
B-09	590.17	10.90	579.27
B-10(S)	590.78	11.26	579.52
B-11	589.74	8.50	581.24
B-12	589.48	8.26	581.22
B-17	589.42	7.93	581.49
B-18	589.18	9.17	580.01
SEWER TRENCH WELLS			
SW89-1	581.18	11.85	569.33
SW89-2	577.54	8.69	568.85

TABLE 7-1 (CONTINUED)
WATER LEVEL DATA - AUGUST 28, 1990

DESIG	TOP OF RISER ELEVATION (FT MSL)	DEPTH TO WATER LEVEL (FT BTOR)	GROUNDWATER ELEVATION (FT MSL)
ZONE 1 WELLS / PIEZOMETERS			
86-21B	588.59	7.35	581.24
86-22B	589.47	9.75	579.72
86-23B	585.24	10.13	575.11
86-24B	589.00	10.85	578.15
87-01(1)	587.99	12.15	575.84
87-02(1)	589.21	12.11	577.10
87-04(1)	589.08	8.76	580.32
87-05(1)	589.37	9.90	579.47
87-06(1)	588.27	8.13	580.14
87-08(1)	589.48	8.63	580.85
87-09(1)	588.70	7.28	581.42
87-10(1)	587.52	11.43	576.09
87-11(1)	589.55	9.00	580.55
87-12(1)	583.84	13.75	570.09
87-13(1)	590.06	9.75	580.31
87-14(1)	589.06	8.71	580.35
87-15(1)	590.27	8.62	581.65
87-16(1)	590.45	9.08	581.38
87-17(1)	589.62	9.87	579.75
87-18(1)	586.02	16.50	569.52
87-19(1)	581.47	12.90	568.57
87-20(1)	579.01	9.32	569.69
87-21(1)	577.33	8.37	568.96
87-22(1)	583.97	14.56	569.41
87-23(1)	587.13	10.08	577.05
89-01(1)	586.12	9.70	576.42
89-02(1)	584.63	10.18	574.45
89-03(1)	581.30	14.56	566.74
89-04(1)	577.92	8.07	569.85
89-05(1A)	577.56	9.96	567.60
89-05(1B)	577.77	9.56	568.21
89-06(1)	575.93	9.24	566.69
89-07(1A)	577.50	10.76	566.74
89-07(1B)	577.48	10.63	566.85
89-08(1)	578.63	11.60	567.03

TABLE 7-1 (CONTINUED)
WATER LEVEL DATA - AUGUST 28, 1990

DESIG	TOP OF RISER ELEVATION (FT MSL)	DEPTH TO WATER LEVEL (FT BTOR)	GROUNDWATER ELEVATION (FT MSL)
89-10(1)	587.50	10.63	576.87
89-11(1)	584.76	7.95	576.81
89-12(1)	586.60	10.67	575.93
89-14(1)	587.59	7.49	580.10
89-15(1)	588.76	9.45	579.31
89-16(1)	576.76	7.17	569.59
89-17(1)	577.59	7.44	570.15
89-18(1)	576.75	9.08	567.67
B-10A	589.66	7.87	581.79
B-13	588.41	7.78	580.63
B-14	589.54	10.17	579.37
B-15	589.03	8.23	580.80
B-16	588.41	7.51	580.90
89-09(1)	588.25	7.36	580.89
ZONE 3 WELLS / PIEZOMETERS			
86-21A2	588.64	8.75	579.89
86-22A2	589.37	9.67	579.70
86-23A2	585.28	9.75	575.53
86-24A2	588.77	10.64	578.13
87-02(3)	588.63	10.20	578.43
87-04(3)	589.49	10.94	578.55
87-05(3)	589.46	10.31	579.15
87-13(3)	589.91	10.86	579.05
87-14(3)	590.35	10.84	579.51
87-15(3)	589.87	10.18	579.69
87-16(3B)	590.51	10.95	579.56
89-02(3)	584.80	9.40	575.40
89-20(3)	584.88	8.13	576.75
ZONE 4 PIEZOMETERS			
86-21A1	588.64	9.79	578.85
86-22A1	589.37	9.77	579.60
86-23A1	585.28	7.97	577.31
86-24A1	588.77	10.36	578.41

TABLE 7-2
GROUNDWATER ELEVATIONS MEASURED IN THE TEMPORARY PIEZOMETERS P1 AND P2 AND THE CORRECTION OF GROUNDWATER ELEVATION

WELL ID	DATUM POINT ELEVATION (FT MSL)	DEPTH TO WATER LEVEL (FT BTOR)	GW ELEVATION 3/24/90 (FT MSL)	DEPTH TO WATER LEVEL (FT BTOR)	GW ELEVATION 8/28/90 (FT MSL)	DIFFERENCE IN ELEVATION (FT)	CORRECTED ELEVATION (FT MSL)
<u>OVERBURDEN WELLS</u>							
P2	586.72	4.50	582.22				581.65
87-15(0)	590.70	10.58	580.12	9.70	581.00	-0.88	
87-17(0)	598.50	11.55	586.95	11.60	586.90	0.05	
B-09	590.17	11.78	578.39	10.90	579.27	-0.88	
					AVERAGE	-0.57	
<u>ZONE 1 WELLS</u>							
P1	586.72	10.95	575.77				575.67
87-09(1)	588.70	7.55	581.15	7.28	581.42	-0.27	
87-17(1)	589.62	9.45	580.17	9.87	579.75	0.42	
B15	589.03	8.68	580.35	8.23	580.80	-0.45	
					AVERAGE	-0.10	

NOTE: THE CORRECTED WATER LEVEL ELEVATIONS FOR THE TEMPORARY PIEZOMETERS P1 AND P1 WERE CALCULATED BY ADDING TO THE 3/24/90 WATER LEVEL THE AVERAGE DIFFERENCE BETWEEN THE TWO SURVEY EVENTS.

TABLE 7-3
GROUNDWATER ELEVATIONS MEASURED IN THE MONITORING WELLS LOCATED IN THE CARBORUNDUM PLANT AREA

WELL ID	DATE			GW ELEVATION (FT MSL)	AVERAGE (FT MSL)
	YY	MM	DD		
OW2-81	82	11	16	585.40	
	84	5	29	582.00	
	84	8	6	580.08	
	85	10	11	577.88	
	85	11	27	581.90	
	87	6	24	580.80	
	88	6	1	581.64	
	89	6	2	582.34	
	89	8	8	580.65	581.47
OW3-81	82	11	16	585.20	
	84	5	29	579.26	
	84	8	6	578.42	
	85	10	11	577.49	
	85	11	27	579.99	
	87	6	24	578.87	
	88	6	1	578.03	
	89	6	2	579.77	
	89	8	8	578.49	579.03
OW3-81	82	11	16	585.10	
	84	5	29	579.44	
	84	8	6	577.99	
	85	10	11	577.44	
	85	11	27	579.94	
	87	6	24	578.72	
	88	6	1	577.85	
	89	6	2	579.74	
	89	8	8	578.42	578.93
OW3-81	82	11	16	585.20	
	84	5	29	579.10	
	84	8	6	577.94	
	85	10	11	576.96	
	85	11	27	579.52	
	87	6	24	578.34	
	88	6	1	577.52	
	89	6	2	579.25	
	89	8	8	577.92	578.51

TABLE 7-4
VERTICAL HYDRAULIC GRADIENTS

DESIG	GROUNDWATER ELEVATION (FT MSL)	ELEVATION OF MID POINT INTERVAL (FT MSL)	DESIG	GROUNDWATER ELEVATION (FT MSL)	ELEVATION OF MID POINT INTERVAL (FT MSL)	VERTICAL HYDRAULIC GRADIENT (FT/FT)
OVERBURDEN WELLS AND PIEZOMETERS			ZONE 1 WELLS AND PIEZOMETERS			
86-21C	582.00	579.35	86-21B	581.24	564.55	-5.14E-02
86-23C	578.86	576.00	86-23B	575.11	559.75	-2.31E-01
87-01(0)	576.99	577.10	87-01(1)	575.84	560.75	-7.03E-02
87-02(0)	579.17	577.75	87-02(1)	577.10	561.33	-1.26E-01
87-04(0)	581.79	579.15	87-04(1)	580.32	562.90	-9.05E-02
87-08(0)	581.38	578.50	87-08(1)	580.85	562.40	-3.29E-02
87-10(0)	579.95	574.95	87-10(1)	576.09	560.60	-2.69E-01
87-13(0)	583.54	578.95	87-13(1)	580.31	562.65	-1.98E-01
87-14(0)	581.49	578.80	87-14(1)	580.35	562.25	-6.89E-02
87-15(0)	581.00	578.85	87-15(1)	581.65	562.75	4.04E-02
87-17(0)	578.34	578.68	87-17(1)	579.75	562.50	8.72E-02
87-18(0)	573.65	576.10	87-18(1)	569.52	560.20	-2.60E-01
87-19(0)	571.90	572.00	87-19(1)	568.57	554.95	-1.95E-01
87-20(0)	573.56	571.40	87-20(1)	569.69	555.80	-2.48E-01
87-21(0)	566.33	569.35	87-21(1)	568.96	552.60	1.57E-01
87-22(0)	DRY	575.00	87-22(1)	569.41	559.85	NA
87-23(0)	578.38	575.90	87-23(1)	577.05	561.05	-8.96E-02
89-14(0)	581.52	578.29	89-14(1)	580.10	562.04	-8.74E-02
B-10(S)	579.52	575.35	B-10A	581.79	564.45	2.08E-01
P2 (OB)	581.65	577.85	P1 (ZONE1)	575.67	567.17	-5.60E-01

TABLE 7-4 (CONTINUED)
VERTICAL HYDRAULIC GRADIENTS

DESIG	GROUNDWATER ELEVATION (FT MSL)	ELEVATION OF MID POINT INTERVAL (FT MSL)	DESIG	GROUNDWATER ELEVATION (FT MSL)	ELEVATION OF MID POINT INTERVAL (FT MSL)	VERTICAL HYDRAULIC GRADIENT (FT/FT)
SHALLOW ZONE 1 WELLS			DEEP ZONE 1 WELLS			
89-05(1B)	568.21	552.80	89-05(1A)	567.60	541.04	-5.18E-02
89-07(1B)	566.85	537.40	89-07(1A)	566.74	527.05	-1.06E-02
ZONE 1 WELLS AND PIEZOMETERS			ZONE 3 WELLS AND PIEZOMETERS			
86-21B	581.24	564.55	86-21A2	579.89	541.00	-5.73E-02
86-22B	579.72	562.65	86-22A2	579.70	545.65	-1.18E-03
86-23B	575.11	559.75	86-23A2	575.53	537.50	1.89E-02
86-24B	578.15	563.25	86-24A2	578.13	538.50	-8.08E-04
87-02(1)	577.10	561.33	87-02(3)	578.43	538.50	5.83E-02
87-04(1)	580.32	562.90	87-04(3)	578.55	540.30	-7.83E-02
87-05(1)	579.47	562.75	87-05(3)	579.15	540.40	-1.43E-02
87-13(1)	580.31	562.65	87-13(3)	579.05	541.15	-5.86E-02
87-14(1)	580.35	562.25	87-14(3)	579.51	541.45	-4.04E-02
87-15(1)	581.65	562.75	87-15(3)	579.69	542.15	-9.51E-02
89-02(1)	574.45	558.60	89-02(3)	575.40	537.73	4.55E-02
89-11(1)	576.81	558.20	89-20(3)	576.75	537.92	-2.96E-03
ZONE 3 PIEZOMETERS			ZONE 4 PIEZOMETERS			
86-21A2	579.89	541.00	86-21A1	578.85	508.55	-3.20E-02
86-22A2	579.70	545.65	86-22A1	579.60	507.75	-2.64E-03
86-23A2	575.53	537.50	86-23A1	577.31	503.50	5.24E-02
86-24A2	578.13	538.50	86-24A1	578.41	506.55	8.76E-03

TABLE 7-5

SUMMARY OF THE HYDROGEOLOGICAL TEST RESULTS

WELL ID	ELEVATION (FEET)		TEST SECTION		K	TYPE OF TEST	HYDROGEOLOGIC UNIT
	GROUND SURFACE	TOP OF RISER	FEET BELOW GROUND SURFACE TOP	BOTTOM	(CM/S)		
87-01(1)	585.60	587.99	19.20	30.50	1.8E-02	PUMP-IN TEST	ZONE 1
87-04(1)	586.40	589.08	17.50	29.50	1.1E-02	PUMP-OUT TEST	ZONE 1
87-08(1)	587.20	589.48	19.20	30.40	3.1E-03	PUMP-OUT TEST	ZONE 1
87-11(1)	587.10	589.55	18.50	30.00	6.4E-03	PUMP-OUT TEST	ZONE 1
87-12(1)	581.40	583.84	17.80	30.20	1.2E-03	PUMP-IN TEST	ZONE 1
87-13(1)	587.00	590.06	18.70	30.00	1.5E-03	PUMP-OUT TEST	ZONE 1
87-14(1)	587.00	589.06	19.50	30.00	2.3E-03	PUMP-OUT TEST	ZONE 1
87-15(1)	587.50	590.27	19.50	30.00	7.7E-03	PUMP-OUT TEST	ZONE 1
87-16(1)	587.50	590.45	19.00	30.00	1.5E-03	PUMP-OUT TEST	ZONE 1
87-18(1)	583.80	586.02	17.00	30.20	9.9E-03	PUMP-IN TEST	ZONE 1
87-22(1)	581.00	583.97	11.70	30.00	6.4E-03	PUMP-IN TEST	ZONE 1
89-01(1)	583.00	586.12	15.60	32.00	1.6E-03	RISING HEAD TEST	ZONE 1
89-02(1)	581.70	584.63	14.30	31.90	2.5E-03	RISING HEAD TEST	ZONE 1
89-03(1)	578.10	581.30	21.60	32.60	1.6E-03	RISING HEAD TEST	ZONE 1
89-04(1)	575.10	577.92	14.30	28.90	8.0E-04	RISING HEAD TEST	ZONE 1
89-05(1A)	574.70	577.56	28.00	39.33	1.0E-03	RISING HEAD TEST	ZONE 1
89-05(1B)	574.70	577.77	17.80	26.00	1.0E-03	RISING HEAD TEST	ZONE 1
89-06(1)	573.00	575.93	21.00	48.20	1.4E-03	RISING HEAD TEST	ZONE 1
89-07(1A)	574.50	577.50	42.00	52.90	1.0E-03	RISING HEAD TEST	ZONE 1
89-07(1B)	574.60	577.48	29.00	40.20	4.8E-04	RISING HEAD TEST	ZONE 1
89-08(1)	575.50	578.63	25.50	49.60	4.1E-04	RISING HEAD TEST	ZONE 1
89-09(1)	587.10	588.25	19.00	30.00	2.2E-04	PUMP-OUT TEST	ZONE 1
89-10(1)	584.79	587.50	22.90	29.80	1.1E-04	RISING HEAD TEST	ZONE 1
89-12(1)	583.73	586.60	17.90	30.00	2.8E-04	RISING HEAD TEST	ZONE 1
89-13(0)	585.64	588.18	5.60	13.00	7.1E-06	RISING HEAD TEST	OVERBURDEN
B-10A	587.40	589.66	19.00	26.90	1.1E-02	PUMP-OUT TEST	ZONE 1
89-2(3)	581.80	584.80	37.00	51.15	1.0E-05	RISING HEAD TEST	ZONE 3
86-21(A)	586.50	588.64	20.80	30.20	1.0E-04	PACKER TEST	ZONE 1/ZONE 2
86-21(A)	586.50	588.64	30.00	40.30	1.1E-05	PACKER TEST	ZONE 2/ZONE 3
86-21(A)	586.50	588.64	39.50	49.80	1.2E-04	PACKER TEST	ZONE 3
86-21(A)	586.50	588.64	49.40	59.90	2.1E-05	PACKER TEST	ZONE 3/ZONE 4

TABLE 7-5
SUMMARY OF THE HYDROGEOLOGICAL TEST RESULTS

WELL ID	ELEVATION (FEET)		TEST SECTION		K	TYPE OF TEST	HYDROGEOLOGIC UNIT
	GROUND SURFACE	TOP OF RISER	FEET BELOW GROUND SURFACE TOP	BOTTOM	(CM/S)		
86-21(A)	586.50	588.64	59.70	70.00	1.0E-05	PACKER TEST	ZONE 4
86-21(A)	586.50	588.64	69.70	80.30	5.2E-04	PACKER TEST	ZONE 4
86-21(A)	586.50	588.64	80.40	90.50	2.8E-05	PACKER TEST	ZONE 4
86-22(A)	587.00	589.37	20.80	30.20	8.6E-04	PACKER TEST	ZONE 1/ZONE 2
86-22(A)	587.00	589.37	29.90	40.20	3.7E-03	PACKER TEST	ZONE 2/ZONE 3
86-22(A)	587.00	589.37	40.00	50.30	3.3E-05	PACKER TEST	ZONE 3
86-22(A)	587.00	589.37	49.90	60.50	2.5E-05	PACKER TEST	ZONE 3/ZONE 4
86-22(A)	587.00	589.37	60.10	70.30	4.9E-06	PACKER TEST	ZONE 4
86-22(A)	587.00	589.37	69.80	80.70	4.7E-05	PACKER TEST	ZONE 4
86-22(A)	587.00	589.37	80.30	90.50	1.0E-05	PACKER TEST	ZONE 4
86-23(A)	582.50	585.28	18.50	30.20	3.4E-03	PACKER TEST	ZONE 1/ZONE 2
86-23(A)	582.50	585.28	29.80	40.30	1.0E-06	PACKER TEST	ZONE 2/ZONE 3
86-23(A)	582.50	585.28	39.80	50.20	8.6E-06	PACKER TEST	ZONE 3
86-23(A)	582.50	585.28	49.90	60.30	1.6E-05	PACKER TEST	ZONE 3
86-23(A)	582.50	585.28	59.80	70.70	8.3E-06	PACKER TEST	ZONE 3/ZONE 4
86-23(A)	582.50	585.28	70.10	80.60	3.0E-06	PACKER TEST	ZONE 4
86-23(A)	582.50	585.28	80.10	90.50	3.1E-06	PACKER TEST	ZONE 4
86-24(A)	586.00	588.70	20.30	30.20	2.8E-03	PACKER TEST	ZONE 1/ZONE 2
86-24(A)	586.00	588.70	29.90	40.20	1.1E-06	PACKER TEST	ZONE 2/ZONE 3
86-24(A)	586.00	588.70	40.00	50.20	2.2E-05	PACKER TEST	ZONE 3
86-24(A)	586.00	588.70	50.00	60.10	2.1E-04	PACKER TEST	ZONE 3
86-24(A)	586.00	588.70	59.90	70.40	8.4E-06	PACKER TEST	ZONE 3/ZONE 4
86-24(A)	586.00	588.70	70.20	80.40	3.9E-06	PACKER TEST	ZONE 4
86-24(A)	586.00	588.70	80.20	90.20	1.3E-05	PACKER TEST	ZONE 4

TABLE 7-6A
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS
SORTED BY SAMPLING POINT
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER (VOLATILE ORGANIC COMPOUNDS)	CONC (ug/l)	QUAL CODE	TOTAL VOC (ug/l)
ZONE 1 WELLS				
87-10(1)	1,1,1-Trichloroethane	2,500.00	J	
87-10(1)	1,2-Dichloroethene (total)	3,300.00	J	
87-10(1)	Acetone	17,000.00	J	
87-10(1)	Methylene Chloride	89,000.00		
87-10(1)	Trichloroethene	390,000.00		
87-10(1)	TOTAL VOC			501,800.00
87-11(1)	Methylene Chloride	380,000.00		
87-11(1)	TOTAL VOC			380,000.00
87-12(1)	1,2-Dichloroethene (total)	4,100.00		
87-12(1)	Methylene Chloride	3,200.00		
87-12(1)	Trichloroethene	10,000.00		
87-12(1)	TOTAL VOC			17,300.00
87-13(1)	1,1,1-Trichloroethane	51,000.00		
87-13(1)	Methylene Chloride	1,400,000.00		
87-13(1)	Trichloroethene	1,100,000.00		
87-13(1)	TOTAL VOC			2,551,000.00
87-14(1)	1,1,1-Trichloroethane	10,000.00	J	
87-14(1)	1,2-Dichloroethene (total)	8,100.00	J	
87-14(1)	Methylene Chloride	59,000.00		
87-14(1)	Trichloroethene	270,000.00		
87-14(1)	TOTAL VOC			347,100.00
87-15(1)	1,2-Dichloroethene (total)	250.00		
87-15(1)	Carbon Disulfide	18.00	J	
87-15(1)	Methylene Chloride	140.00		
87-15(1)	Trichloroethene	18.00	J	
87-15(1)	TOTAL VOC			426.00
87-17(1)	1,1,1-Trichloroethane	23.00		
87-17(1)	1,1-Dichloroethane	5.00		
87-17(1)	1,2-Dichloroethene (total)	140.00		
87-17(1)	Acetone	6.00	BJ	
87-17(1)	Carbon Disulfide	6.00		
87-17(1)	Trichloroethene	10.00		
87-17(1)	Vinyl Chloride	20.00		
87-17(1)	TOTAL VOC			210.00

NOTES:

J: Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.

B: This flag is used when the analyte is found in the associated blank as well as in the sample.

D: This flag identifies all compounds identified during a reanalysis of a diluted sample.

E: This flag identifies compounds whose concentrations exeed the calibration range of the GS/MS instrument for that specific analysis.

TABLE 7-6A (CONTINUED)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS
SORTED BY SAMPLING POINT
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER (VOLATILE ORGANIC COMPOUNDS)	CONC (ug/l)	QUAL CODE	TOTAL VOC (ug/l)
87-18(1)	1,1,1-Trichloroethane	200.00	J	
87-18(1)	1,2-Dichloroethene (total)	12,000.00		
87-18(1)	Trichloroethene	860.00		
87-18(1)	Vinyl Chloride	130.00	J	
87-18(1)	TOTAL VOC			13,190.00
87-20(1)	1,1-Dichloroethene	1.00	J	
87-20(1)	1,2-Dichloroethene (total)	200.00		
87-20(1)	Chloroform	3.00	J	
87-20(1)	Trichloroethene	140.00		
87-20(1)	Vinyl Chloride	200.00		
87-20(1)	TOTAL VOC			544.00
87-21(1)	1,2-Dichloroethene (total)	630.00		
87-21(1)	Trichloroethene	1,200.00		
87-21(1)	TOTAL VOC			1,830.00
87-22(1)	1,1-Dichloroethene	47.00	J	
87-22(1)	1,2-Dichloroethene (total)	4,700.00	E	
87-22(1)	Trichloroethene	15,000.00	E	
87-22(1)	Vinyl Chloride	420.00		
87-22(1)	TOTAL VOC			20,167.00
87-23(1)	1,2-Dichloroethene (total)	87.00		
87-23(1)	Trichloroethene	8.00		
87-23(1)	Vinyl Chloride	17.00		
87-23(1)	TOTAL VOC			112.00
87-2(1)	1,2-Dichloroethene (total)	110.00		
87-2(1)	Chloroform	3.00	J	
87-2(1)	Trichloroethene	180.00		
87-2(1)	Vinyl Chloride	20.00	J	
87-2(1)	TOTAL VOC			313.00
87-4(1)	Methylene Chloride	13,000.00		
87-4(1)	TOTAL VOC			13,000.00
87-5(1)	1,1,1-Trichloroethane	7,400.00	J	
87-5(1)	Methylene Chloride	260,000.00		
87-5(1)	Trichloroethene	300,000.00		
87-5(1)	TOTAL VOC			567,400.00

NOTES:

J: Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.

B: This flag is used when the analyte is found in the associated blank as well as in the sample.

D: This flag identifies all compounds identified during a reanalysis of a diluted sample.

E: This flag identifies compounds whose concentrations exeed the calibration range of the GS/MS instrument for that specific analysis.

TABLE 7-6A (CONTINUED)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS
SORTED BY SAMPLING POINT
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER (VOLATILE ORGANIC COMPOUNDS)	CONC (ug/l)	QUAL CODE	TOTAL VOC (ug/l)
87-6(1)	1,2-Dichloroethene (total)	3,100.00		
87-6(1)	Methylene Chloride	38,000.00		
87-6(1)	Trichloroethene	82,000.00		
87-6(1)	TOTAL VOC			123,100.00
87-8(1)	1,2-Dichloroethene (total)	1,200.00		
87-8(1)	Methylene Chloride	36.00	J	
87-8(1)	Trichloroethene	200.00		
87-8(1)	Vinyl Chloride	69.00	J	
87-8(1)	TOTAL VOC			1,505.00
87-9(1)	1,1,1-Trichloroethane	70.00		
87-9(1)	1,2-Dichloroethene (total)	460.00		
87-9(1)	Vinyl Chloride	150.00		
87-9(1)	TOTAL VOC			680.00
89-08(1)	Carbon Disulfide	3.00	J	
89-08(1)	TOTAL VOC			3.00
89-10(1)	1,1,1-Trichloroethane	1,400.00	J	
89-10(1)	1,2-Dichloroethene (total)	1,700.00	J	
89-10(1)	Chloromethane	4,800.00	J	
89-10(1)	Methylene Chloride	82,000.00		
89-10(1)	Trichloroethene	150,000.00		
89-10(1)	TOTAL VOC			239,900.00
89-11(1)	1,1-Dichloroethene	2.00	J	
89-11(1)	1,2-Dichloroethene (total)	73.00		
89-11(1)	Methylene Chloride	66.00		
89-11(1)	Trichloroethene	16.00		
89-11(1)	Vinyl Chloride	6.00	J	
89-11(1)	TOTAL VOC			163.00
89-12(1)	Methylene Chloride	21,000.00		
89-12(1)	Trichloroethene	110,000.00		
89-12(1)	TOTAL VOC			131,000.00
89-14(1)	1,2-Dichloroethene (total)	26.00		
89-14(1)	Trichloroethene	3.00	J	
89-14(1)	TOTAL VOC			29.00
89-15(1)	1,2-Dichloroethene (total)	220.00	J	
89-15(1)	Methylene Chloride	14,000.00		
89-15(1)	Trichloroethene	16,000.00		
89-15(1)	TOTAL VOC			30,220.00

NOTES:

J: Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.

B: This flag is used when the analyte is found in the associated blank as well as in the sample.

D: This flag identifies all compounds identified during a reanalysis of a diluted sample.

E: This flag identifies compounds whose concentrations exeed the calibration range of the GS/MS instrument for that specific analysis.

TABLE 7-6A (CONTINUED)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS
SORTED BY SAMPLING POINT
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER (VOLATILE ORGANIC COMPOUNDS)	CONC (ug/l)	QUAL CODE	TOTAL VOC (ug/l)
89-16(1)	1,2-Dichloroethene (total)	1.00	J	
89-16(1)	Methylene Chloride	2.00	BJ	
89-16(1)	TOTAL VOC			3.00
89-1(1)	1,1-Dichloroethene	22.00	J	
89-1(1)	1,2-Dichloroethene (total)	790.00		
89-1(1)	Trichloroethene	12.00	J	
89-1(1)	Vinyl Chloride	320.00		
89-1(1)	TOTAL VOC			1,144.00
89-2(1)	1,2-Dichloroethene (total)	320.00		
89-2(1)	Methylene Chloride	17.00		
89-2(1)	Trichloroethene	22.00		
89-2(1)	Vinyl Chloride	31.00	J	
89-2(1)	TOTAL VOC			390.00
89-4(1)	1,1-Dichloroethene	27.00		
89-4(1)	1,2-Dichloroethene (total)	210.00		
89-4(1)	Carbon Disulfide	53.00		
89-4(1)	Methylene Chloride	3.00	BJ	
89-4(1)	Trichloroethene	18.00		
89-4(1)	Vinyl Chloride	96.00		
89-4(1)	TOTAL VOC			407.00
89-5(1A)	1,1-Dichloroethene	10.00		
89-5(1A)	1,2-Dichloroethene (total)	340.00		
89-5(1A)	Benzene	1.00	J	
89-5(1A)	Carbon Disulfide	11.00		
89-5(1A)	Toluene	2.00	J	
89-5(1A)	Trichloroethene	1.00	J	
89-5(1A)	Vinyl Chloride	110.00		
89-5(1A)	TOTAL VOC			475.00
89-5(1A)DL	1,1-Dichloroethene	8.00	DJ	
89-5(1A)DL	1,2-Dichloroethene (total)	330.00	D	
89-5(1A)DL	Carbon Disulfide	9.00	DJ	
89-5(1A)DL	Vinyl Chloride	85.00	D	
89-5(1A)DL	TOTAL VOC			432.00

NOTES:

J: Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.

B: This flag is used when the analyte is found in the associated blank as well as in the sample.

D: This flag identifies all compounds identified during a reanalysis of a diluted sample.

E: This flag identifies compounds whose concentrations exeed the calibration range of the GS/MS instrument for that specific analysis.

TABLE 7-6A (CONTINUED)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS
SORTED BY SAMPLING POINT
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER (VOLATILE ORGANIC COMPOUNDS)	CONC (ug/l)	QUAL CODE	TOTAL VOC (ug/l)
89-5(1B)	1,2-Dichloroethene (total)	8.00		
89-5(1B)	Ethylbenzene	1.00	J	
89-5(1B)	Vinyl Chloride	38.00		
89-5(1B)	Xylene (total)	9.00		
89-5(1B)	TOTAL VOC			56.00
B-10A(1)	1,2-Dichloroethene (total)	4,600.00	J	
B-10A(1)	Acetone	3,600.00	J	
B-10A(1)	Trichloroethene	65,000.00		
B-10A(1)	TOTAL VOC			73,200.00
B-13(1)	1,2-Dichloroethene (total)	200.00		
B-13(1)	Acetone	270.00	BJ	
B-13(1)	Methylene Chloride	3,700.00	B	
B-13(1)	Trichloroethene	35.00	J	
B-13(1)	TOTAL VOC			4,205.00
B-14(1)	1,1,1-Trichloroethane	140.00		
B-14(1)	1,2-Dichloroethene (total)	1,100.00		
B-14(1)	Carbon Disulfide	110.00		
B-14(1)	Trichloroethene	270.00		
B-14(1)	Vinyl Chloride	200.00		
B-14(1)	TOTAL VOC			1,820.00
B-15(1)	1,1,1-Trichloroethane	110.00		
B-15(1)	1,1-Dichloroethane	17.00		
B-15(1)	1,1-Dichloroethene	4.00	J	
B-15(1)	1,2-Dichloroethene (total)	190.00		
B-15(1)	Acetone	6.00	J	
B-15(1)	Chloroform	3.00	J	
B-15(1)	Trichloroethene	5.00	J	
B-15(1)	Vinyl Chloride	38.00		
B-15(1)	TOTAL VOC			373.00
B-16(1)	1,2-Dichloroethene (total)	200.00		
B-16(1)	Carbon Disulfide	37.00		
B-16(1)	TOTAL VOC			237.00

NOTES:

J: Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.

B: This flag is used when the analyte is found in the associated blank as well as in the sample.

D: This flag identifies all compounds identified during a reanalysis of a diluted sample.

E: This flag identifies compounds whose concentrations exeed the calibration range of the GS/MS instrument for that specific analysis.

TABLE 7-6A (CONTINUED)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS
SORTED BY SAMPLING POINT
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER (VOLATILE ORGANIC COMPOUNDS)	CONC (ug/l)	QUAL CODE	TOTAL VOC (ug/l)
OVERBURDEN WELLS				
87-1(0)	1,1,1-Trichloroethane	20.00	J	
87-1(0)	1,2-Dichloroethene (total)	1,400.00		
87-1(0)	Trichloroethene	600.00		
87-1(0)	TOTAL VOC			2,020.00
87-10(0)	Chloroform	6.00		
87-10(0)	Trichloroethene	2.00	J	
87-10(0)	TOTAL VOC			8.00
87-14(0)	1,2-Dichloroethene (total)	5,100.00		
87-14(0)	Methylene Chloride	15,000.00		
87-14(0)	Trichloroethene	65,000.00		
87-14(0)	TOTAL VOC			85,100.00
87-17(0)	Acetone	16,000.00	BJ	
87-17(0)	Methylene Chloride	510,000.00		
87-17(0)	Trichloroethene	74,000.00		
87-17(0)	TOTAL VOC			600,000.00
87-18(0)	1,2-Dichloroethene (total)	4.00	J	
87-18(0)	Methylene Chloride	13.00		
87-18(0)	Trichloroethene	260.00		
87-18(0)	TOTAL VOC			277.00
87-20(0)	Methylene Chloride	1.00	BJ	
87-20(0)	TOTAL VOC			1.00
87-22(0)	1,2-Dichloroethene (total)	2.00	J	
87-22(0)	Acetone	13.00	B	
87-22(0)	Methylene Chloride	1.00	BJ	
87-22(0)	Trichloroethene	17.00		
87-22(0)	TOTAL VOC			33.00
87-2(0)	1,2-Dichloroethene (total)	9,700.00		
87-2(0)	Trichloroethene	17,000.00		
87-2(0)	TOTAL VOC			26,700.00
87-8(0)	1,2-Dichloroethene (total)	28,000.00		
87-8(0)	Methylene Chloride	1,700.00		
87-8(0)	Trichloroethene	10,000.00		
87-8(0)	TOTAL VOC			39,700.00

NOTES:

J: Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.

B: This flag is used when the analyte is found in the associated blank as well as in the sample.

D: This flag identifies all compounds identified during a reanalysis of a diluted sample.

E: This flag identifies compounds whose concentrations exeed the calibration range of the GS/MS instrument for that specific analysis.

TABLE 7-6A (CONTINUED)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS
SORTED BY SAMPLING POINT
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER (VOLATILE ORGANIC COMPOUNDS)	CONC (ug/l)	QUAL CODE	TOTAL VOC (ug/l)
89-13(0)	1,2-Dichloroethene (total)	33.00		
89-13(0)	Trichloroethene	5.00		
89-13(0)	Vinyl Chloride	14.00		
89-13(0)	TOTAL VOC			52.00
B-10S(0)	1,2-Dichloroethene (total)	2,100.00		
B-10S(0)	Chloroform	580.00	J	
B-10S(0)	Methylene Chloride	720.00	J	
B-10S(0)	Trichloroethene	36,000.00		
B-10S(0)	TOTAL VOC			39,400.00
B-11(0)	Methylene Chloride	1,500,000.00		
B-11(0)	Trichloroethene	39,000.00	J	
B-11(0)	TOTAL VOC			1,539,000.00
B-12(0)	1,2-Dichloroethene (total)	5.00		
B-12(0)	Trichloroethene	41.00		
B-12(0)	TOTAL VOC			46.00
B-17(0)	1,2-Dichloroethene (total)	190.00		
B-17(0)	Methylene Chloride	130.00		
B-17(0)	Trichloroethene	810.00		
B-17(0)	TOTAL VOC			1,130.00
B-18(0)	1,2-Dichloroethene (total)	3,200.00		
B-18(0)	Trichloroethene	7,800.00		
B-18(0)	TOTAL VOC			11,000.00
B-1(0)	1,2-Dichloroethene (total)	4,000.00		
B-1(0)	Methylene Chloride	370.00		
B-1(0)	Trichloroethene	7,100.00		
B-1(0)	Vinyl Chloride	120.00	J	
B-1(0)	TOTAL VOC			11,590.00
B-3(0)	Methylene Chloride	380,000.00		
B-3(0)	Trichloroethene	92,000.00		
B-3(0)	TOTAL VOC			472,000.00
B-6(0)	1,2-Dichloroethene (total)	10,000.00	J	
B-6(0)	Methylene Chloride	12,000.00	J	
B-6(0)	Trichloroethene	200,000.00		
B-6(0)	TOTAL VOC			222,000.00
B-7(0)	Methylene Chloride	65,000.00		
B-7(0)	TOTAL VOC			65,000.00

NOTES:

J: Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.

B: This flag is used when the analyte is found in the associated blank as well as in the sample.

D: This flag identifies all compounds identified during a reanalysis of a diluted sample.

E: This flag identifies compounds whose concentrations exeed the calibration range of the GS/MS instrument for that specific analysis.

TABLE 7-6A (CONTINUED)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS
SORTED BY SAMPLING POINT
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER (VOLATILE ORGANIC COMPOUNDS)	CONC (ug/l)	QUAL CODE	TOTAL VOC (ug/l)
B-9(0)	Acetone	11.00	B	
B-9(0)	Benzene	2.00	J	
B-9(0)	Toluene	1.00	J	
B-9(0)	Vinyl Chloride	6.00	J	
B-9(0)	Xylene (total)	3.00	J	
B-9(0)	TOTAL VOC			23.00

NOTES:

J: Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.

B: This flag is used when the analyte is found in the associated blank as well as in the sample.

D: This flag identifies all compounds identified during a reanalysis of a diluted sample.

E: This flag identifies compounds whose concentrations exeed the calibration range of the GS/MS instrument for that specific analysis.

TABLE 7-6A (CONTINUED)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS
SORTED BY SAMPLING POINT
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER (VOLATILE ORGANIC COMPOUNDS)	CONC (ug/l)	QUAL CODE	TOTAL VOC (ug/l)
SEWER TRENCH WELLS				
SW89-1	Chloroform	4.00	J	
SW89-1	Trichloroethene	2.00	J	
SW89-1	TOTAL VOC			6.00
SW89-2	1,1,1-Trichloroethane	4.00	J	
SW89-2	1,2-Dichloroethene (total)	240.00		
SW89-2	Chloroform	4.00	J	
SW89-2	Trichloroethene	130.00		
SW89-2	TOTAL VOC			378.00

NOTES:

J: Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.

B: This flag is used when the analyte is found in the associated blank as well as in the sample.

D: This flag identifies all compounds identified during a reanalysis of a diluted sample.

E: This flag identifies compounds whose concentrations exeed the calibration range of the GS/MS instrument for that specific analysis.

TABLE 7-6A (CONTINUED)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS
SORTED BY SAMPLING POINT
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER (VOLATILE ORGANIC COMPOUNDS)	CONC (ug/l)	QUAL CODE	TOTAL VOC (ug/l)
ZONE 3 WELLS				
87-13(3)	1,2-Dichloroethene (total)	880.00		
87-13(3)	Carbon Disulfide	87.00		
87-13(3)	Methylene Chloride	20.00	J	
87-13(3)	Trichloroethene	690.00		
87-13(3)	TOTAL VOC			1,677.00
87-14(3)	1,1,1-Trichloroethane	5.00		
87-14(3)	Carbon Disulfide	15.00		
87-14(3)	Methylene Chloride	3.00	J	
87-14(3)	Trichloroethene	29.00		
87-14(3)	TOTAL VOC			52.00
87-15(3)	Carbon Disulfide	1.00	J	
87-15(3)	TOTAL VOC			1.00
87-16(3)	1,1,1-Trichloroethane	34.00		
87-16(3)	1,1-Dichloroethane	16.00		
87-16(3)	1,2-Dichloroethene (total)	150.00		
87-16(3)	Carbon Disulfide	48.00		
87-16(3)	Trichloroethene	2.00	J	
87-16(3)	Vinyl Chloride	160.00		
87-16(3)	TOTAL VOC			410.00
87-4(3)	1,1,1-Trichloroethane	1.00	J	
87-4(3)	Carbon Disulfide	9.00		
87-4(3)	Trichloroethene	3.00	J	
87-4(3)	TOTAL VOC			13.00
87-5(3)	1,1,1-Trichloroethane	5.00		
87-5(3)	1,1,2-Trichloroethane	2.00	J	
87-5(3)	1,1-Dichloroethane	6.00		
87-5(3)	1,2-Dichloroethene (total)	150.00		
87-5(3)	2-Hexanone	15.00		
87-5(3)	4-Methyl-2-Pentanone	16.00		
87-5(3)	Trichloroethene	11.00		
87-5(3)	Vinyl Chloride	120.00		
87-5(3)	TOTAL VOC			325.00

NOTES:

J: Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.

B: This flag is used when the analyte is found in the associated blank as well as in the sample.

D: This flag identifies all compounds identified during a reanalysis of a diluted sample.

E: This flag identifies compounds whose concentrations exeed the calibration range of the GS/MS instrument for that specific analysis.

TABLE 7-6A (CONTINUED)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS
SORTED BY SAMPLING POINT
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER (VOLATILE ORGANIC COMPOUNDS)	CONC (ug/l)	QUAL CODE	TOTAL VOC (ug/l)
89-20(3)	Carbon Disulfide	250.00	J	
89-20(3)	Methylene Chloride	3,300.00		
89-20(3)	Trichloroethene	11,000.00		
89-20(3)	TOTAL VOC			14,550.00
89-2(3)	Carbon Disulfide	2.00	J	
89-2(3)	TOTAL VOC			2.00

NOTES:

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B: This flag is used when the analyte is found in the associated blank as well as in the sample.

D: This flag identifies all compounds identified during a reanalysis of a diluted sample.

E: This flag identifies compounds whose concentrations exeed the calibration range of the GS/MS instrument for that specific analysis.

TABLE 7-6B
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS
SORTED BY PARAMETER
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER (VOLATILE ORGANIC COMPOUNDS)	CONC (ug/l)	QUAL CODE	TOTAL VOC (ug/l)
ZONE 1 WELLS				
87-13(1)	1,1,1-Trichloroethane	51,000.00		
87-14(1)	1,1,1-Trichloroethane	10,000.00	J	
87-5(1)	1,1,1-Trichloroethane	7,400.00	J	
87-10(1)	1,1,1-Trichloroethane	2,500.00	J	
89-10(1)	1,1,1-Trichloroethane	1,400.00	J	
87-18(1)	1,1,1-Trichloroethane	200.00	J	
B-14(1)	1,1,1-Trichloroethane	140.00		
B-15(1)	1,1,1-Trichloroethane	110.00		
87-9(1)	1,1,1-Trichloroethane	70.00		
87-17(1)	1,1,1-Trichloroethane	23.00		
B-15(1)	1,1-Dichloroethane	17.00		
87-17(1)	1,1-Dichloroethane	5.00		
87-22(1)	1,1-Dichloroethene	47.00	J	
89-4(1)	1,1-Dichloroethene	27.00		
89-1(1)	1,1-Dichloroethene	22.00	J	
89-5(1A)	1,1-Dichloroethene	10.00		
89-5(1A)**DL**	1,1-Dichloroethene	8.00	DJ	
B-15(1)	1,1-Dichloroethene	4.00	J	
89-11(1)	1,1-Dichloroethene	2.00	J	
87-20(1)	1,1-Dichloroethene	1.00	J	
87-18(1)	1,2-Dichloroethene (total)	12,000.00		
87-14(1)	1,2-Dichloroethene (total)	8,100.00	J	
87-22(1)	1,2-Dichloroethene (total)	4,700.00	E	
B-10A(1)	1,2-Dichloroethene (total)	4,600.00	J	
87-12(1)	1,2-Dichloroethene (total)	4,100.00		
87-10(1)	1,2-Dichloroethene (total)	3,300.00	J	
87-6(1)	1,2-Dichloroethene (total)	3,100.00		
89-10(1)	1,2-Dichloroethene (total)	1,700.00	J	
87-8(1)	1,2-Dichloroethene (total)	1,200.00		
B-14(1)	1,2-Dichloroethene (total)	1,100.00		
89-1(1)	1,2-Dichloroethene (total)	790.00		
87-21(1)	1,2-Dichloroethene (total)	630.00		
87-9(1)	1,2-Dichloroethene (total)	460.00		
89-5(1A)	1,2-Dichloroethene (total)	340.00		

NOTES:

J: Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.

B: This flag is used when the analyte is found in the associated blank as well as in the sample.

D: This flag identifies all compounds identified during a reanalysis of a diluted sample.

E: This flag identifies compounds whose concentrations exeed the calibration range of the GS/MS instrument for that specific analysis.

TABLE 7-6B (CONTINUED)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS
SORTED BY PARAMETER
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER (VOLATILE ORGANIC COMPOUNDS)	CONC (ug/l)	QUAL CODE	TOTAL VOC (ug/l)
89-5(1A)DL	1,2-Dichloroethene (total)	330.00	D	
89-2(1)	1,2-Dichloroethene (total)	320.00		
87-15(1)	1,2-Dichloroethene (total)	250.00		
89-15(1)	1,2-Dichloroethene (total)	220.00	J	
89-4(1)	1,2-Dichloroethene (total)	210.00		
87-20(1)	1,2-Dichloroethene (total)	200.00		
B-13(1)	1,2-Dichloroethene (total)	200.00		
B-16(1)	1,2-Dichloroethene (total)	200.00		
B-15(1)	1,2-Dichloroethene (total)	190.00		
87-17(1)	1,2-Dichloroethene (total)	140.00		
87-2(1)	1,2-Dichloroethene (total)	110.00		
87-23(1)	1,2-Dichloroethene (total)	87.00		
89-11(1)	1,2-Dichloroethene (total)	73.00		
89-14(1)	1,2-Dichloroethene (total)	26.00		
89-5(1B)	1,2-Dichloroethene (total)	8.00		
89-16(1)	1,2-Dichloroethene (total)	1.00	J	
87-10(1)	Acetone	17,000.00	J	
B-10A(1)	Acetone	3,600.00	J	
B-13(1)	Acetone	270.00	BJ	
B-15(1)	Acetone	6.00	J	
87-17(1)	Acetone	6.00	BJ	
89-5(1A)	Benzene	1.00	J	
B-14(1)	Carbon Disulfide	110.00		
89-4(1)	Carbon Disulfide	53.00		
B-16(1)	Carbon Disulfide	37.00		
87-15(1)	Carbon Disulfide	18.00	J	
89-5(1A)	Carbon Disulfide	11.00		
89-5(1A)DL	Carbon Disulfide	9.00	DJ	
87-17(1)	Carbon Disulfide	6.00		
89-08(1)	Carbon Disulfide	3.00	J	

NOTES:

J: Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.

B: This flag is used when the analyte is found in the associated blank as well as in the sample.

D: This flag identifies all compounds identified during a reanalysis of a diluted sample.

E: This flag identifies compounds whose concentrations exeed the calibration range of the GS/MS instrument for that specific analysis.

TABLE 7-6B (CONTINUED)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS
SORTED BY PARAMETER
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER (VOLATILE ORGANIC COMPOUNDS)	CONC (ug/l)	QUAL CODE	TOTAL VOC (ug/l)
87-2(1)	Chloroform	3.00	J	
B-15(1)	Chloroform	3.00	J	
87-20(1)	Chloroform	3.00	J	
89-10(1)	Chloromethane	4,800.00	J	
89-5(1B)	Ethylbenzene	1.00	J	
87-13(1)	Methylene Chloride	1,400,000.00		
87-11(1)	Methylene Chloride	380,000.00		
87-5(1)	Methylene Chloride	260,000.00		
87-10(1)	Methylene Chloride	89,000.00		
89-10(1)	Methylene Chloride	82,000.00		
87-14(1)	Methylene Chloride	59,000.00		
87-6(1)	Methylene Chloride	38,000.00		
89-12(1)	Methylene Chloride	21,000.00		
89-15(1)	Methylene Chloride	14,000.00		
87-4(1)	Methylene Chloride	13,000.00		
B-13(1)	Methylene Chloride	3,700.00	B	
87-12(1)	Methylene Chloride	3,200.00		
87-15(1)	Methylene Chloride	140.00		
89-11(1)	Methylene Chloride	66.00		
87-8(1)	Methylene Chloride	36.00	J	
89-2(1)	Methylene Chloride	17.00		
89-4(1)	Methylene Chloride	3.00	BJ	
89-16(1)	Methylene Chloride	2.00	BJ	
89-5(1A)	Toluene	2.00	J	
87-13(1)	Trichloroethene	1,100,000.00		
87-10(1)	Trichloroethene	390,000.00		
87-5(1)	Trichloroethene	300,000.00		
87-14(1)	Trichloroethene	270,000.00		
89-10(1)	Trichloroethene	150,000.00		
89-12(1)	Trichloroethene	110,000.00		
87-6(1)	Trichloroethene	82,000.00		
B-10A(1)	Trichloroethene	65,000.00		
89-15(1)	Trichloroethene	16,000.00		

NOTES:

J: Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.

B: This flag is used when the analyte is found in the associated blank as well as in the sample.

D: This flag identifies all compounds identified during a reanalysis of a diluted sample.

E: This flag identifies compounds whose concentrations exeed the calibration range of the GS/MS instrument for that specific analysis.

TABLE 7-6B (CONTINUED)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS
SORTED BY PARAMETER
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER (VOLATILE ORGANIC COMPOUNDS)	CONC (ug/l)	QUAL CODE	TOTAL VOC (ug/l)
87-22(1)	Trichloroethene	15,000.00	E	
87-12(1)	Trichloroethene	10,000.00		
87-21(1)	Trichloroethene	1,200.00		
87-18(1)	Trichloroethene	860.00		
B-14(1)	Trichloroethene	270.00		
87-8(1)	Trichloroethene	200.00		
87-2(1)	Trichloroethene	180.00		
87-20(1)	Trichloroethene	140.00		
B-13(1)	Trichloroethene	35.00	J	
89-2(1)	Trichloroethene	22.00		
89-4(1)	Trichloroethene	18.00		
87-15(1)	Trichloroethene	18.00	J	
89-11(1)	Trichloroethene	16.00		
89-1(1)	Trichloroethene	12.00	J	
87-17(1)	Trichloroethene	10.00		
87-23(1)	Trichloroethene	8.00		
B-15(1)	Trichloroethene	5.00	J	
89-14(1)	Trichloroethene	3.00	J	
89-5(1A)	Trichloroethene	1.00	J	
87-22(1)	Vinyl Chloride	420.00		
89-1(1)	Vinyl Chloride	320.00		
B-14(1)	Vinyl Chloride	200.00		
87-20(1)	Vinyl Chloride	200.00		
87-9(1)	Vinyl Chloride	150.00		
87-18(1)	Vinyl Chloride	130.00	J	
89-5(1A)	Vinyl Chloride	110.00		
89-4(1)	Vinyl Chloride	96.00		
89-5(1A)DL	Vinyl Chloride	85.00	D	
87-8(1)	Vinyl Chloride	69.00	J	
B-15(1)	Vinyl Chloride	38.00		
89-5(1B)	Vinyl Chloride	38.00		
89-2(1)	Vinyl Chloride	31.00	J	
87-2(1)	Vinyl Chloride	20.00	J	
87-17(1)	Vinyl Chloride	20.00		
87-23(1)	Vinyl Chloride	17.00		
89-11(1)	Vinyl Chloride	6.00	J	

NOTES:

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B: This flag is used when the analyte is found in the associated blank as well as in the sample.

D: This flag identifies all compounds identified during a reanalysis of a diluted sample.

E: This flag identifies compounds whose concentrations exeed the calibration range of the GS/MS instrument for that specific analysis.

TABLE 7-6B (CONTINUED)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS
SORTED BY PARAMETER
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER (VOLATILE ORGANIC COMPOUNDS)	CONC (ug/l)	QUAL CODE	TOTAL VOC (ug/l)
89-5(1B)	Xylene (total)	9.00		
87-13(1)	TOTAL VOC ZONE 1 WELLS			2,551,000.00
87-5(1)	TOTAL VOC ZONE 1 WELLS			567,400.00
87-10(1)	TOTAL VOC ZONE 1 WELLS			501,800.00
87-11(1)	TOTAL VOC ZONE 1 WELLS			380,000.00
87-14(1)	TOTAL VOC ZONE 1 WELLS			347,100.00
89-10(1)	TOTAL VOC ZONE 1 WELLS			239,900.00
89-12(1)	TOTAL VOC ZONE 1 WELLS			131,000.00
87-6(1)	TOTAL VOC ZONE 1 WELLS			123,100.00
B-10A(1)	TOTAL VOC ZONE 1 WELLS			73,200.00
89-15(1)	TOTAL VOC ZONE 1 WELLS			30,220.00
87-22(1)	TOTAL VOC ZONE 1 WELLS			20,167.00
87-12(1)	TOTAL VOC ZONE 1 WELLS			17,300.00
87-18(1)	TOTAL VOC ZONE 1 WELLS			13,190.00
87-4(1)	TOTAL VOC ZONE 1 WELLS			13,000.00
B-13(1)	TOTAL VOC ZONE 1 WELLS			4,205.00
87-21(1)	TOTAL VOC ZONE 1 WELLS			1,830.00
B-14(1)	TOTAL VOC ZONE 1 WELLS			1,820.00
87-8(1)	TOTAL VOC ZONE 1 WELLS			1,505.00
89-1(1)	TOTAL VOC ZONE 1 WELLS			1,144.00
87-9(1)	TOTAL VOC ZONE 1 WELLS			680.00
87-20(1)	TOTAL VOC ZONE 1 WELLS			544.00
89-5(1A)	TOTAL VOC ZONE 1 WELLS			475.00
89-5(1A)DL	TOTAL VOC ZONE 1 WELLS			432.00
87-15(1)	TOTAL VOC ZONE 1 WELLS			426.00
89-4(1)	TOTAL VOC ZONE 1 WELLS			407.00
89-2(1)	TOTAL VOC ZONE 1 WELLS			390.00
B-15(1)	TOTAL VOC ZONE 1 WELLS			373.00
87-2(1)	TOTAL VOC ZONE 1 WELLS			313.00
B-16(1)	TOTAL VOC ZONE 1 WELLS			237.00
87-17(1)	TOTAL VOC ZONE 1 WELLS			210.00
89-11(1)	TOTAL VOC ZONE 1 WELLS			163.00
87-23(1)	TOTAL VOC ZONE 1 WELLS			112.00
89-5(1B)	TOTAL VOC ZONE 1 WELLS			56.00
89-14(1)	TOTAL VOC ZONE 1 WELLS			29.00
89-08(1)	TOTAL VOC ZONE 1 WELLS			3.00
89-16(1)	TOTAL VOC ZONE 1 WELLS			3.00

NOTES:

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B: This flag is used when the analyte is found in the associated blank as well as in the sample.

D: This flag identifies all compounds identified during a reanalysis of a diluted sample.

E: This flag identifies compounds whose concentrations exeed the calibration range of the GS/MS instrument for that specific analysis.

TABLE 7-6B (CONTINUED)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS
SORTED BY PARAMETER
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER (VOLATILE ORGANIC COMPOUNDS)	CONC (ug/l)	QUAL CODE	TOTAL VOC (ug/l)
OVERBURDEN WELLS				
87-1(0)	1,1,1-Trichloroethane	20.00	J	
87-8(0)	1,2-Dichloroethene (total)	28,000.00		
B-6(0)	1,2-Dichloroethene (total)	10,000.00	J	
87-2(0)	1,2-Dichloroethene (total)	9,700.00		
87-14(0)	1,2-Dichloroethene (total)	5,100.00		
B-1(0)	1,2-Dichloroethene (total)	4,000.00		
B-18(0)	1,2-Dichloroethene (total)	3,200.00		
B-10S(0)	1,2-Dichloroethene (total)	2,100.00		
87-1(0)	1,2-Dichloroethene (total)	1,400.00		
B-17(0)	1,2-Dichloroethene (total)	190.00		
89-13(0)	1,2-Dichloroethene (total)	33.00		
B-12(0)	1,2-Dichloroethene (total)	5.00		
87-18(0)	1,2-Dichloroethene (total)	4.00	J	
87-22(0)	1,2-Dichloroethene (total)	2.00	J	
87-17(0)	Acetone	16,000.00	BJ	
87-22(0)	Acetone	13.00	B	
B-9(0)	Acetone	11.00	B	
B-9(0)	Benzene	2.00	J	
B-10S(0)	Chloroform	580.00	J	
87-10(0)	Chloroform	6.00		
B-11(0)	Methylene Chloride	1,500,000.00		
87-17(0)	Methylene Chloride	510,000.00		
B-3(0)	Methylene Chloride	380,000.00		
B-7(0)	Methylene Chloride	65,000.00		
87-14(0)	Methylene Chloride	15,000.00		
B-6(0)	Methylene Chloride	12,000.00	J	
87-8(0)	Methylene Chloride	1,700.00		
B-10S(0)	Methylene Chloride	720.00	J	
B-1(0)	Methylene Chloride	370.00		
B-17(0)	Methylene Chloride	130.00		
87-18(0)	Methylene Chloride	13.00		
87-20(0)	Methylene Chloride	1.00	BJ	

NOTES:

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B: This flag is used when the analyte is found in the associated blank as well as in the sample.

D: This flag identifies all compounds identified during a reanalysis of a diluted sample.

E: This flag identifies compounds whose concentrations exeed the calibration range of the GS/MS instrument for that specific analysis.

TABLE 7-6B (CONTINUED)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS
SORTED BY PARAMETER
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER (VOLATILE ORGANIC COMPOUNDS)	CONC (ug/l)	QUAL CODE	TOTAL VOC (ug/l)
87-22(0)	Methylene Chloride	1.00	BJ	
B-9(0)	Toluene	1.00	J	
B-6(0)	Trichloroethene	200,000.00		
B-3(0)	Trichloroethene	92,000.00		
87-17(0)	Trichloroethene	74,000.00		
87-14(0)	Trichloroethene	65,000.00		
B-11(0)	Trichloroethene	39,000.00	J	
B-10S(0)	Trichloroethene	36,000.00		
87-2(0)	Trichloroethene	17,000.00		
87-8(0)	Trichloroethene	10,000.00		
B-18(0)	Trichloroethene	7,800.00		
B-1(0)	Trichloroethene	7,100.00		
B-17(0)	Trichloroethene	810.00		
87-1(0)	Trichloroethene	600.00		
87-18(0)	Trichloroethene	260.00		
B-12(0)	Trichloroethene	41.00		
87-22(0)	Trichloroethene	17.00		
89-13(0)	Trichloroethene	5.00		
87-10(0)	Trichloroethene	2.00	J	
B-1(0)	Vinyl Chloride	120.00	J	
89-13(0)	Vinyl Chloride	14.00		
B-9(0)	Vinyl Chloride	6.00	J	
B-9(0)	Xylene (total)	3.00	J	
B-11(0)	TOTAL VOC OVERBURDEN WELLS			1,539,000.00
87-17(0)	TOTAL VOC OVERBURDEN WELLS			600,000.00
B-3(0)	TOTAL VOC OVERBURDEN WELLS			472,000.00
B-6(0)	TOTAL VOC OVERBURDEN WELLS			222,000.00
87-14(0)	TOTAL VOC OVERBURDEN WELLS			85,100.00
B-7(0)	TOTAL VOC OVERBURDEN WELLS			65,000.00
87-8(0)	TOTAL VOC OVERBURDEN WELLS			39,700.00
B-10S(0)	TOTAL VOC OVERBURDEN WELLS			39,400.00
87-2(0)	TOTAL VOC OVERBURDEN WELLS			26,700.00
B-1(0)	TOTAL VOC OVERBURDEN WELLS			11,590.00

NOTES:

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B: This flag is used when the analyte is found in the associated blank as well as in the sample.

D: This flag identifies all compounds identified during a reanalysis of a diluted sample.

E: This flag identifies compounds whose concentrations exeed the calibration range of the GS/MS instrument for that specific analysis.

TABLE 7-6B (CONTINUED)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS
SORTED BY PARAMETER
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER (VOLATILE ORGANIC COMPOUNDS)	CONC (ug/l)	QUAL CODE	TOTAL VOC (ug/l)
B-18(0)	TOTAL VOC OVERBURDEN WELLS			11,000.00
87-1(0)	TOTAL VOC OVERBURDEN WELLS			2,020.00
B-17(0)	TOTAL VOC OVERBURDEN WELLS			1,130.00
87-18(0)	TOTAL VOC OVERBURDEN WELLS			277.00
89-13(0)	TOTAL VOC OVERBURDEN WELLS			52.00
B-12(0)	TOTAL VOC OVERBURDEN WELLS			46.00
87-22(0)	TOTAL VOC OVERBURDEN WELLS			33.00
B-9(0)	TOTAL VOC OVERBURDEN WELLS			23.00
87-10(0)	TOTAL VOC OVERBURDEN WELLS			8.00
87-20(0)	TOTAL VOC OVERBURDEN WELLS			1.00

NOTES:

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B: This flag is used when the analyte is found in the associated blank as well as in the sample.

D: This flag identifies all compounds identified during a reanalysis of a diluted sample.

E: This flag identifies compounds whose concentrations exeed the calibration range of the GS/MS instrument for that specific analysis.

TABLE 7-6B (CONTINUED)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS
SORTED BY PARAMETER
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER (VOLATILE ORGANIC COMPOUNDS)	CONC (ug/l)	QUAL CODE	TOTAL VOC (ug/l)
SEWER TRENCH WELLS				
SW89-2	1,1,1-Trichloroethane	4.00	J	
SW89-2	1,2-Dichloroethene (total)	240.00		
SW89-2	Chloroform	4.00	J	
SW89-1	Chloroform	4.00	J	
SW89-2	Trichloroethene	130.00		
SW89-1	Trichloroethene	2.00	J	
SW89-2	TOTAL VOC SEWER TRENCH WELLS			378.00
SW89-1	TOTAL VOC SEWER TRENCH WELLS			6.00

NOTES:

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B: This flag is used when the analyte is found in the associated blank as well as in the sample.

D: This flag identifies all compounds identified during a reanalysis of a diluted sample.

E: This flag identifies compounds whose concentrations exeed the calibration range of the GS/MS instrument for that specific analysis.

TABLE 7-6B (CONTINUED)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS
SORTED BY PARAMETER
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER (VOLATILE ORGANIC COMPOUNDS)	CONC (ug/l)	QUAL CODE	TOTAL VOC (ug/l)
ZONE 3 WELLS				
87-16(3)	1,1,1-Trichloroethane	34.00		
87-14(3)	1,1,1-Trichloroethane	5.00		
87-5(3)	1,1,1-Trichloroethane	5.00		
87-4(3)	1,1,1-Trichloroethane	1.00	J	
87-5(3)	1,1,2-Trichloroethane	2.00	J	
87-16(3)	1,1-Dichloroethane	16.00		
87-5(3)	1,1-Dichloroethane	6.00		
87-13(3)	1,2-Dichloroethene (total)	880.00		
87-16(3)	1,2-Dichloroethene (total)	150.00		
87-5(3)	1,2-Dichloroethene (total)	150.00		
87-5(3)	2-Hexanone	15.00		
87-5(3)	4-Methyl-2-Pentanone	16.00		
89-20(3)	Carbon Disulfide	250.00	J	
87-13(3)	Carbon Disulfide	87.00		
87-16(3)	Carbon Disulfide	48.00		
87-14(3)	Carbon Disulfide	15.00		
87-4(3)	Carbon Disulfide	9.00		
89-2(3)	Carbon Disulfide	2.00	J	
87-15(3)	Carbon Disulfide	1.00	J	
89-20(3)	Methylene Chloride	3,300.00		
87-13(3)	Methylene Chloride	20.00	J	
87-14(3)	Methylene Chloride	3.00	J	
89-20(3)	Trichloroethene	11,000.00		
87-13(3)	Trichloroethene	690.00		
87-14(3)	Trichloroethene	29.00		
87-5(3)	Trichloroethene	11.00		
87-4(3)	Trichloroethene	3.00	J	
87-16(3)	Trichloroethene	2.00	J	

NOTES:

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B: This flag is used when the analyte is found in the associated blank as well as in the sample.

D: This flag identifies all compounds identified during a reanalysis of a diluted sample.

E: This flag identifies compounds whose concentrations exeed the calibration range of the GS/MS instrument for that specific analysis.

TABLE 7-6B (CONTINUED)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS
SORTED BY PARAMETER
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER (VOLATILE ORGANIC COMPOUNDS)	CONC (ug/l)	QUAL CODE	TOTAL VOC (ug/l)
87-16(3)	Vinyl Chloride	160.00		
87-5(3)	Vinyl Chloride	120.00		
89-20(3)	TOTAL VOC ZONE 3 WELLS			14,550.00
87-13(3)	TOTAL VOC ZONE 3 WELLS			1,677.00
87-16(3)	TOTAL VOC ZONE 3 WELLS			410.00
87-5(3)	TOTAL VOC ZONE 3 WELLS			325.00
87-14(3)	TOTAL VOC ZONE 3 WELLS			52.00
87-4(3)	TOTAL VOC ZONE 3 WELLS			13.00
89-2(3)	TOTAL VOC ZONE 3 WELLS			2.00
87-15(3)	TOTAL VOC ZONE 3 WELLS			1.00

NOTES:

J: Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.

B: This flag is used when the analyte is found in the associated blank as well as in the sample.

D: This flag identifies all compounds identified during a reanalysis of a diluted sample.

E: This flag identifies compounds whose concentrations exeed the calibration range of the GS/MS instrument for that specific analysis.

TABLE 7-7A
SUMMARY OF DETECTED SEMIVOLATILE ORGANIC COMPOUNDS
SORTED BY SAMPLING POINT
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER SEMIVOLATILE ORGANIC COMPOUNDS	CONC (ug/l)	QUAL CODE	TOTAL SEMI VOC (ug/l)
ZONE 1 WELLS				
87-01(1)	bis(2-Ethylhexyl)phthalate	3.00	J	
87-01(1)	TOTAL SEMI VOC			3.00
87-04(1)	bis(2-Ethylhexyl)phthalate	19.00	B	
87-04(1)	Di-n-octylphthalate	3.00	J	
87-04(1)	TOTAL SEMI VOC			22.00
87-05(1)	2,4-Dimethylphenol	2.00	J	
87-05(1)	4-Methylphenol	6.00	J	
87-05(1)	Benzoic acid	2.00	J	
87-05(1)	bis(2-Ethylhexyl)phthalate	3.00	J	
87-05(1)	Phenol	3.00	J	
87-05(1)	TOTAL SEMI VOC			16.00
87-06(1)	2-Methylnaphthalene	25.00	J	
87-06(1)	bis(2-Ethylhexyl)phthalate	38.00	J	
87-06(1)	Naphthalene	29.00	J	
87-06(1)	Phenanthrene	27.00	J	
87-06(1)	Pyrene	25.00	J	
87-06(1)	TOTAL SEMI VOC			144.00
87-08(1)	bis(2-Ethylhexyl)phthalate	6.00	BJ	
87-08(1)	TOTAL SEMI VOC			6.00
87-10(1)	bis(2-Ethylhexyl)phthalate	11.00	B	
87-10(1)	TOTAL SEMI VOC			11.00
87-11(1)	bis(2-Ethylhexyl)phthalate	6.00	BJ	
87-11(1)	TOTAL SEMI VOC			6.00
87-12(1)	bis(2-Ethylhexyl)phthalate	12.00	B	
87-12(1)	TOTAL SEMI VOC			12.00
87-13(1)	2,4-Dimethylphenol	4.00	J	
87-13(1)	4-Methylphenol	7.00	J	
87-13(1)	4-Nitrophenol	10.00	J	
87-13(1)	Benzoic acid	31.00	J	
87-13(1)	Fluoranthene	5.00	J	
87-13(1)	Phenol	8.00	J	
87-13(1)	TOTAL SEMI VOC			65.00
87-14(1)	4-Methylphenol	16.00		
87-14(1)	bis(2-Ethylhexyl)phthalate	15.00	B	
87-14(1)	TOTAL SEMI VOC			31.00
87-15(1)	bis(2-Ethylhexyl)phthalate	31.00	B	
87-15(1)	Di-n-octylphthalate	17.00		
87-15(1)	TOTAL SEMI VOC			48.00

NOTES:

J: Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.

B: This flag is used when the analyte is found in the associated blank as well as in the sample.

TABLE 7-7A (CONTINUED)
SUMMARY OF DETECTED SEMIVOLATILE ORGANIC COMPOUNDS
SORTED BY SAMPLING POINT
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER SEMIVOLATILE ORGANIC COMPOUNDS	CONC (ug/l)	QUAL CODE	TOTAL SEMI VOC (ug/l)
87-17(1)	bis(2-Ethylhexyl)phthalate	5.00	J	
87-17(1)	TOTAL SEMI VOC			5.00
87-20(1)	bis(2-Ethylhexyl)phthalate	6.00	BJ	
87-20(1)	TOTAL SEMI VOC			6.00
87-21(1)	bis(2-Ethylhexyl)phthalate	6.00	BJ	
87-21(1)	TOTAL SEMI VOC			6.00
89-01(1)	Di-n-butylphthalate	2.00	J	
89-01(1)	TOTAL SEMI VOC			2.00
89-02(1)	bis(2-Ethylhexyl)phthalate	8.00	BJ	
89-02(1)	TOTAL SEMI VOC			8.00
89-04(1)	bis(2-Ethylhexyl)phthalate	4.00	BJ	
89-04(1)	TOTAL SEMI VOC			4.00
89-10(1)	bis(2-Ethylhexyl)phthalate	13.00	B	
89-10(1)	Di-n-octylphthalate	3.00	J	
89-10(1)	TOTAL SEMI VOC			16.00
89-11(1)	Di-n-butylphthalate	2.00	J	
89-11(1)	TOTAL SEMI VOC			2.00
89-12(1)	bis(2-Ethylhexyl)phthalate	10.00	BJ	
89-12(1)	TOTAL SEMI VOC			10.00
89-14(1)	Di-n-butylphthalate	2.00	J	
89-14(1)	TOTAL SEMI VOC			2.00
89-15(1)	bis(2-Ethylhexyl)phthalate	7.00	J	
89-15(1)	Di-n-butylphthalate	2.00	BJ	
89-15(1)	TOTAL SEMI VOC			9.00
B-14(1)	bis(2-Ethylhexyl)phthalate	3.00	J	
B-14(1)	TOTAL SEMI VOC			3.00
B-15(1)	bis(2-Ethylhexyl)phthalate	56.00	B	
B-15(1)	TOTAL SEMI VOC			56.00
B-16(1)	bis(2-Ethylhexyl)phthalate	11.00	B	
B-16(1)	Di-n-octylphthalate	3.00	J	
B-16(1)	TOTAL SEMI VOC			14.00

NOTES:

J: Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.

B: This flag is used when the analyte is found in the associated blank as well as in the sample.

TABLE 7-7A (CONTINUED)
SUMMARY OF DETECTED SEMIVOLATILE ORGANIC COMPOUNDS
SORTED BY SAMPLING POINT
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER SEMIVOLATILE ORGANIC COMPOUNDS	CONC (ug/l)	QUAL CODE	TOTAL SEMI VOC (ug/l)
OVERBURDEN WELLS				
B-17(0)	bis(2-Ethylhexyl)phthalate	5.00	BJ	
B-17(0)	TOTAL SEMI VOC			5.00
B-8(0)	bis(2-Ethylhexyl)phthalate	3.00	J	
B-8(0)	TOTAL SEMI VOC			3.00
ZONE 3 WELLS				
87-05(3)	bis(2-Ethylhexyl)phthalate	10.00		
87-05(3)	TOTAL SEMI VOC			10.00
87-15(3)	bis(2-Ethylhexyl)phthalate	15.00	B	
87-15(3)	Di-n-octylphthalate	53.00		
87-15(3)	TOTAL SEMI VOC			68.00
89-20(3)	bis(2-Ethylhexyl)phthalate	5.00	BJ	
89-20(3)	TOTAL SEMI VOC			5.00

NOTES:

J: Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.

B: This flag is used when the analyte is found in the associated blank as well as in the sample.

TABLE 7-7B
SUMMARY OF DETECTED SEMIVOLATILE ORGANIC COMPOUNDS
SORTED BY PARAMETER
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER (SEMIVOLATILE ORGANIC COMPOUNDS)	CONC (ug/l)	QUAL CODE	TOTAL SEMI VOC (ug/l)
<u>ZONE 1 WELLS</u>				
87-13(1)	2,4-Dimethylphenol	4.00	J	
87-05(1)	2,4-Dimethylphenol	2.00	J	
87-06(1)	2-Methylnaphthalene	25.00	J	
87-14(1)	4-Methylphenol	16.00		
87-13(1)	4-Methylphenol	7.00	J	
87-05(1)	4-Methylphenol	6.00	J	
87-13(1)	4-Nitrophenol	10.00	J	
87-13(1)	Benzoic acid	31.00	J	
87-05(1)	Benzoic acid	2.00	J	
B-15(1)	bis(2-Ethylhexyl)phthalate	56.00	B	
87-06(1)	bis(2-Ethylhexyl)phthalate	38.00	J	
87-15(1)	bis(2-Ethylhexyl)phthalate	31.00	B	
87-04(1)	bis(2-Ethylhexyl)phthalate	19.00	B	
87-14(1)	bis(2-Ethylhexyl)phthalate	15.00.	B	
89-10(1)	bis(2-Ethylhexyl)phthalate	13.00	B	
87-12(1)	bis(2-Ethylhexyl)phthalate	12.00	B	
87-10(1)	bis(2-Ethylhexyl)phthalate	11.00	B	
B-16(1)	bis(2-Ethylhexyl)phthalate	11.00	B	
89-12(1)	bis(2-Ethylhexyl)phthalate	10.00	BJ	
89-02(1)	bis(2-Ethylhexyl)phthalate	8.00	BJ	
89-15(1)	bis(2-Ethylhexyl)phthalate	7.00	J	
87-20(1)	bis(2-Ethylhexyl)phthalate	6.00	BJ	
87-11(1)	bis(2-Ethylhexyl)phthalate	6.00	BJ	
87-08(1)	bis(2-Ethylhexyl)phthalate	6.00	BJ	
87-21(1)	bis(2-Ethylhexyl)phthalate	6.00	BJ	
87-17(1)	bis(2-Ethylhexyl)phthalate	5.00	J	
89-04(1)	bis(2-Ethylhexyl)phthalate	4.00	BJ	
87-05(1)	bis(2-Ethylhexyl)phthalate	3.00	J	
87-01(1)	bis(2-Ethylhexyl)phthalate	3.00	J	
B-14(1)	bis(2-Ethylhexyl)phthalate	3.00	J	
89-14(1)	Di-n-butylphthalate	2.00	J	
89-15(1)	Di-n-butylphthalate	2.00	BJ	
89-01(1)	Di-n-butylphthalate	2.00	J	
89-11(1)	Di-n-butylphthalate	2.00	J	

NOTES:

J: Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.

B: This flag is used when the analyte is found in the associated blank as well as in the sample.

TABLE 7-7B (CONTINUED)
SUMMARY OF DETECTED SEMIVOLATILE ORGANIC COMPOUNDS
SORTED BY PARAMETER
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER (SEMIVOLATILE ORGANIC COMPOUNDS)	CONC (ug/l)	QUAL CODE	TOTAL SEMI VOC (ug/l)
87-15(1)	Di-n-octylphthalate	17.00		
87-04(1)	Di-n-octylphthalate	3.00	J	
89-10(1)	Di-n-octylphthalate	3.00	J	
B-16(1)	Di-n-octylphthalate	3.00	J	
87-13(1)	Fluoranthene	5.00	J	
87-06(1)	Naphthalene	29.00	J	
87-06(1)	Phenanthrene	27.00	J	
87-13(1)	Phenol	8.00	J	
87-05(1)	Phenol	3.00	J	
87-06(1)	Pyrene	25.00	J	
87-06(1)	TOTAL SEMI VOC			144.00
87-13(1)	TOTAL SEMI VOC			65.00
B-15(1)	TOTAL SEMI VOC			56.00
87-15(1)	TOTAL SEMI VOC			48.00
87-14(1)	TOTAL SEMI VOC			31.00
87-04(1)	TOTAL SEMI VOC			22.00
89-10(1)	TOTAL SEMI VOC			16.00
87-05(1)	TOTAL SEMI VOC			16.00
B-16(1)	TOTAL SEMI VOC			14.00
87-12(1)	TOTAL SEMI VOC			12.00
87-10(1)	TOTAL SEMI VOC			11.00
89-12(1)	TOTAL SEMI VOC			10.00
89-15(1)	TOTAL SEMI VOC			9.00
89-02(1)	TOTAL SEMI VOC			8.00
87-08(1)	TOTAL SEMI VOC			6.00
87-11(1)	TOTAL SEMI VOC			6.00
87-20(1)	TOTAL SEMI VOC			6.00
87-21(1)	TOTAL SEMI VOC			6.00
87-17(1)	TOTAL SEMI VOC			5.00
89-04(1)	TOTAL SEMI VOC			4.00
B-14(1)	TOTAL SEMI VOC			3.00
87-01(1)	TOTAL SEMI VOC			3.00
89-11(1)	TOTAL SEMI VOC			2.00
89-14(1)	TOTAL SEMI VOC			2.00
89-01(1)	TOTAL SEMI VOC			2.00

NOTES:

J: Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.

B: This flag is used when the analyte is found in the associated blank as well as in the sample.

TABLE 7-7B (CONTINUED)
SUMMARY OF DETECTED SEMIVOLATILE ORGANIC COMPOUNDS
SORTED BY PARAMETER
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER (SEMIVOLATILE ORGANIC COMPOUNDS)	CONC (ug/l)	QUAL CODE	TOTAL SEMI VOC (ug/l)
OVERBURDEN WELLS				
B-17(0)	bis(2-Ethylhexyl)phthalate	5.00	BJ	
B-8(0)	bis(2-Ethylhexyl)phthalate	3.00	J	
B-17(0)	TOTAL SEMI VOC			5.00
B-8(0)	TOTAL SEMI VOC			3.00
ZONE 3 WELLS				
87-15(3)	bis(2-Ethylhexyl)phthalate	15.00	B	
87-05(3)	bis(2-Ethylhexyl)phthalate	10.00		
89-20(3)	bis(2-Ethylhexyl)phthalate	5.00	BJ	
87-15(3)	Di-n-octylphthalate	53.00		
87-15(3)	TOTAL SEMI VOC			68.00
87-05(3)	TOTAL SEMI VOC			10.00
89-20(3)	TOTAL SEMI VOC			5.00

NOTES:

J: Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.

B: This flag is used when the analyte is found in the associated blank as well as in the sample.

TABLE 7-8A
SUMMARY OF DETECTED PESTICIDE/PCB COMPOUNDS
SORTED BY SAMPLING POINT
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER (PESTICIDE/PCB)	CONC (ug/l)	QUAL CODE	TOTAL PEST/PCB (ug/l)
ZONE 1 WELLS				
87-10(1)	Aroclor-1254	3.00		
87-10(1)	TOTAL PESTICIDES AND PCB's			3.00
87-13(1)	Aroclor-1254	12.00		
87-13(1)	TOTAL PESTICIDES AND PCB's			12.00
87-14(1)	Aroclor-1254	1.80		
87-14(1)	gamma-BHC (Lindane)	0.14		
87-14(1)	TOTAL PESTICIDES AND PCB's			1.94
87-23(1)	Aroclor-1254	1.70		
87-23(1)	TOTAL PESTICIDES AND PCB's			1.70
87-5(1)	Aroclor-1254	0.25	J	
87-5(1)	TOTAL PESTICIDES AND PCB's			0.25
87-6(1)	Aroclor-1254	31.00		
87-6(1)	TOTAL PESTICIDES AND PCB's			31.00
89-10(1)	Aroclor-1254	0.63	J	
89-10(1)	TOTAL PESTICIDES AND PCB's			0.63
89-15(1)	Aroclor-1254	3.90	J	
89-15(1)	TOTAL PESTICIDES AND PCB's			3.90
B-10A(1)	Aroclor-1254	38.00		
B-10A(1)	gamma-BHC (Lindane)	3.50		
B-10A(1)	TOTAL PESTICIDES AND PCB's			41.50

NOTES:

J: Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but grater than zero.

TABLE 7-8B
SUMMARY OF DETECTED PESTICIDE/PCB COMPOUNDS
SORTED BY PARAMETER
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER (PESTICIDE/PCB)	CONC (ug/l)	QUAL CODE	TOTAL PEST/PCB (ug/l)
ZONE 1 WELLS				
B-10A(1)	Aroclor-1254	38.00		
87-6(1)	Aroclor-1254	31.00		
87-13(1)	Aroclor-1254	12.00		
89-15(1)	Aroclor-1254	3.90	J	
87-10(1)	Aroclor-1254	3.00		
87-14(1)	Aroclor-1254	1.80		
87-23(1)	Aroclor-1254	1.70		
89-10(1)	Aroclor-1254	0.63	J	
87-5(1)	Aroclor-1254	0.25	J	
B-10A(1)	gamma-BHC (Lindane)	3.50		
87-14(1)	gamma-BHC (Lindane)	0.14		
B-10A(1)	TOTAL PESTICIDES AND PCB's			41.50
87-6(1)	TOTAL PESTICIDES AND PCB's			31.00
87-13(1)	TOTAL PESTICIDES AND PCB's			12.00
89-15(1)	TOTAL PESTICIDES AND PCB's			3.90
87-10(1)	TOTAL PESTICIDES AND PCB's			3.00
87-14(1)	TOTAL PESTICIDES AND PCB's			1.94
87-23(1)	TOTAL PESTICIDES AND PCB's			1.70
89-10(1)	TOTAL PESTICIDES AND PCB's			0.63
87-5(1)	TOTAL PESTICIDES AND PCB's			0.25

NOTES:

J: Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.

TABLE 7-9
LIST OF DETECTED PARAMETERS - SEPTEMBER 1989 SAMPLING EVENT

DESIG	DATE SAMPLED	PARAMETER	UNITS	CONCENTRATION	DETECTION LIMIT
		VOLATILE ORGANICS			
87-13(1)DNAPL	890921	Trichloroethylene	ug/l	668000000.00	5000.00
87-13(1)DNAPL	890921	Methylene chloride	ug/l	162000000.00	5000.00
87-13(1)DNAPL	890921	1,1,1-Trichloroethane	ug/l	106000000.00	5000.00
87-13(1)DNAPL	890921	Acetone	ug/l	45100000.00	50000.00
87-13(1)DNAPL	890921	1,1-Dichloroethylene	ug/l	3260000.00	5000.00
87-13(1)DNAPL	890921	Toluene	ug/l	2080000.00	5000.00
87-13(1)DNAPL	890921	Trichlorofluoromethane	ug/l	1900000.00	5000.00
87-13(1)DNAPL	890921	Xylene (total)	ug/l	686000.00	5000.00
87-13(1)DNAPL	890921	Ethylbenzene	ug/l	640000.00	5000.00
87-13(1)DNAPL	890921	1,2-Trans-dichloroethylene	ug/l	580000.00	5000.00
87-13(1)DNAPL	890921	Tetrachloroethylene	ug/l	315000.00	5000.00
87-13(1)DNAPL	890921	Vinyl chloride	ug/l	80000.00	2000.00
87-13(1)DNAPL	890921	Chloroform	ug/l	74100.00	5000.00
87-13(1)DNAPL	890921	Benzene	ug/l	<DL	2000.00
87-16(1)	890921	Trichloroethylene	ug/l	276000.00	5.00
87-16(1)	890921	Methylene chloride	ug/l	66400.00	5.00
87-16(1)	890921	1,1,1-Trichloroethane	ug/l	43400.00	5.00
87-16(1)	890921	Acetone	ug/l	18900.00	50.00
87-16(1)	890921	1,1-Dichloroethylene	ug/l	1330.00	5.00
87-16(1)	890921	Toluene	ug/l	850.00	5.00
87-16(1)	890921	Trichlorofluoromethane	ug/l	786.00	5.00
87-16(1)	890921	Chloroform	ug/l	303.00	5.00
87-16(1)	890921	Xylene (total)	ug/l	264.00	5.00
87-16(1)	890921	Ethylbenzene	ug/l	262.00	5.00
87-16(1)	890921	1,2-Trans-dichloroethylene	ug/l	236.00	5.00
87-16(1)	890921	Tetrachloroethylene	ug/l	129.00	5.00
87-16(1)	890921	Vinyl chloride	ug/l	32.60	2.00
87-16(1)	890921	Benzene	ug/l	24.10	2.00
87-10(1)	890921	Trichloroethylene	ug/l	37000.00	190.00
87-10(1)	890921	Methylene chloride	ug/l	26000.00	180.00
87-10(1)	890921	1,2-Trans-dichloroethylene	ug/l	3150.00	180.00
87-10(1)	890921	Toluene	ug/l	139.00	1.50
87-10(1)	890921	1,1,1-Trichloroethane	ug/l	109.00	1.40
87-10(1)	890921	Tetrachloroethylene	ug/l	62.80	2.40
87-10(1)	890921	Ethylbenzene	ug/l	31.10	2.10
87-10(1)	890921	Vinyl chloride	ug/l	25.70	5.00
87-10(1)	890921	1,1-Dichloroethylene	ug/l	18.90	2.20
87-10(1)	890921	Chloroform	ug/l	9.50	1.80
86-23(1)	890921	Trichloroethylene	ug/l	3660.00	19.00
86-23(1)	890921	Methylene chloride	ug/l	1380.00	1.80

NOTES

* SAMPLE ANALYSED BY ETC; THE OTHER SAMPLES HAVE BEEN ANALYSED BY ALPHA ANALYTICAL

<DL : LESS THEN DETECTION LIMIT

TABLE 7-9 (CONTINUED)
LIST OF DETECTED PARAMETERS - SEPTEMBER 1989 SAMPLING EVENT

DESIG	DATE SAMPLED	PARAMETER	UNITS	CONCENTRATION	DETECTION LIMIT
86-23(1)	890921	1,2-Trans-dichloroethylene	ug/l	1330.00	1.80
86-23(1)	890921	1,1,1-Trichloroethane	ug/l	307.00	1.40
86-23(1)	890921	Toluene	ug/l	49.60	1.50
86-23(1)	890921	Acetone	ug/l	34.40	25.00
86-23(1)	890921	Ethylbenzene	ug/l	5.20	2.10
86-23(1)	890921	Tetrachloroethylene	ug/l	4.60	2.40
86-23(1)	890921	1,1-Dichloroethylene	ug/l	<DL	2.20
87-22(1)	891020	Trichloroethylene	ug/l	17100.00	95.00
87-22(1)	891020	Methylene chloride	ug/l	4480.00	90.00
87-22(1)	891020	1,1,1-Trichloroethane	ug/l	430.00	70.00
87-22(1)	891020	Tetrachloroethylene	ug/l	353.00	120.00
87-22(1)	891020	1,2-Trans-dichloroethylene	ug/l	90.00	40.00
87-22(1)	891020	Toluene	ug/l	<DL	75.00
87-18(1)	891020	1,2-Trans-dichloroethylene	ug/l	11600.00	90.00
87-18(1)	891020	Methylene chloride	ug/l	3000.00	90.00
87-18(1)	891020	Trichloroethylene	ug/l	1010.00	95.00
87-18(1)	891020	Tetrachloroethylene	ug/l	240.00	120.00
87-18(1)	891020	Toluene	ug/l	<DL	75.00
86-21(1)	890921	Trichloroethylene	ug/l	1020.00	19.00
86-21(1)	890921	1,2-Trans-dichloroethylene	ug/l	113.00	1.80
86-21(1)	890921	1,1,1-Trichloroethane	ug/l	15.00	1.40
86-21(1)	890921	Methylene chloride	ug/l	12.90	1.80
86-21(1)	890921	1,1,2,2-Tetrachloroethane	ug/l	<DL	2.20
86-21(1)	890921	1,1-Dichloroethylene	ug/l	<DL	2.20
		SEMIVOLATILE ORGANICS-ACID EXTRACTABLE			
87-13(1)DNAPL	890921	2,3,4,6-Tetrachlorophenol	ug/l	52.10	100.00
87-13(1)DNAPL	890921	2,4-Dimethylphenol	ug/l	23.70	100.00
87-13(1)DNAPL	890921	2-Chlorophenol	ug/l	17.20	100.00
87-13(1)DNAPL	890921	2,4-Dichlorophenol	ug/l	<DL	100.00
87-13(1)DNAPL	890921	o-Nitrophenol	ug/l	<DL	100.00
		SEMIVOLATILE ORGANICS-BASE NEUTRAL EXTRACTABLE			
87-13(1)DNAPL	890921	1,2,4,5-Tetrachlorobenzene	ug/l	7410.00	100.00
87-13(1)DNAPL	890921	Naphthalene	ug/l	2180.00	100.00
87-13(1)DNAPL	890921	Di-n-octyl phthalate	ug/l	652.00	100.00
87-13(1)DNAPL	890921	o-Dichlorobenzene	ug/l	406.00	100.00
87-13(1)DNAPL	890921	p-Dichlorobenzene	ug/l	212.00	100.00
87-13(1)DNAPL	890921	Anthracene	ug/l	120.00	100.00
87-13(1)DNAPL	890921	Phenanthrene	ug/l	<DL	100.00
87-13(1)DNAPL	890921	Benzo(a)anthracene	ug/l	<DL	100.00
87-13(1)DNAPL	890921	Di-n-butyl phthalate	ug/l	<DL	100.00
87-13(1)DNAPL	890921	2-Methyl napthalene	ug/l	<DL	100.00

NOTES
* SAMPLE ANALYSED BY ETC; THE OTHER SAMPLES HAVE BEEN ANALYSED BY ALPHA ANALYTICAL
<DL : LESS THEN DETECTION LIMIT

TABLE 7-9 (CONTINUED)
LIST OF DETECTED PARAMETERS - SEPTEMBER 1989 SAMPLING EVENT

DESIG	DATE SAMPLED	PARAMETER	UNITS	CONCENTRATION	DETECTION LIMIT
87-13(1)DNAPL	890921	Acenaphthylene	ug/l	<DL	100.00
87-13(1)DNAPL	890921	Fluorene	ug/l	<DL	100.00
87-13(1)DNAPL	890921	2-Chloronaphthalene	ug/l	<DL	100.00
87-13(1)DNAPL	890921	Butyl benzyl phthalate	ug/l	<DL	100.00
87-13(1)DNAPL	890921	m-Dichlorobenzene	ug/l	<DL	100.00
87-16(1)	890921	Di-n-octyl phthalate	ug/l	80.00	10.00
87-16(1)	890921	o-Dichlorobenzene	ug/l	36.10	10.00
87-16(1)	890921	1,2,4,5-Tetrachlorobenzene	ug/l	33.40	10.00
87-16(1)	890921	Naphthalene	ug/l	27.40	10.00
87-16(1)	890921	Anthracene	ug/l	<DL	10.00
87-16(1)dup	890921	Di-n-octyl phthalate	ug/l	64.10	10.00
87-16(1)dup	890921	o-Dichlorobenzene	ug/l	42.10	10.00
87-16(1)dup	890921	1,2,4,5-Tetrachlorobenzene	ug/l	36.20	10.00
87-16(1)dup	890921	Naphthalene	ug/l	33.00	10.00
87-16(1)dup	890921	Anthracene	ug/l	12.70	10.00
87-16(1)dup	890921	m-Dichlorobenzene	ug/l	<DL	10.00
87-22(1)	891020	Di-n-octyl phthalate	ug/l	10.80	2.50
87-22(1)	891020	Naphthalene	ug/l	6.80	1.60
87-22(1)	891020	Anthracene	ug/l	<DL	1.90
87-18(1)	891020	Di-n-octyl phthalate	ug/l	12.70	2.50
87-18(1)	891020	Naphthalene	ug/l	7.30	1.60
87-18(1)	891020	Anthracene	ug/l	6.80	1.90
87-18(1)	891020	2-Chloronaphthalene	ug/l	<DL	1.90
		PESTICIDES AND PCB's			
87-13(1)DNAPL	890921	PCB-1254	ug/l	186000.00	2400.00
87-13(1)DNAPL	890921	PCB-1254	ug/l	352000.00	9900.00
87-13(1)DNAPL	890921	PCB-1260	ug/l	102000.00	2400.00
87-13(1)DNAPL	890921	PCB-1242	ug/l	<DL	2400.00
87-13(1)	890921	PCB-1254	ug/l	101.00	2.40
87-13(1)*	890921	PCB-1254	ug/l	80.50	1.00
87-13(1)	890921	PCB-1260	ug/l	90.30	2.40
87-13(1)dup	890921	PCB-1254	ug/l	41.40	2.40
87-13(1)dup	890921	PCB-1260	ug/l	29.60	2.40
87-16(1)	890921	PCB-1254	ug/l	71.20	2.40
87-16(1)	890921	PCB-1260	ug/l	8.00	2.40
87-6(1)	890921	PCB-1254	ug/l	4.40	2.40
87-6(1)	890921	PCB-1260	ug/l	4.10	2.40
		INORGANICS			
87-13(1)DNAPL	890921	Lead	ug/l	13000.00	400.00
87-13(1)DNAPL	890921	Zinc	ug/l	4000.00	200.00
87-13(1)DNAPL	890921	Barium	ug/l	2670.00	200.00

NOTES

* SAMPLE ANALYSED BY ETC; THE OTHER SAMPLES HAVE BEEN ANALYSED BY ALPHA ANALYTICAL

<DL : LESS THEN DETECTION LIMIT

TABLE 7-9 (CONTINUED)
LIST OF DETECTED PARAMETERS - SEPTEMBER 1989 SAMPLING EVENT

DESIG	DATE SAMPLED	PARAMETER	UNITS	CONCENTRATION		DETECTION LIMIT
87-13(1)DNAPL	890921	Selenium	ug/l		768.00	200.00
87-13(1)DNAPL	890921	Copper	ug/l	<DL		200.00
87-13(1)DNAPL	890921	Thallium	ug/l	<DL		4000.00
87-13(1)DNAPL	890921	Antimony	ug/l	<DL		3000.00
87-13(1)DNAPL	890921	Sulfide as S	ug/l	<DL		100000.00
87-13(1)DNAPL	890921	Tin	ug/l	<DL		80000.00
87-16(1)	890921	Zinc	ug/l		360.00	20.00
87-16(1)	890921	Selenium	ug/l		73.00	20.00
87-16(1)	890921	Copper	ug/l		50.00	20.00
87-16(1)	890921	Arsenic	ug/l		10.00	10.00
87-16(1)	890921	Tin	ug/l	<DL		8000.00
87-16(1)	890921	Sulfide as S	ug/l	<DL		10000.00
87-16(1)	890921	Thallium	ug/l	<DL		400.00
87-16(1)dup	890921	Zinc	ug/l		480.00	20.00
87-16(1)dup	890921	Selenium	ug/l		108.00	20.00
87-16(1)dup	890921	Copper	ug/l		50.00	20.00
87-16(1)dup	890921	Arsenic	ug/l		16.00	10.00
87-16(1)dup	890921	Chromium	ug/l	<DL		70.00
87-16(1)dup	890921	Tin	ug/l	<DL		8000.00
87-16(1)dup	890921	Thallium	ug/l	<DL		400.00
87-16(1)dup	890921	Sulfide as S	ug/l	<DL		10000.00
87-16(1)dup	890921	Cyanide, Total	ug/l	<DL		40.00
87-16(1)dup	890921	Antimony	ug/l	<DL		300.00

NOTES
* SAMPLE ANALYSED BY ETC; THE OTHER SAMPLES HAVE BEEN ANALYSED BY ALPHA ANALYTICAL
<DL : LESS THEN DETECTION LIMIT

TABLE 7-10

LIST OF DETECTED VOLATILE ORGANICS - SEPTEMBER 1989 SAMPLING EVENT

PARAMETER DETECTED IN DNAPL SAMPLE	SAMPLE 87-13(1)D CONC (ug/l)	C/TotC (%)	SAMPLE 87-16(1) CONC (ug/l)	C/TotC (%)	SAMPLE 87-10(1) CONC (ug/l)	C/TotC (%)	SAMPLE 86-21(1) CONC (ug/l)	C/TotC (%)	SAMPLE 86-23(1) CONC (ug/l)	C/TotC (%)	SAMPLE 87-18(1) CONC (ug/l)	C/TotC (%)	SAMPLE 87-22(1) CONC (ug/l)	C/TotC (%)
Trichloroethylene	668,000.00	67.43	276,000.00	67.50	37,000.00	55.60	1,020.00	87.78	3,660.00	54.05	1,010.00	6.36	17,100.00	54.04
Methylene chloride	162,000.00	16.35	66,400.00	16.24	26,000.00	39.07	12.90	1.11	1,380.00	20.38	3,000.00	18.88	4,480.00	14.16
1,1,1-Trichloroethane	106,000.00	10.70	43,400.00	10.61	109.00	0.16	15.00	1.29	307.00	4.53	0.00	0.00	430.00	1.36
Acetone	45,100.00	4.55	18,900.00	4.62	0.00	0.00	0.00	0.00	34.40	0.51	#	0.00	#	0.00
1,1-Dichloroethylene	3,260.00	0.33	1,330.00	0.33	18.90	0.03	1.10 *	0.09	1.10	0.02	0.00	0.00	0.00	0.00
Toluene	2,080.00	0.21	850.00	0.21	139.00	0.21	0.00	0.00	49.60	0.73	37.50 *	0.24	37.50 *	0.12
Trichlorofluoromethane	1,900.00	0.19	786.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Xilene (total)	686.00	0.07	264.00	0.06	#	0.00	#	0.00	#	0.00	#	0.00	#	0.00
Ethyl benzene	640.00	0.06	262.00	0.06	31.10	0.05	0.00	0.00	5.20	0.08	0.00	0.00	0.00	0.00
trans-1,2-Dichloroethylene	580.00	0.06	236.00	0.06	3,150.00	4.73	113.00	9.72	1,330.00	19.64	11,600.00	73.01	9,240.00	29.20
Tetrachloroethylene	315.00	0.03	129.00	0.03	62.80	0.09	0.00	0.00	4.60	0.07	240.00	1.51	353.00	1.12
Vinyl chloride	80.00	0.01	32.60	0.01	25.70	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chloroform	74.10	0.01	303.00	0.07	9.50	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Benzene	1.00 *	0.00	24.10	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	990,716.10	100.00	408,916.70	100.00	66,546.00	100.00	1,162.00	100.00	6,771.90	100.00	15,887.50	100.00	31,640.50	100.00

Not analised

* BDL Considered 1/2 of the detection limit.

** 0 = Not detected.

TABLE 7-11
SUMMARY OF DETECTED ORGANIC CONSTITUENTS IN STREAM WATER SAMPLES - BERGHOLTZ CREEK
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER	CONC (ug/l)	QUAL CODE	TOTAL (ug/l)
VOLATILE ORGANIC COMPOUNDS				
WS-2	Xylene (total)	2.00	J	
WS-2	TOTAL VOC			2.00
WS-3	1,2-Dichloroethene (total)	7.00		
WS-3	Acetone	62.00	J	
WS-3	Chloroform	1.00	J	
WS-3	TOTAL VOC			70.00
WS-4	1,2-Dichloroethene (total)	6.00		
WS-4	Chloroform	1.00	J	
WS-4	Trichloroethene	1.00	J	
WS-4	TOTAL VOC			8.00
SEMIVOLATILE ORGANIC COMPOUNDS				
WS-1	bis(2-Ethylhexyl)phthalate	6.00	J	
WS-1	Di-n-butylphthalate	4.00	J	
WS-1	TOTAL SEMI VOC			10.00
WS-2	bis(2-Ethylhexyl)phthalate	8.00	J	
WS-2	Di-n-butylphthalate	3.00	J	
WS-2	TOTAL SEMI VOC			11.00
WS-3	bis(2-Ethylhexyl)phthalate	2.00	J	
WS-3	Di-n-butylphthalate	3.00	J	
WS-3	TOTAL SEMI VOC			5.00
WS-4	bis(2-Ethylhexyl)phthalate	2.00	J	
WS-4	Di-n-butylphthalate	2.00	J	
WS-4	TOTAL SEMI VOC			4.00

NOTES:

J: Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.

B: This flag is used when the analyte is found in the associated blank as well as in the sample.

TABLE 7-12
SUMMARY OF DETECTED ORGANIC CONSTITUENTS IN STREAM SEDIMENT SAMPLES - BERGHOLTZ CREEK
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER	CONC (ug/Kg)	QUAL CODE	TOTAL (ug/Kg)
VOLATILE ORGANIC COMPOUNDS				
S-1	Acetone	21.00	J	
S-1	TOTAL VOC			21.00
S-2	Methylene Chloride	5.00	J	
S-2	TOTAL VOC			5.00
S-3	Methylene Chloride	4.00	J	
S-3	Toluene	3.00	J	
S-3	TOTAL VOC			7.00
S-4	Acetone	55.00		
S-4	Methylene Chloride	7.00	J	
S-4	Toluene	2.00	J	
S-4	Xylene (total)	5.00	J	
S-4	TOTAL VOC			69.00

NOTES:

J: Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.

B: This flag is used when the analyte is found in the associated blank as well as in the sample.

TABLE 7-12 (CONTINUED)
SUMMARY OF DETECTED ORGANIC CONSTITUENTS IN STREAM SEDIMENT SAMPLES - BERGHOLTZ CREEK
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER	CONC (ug/Kg)	QUAL CODE	TOTAL (ug/Kg)
SEMIVOLATILE ORGANIC COMPOUNDS				
S-1	Benzo(a)anthracene	150.00	J	
S-1	Chrysene	170.00	J	
S-1	Fluoranthene	280.00	J	
S-1	Phenanthrene	150.00	J	
S-1	Pyrene	240.00	J	
S-1	TOTAL SEMI VOC			990.00
S-3	Acenaphthene	140.00	J	
S-3	Anthracene	200.00	J	
S-3	Benzoic acid	340.00	J	
S-3	Benzo(a)anthracene	830.00	J	
S-3	Benzo(a)pyrene	310.00	J	
S-3	Benzo(b)fluoranthene	700.00	J	
S-3	Benzo(k)fluoranthene	590.00	J	
S-3	bis(2-Ethylhexyl)phthalate	120.00	J	
S-3	Chrysene	820.00	J	
S-3	Fluoranthene	2,000.00		
S-3	Fluorene	130.00	J	
S-3	Indeno(1,2,3-cd)pyrene	280.00	J	
S-3	Phenanthrene	1,300.00		
S-3	Pyrene	1,500.00		
S-3	TOTAL SEMI VOC			9,260.00
S-4	Acenaphthene	430.00	J	
S-4	Anthracene	760.00	J	
S-4	Benzoic acid	360.00	J	
S-4	Benzo(a)anthracene	3,400.00		
S-4	Benzo(a)pyrene	1,600.00		
S-4	Benzo(b)fluoranthene	2,900.00		
S-4	Benzo(g,h,i)perylene	290.00	J	
S-4	Benzo(k)fluoranthene	2,200.00		
S-4	bis(2-Ethylhexyl)phthalate	270.00	J	
S-4	Chrysene	3,400.00		
S-4	Dibenzofuran	230.00	J	
S-4	Di-n-butylphthalate	160.00	J	
S-4	Fluoranthene	7,900.00		
S-4	Fluorene	370.00	J	
S-4	Indeno(1,2,3-cd)pyrene	1,100.00		
S-4	Naphthalene	170.00	J	
S-4	Phenanthrene	4,600.00		
S-4	Pyrene	4,800.00		
S-4	TOTAL SEMI VOC			34,940.00

NOTES:

J: Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.

B: This flag is used when the analyte is found in the associated blank as well as in the sample.

TABLE 7-12 (CONTINUED)
SUMMARY OF DETECTED ORGANIC CONSTITUENTS IN STREAM SEDIMENT SAMPLES - BERGHOLTZ CREEK
(CLP DATA - 1990)

SAMPLING POINT	PARAMETER	CONC (ug/Kg)	QUAL CODE	TOTAL (ug/Kg)
PESTICIDES SND PCB's				
S-3	Aroclor-1254	200.00	J	
S-3	TOTAL PCB's			200.00

NOTES:

J: Indicates an estimated value. This flag is used when the mass spectral data indicates the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.

B: This flag is used when the analyte is found in the associated blank as well as in the sample.

TABLE 7-13A
SUMMARY OF DETECTED PARAMETERS IN THE SOIL SAMPLES SORTED BY SAMPLING POINT

SAMPLING POINT AND DEPTH OF SAMPLE	ANALYTICAL METHOD	PARAMETER	UNITS	CONC	TOTAL
#S1D 2'-4'	Method 8240	1,2-Dichloroethene^(cis/trans)	ug/kg	27.00	
#S1D 2'-4'	Method 8240	Acetone	ug/kg	34.00	
#S1D 2'-4'	Method 8240	Trichloroethene	ug/kg	220.00	
#S1D 2'-4'	Method 8240	TOTAL VOC	ug/kg		281
#S1S 6"-18"	Method 8080	Aldrin	ug/kg	26.00	
#S1S 6"-18"	Method 8080	Aroclor 1254	ug/kg	1100.00	
#S1S 6"-18"	Method 8080	beta-BHC	ug/kg	74.00	
#S1S 6"-18"	Method 8080	TOTAL PESTICIDES AND PCB's	ug/kg		1200
#S1S 6"-18"	Method 8270	Benzo(a)anthracene	ug/kg	960.00	
#S1S 6"-18"	Method 8270	Benzo(a)pyrene	ug/kg	1100.00	
#S1S 6"-18"	Method 8270	Benzo(b)fluoranthene	ug/kg	1400.00	
#S1S 6"-18"	Method 8270	Benzo(g,h,i)perylene	ug/kg	510.00	
#S1S 6"-18"	Method 8270	Benzo(k)fluoranthene	ug/kg	1100.00	
#S1S 6"-18"	Method 8270	Chrysene	ug/kg	1100.00	
#S1S 6"-18"	Method 8270	Fluoranthene	ug/kg	1600.00	
#S1S 6"-18"	Method 8270	Indeno(1,2,3-cd)pyrene	ug/kg	490.00	
#S1S 6"-18"	Method 8270	Pyrene	ug/kg	1200.00	
#S1S 6"-18"	Method 8270	TOTAL SEMI VOC	ug/kg		9460
#S2D 2'-4'	Method 8080	Aroclor 1254	ug/kg	290.00	
#S2D 2'-4'	Method 8080	TOTAL PESTICIDES AND PCB's	ug/kg		290
#S2D 2'-4'	Method 8240	Acetone	ug/kg	29.00	
#S2D 2'-4'	Method 8240	TOTAL VOC	ug/kg		29

TABLE 7-13A (CONTINUED)
SUMMARY OF DETECTED PARAMETERS
IN THE SOIL SAMPLES
SORTED BY SAMPLING POINT

SAMPLING POINT AND DEPTH OF SAMPLE	ANALYTICAL METHOD	PARAMETER	UNITS	CONC	TOTAL
#S2S 6″-18″	Method 8080	Aroclor 1254	ug/kg	690.00	
#S2S 6″-18″	Method 8080	Aroclor 1260	ug/kg	430.00	
#S2S 6″-18″	Method 8080	TOTAL PESTICIDES AND PCB's	ug/kg		1120
#S2S 6″-18″	Method 8240	Acetone	ug/kg	12.00	
#S2S 6″-18″	Method 8240	TOTAL VOC	ug/kg		12
#S2S 6″-18″	Method 8270	Di-n-octyl phthalate	ug/kg	2500.00	
#S2S 6″-18″	Method 8270	TOTAL SEMI VOC	ug/kg		2500
#S3D 2'-4'	Method 8240	2-Butanone	ug/kg	81.00	
#S3D 2'-4'	Method 8240	Acetone	ug/kg	310.00	
#S3D 2'-4'	Method 8240	Carbon disulfide	ug/kg	12.00	
#S3D 2'-4'	Method 8240	TOTAL VOC	ug/kg		403
#S3S 8″-20″	Method 8240	Acetone	ug/kg	13.00	
#S3S 8″-20″	Method 8240	TOTAL VOC	ug/kg		13
#S3S 8″-20″	Method 8270	Fluoranthene	ug/kg	410.00	
#S3S 8″-20″	Method 8270	TOTAL SEMI VOC	ug/kg		410
#S4D 2'-4'	Method 8240	2-Butanone	ug/kg	200.00	
#S4D 2'-4'	Method 8240	Acetone	ug/kg	840.00	
#S4D 2'-4'	Method 8240	Methylene chloride	ug/kg	1700.00	
#S4D 2'-4'	Method 8240	TOTAL VOC	ug/kg		2740
#S4S 6″-18″	Method 8240	Acetone	ug/kg	36.00	
#S4S 6″-18″	Method 8240	Methylene chloride	ug/kg	6.80	
#S4S 6″-18″	Method 8240	Trichloroethene	ug/kg	37.00	
#S4S 6″-18″	Method 8240	TOTAL VOC	ug/kg		79.8

TABLE 7-13A (CONTINUED)
SUMMARY OF DETECTED PARAMETERS
IN THE SOIL SAMPLES
SORTED BY SAMPLING POINT

SAMPLING POINT AND DEPTH OF SAMPLE	ANALYTICAL METHOD	PARAMETER	UNITS	CONC	TOTAL
#S5D 2'-4'	Method 8240	2-Butanone	ug/kg	11.00	
#S5D 2'-4'	Method 8240	Acetone	ug/kg	85.00	
#S5D 2'-4'	Method 8240	Trichloroethene	ug/kg	14.00	
#S5D 2'-4'	Method 8240	TOTAL VOC	ug/kg		110
#S5S 12"-24"	Method 8240	Acetone	ug/kg	10.00	
#S5S 12"-24"	Method 8240	Trichloroethene	ug/kg	16.00	
#S5S 12"-24"	Method 8240	TOTAL VOC	ug/kg		26
#S5S 12"-24"	Method 8270	Benzo(a)anthracene	ug/kg	1000.00	
#S5S 12"-24"	Method 8270	Benzo(a)pyrene	ug/kg	710.00	
#S5S 12"-24"	Method 8270	Benzo(b)fluoranthene	ug/kg	1000.00	
#S5S 12"-24"	Method 8270	Benzo(g,h,i)perylene	ug/kg	440.00	
#S5S 12"-24"	Method 8270	Benzo(k)fluoranthene	ug/kg	640.00	
#S5S 12"-24"	Method 8270	Chrysene	ug/kg	850.00	
#S5S 12"-24"	Method 8270	Fluoranthene	ug/kg	2500.00	
#S5S 12"-24"	Method 8270	Indeno(1,2,3-cd)pyrene	ug/kg	430.00	
#S5S 12"-24"	Method 8270	Phenanthrene	ug/kg	1800.00	
#S5S 12"-24"	Method 8270	Pyrene	ug/kg	2100.00	
#S5S 12"-24"	Method 8270	TOTAL SEMI VOC	ug/kg		11470
#S6D 2'-4'	Method 8240	2-Butanone	ug/kg	74.00	
#S6D 2'-4'	Method 8240	Acetone	ug/kg	350.00	
#S6D 2'-4'	Method 8240	Methylene chloride	ug/kg	8.80	
#S6D 2'-4'	Method 8240	TOTAL VOC	ug/kg		432.8

TABLE 7-13A (CONTINUED)
SUMMARY OF DETECTED PARAMETERS IN THE SOIL SAMPLES SORTED BY SAMPLING POINT

SAMPLING POINT AND DEPTH OF SAMPLE	ANALYTICAL METHOD	PARAMETER	UNITS	CONC	TOTAL
#S6S 6″-18″	Method 8270	Benzo(a)anthracene	ug/kg	930.00	
#S6S 6″-18″	Method 8270	Benzo(a)pyrene	ug/kg	670.00	
#S6S 6″-18″	Method 8270	Benzo(b)fluoranthene	ug/kg	820.00	
#S6S 6″-18″	Method 8270	Benzo(g,h,i)perylene	ug/kg	460.00	
#S6S 6″-18″	Method 8270	Benzo(k)fluoranthene	ug/kg	700.00	
#S6S 6″-18″	Method 8270	Chrysene	ug/kg	920.00	
#S6S 6″-18″	Method 8270	Fluoranthene	ug/kg	1800.00	
#S6S 6″-18″	Method 8270	Indeno(1,2,3-cd)pyrene	ug/kg	400.00	
#S6S 6″-18″	Method 8270	Phenanthrene	ug/kg	480.00	
#S6S 6″-18″	Method 8270	Pyrene	ug/kg	1700.00	
#S6S 6″-18″	Method 8270	TOTAL SEMI VOC	ug/kg		8880
#S7D 2′-4′	Method 8080	Aroclor 1254	ug/kg	240.00	
#S7D 2′-4′	Method 8080	TOTAL PESTICIDES AND PCB's	ug/kg		240
#S7D 2′-4′	Method 8240	1,2-Dichloroethene^(cis/trans)	ug/kg	5.80	
#S7D 2′-4′	Method 8240	Acetone	ug/kg	17.00	
#S7D 2′-4′	Method 8240	Trichloroethene	ug/kg	20.00	
#S7D 2′-4′	Method 8240	TOTAL VOC	ug/kg		42.8
#S7D 2′-4′	Method 8270	Anthracene	ug/kg	500.00	
#S7D 2′-4′	Method 8270	Benzo(a)anthracene	ug/kg	1400.00	
#S7D 2′-4′	Method 8270	Benzo(a)pyrene	ug/kg	1400.00	
#S7D 2′-4′	Method 8270	Benzo(b)fluoranthene	ug/kg	1500.00	
#S7D 2′-4′	Method 8270	Benzo(k)fluoranthene	ug/kg	1300.00	
#S7D 2′-4′	Method 8270	Chrysene	ug/kg	1300.00	
#S7D 2′-4′	Method 8270	Fluoranthene	ug/kg	2600.00	
#S7D 2′-4′	Method 8270	Fluorene	ug/kg	410.00	
#S7D 2′-4′	Method 8270	Indeno(1,2,3-cd)pyrene	ug/kg	670.00	
#S7D 2′-4′	Method 8270	Phenanthrene	ug/kg	2200.00	
#S7D 2′-4′	Method 8270	Pyrene	ug/kg	2600.00	
#S7D 2′-4′	Method 8270	TOTAL SEMI VOC	ug/kg		15880

TABLE 7-13A (CONTINUED)
SUMMARY OF DETECTED PARAMETERS
IN THE SOIL SAMPLES
SORTED BY SAMPLING POINT

SAMPLING POINT AND DEPTH OF SAMPLE	ANALYTICAL METHOD	PARAMETER	UNITS	CONC	TOTAL
#S7S 16"-22"	Method 8240	Acetone	ug/kg	26.00	
#S7S 16"-22"	Method 8240	Trichloroethene	ug/kg	8.30	
#S7S 16"-22"	Method 8240	TOTAL VOC	ug/kg		34.3
#S8D 2'-4'	Method 8240	1,1,1-Trichloroethane	ug/kg	63000.00	
#S8D 2'-4'	Method 8240	Trichloroethene	ug/kg	18000.00	
#S8D 2'-4'	Method 8240	TOTAL VOC	ug/kg		81000
#S9D 2'-4'	Method 8240	2-Butanone	ug/kg	23.00	
#S9D 2'-4'	Method 8240	Acetone	ug/kg	120.00	
#S9D 2'-4'	Method 8240	Ethylbenzene	ug/kg	9.80	
#S9D 2'-4'	Method 8240	Trichloroethene	ug/kg	6.90	
#S9D 2'-4'	Method 8240	TOTAL VOC	ug/kg		159.7
#S9S 6"-18"	Method 8080	Aroclor 1254	ug/kg	2400.00	
#S9S 6"-18"	Method 8080	TOTAL PESTICIDES AND PCB's	ug/kg		2400
#S9S 6"-18"	Method 8240	1,1,1-Trichloroethane	ug/kg	5.30	
#S9S 6"-18"	Method 8240	Methylene chloride	ug/kg	5.40	
#S9S 6"-18"	Method 8240	Trichloroethene	ug/kg	33.00	
#S9S 6"-18"	Method 8240	TOTAL VOC	ug/kg		43.7
#S9S 6"-18"	Method 8270	Benzo(g,h,i)perylene	ug/kg	340.00	
#S9S 6"-18"	Method 8270	Fluoranthene	ug/kg	590.00	
#S9S 6"-18"	Method 8270	Phenanthrene	ug/kg	520.00	
#S9S 6"-18"	Method 8270	Pyrene	ug/kg	620.00	
#S9S 6"-18"	Method 8270	TOTAL SEMI VOC	ug/kg		2070

TABLE 7-13A (CONTINUED)
SUMMARY OF DETECTED PARAMETERS
IN THE SOIL SAMPLES
SORTED BY SAMPLING POINT

SAMPLING POINT AND DEPTH OF SAMPLE	ANALYTICAL METHOD	PARAMETER	UNITS	CONC	TOTAL
#S10D 2'-4'	Method 8240	2-Butanone	ug/kg	74.00	
#S10D 2'-4'	Method 8240	Acetone	ug/kg	330.00	
#S10D 2'-4'	Method 8240	TOTAL VOC	ug/kg		404
#S10D 2'-4'	Method 8270	Anthracene	ug/kg	730.00	
#S10D 2'-4'	Method 8270	Benzo(a)anthracene	ug/kg	3800.00	
#S10D 2'-4'	Method 8270	Benzo(a)pyrene	ug/kg	2600.00	
#S10D 2'-4'	Method 8270	Benzo(b)fluoranthene	ug/kg	3300.00	
#S10D 2'-4'	Method 8270	Benzo(g,h,i)perylene	ug/kg	810.00	
#S10D 2'-4'	Method 8270	Benzo(k)fluoranthene	ug/kg	2600.00	
#S10D 2'-4'	Method 8270	Chrysene	ug/kg	4000.00	
#S10D 2'-4'	Method 8270	Fluoranthene	ug/kg	8200.00	
#S10D 2'-4'	Method 8270	Indeno(1,2,3-cd)pyrene	ug/kg	940.00	
#S10D 2'-4'	Method 8270	Phenanthrene	ug/kg	4000.00	
#S10D 2'-4'	Method 8270	Pyrene	ug/kg	6200.00	
#S10D 2'-4'	Method 8270	TOTAL SEMI VOC	ug/kg		37180
#S10S 6"-18"	Method 8240	Acetone	ug/kg	13.00	
#S10S 6"-18"	Method 8240	TOTAL VOC	ug/kg		13
#S10S 6"-18"	Method 8270	Benzo(a)anthracene	ug/kg	1700.00	
#S10S 6"-18"	Method 8270	Benzo(a)pyrene	ug/kg	1100.00	
#S10S 6"-18"	Method 8270	Benzo(b)fluoranthene	ug/kg	1400.00	
#S10S 6"-18"	Method 8270	Benzo(g,h,i)perylene	ug/kg	370.00	
#S10S 6"-18"	Method 8270	Benzo(k)fluoranthene	ug/kg	1200.00	
#S10S 6"-18"	Method 8270	Chrysene	ug/kg	1700.00	
#S10S 6"-18"	Method 8270	Fluoranthene	ug/kg	3600.00	
#S10S 6"-18"	Method 8270	Indeno(1,2,3-cd)pyrene	ug/kg	420.00	
#S10S 6"-18"	Method 8270	Phenanthrene	ug/kg	1700.00	
#S10S 6"-18"	Method 8270	Pyrene	ug/kg	3000.00	
#S10S 6"-18"	Method 8270	TOTAL SEMI VOC	ug/kg		16190

TABLE 7-13A (CONTINUED)
SUMMARY OF DETECTED PARAMETERS
IN THE SOIL SAMPLES
SORTED BY SAMPLING POINT

SAMPLING POINT AND DEPTH OF SAMPLE	ANALYTICAL METHOD	PARAMETER	UNITS	CONC	TOTAL
#S11D 2.0'-4.0'	Method 8240	2-Butanone	ug/kg	10.00	
#S11D 2.0'-4.0'	Method 8240	Acetone	ug/kg	46.00	
#S11D 2.0'-4.0'	Method 8240	TOTAL VOC	ug/kg		56
#S11D 2.0'-4.0'	Method 8270	Fluoranthene	ug/kg	430.00	
#S11D 2.0'-4.0'	Method 8270	Phenanthrene	ug/kg	380.00	
#S11D 2.0'-4.0'	Method 8270	Pyrene	ug/kg	340.00	
#S11D 2.0'-4.0'	Method 8270	TOTAL SEMI VOC	ug/kg		1150
#S11S 6"-18"	Method 8080	Aroclor 1260	ug/kg	180.00	
#S11S 6"-18"	Method 8080	TOTAL PESTICIDES AND PCB's	ug/kg		180
#S11S 6"-18"	Method 8240	Acetone	ug/kg	45.00	
#S11S 6"-18"	Method 8240	TOTAL VOC	ug/kg		45
EQIUPMENT BLANK #2	Method 8240	2-Butanone (MEK)	ug/L	52.00	
EQIUPMENT BLANK #2	Method 8240	Acetone	ug/L	25.00	
EQIUPMENT BLANK #2	Method 8240	TOTAL VOC	ug/L		77
Equipment blank 3"	Method 8240	2-Butanone (MEK)	ug/L	55.00	
Equipment blank 3"	Method 8240	Acetone	ug/L	24.00	
Equipment blank 3"	Method 8240	TOTAL VOC	ug/L		79

TABLE 7-13B
SUMMARY OF DETECTED PARAMETERS
IN THE SOIL SAMPLES
SORTED BY PARAMETER

SAMPLING POINT AND DEPTH OF SAMPLE	ANALYTICAL METHOD	PARAMETER	UNITS	CONC
PESTICIDES AND PCB's				
#S1S 6"-18"	Method 8080	Aldrin	ug/kg	26.00
#S9S 6"-18"	Method 8080	Aroclor 1254	ug/kg	2400.00
#S1S 6"-18"	Method 8080	Aroclor 1254	ug/kg	1100.00
#S2S 6"-18"	Method 8080	Aroclor 1254	ug/kg	690.00
#S2S 6"-18"	Method 8080	Aroclor 1260	ug/kg	430.00
#S2D 2'-4'	Method 8080	Aroclor 1254	ug/kg	290.00
#S7D 2'-4'	Method 8080	Aroclor 1254	ug/kg	240.00
#S11S 6"-18"	Method 8080	Aroclor 1260	ug/kg	180.00
#S1S 6"-18"	Method 8080	beta-BHC	ug/kg	74.00
#S9S 6"-18"	Method 8080	TOTAL PESTICIDES AND PCB's	ug/kg	2400.00
#S1S 6"-18"	Method 8080	TOTAL PESTICIDES AND PCB's	ug/kg	1200.00
#S2S 6"-18"	Method 8080	TOTAL PESTICIDES AND PCB's	ug/kg	1120.00
#S2D 2'-4'	Method 8080	TOTAL PESTICIDES AND PCB's	ug/kg	290.00
#S7D 2'-4'	Method 8080	TOTAL PESTICIDES AND PCB's	ug/kg	240.00
#S11S 6"-18"	Method 8080	TOTAL PESTICIDES AND PCB's	ug/kg	180.00

TABLE 7-13B (CONTINUED)
SUMMARY OF DETECTED PARAMETERS IN THE SOIL SAMPLES SORTED BY PARAMETER

SAMPLING POINT AND DEPTH OF SAMPLE	ANALYTICAL METHOD	PARAMETER	UNITS	CONC
VOLATILE ORGANIC COMPOUNDS				
#S8D 2'-4'	Method 8240	1,1,1-Trichloroethane	ug/kg	63000.00
#S9S 6"-18"	Method 8240	1,1,1-Trichloroethane	ug/kg	5.30
#S1D 2'-4'	Method 8240	1,2-Dichloroethene^(cis/trans)	ug/kg	27.00
#S7D 2'-4'	Method 8240	1,2-Dichloroethene^(cis/trans)	ug/kg	5.80
#S4D 2'-4'	Method 8240	2-Butanone	ug/kg	200.00
#S3D 2'-4'	Method 8240	2-Butanone	ug/kg	81.00
#S6D 2'-4'	Method 8240	2-Butanone	ug/kg	74.00
#S10D 2'-4'	Method 8240	2-Butanone	ug/kg	74.00
#S9D 2'-4'	Method 8240	2-Butanone	ug/kg	23.00
#S5D 2'-4'	Method 8240	2-Butanone	ug/kg	11.00
#S11D 2.0'-4.0'	Method 8240	2-Butanone	ug/kg	10.00
Equipment blank 3"	Method 8240	2-Butanone (MEK)	ug/L	55.00
EQIUPMENT BLANK #2	Method 8240	2-Butanone (MEK)	ug/L	52.00
#S4D 2'-4'	Method 8240	Acetone	ug/kg	840.00
#S6D 2'-4'	Method 8240	Acetone	ug/kg	350.00
#S10D 2'-4'	Method 8240	Acetone	ug/kg	330.00
#S3D 2'-4'	Method 8240	Acetone	ug/kg	310.00
#S9D 2'-4'	Method 8240	Acetone	ug/kg	120.00
#S5D 2'-4'	Method 8240	Acetone	ug/kg	85.00
#S11D 2.0'-4.0'	Method 8240	Acetone	ug/kg	46.00
#S11S 6"-18"	Method 8240	Acetone	ug/kg	45.00
#S4S 6"-18"	Method 8240	Acetone	ug/kg	36.00
#S1D 2'-4'	Method 8240	Acetone	ug/kg	34.00
#S2D 2'-4'	Method 8240	Acetone	ug/kg	29.00
#S7S 16"-22"	Method 8240	Acetone	ug/kg	26.00
#S7D 2'-4'	Method 8240	Acetone	ug/kg	17.00

TABLE 7-13B (CONTINUED)
SUMMARY OF DETECTED PARAMETERS
IN THE SOIL SAMPLES
SORTED BY PARAMETER

SAMPLING POINT AND DEPTH OF SAMPLE	ANALYTICAL METHOD	PARAMETER	UNITS	CONC
#S10S 6″-18″	Method 8240	Acetone	ug/kg	13.00
#S3S 8″-20″	Method 8240	Acetone	ug/kg	13.00
#S2S 6″-18″	Method 8240	Acetone	ug/kg	12.00
#S5S 12″-24″	Method 8240	Acetone	ug/kg	10.00
EQIUPMENT BLANK #2	Method 8240	Acetone	ug/L	25.00
Equipment blank 3″	Method 8240	Acetone	ug/L	24.00
#S3D 2'-4'	Method 8240	Carbon disulfide	ug/kg	12.00
#S9D 2'-4'	Method 8240	Ethylbenzene	ug/kg	9.80
#S4D 2'-4'	Method 8240	Methylene chloride	ug/kg	1700.00
#S6D 2'-4'	Method 8240	Methylene chloride	ug/kg	8.80
#S4S 6″-18″	Method 8240	Methylene chloride	ug/kg	6.80
#S9S 6″-18″	Method 8240	Methylene chloride	ug/kg	5.40
#S8D 2'-4'	Method 8240	Trichloroethene	ug/kg	18000.00
#S1D 2'-4'	Method 8240	Trichloroethene	ug/kg	220.00
#S4S 6″-18″	Method 8240	Trichloroethene	ug/kg	37.00
#S9S 6″-18″	Method 8240	Trichloroethene	ug/kg	33.00
#S7D 2'-4'	Method 8240	Trichloroethene	ug/kg	20.00
#S5S 12″-24″	Method 8240	Trichloroethene	ug/kg	16.00
#S5D 2'-4'	Method 8240	Trichloroethene	ug/kg	14.00
#S7S 16″-22″	Method 8240	Trichloroethene	ug/kg	8.30
#S9D 2'-4'	Method 8240	Trichloroethene	ug/kg	6.90

TABLE 7-13B (CONTINUED)
SUMMARY OF DETECTED PARAMETERS
IN THE SOIL SAMPLES
SORTED BY PARAMETER

SAMPLING POINT AND DEPTH OF SAMPLE	ANALYTICAL METHOD	PARAMETER	UNITS	CONC
#S8D 2'-4'	Method 8240	TOTAL VOC	ug/kg	81000.00
#S4D 2'-4'	Method 8240	TOTAL VOC	ug/kg	2740.00
#S6D 2'-4'	Method 8240	TOTAL VOC	ug/kg	432.80
#S10D 2'-4'	Method 8240	TOTAL VOC	ug/kg	404.00
#S3D 2'-4'	Method 8240	TOTAL VOC	ug/kg	403.00
#S1D 2'-4'	Method 8240	TOTAL VOC	ug/kg	281.00
#S9D 2'-4'	Method 8240	TOTAL VOC	ug/kg	159.70
#S5D 2'-4'	Method 8240	TOTAL VOC	ug/kg	110.00
#S4S 6"-18"	Method 8240	TOTAL VOC	ug/kg	79.80
#S11D 2.0'-4.0'	Method 8240	TOTAL VOC	ug/kg	56.00
#S11S 6"-18"	Method 8240	TOTAL VOC	ug/kg	45.00
#S9S 6"-18"	Method 8240	TOTAL VOC	ug/kg	43.70
#S7D 2'-4'	Method 8240	TOTAL VOC	ug/kg	42.80
#S7S 16"-22"	Method 8240	TOTAL VOC	ug/kg	34.30
#S2D 2'-4'	Method 8240	TOTAL VOC	ug/kg	29.00
#S5S 12"-24"	Method 8240	TOTAL VOC	ug/kg	26.00
#S10S 6"-18"	Method 8240	TOTAL VOC	ug/kg	13.00
#S3S 8"-20"	Method 8240	TOTAL VOC	ug/kg	13.00
#S2S 6"-18"	Method 8240	TOTAL VOC	ug/kg	12.00
Equipment blank 3"	Method 8240	TOTAL VOC	ug/L	79.00
EQIUPMENT BLANK #2	Method 8240	TOTAL VOC	ug/L	77.00

TABLE 7-13B (CONTINUED)
SUMMARY OF DETECTED PARAMETERS
IN THE SOIL SAMPLES
SORTED BY PARAMETER

SAMPLING POINT AND DEPTH OF SAMPLE	ANALYTICAL METHOD	PARAMETER	UNITS	CONC
SEMIVOLATILE ORGANIC COMPOUNDS				
#S10D 2'-4'	Method 8270	Anthracene	ug/kg	730.00
#S7D 2'-4'	Method 8270	Anthracene	ug/kg	500.00
#S10D 2'-4'	Method 8270	Benzo(a)anthracene	ug/kg	3800.00
#S10S 6"-18"	Method 8270	Benzo(a)anthracene	ug/kg	1700.00
#S7D 2'-4'	Method 8270	Benzo(a)anthracene	ug/kg	1400.00
#S5S 12"-24"	Method 8270	Benzo(a)anthracene	ug/kg	1000.00
#S1S 6"-18"	Method 8270	Benzo(a)anthracene	ug/kg	960.00
#S6S 6"-18"	Method 8270	Benzo(a)anthracene	ug/kg	930.00
#S10D 2'-4'	Method 8270	Benzo(a)pyrene	ug/kg	2600.00
#S7D 2'-4'	Method 8270	Benzo(a)pyrene	ug/kg	1400.00
#S1S 6"-18"	Method 8270	Benzo(a)pyrene	ug/kg	1100.00
#S10S 6"-18"	Method 8270	Benzo(a)pyrene	ug/kg	1100.00
#S5S 12"-24"	Method 8270	Benzo(a)pyrene	ug/kg	710.00
#S6S 6"-18"	Method 8270	Benzo(a)pyrene	ug/kg	670.00
#S10D 2'-4'	Method 8270	Benzo(b)fluoranthene	ug/kg	3300.00
#S7D 2'-4'	Method 8270	Benzo(b)fluoranthene	ug/kg	1500.00
#S10S 6"-18"	Method 8270	Benzo(b)fluoranthene	ug/kg	1400.00
#S1S 6"-18"	Method 8270	Benzo(b)fluoranthene	ug/kg	1400.00
#S5S 12"-24"	Method 8270	Benzo(b)fluoranthene	ug/kg	1000.00
#S6S 6"-18"	Method 8270	Benzo(b)fluoranthene	ug/kg	820.00

TABLE 7-13B (CONTINUED)
SUMMARY OF DETECTED PARAMETERS IN THE SOIL SAMPLES
SORTED BY PARAMETER

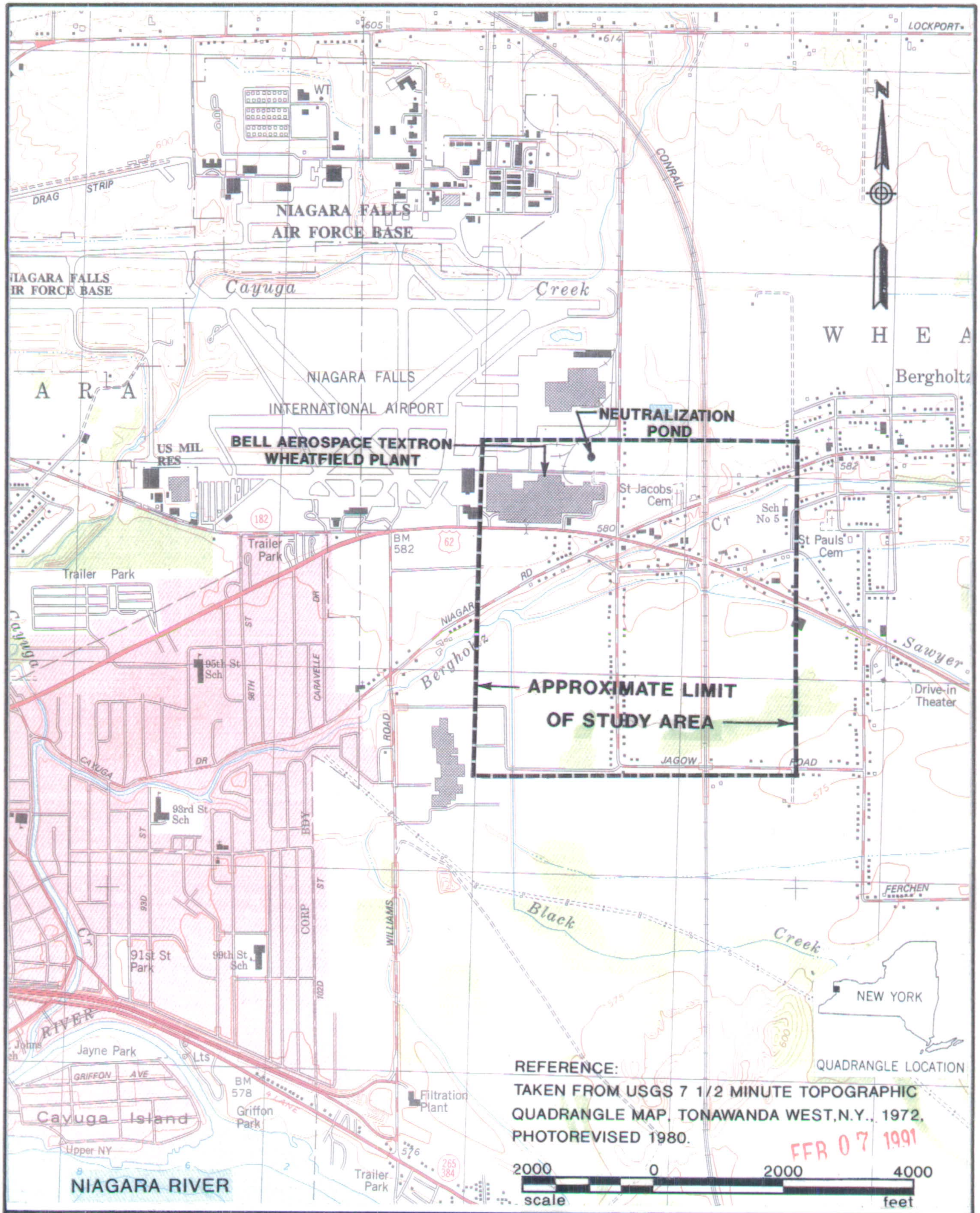
SAMPLING POINT AND DEPTH OF SAMPLE	ANALYTICAL METHOD	PARAMETER	UNITS	CONC
#S10D 2'-4'	Method 8270	Benzo(g,h,i)perylene	ug/kg	810.00
#S1S 6"-18"	Method 8270	Benzo(g,h,i)perylene	ug/kg	510.00
#S6S 6"-18"	Method 8270	Benzo(g,h,i)perylene	ug/kg	460.00
#S5S 12"-24"	Method 8270	Benzo(g,h,i)perylene	ug/kg	440.00
#S10S 6"-18"	Method 8270	Benzo(g,h,i)perylene	ug/kg	370.00
#S9S 6"-18"	Method 8270	Benzo(g,h,i)perylene	ug/kg	340.00
#S10D 2'-4'	Method 8270	Benzo(k)fluoranthene	ug/kg	2600.00
#S7D 2'-4'	Method 8270	Benzo(k)fluoranthene	ug/kg	1300.00
#S10S 6"-18"	Method 8270	Benzo(k)fluoranthene	ug/kg	1200.00
#S1S 6"-18"	Method 8270	Benzo(k)fluoranthene	ug/kg	1100.00
#S6S 6"-18"	Method 8270	Benzo(k)fluoranthene	ug/kg	700.00
#S5S 12"-24"	Method 8270	Benzo(k)fluoranthene	ug/kg	640.00
#S10D 2'-4'	Method 8270	Chrysene	ug/kg	4000.00
#S10S 6"-18"	Method 8270	Chrysene	ug/kg	1700.00
#S7D 2'-4'	Method 8270	Chrysene	ug/kg	1300.00
#S1S 6"-18"	Method 8270	Chrysene	ug/kg	1100.00
#S6S 6"-18"	Method 8270	Chrysene	ug/kg	920.00
#S5S 12"-24"	Method 8270	Chrysene	ug/kg	850.00
#S2S 6"-18"	Method 8270	Di-n-octyl phthalate	ug/kg	2500.00

TABLE 7-13B (CONTINUED)
SUMMARY OF DETECTED PARAMETERS
IN THE SOIL SAMPLES
SORTED BY PARAMETER

SAMPLING POINT AND DEPTH OF SAMPLE	ANALYTICAL METHOD	PARAMETER	UNITS	CONC
#S10D 2'-4'	Method 8270	Fluoranthene	ug/kg	8200.00
#S10S 6"-18"	Method 8270	Fluoranthene	ug/kg	3600.00
#S7D 2'-4'	Method 8270	Fluoranthene	ug/kg	2600.00
#S5S 12"-24"	Method 8270	Fluoranthene	ug/kg	2500.00
#S6S 6"-18"	Method 8270	Fluoranthene	ug/kg	1800.00
#S1S 6"-18"	Method 8270	Fluoranthene	ug/kg	1600.00
#S9S 6"-18"	Method 8270	Fluoranthene	ug/kg	590.00
#S11D 2.0'-4.0'	Method 8270	Fluoranthene	ug/kg	430.00
#S3S 8"-20"	Method 8270	Fluoranthene	ug/kg	410.00
#S7D 2'-4'	Method 8270	Fluorene	ug/kg	410.00
#S10D 2'-4'	Method 8270	Indeno(1,2,3-cd)pyrene	ug/kg	940.00
#S7D 2'-4'	Method 8270	Indeno(1,2,3-cd)pyrene	ug/kg	670.00
#S1S 6"-18"	Method 8270	Indeno(1,2,3-cd)pyrene	ug/kg	490.00
#S5S 12"-24"	Method 8270	Indeno(1,2,3-cd)pyrene	ug/kg	430.00
#S10S 6"-18"	Method 8270	Indeno(1,2,3-cd)pyrene	ug/kg	420.00
#S6S 6"-18"	Method 8270	Indeno(1,2,3-cd)pyrene	ug/kg	400.00
#S10D 2'-4'	Method 8270	Phenanthrene	ug/kg	4000.00
#S7D 2'-4'	Method 8270	Phenanthrene	ug/kg	2200.00
#S5S 12"-24"	Method 8270	Phenanthrene	ug/kg	1800.00
#S10S 6"-18"	Method 8270	Phenanthrene	ug/kg	1700.00
#S9S 6"-18"	Method 8270	Phenanthrene	ug/kg	520.00
#S6S 6"-18"	Method 8270	Phenanthrene	ug/kg	480.00
#S11D 2.0'-4.0'	Method 8270	Phenanthrene	ug/kg	380.00

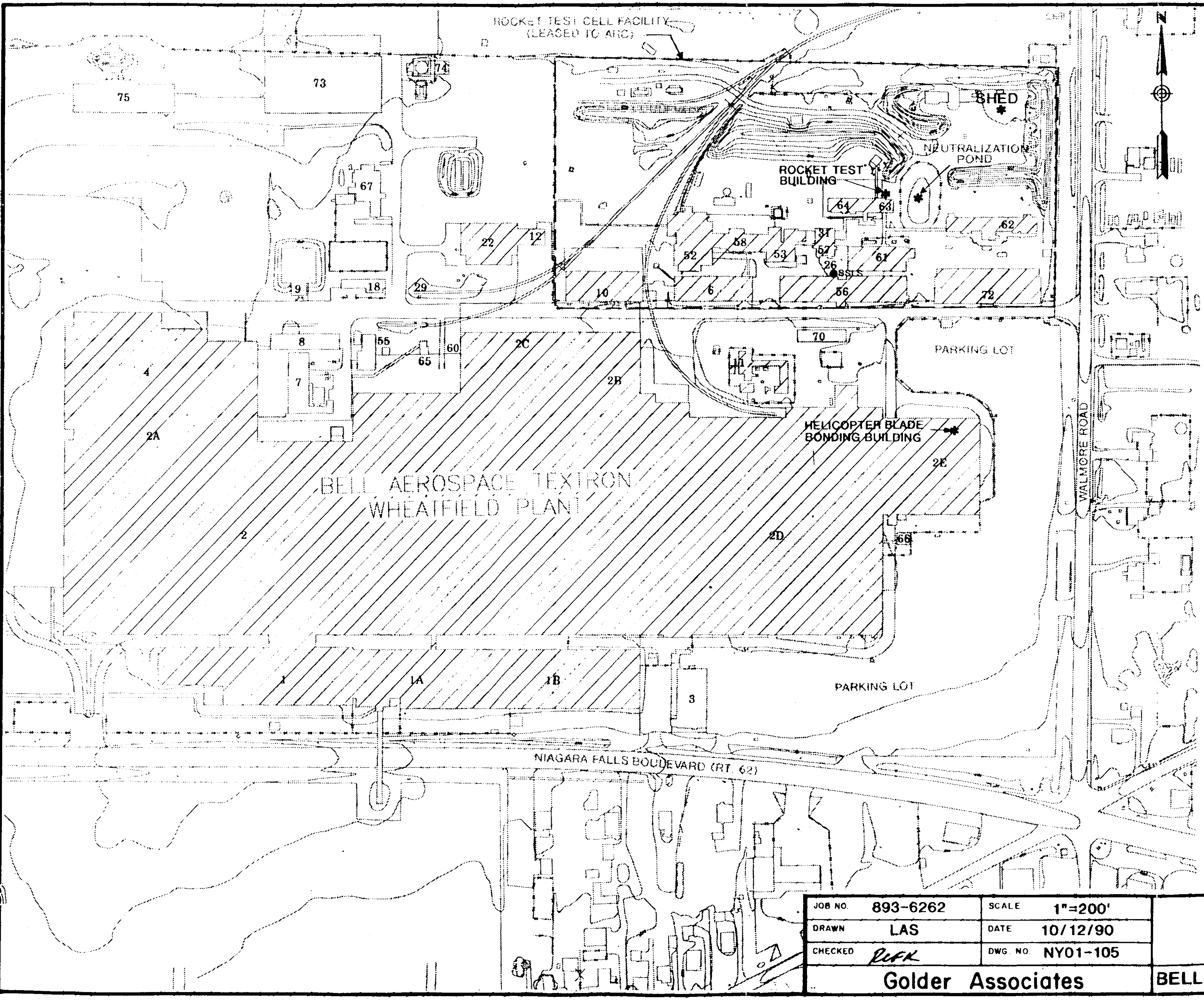
TABLE 7-13B (CONTINUED)
SUMMARY OF DETECTED PARAMETERS
IN THE SOIL SAMPLES
SORTED BY PARAMETER

SAMPLING POINT AND DEPTH OF SAMPLE	ANALYTICAL METHOD	PARAMETER	UNITS	CONC
#S10D 2'-4'	Method 8270	Pyrene	ug/kg	6200.00
#S10S 6"-18"	Method 8270	Pyrene	ug/kg	3000.00
#S7D 2'-4'	Method 8270	Pyrene	ug/kg	2600.00
#S5S 12"-24"	Method 8270	Pyrene	ug/kg	2100.00
#S6S 6"-18"	Method 8270	Pyrene	ug/kg	1700.00
#S1S 6"-18"	Method 8270	Pyrene	ug/kg	1200.00
#S9S 6"-18"	Method 8270	Pyrene	ug/kg	620.00
#S11D 2.0'-4.0'	Method 8270	Pyrene	ug/kg	340.00
#S10D 2'-4'	Method 8270	TOTAL SEMI VOC	ug/kg	37180.00
#S10S 6"-18"	Method 8270	TOTAL SEMI VOC	ug/kg	16190.00
#S7D 2'-4'	Method 8270	TOTAL SEMI VOC	ug/kg	15880.00
#S5S 12"-24"	Method 8270	TOTAL SEMI VOC	ug/kg	11470.00
#S1S 6"-18"	Method 8270	TOTAL SEMI VOC	ug/kg	9460.00
#S6S 6"-18"	Method 8270	TOTAL SEMI VOC	ug/kg	8880.00
#S2S 6"-18"	Method 8270	TOTAL SEMI VOC	ug/kg	2500.00
#S9S 6"-18"	Method 8270	TOTAL SEMI VOC	ug/kg	2070.00
#S11D 2.0'-4.0'	Method 8270	TOTAL SEMI VOC	ug/kg	1150.00
#S3S 8"-20"	Method 8270	TOTAL SEMI VOC	ug/kg	410.00



REFERENCE:
TAKEN FROM USGS 7 1/2 MINUTE TOPOGRAPHIC QUADRANGLE MAP, TONAWANDA WEST, N.Y., 1972, PHOTOREVISED 1980.

JOB No.:	893-6262	SCALE:	1"=2000'	**SITE LOCATION MAP**
DRAWN:	TLF	DATE:	10/05/90	
CHECKED:	Refk	DWG. No.:	NY01-104	
Golder Associates				BELL AEROSPACE TEXTRON FIGURE **1-1**



LEGEND

Building No.	
1	Admin. and Engineering Offices
1A	Engineering (2 floors)
1B	Engineering (3 floors)
2	Main Manufacturing
2A	Machine Shop and Cribs
2B	Foundry
2C	Maint. and Plaster Shop
2D	Manufacturing Addition
2E	Manufacturing Addition
3	Employment
4	Flight Research and Tool Room Bldg
5	Production Hangar
6	Storage and Reclamation
7	Air Compressor House
8	Oil Storage
9	Pump House
10	Automotive Garage
11	Power Station
12	Incinerator
15	Electronic Data Center
15A	A.C. Pump House
16	Fire Truck Garage
18	Lab Packs.Small Quantity Accumulation (NE Corner Only)
19	Drum Accumulation
22	Boiler House
26	Sewage Ejector
29	Gasoline Pump House (Sta. "A")
31	Rocket Maintenance Building
52	Rocket Flow Test
53	Rocket Machine Shop
54	Drum Accumulation
55	Aerodynamics Bldg.
56	Rocket Engineering Bldg.
57	Rocket Welding Bldg.
58	Rocket Test Cells A,B,C,D,S
59	Rocket Research
60	Vibration Tower & Control Room
61	Rocket Instrumentation Bldg
62	Test Cells W,X,Y,Z
63	Rocket Tank Test Bldg.
64	Test Cells H & K
65	Explosion Test Bldg.
66	Mechanical Equipment Bldg.
67	Propulsion Test Bldg
70	Rocket Area Storage Guard Houses
72	Rocket Components Test
73	ACV Test Facility
74	Rain Erosion Test Facility
75	Chemistry Laboratory

● SSLS SANITARY SEWER LIFT STATION

✱ SOLID WASTE MANAGEMENT UNITS INVESTIGATED BY NEUTRALIZATION POND STUDIES

NOTE: THE SOLID WASTE MANAGEMENT UNITS AT THE PLANT WILL BE SHOWN ON THE FINAL VERSION OF THIS FIGURE.

FEB 08 1991

JOB NO.	893-6262	SCALE	1"=200'
DRAWN	LAS	DATE	10/12/90
CHECKED	RCFK	DWG. NO.	NY01-105

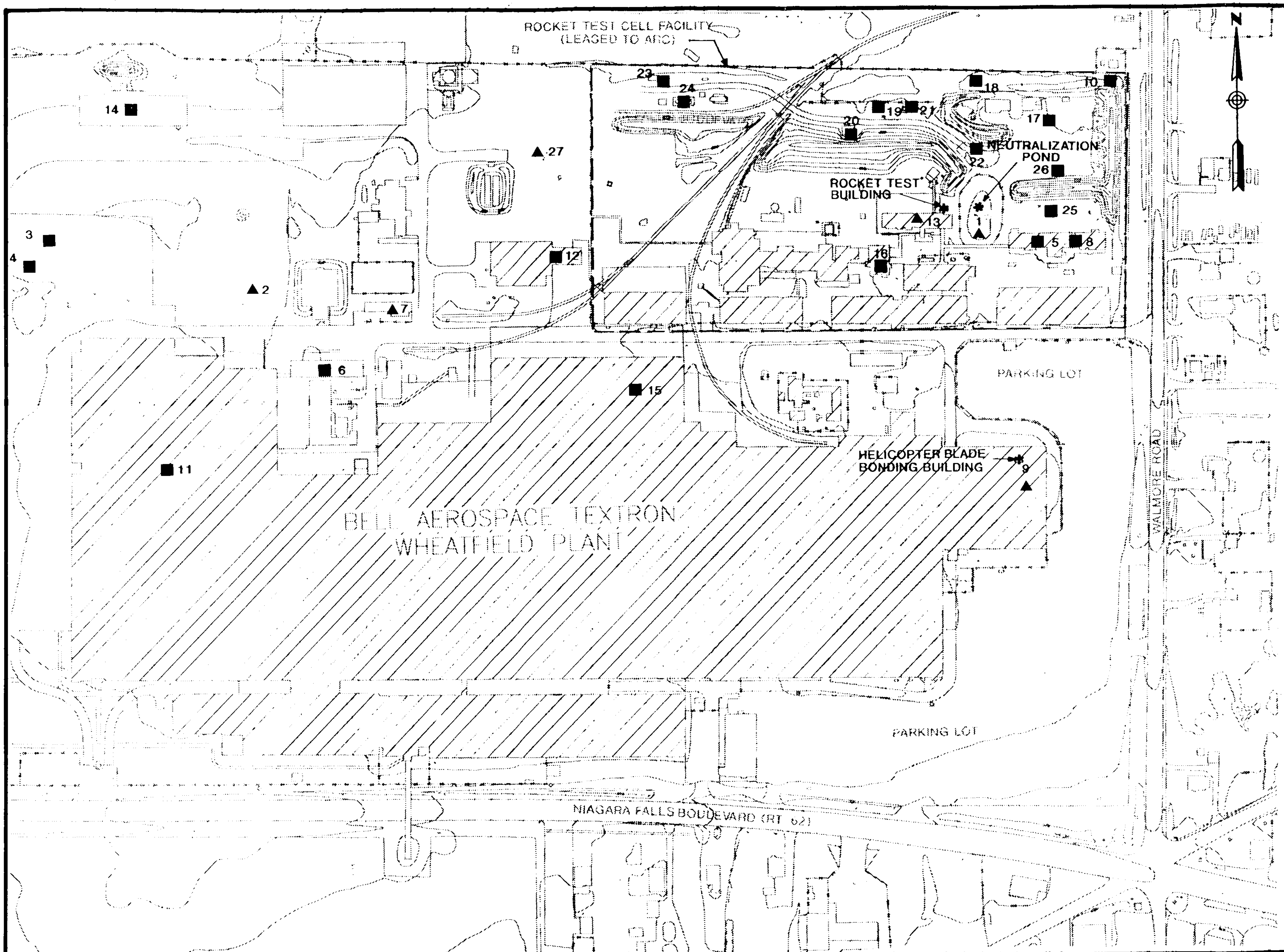
Golder Associates

FACILITY LAYOUT

BELL AEROSPACE TEXTRON

FIGURE 1-2

152110



LEGEND

Unit No.	Description	Status
1.	Neutralization Pond	RR
2.	Former Drum Storage Yard	RR
3.	Drum Accumulation	NFAR
4.	Drum Accumulation	NFAR
5.	Drum Accumulation	NFAR
6.	Drum Accumulation	NFAR
7.	Lab Pack Accumulation	RR
8.	Rock Engine Test Cells W,X,Y,Z	NFAR
9.	Helicopter Blade Bonding Building	RR
10.	Underground Transfer Lines	NFAR
11.	Underground Tanks for Aviation Gas	NFAR
12.	Incinerator	NFAR
13.	Rocket Tank Test Building	RR
14.	Chemistry Laboratory	NFAR
15.	Foundry	NFAR
16.	H Test Cells	NFAR
17.	Drum Storage Shed	NFAR
18.	Fuel Area Shed	NFAR
19.	Peroxide Catalyst Bed	NFAR
20.	Peroxide Drum Storage Area	NFAR
21.	Caustic Storage	NFAR
22.	Liquid Caustic Storage Tank	NFAR
23.	Acid Drum Storage Area	NFAR
24.	Acid Storage Tanks	NFAR
25.	Slag	NFAR
26.	Drum Storage	NFAR
27.	Drum Accumulation Boiler Houses	RR

NOTE: RR - Remediation Required
NFAR - No Further Action Required

✡	SOLID WASTE MANAGEMENT UNITS INVESTIGATED BY NEUTRALIZATION POND STUDIES
▲	SOLID WASTE MANAGEMENT UNITS REQUIRING REMEDIATION
■	SOLID WASTE MANAGEMENT UNITS REQUIRING NO FURTHER ACTION

FEB 08 1991

JOB NO	893-6262	SCALE	1"=200'
DRAWN	LAS	DATE	02/08/91
CHECKED		DWG NO.	NY01-147

Golder Associates

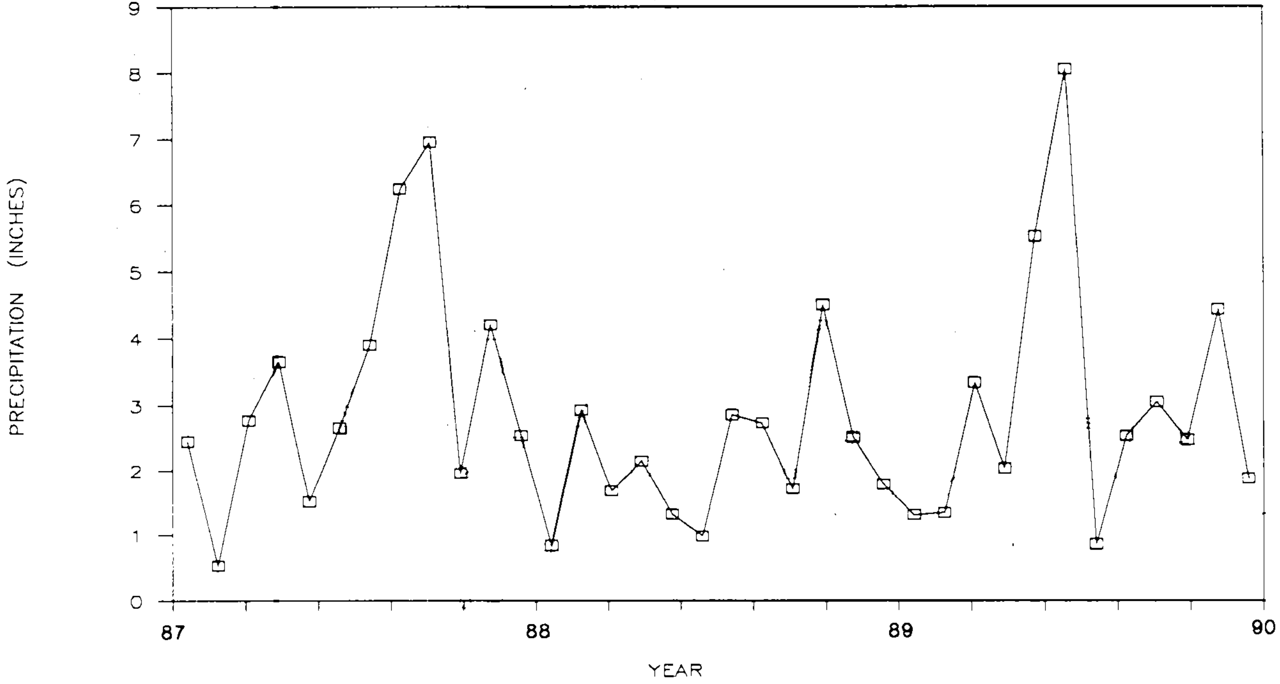
SOLID WASTE MANAGEMENT UNITS

BELL AEROSPACE TEXTRON

FIGURE **1-3**

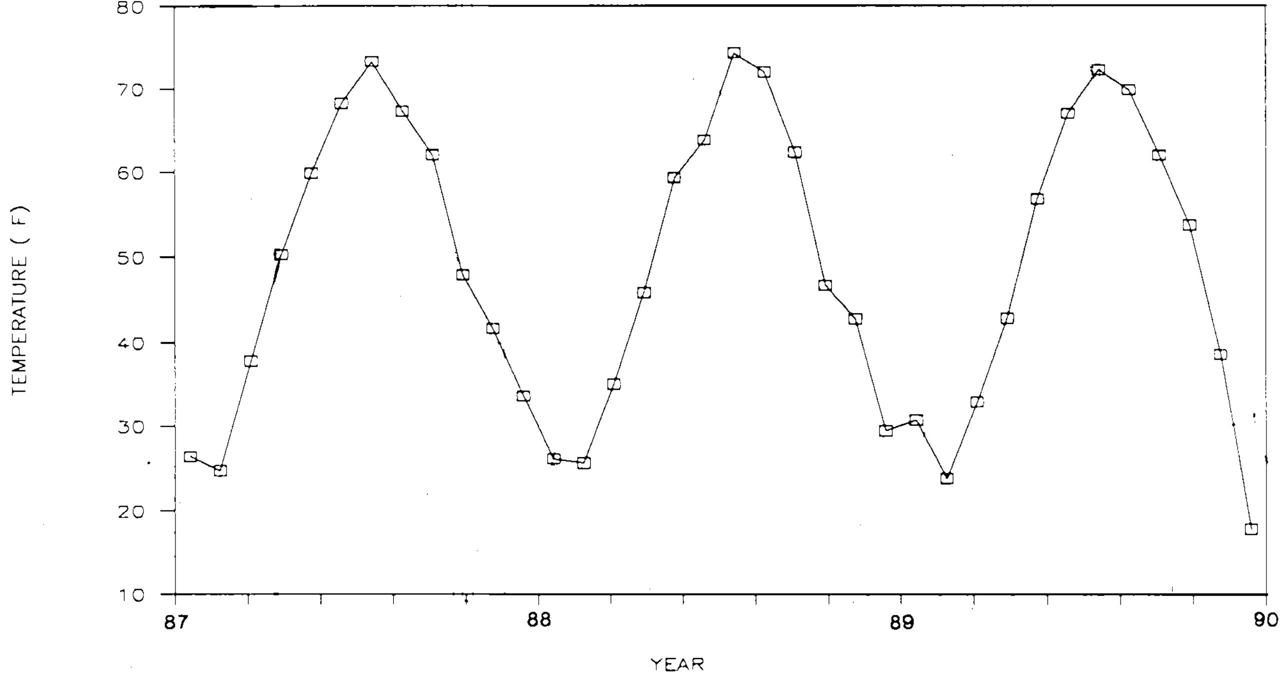
AVERAGE MONTHLY PRECIPITATION

LOCKPORT 2 NE, NIAGARA COUNTY, NY



AVERAGE MONTHLY TEMPERATURE

LOCKPORT 2 NE, NIAGARA COUNTY, NY



FEB 08 1991

JOB No.: 893-6262	SCALE: N.T.S.
DRAWN: LAS	DATE: 10/10/90
CHECKED:	DWG. No.: NY01-106

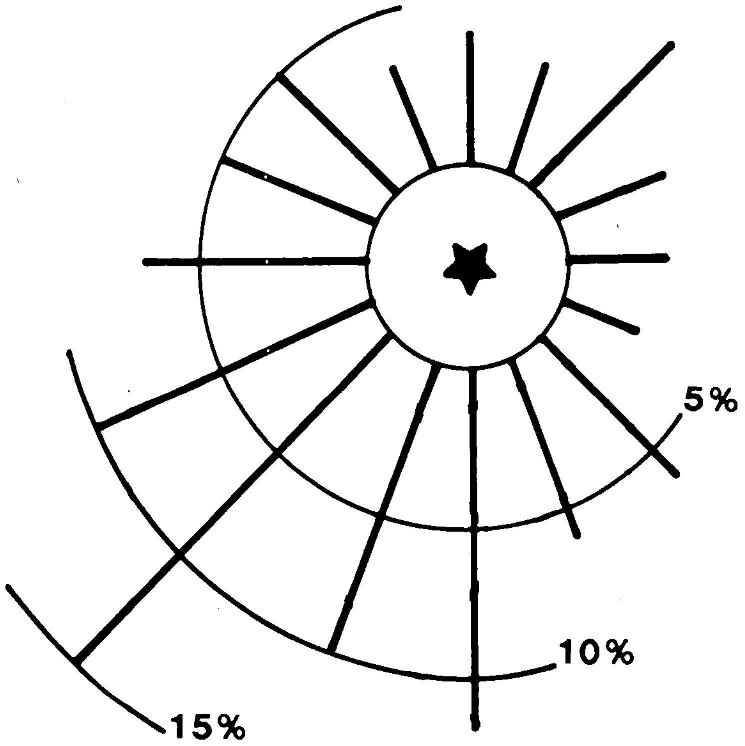
Golder Associates

AVERAGE MONTHLY PRECIPITATION AND TEMPERATURE LOCKPORT NE., NIAGARA CO.,NY

BELL AEROSPACE TEXTRON

FIGURE **2-1**

158896

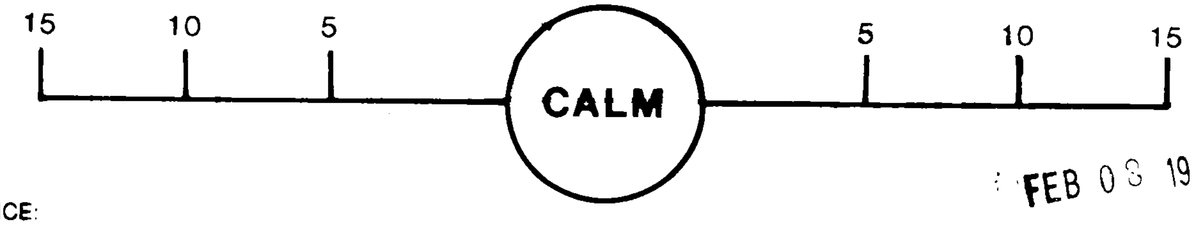


LEGEND

WIND ROSES SHOW PERCENTAGE OF TIME WIND BLEW FROM THE 16 COMPASS POINTS OR WAS CALM.

★ INDICATES LESS THAN 0.5% CALM

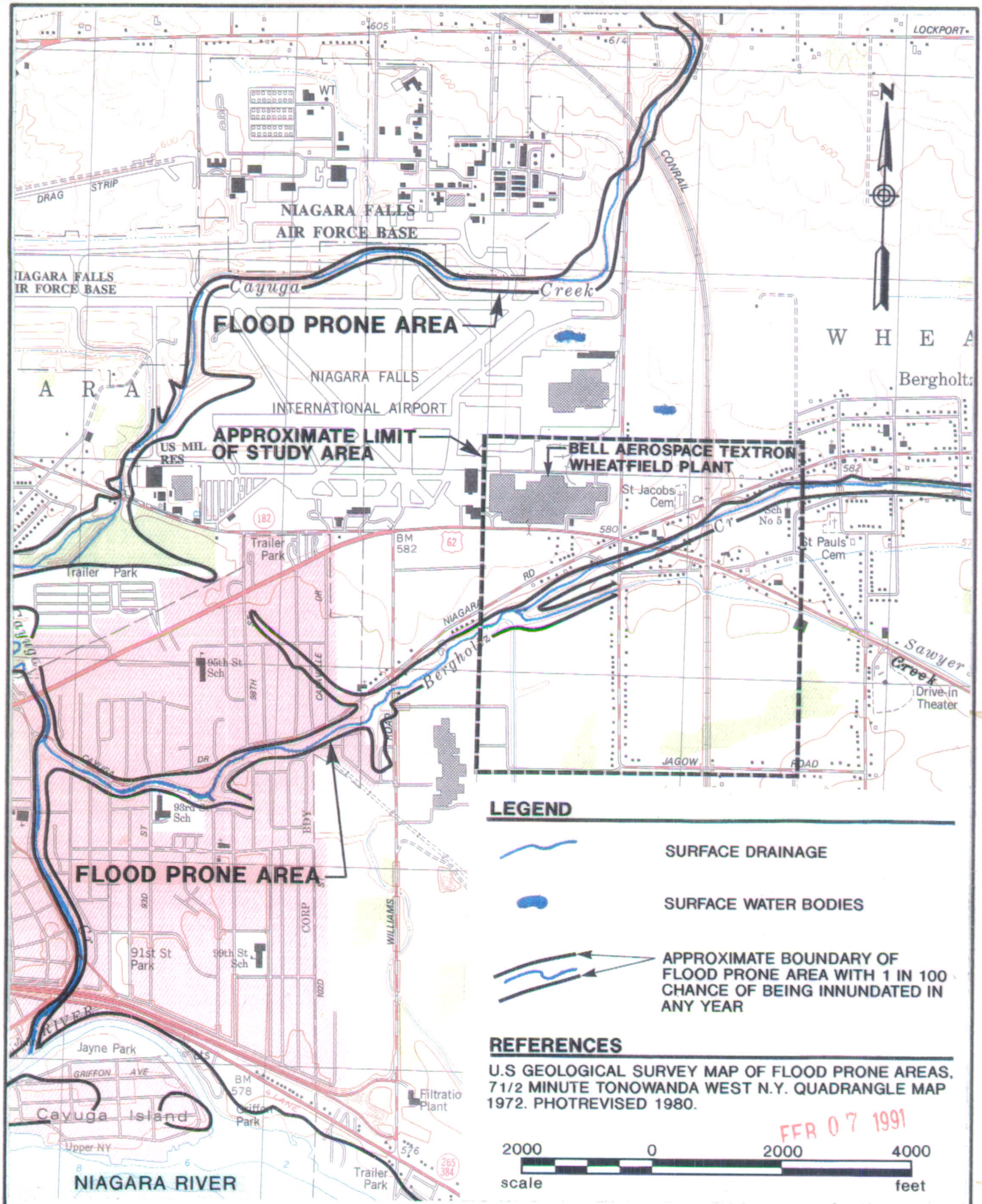
HOURLY PERCENTAGES



FEB 08 1991

REFERENCE:
CLIMATE ATLAS OF UNITED STATES, US DEPARTMENT OF COMMERCE, ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION

JOB No.:	893-6262	SCALE:	N/A	**ANNUAL SURFACE WIND ROSE BUFFALO AREA**	
DRAWN:	LAS	DATE:	10/12/90		
CHECKED:		DWG. No.:	NY01-107		
Golder Associates				BELL AEROSPACE TEXTRON	FIGURE **2-2**



LEGEND

SURFACE DRAINAGE

SURFACE WATER BODIES

APPROXIMATE BOUNDARY OF FLOOD PRONE AREA WITH 1 IN 100 CHANCE OF BEING INNUNDATED IN ANY YEAR

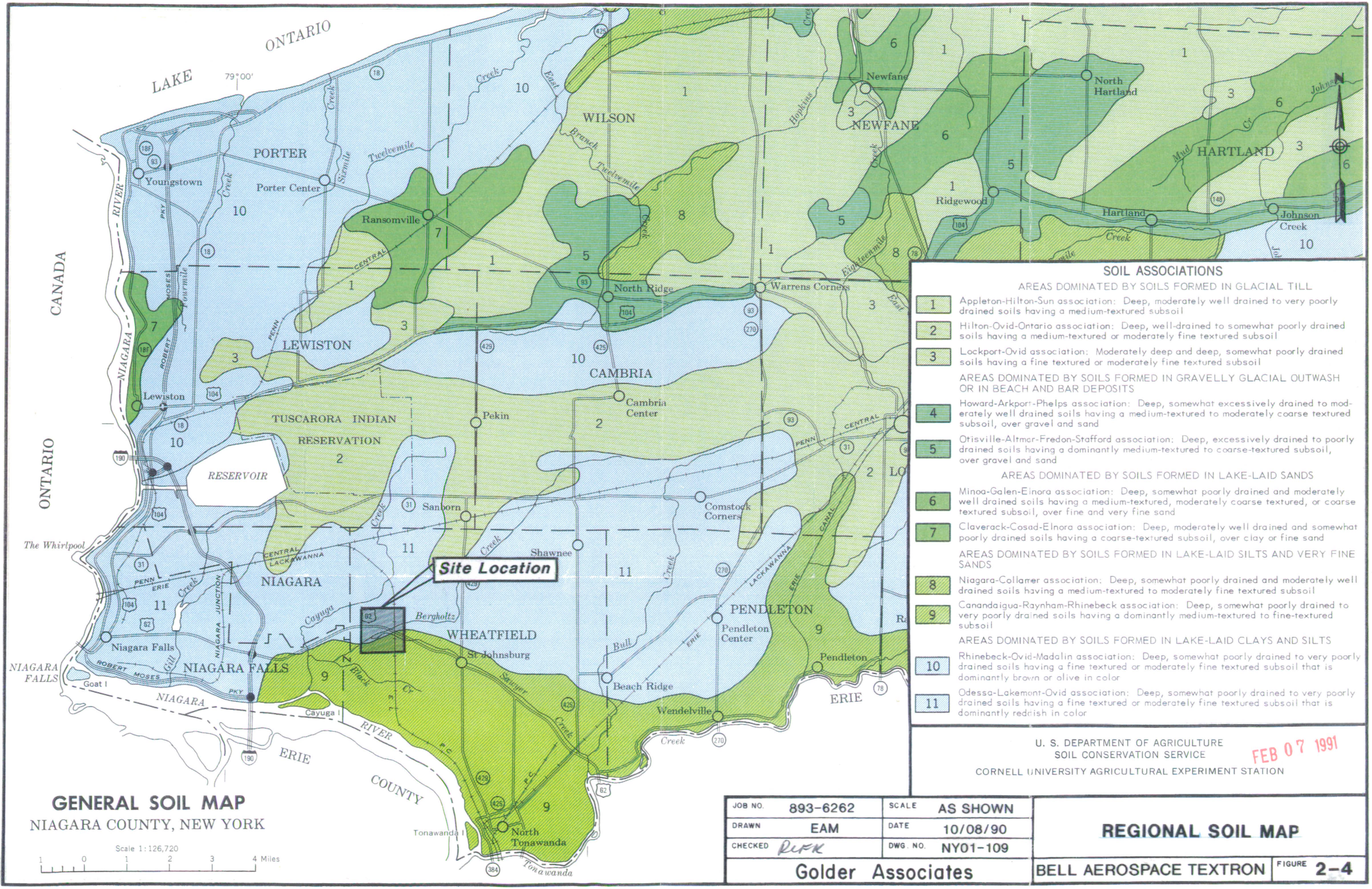
REFERENCES

U.S GEOLOGICAL SURVEY MAP OF FLOOD PRONE AREAS, 71/2 MINUTE TONOWANDA WEST N.Y. QUADRANGLE MAP 1972. PHOTREVISED 1980.

FEB 07 1991

2000 0 2000 4000
scale feet

JOB No.: 893-6262	SCALE: 1" = 2000'	**SURFACE DRAINAGE AND LIMITS OF FLOOD PRONE AREAS**
DRAWN: RDT	DATE: 10/05/90	
CHECKED: RcFK	DWG. No.: NY01-108	
Golder Associates		BELL AEROSPACE TEXTRON FIGURE **2-3**



GENERAL SOIL MAP

NIAGARA COUNTY, NEW YORK

Scale 1:126,720

1 0 1 2 3 4 Miles

152110

SOIL ASSOCIATIONS

AREAS DOMINATED BY SOILS FORMED IN GLACIAL TILL

1	Appleton-Hilton-Sun association: Deep, moderately well drained to very poorly drained soils having a medium-textured subsoil
2	Hilton-Ovid-Ontario association: Deep, well-drained to somewhat poorly drained soils having a medium-textured or moderately fine textured subsoil
3	Lockport-Ovid association: Moderately deep and deep, somewhat poorly drained soils having a fine textured or moderately fine textured subsoil

AREAS DOMINATED BY SOILS FORMED IN GRAVELLY GLACIAL OUTWASH OR IN BEACH AND BAR DEPOSITS

4	Howard-Arkport-Phelps association: Deep, somewhat excessively drained to moderately well drained soils having a medium-textured to moderately coarse textured subsoil, over gravel and sand
5	Otisville-Altmar-Fredon-Stafford association: Deep, excessively drained to poorly drained soils having a dominantly medium-textured to coarse-textured subsoil, over gravel and sand

AREAS DOMINATED BY SOILS FORMED IN LAKE-LAID SANDS

6	Minoa-Galen-Elnora association: Deep, somewhat poorly drained and moderately well drained soils having a medium-textured, moderately coarse textured, or coarse textured subsoil, over fine and very fine sand
7	Claverack-Cosad-Elnora association: Deep, moderately well drained and somewhat poorly drained soils having a coarse-textured subsoil, over clay or fine sand

AREAS DOMINATED BY SOILS FORMED IN LAKE-LAID SILTS AND VERY FINE SANDS

8	Niagara-Collamer association: Deep, somewhat poorly drained and moderately well drained soils having a medium-textured to moderately fine textured subsoil
9	Canandaigua-Raynham-Rhinebeck association: Deep, somewhat poorly drained to very poorly drained soils having a dominantly medium-textured to fine-textured subsoil

AREAS DOMINATED BY SOILS FORMED IN LAKE-LAID CLAYS AND SILTS

10	Rhinebeck-Ovid-Madalin association: Deep, somewhat poorly drained to very poorly drained soils having a fine textured or moderately fine textured subsoil that is dominantly brown or olive in color
11	Odessa-Lakemont-Ovid association: Deep, somewhat poorly drained to very poorly drained soils having a fine textured or moderately fine textured subsoil that is dominantly reddish in color

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
CORNELL UNIVERSITY AGRICULTURAL EXPERIMENT STATION

FEB 07 1991

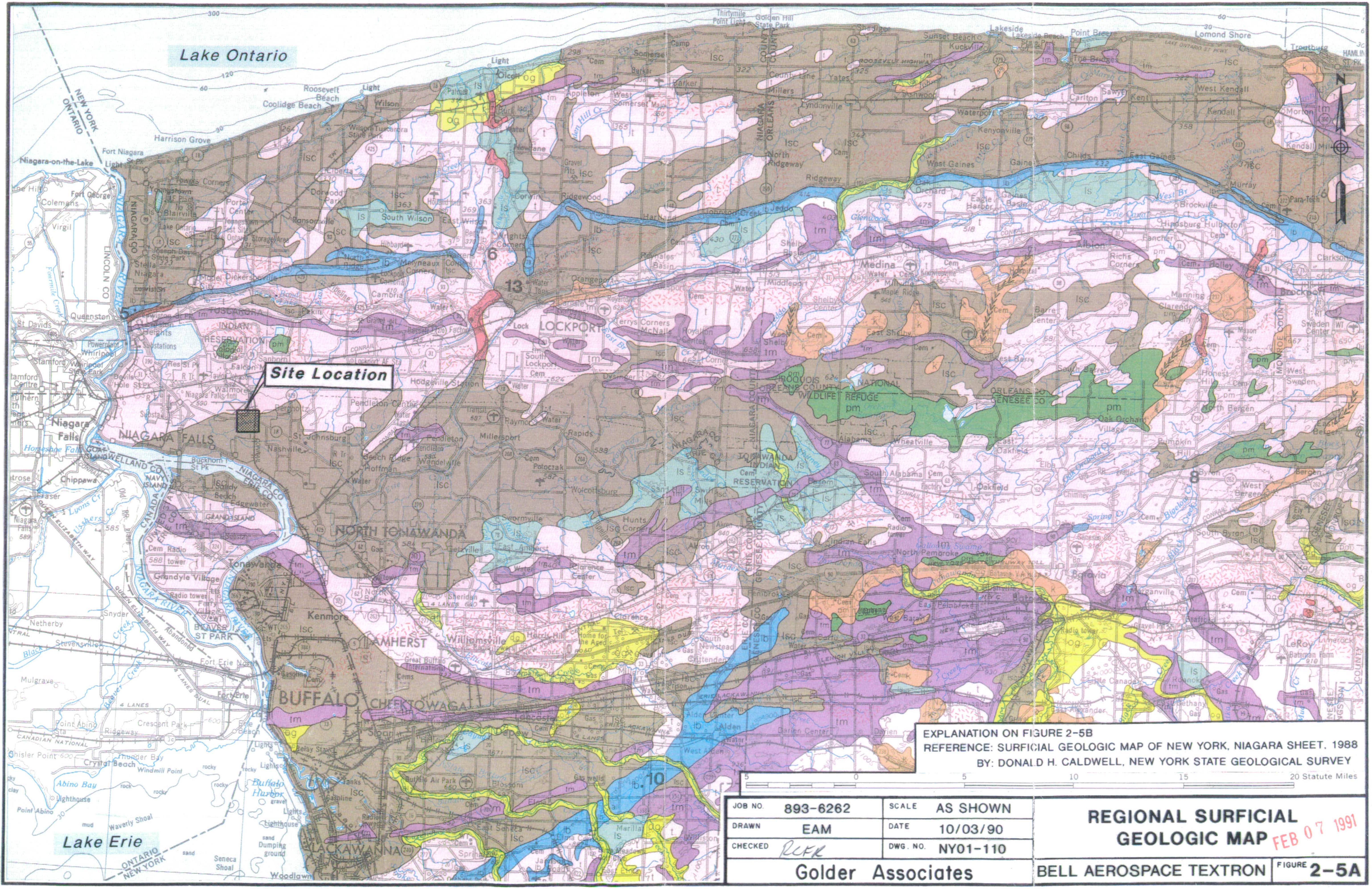
JOB NO.	893-6262	SCALE	AS SHOWN
DRAWN	EAM	DATE	10/08/90
CHECKED	RLFK	DWG. NO.	NY01-109

Golder Associates

REGIONAL SOIL MAP

BELL AEROSPACE TEXTRON

FIGURE **2-4**



EXPLANATION ON FIGURE 2-5B
REFERENCE: SURFICIAL GEOLOGIC MAP OF NEW YORK, NIAGARA SHEET, 1988
BY: DONALD H. CALDWELL, NEW YORK STATE GEOLOGICAL SURVEY

JOB NO.	893-6262	SCALE	AS SHOWN	REGIONAL SURFICIAL GEOLOGIC MAP
DRAWN	EAM	DATE	10/03/90	
CHECKED	RCFR	DWG. NO.	NY01-110	
Golder Associates				BELL AEROSPACE TEXTRON
				FIGURE 2-5A

FEB 07 1991

152110

EXPLANATION

al	al — Recent deposits Generally confined to floodplains within a valley, oxidized, non-calcareous, fine sand to gravel, in larger valleys may be overlain by silt, subject to frequent flooding, thickness 1–10 meters.
pm	pm — Swamp deposits Peat-muck, organic silt and sand in poorly drained areas, un-oxidized, may overlay marl and lake silts, potential land instability, thickness generally 2–20 meters.
lb	lb — Lacustrine beach Generally well sorted sand and gravel, stratified, permeable and well drained, deposited at a lake shoreline, generally non-calcareous, may have wave-winnowed lag gravel, thickness variable (1–5 meters).
lsc	lsc — Lacustrine silt and clay Generally laminated silt and clay, deposited in proglacial lakes, generally calcareous, potential land instability, thickness variable (up to 100 meters); stipple overprint where bedrock is within 1-3 meters of the surface.
ls	ls — Lacustrine sand Sand deposits associated with large bodies of water, generally a near-shore deposit or near a sand source, well sorted, stratified, generally quartz sand, thickness variable (2–20 meters).
og	og — Outwash sand and gravel Coarse to fine gravel with sand, proglacial fluvial deposition, well rounded and stratified, generally finer texture away from ice border, may be calcreted beyond Wisconsinan glacial limit, thickness variable (2–20 meters).
k	k — Kame deposits Includes kames, eskers, kame terraces, kame deltas, coarse to fine gravel and/or sand, deposition adjacent to ice (if at ice margin, relief is below elevation of associated outwash), lateral variability in sorting, coarseness and thickness, may be calcreted beyond Wisconsinan glacial limit, thickness variable (10–30 meters).
tm	tm — Till moraine More variably sorted than till, generally more permeable than till, deposition adjacent to ice, more variably drained, may include ablation till, thickness variable (10–30 meters).
t	t — Till Variable texture (e.g. clay, silt-clay, boulder clay), usually poorly sorted diamict, deposition beneath glacier ice, relatively impermeable (loamy matrix), variable clast content — ranging from abundant well-rounded diverse lithologies in valley tills to relatively angular, more limited lithologies in upland tills, tends to be sandy in areas underlain by gneiss or sandstone, potential land instability on steep slopes, thickness variable (1–50 meters).
r	r — Bedrock Exposed or generally within 1 meter of the surface.
▨	Bedrock stipple overprint Bedrock may be within 1–3 meters of the surface, may sporadically crop out, variable mantle of rock debris and glacial till.

MAP SYMBOLS

∽	Contact
≍	Glacial meltwater channel
.6	Dated radiocarbon locality
<<<<<	Esker

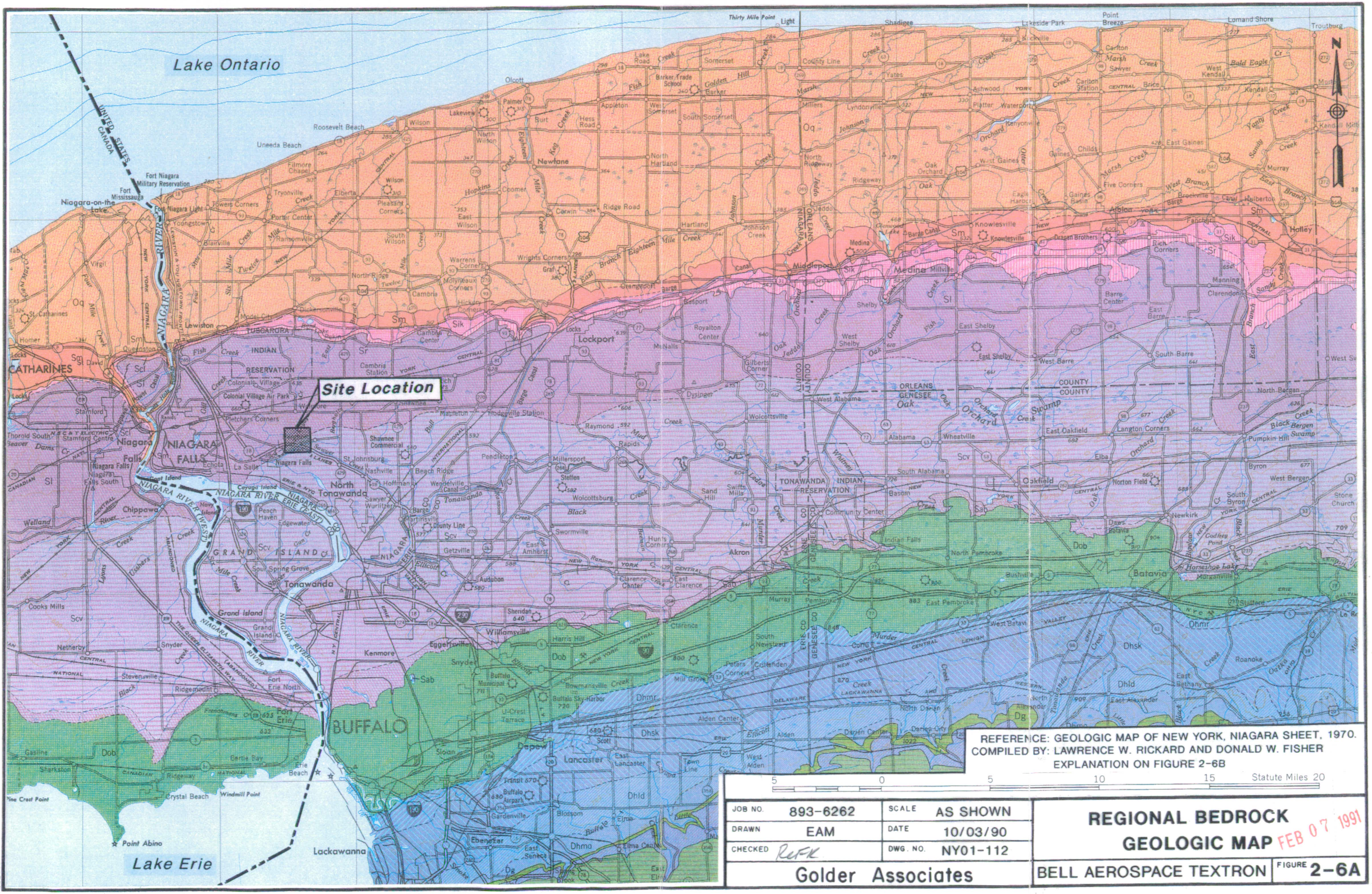
SURFICIAL GEOLOGIC MAP ON FIGURE 2-5A

FEB 07 1991

REFERENCE: SURFICIAL GEOLOGIC MAP OF NEW YORK, NIAGARA SHEET, 1988
BY: DONALD H. CALDWELL, NEW YORK STATE GEOLOGICAL SURVEY

JOB NO.	893-6262	SCALE	N/A	LEGEND TO REGIONAL SURFICIAL GEOLOGIC MAP
DRAWN	EAM	DATE	10/03/90	
CHECKED	RCFK	DWG. NO.	NY01-111	
Golder Associates				BELL AEROSPACE TEXTRON — FIGURE 2-5B

152110



REFERENCE: GEOLOGIC MAP OF NEW YORK, NIAGARA SHEET, 1970.
COMPILED BY: LAWRENCE W. RICKARD AND DONALD W. FISHER
EXPLANATION ON FIGURE 2-6B

JOB NO.	893-6262	SCALE	AS SHOWN
DRAWN	EAM	DATE	10/03/90
CHECKED	RcFK	DWG. NO.	NY01-112

Golder Associates

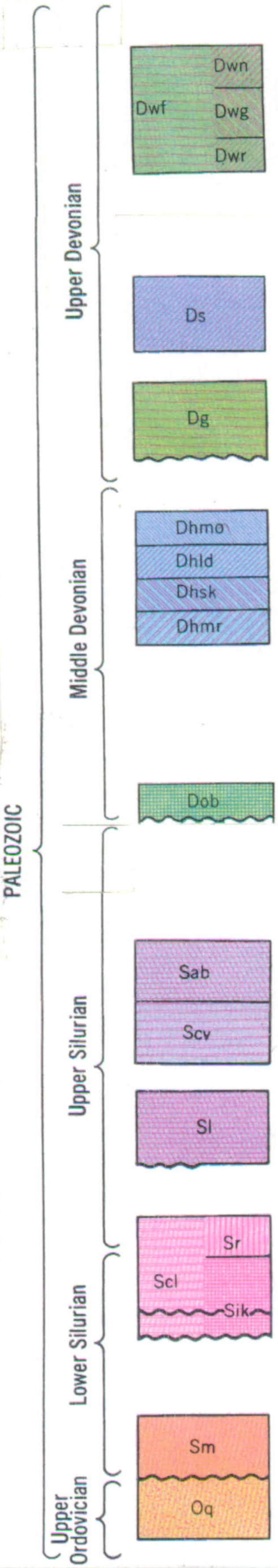
REGIONAL BEDROCK GEOLOGIC MAP

FEB 07 1991

BELL AEROSPACE TEXTRON

FIGURE **2-6A**

152110



WEST FALLS GROUP
400-950 ft. (120-290 m.)

Dwf	Angola and Rhinestreet Shales.
Dwn	Nunda Formation—sandstone, shale.
Dwg	West Hill and Gardeau Formations—shale, siltstone; Roricks Glen Shale; upper Beers Hill Shale; Grimes Siltstone.
Dwr	lower Beers Hill Shale; Dunn Hill, Millport, and Moreland Shales.

SONYEA GROUP
50-200 ft. (15-60 m.)

Ds	Cashaqua and Middlesex Shales.

GENESEE GROUP
10-150 ft. (3-45 m.)

Dg	West River Shale; Genundewa Limestone; Penn Yan and Geneseo Shales; North Evans Limestone.

HAMILTON GROUP
200-500 ft. (60-150 m.)

Dhmo	Moscow Formation—Windom and Kashong Shales, Menteth Limestone Members.
Dhld	Ludlowville Formation—Deep Run Shale, Tichenor Limestone, Wanakah and Ledyard Shales, Centerfield Limestone Members.
Dhsk	Skaneateles Formation—Levanna Shale, Stafford Limestone Members.
Dhmr	Marcellus Formation—Oatka Creek Shale Member.

ONONDAGA AND BOIS BLANC LIMESTONES
150 ft. (45 m.)

Dob	In New York: Onondaga Limestone—Seneca, Morehouse (cherty), and Clarence Limestone Members, Edgecliff cherty Limestone Member, local coral bioherms; Bois Blanc Limestone—sandy, thin, discontinuous.

AKRON DOLOSTONE AND SALINA GROUP
400-700 ft. (120-210 m.)

Sab	Akron Dolostone; Bertie Formation—dolostone, shale.
Scv	Camillus, Syracuse, and Vernon Formations—shale, dolostone, salt, and gypsum.

LOCKPORT GROUP
150-200 ft. (45-60 m.)

Sl	Guelph, Oak Orchard, Eramosa, and Goat Island Dolostones; Gasport Limestone—local bioherms.

CLINTON GROUP
100-150 ft. (30-45 m.)

Scl	Decew Dolostone; Rochester Shale; Irondequoit and Merriton Limestones.
Sr	Decew Dolostone; Rochester Shale.
Sik	Irondequoit Limestone; Rockway Dolostone; Hickory Corners Limestone; Neahga Shale; Kodak Sandstone.

MEDINA GROUP AND QUEENSTON FORMATION
800 ft. (250 m.)

Sm	Thorold Sandstone; Grimsby Formation—sandstone, shale; Power Glen and Cabot Head Shales; Whirlpool Sandstone.
Oq	Queenston Shale.

MAP SYMBOLS

Observed or approximately located contact

Conjectural contact; includes projections beneath extensive Quaternary cover and many contacts based on reconnaissance mapping.

Hypothetical contact; projection across unmapped area.

NOTE: Where the uniformity of lithology and availability of pattern combinations permit, the dominant lithology of a mapping unit is symbolized as follows:

Cross-hatch patterns:
- **rhombic grid—dolostones**
- **rectangular grid—limestones**

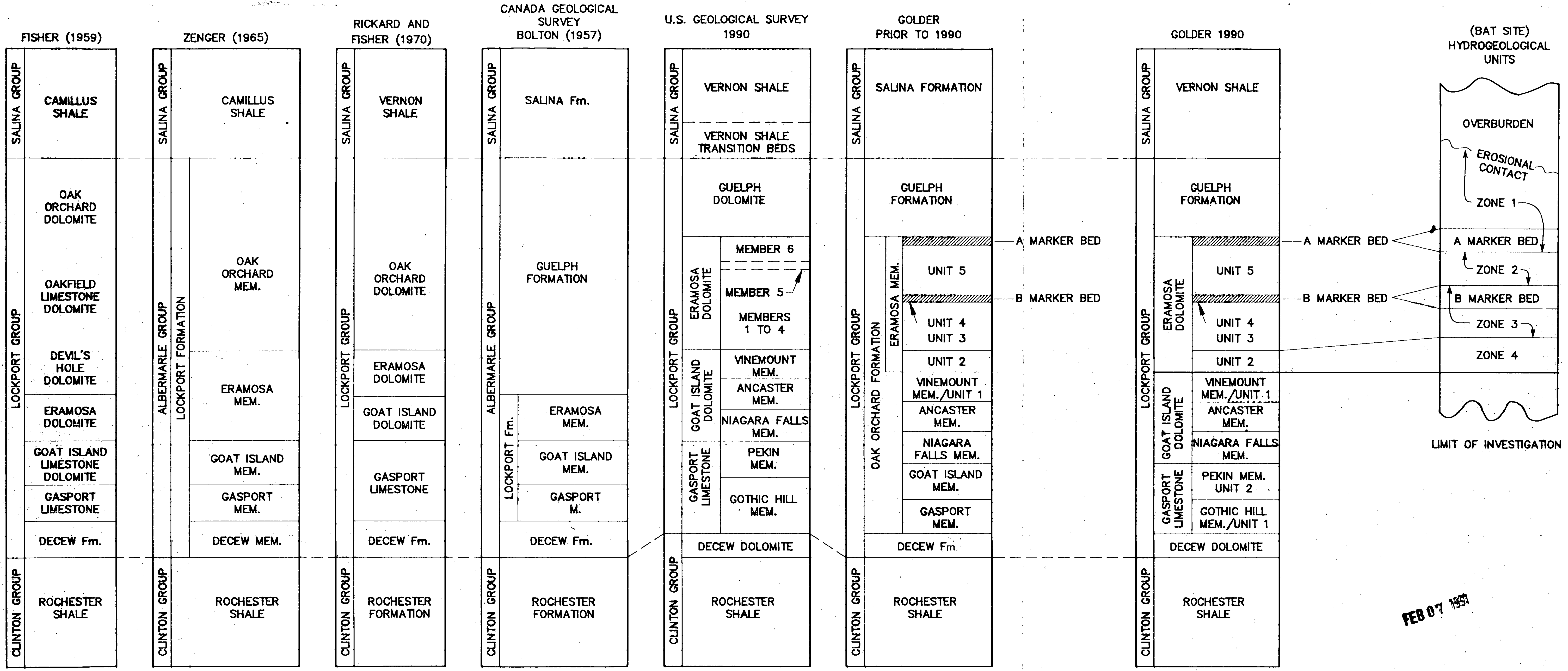
Line patterns:
- **straight—pelitic rocks, shales, shales interbedded with siltstones and sandstones**

Stipple patterns:
- **regular red—quartz sandstones and quartzites**
- **random red—non-marine sedimentary rocks**

An irregular lower margin on the "color boxes" signifies that the unit has an unconformable relationship with subjacent units, however not necessarily with the next unit listed. Wavy lines signify parallel unconformities; sawtooth lines signify angular unconformities.

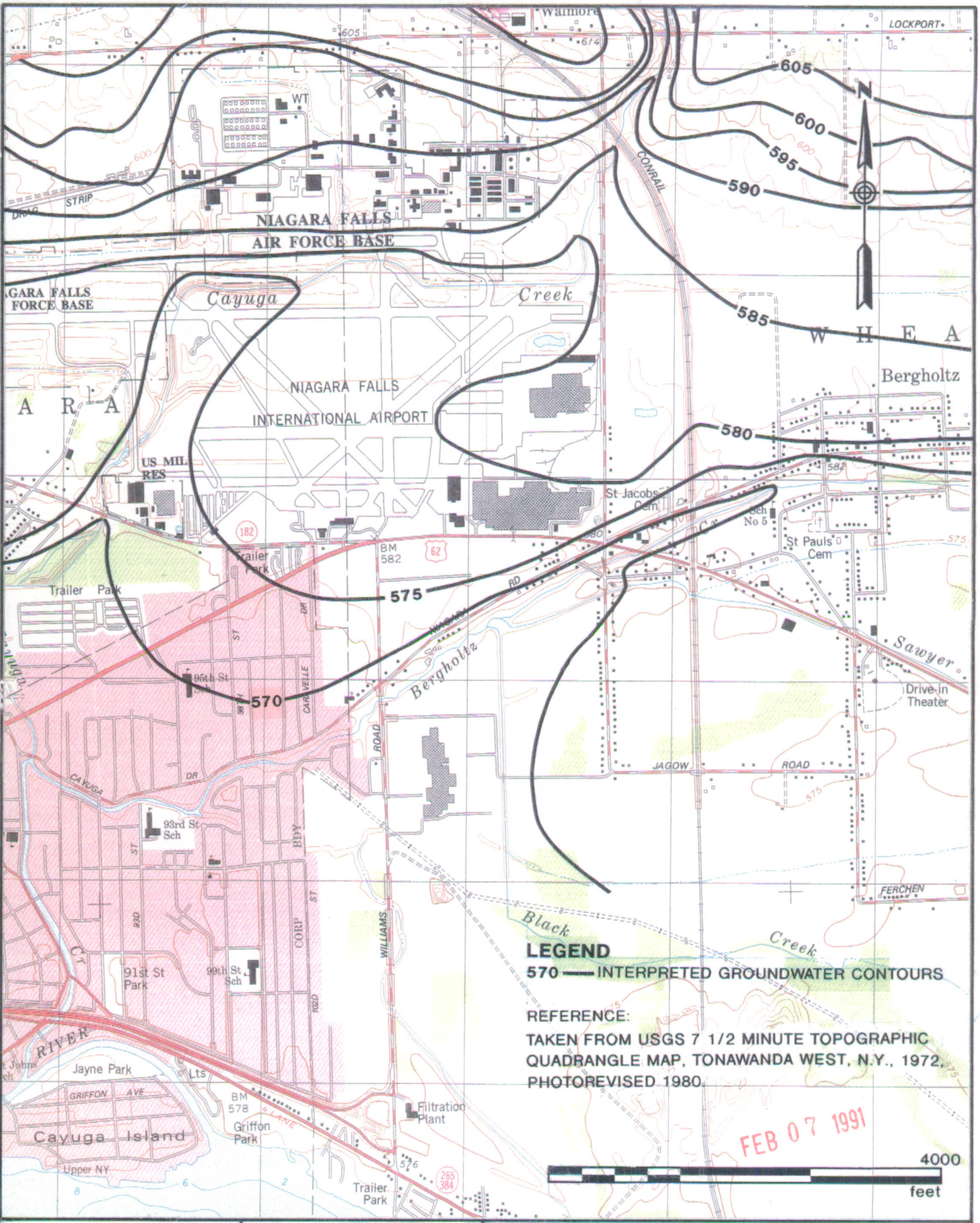
REFERENCE:
GEOLOGIC MAP ON FIGURE 2-6A

JOB No.: 893-6262	SCALE: N/A	**LEGEND FOR BEDROCK GEOLOGIC MAP**
DRAWN: EAM	DATE: 10/03/90	
CHECKED: RCFK	DWG. No.: NY01-113	
Golder Associates		BELL AEROSPACE TEXTRON — FIGURE **2-6B**



FEB 07 1991

JOB No.:	893–6262	SCALE:	N.T.S.	**STRATIGRAPHIC SECTIONS SHOWING NOMENCLATURE DEVELOPMENT**
DRAWN:	KKM	DATE:	10/11/90	
CHECKED:		DWG. No.:	NY01-114	
Golder Associates				BELL AEROSPACE TEXTRON FIGURE **2-7**



LEGEND

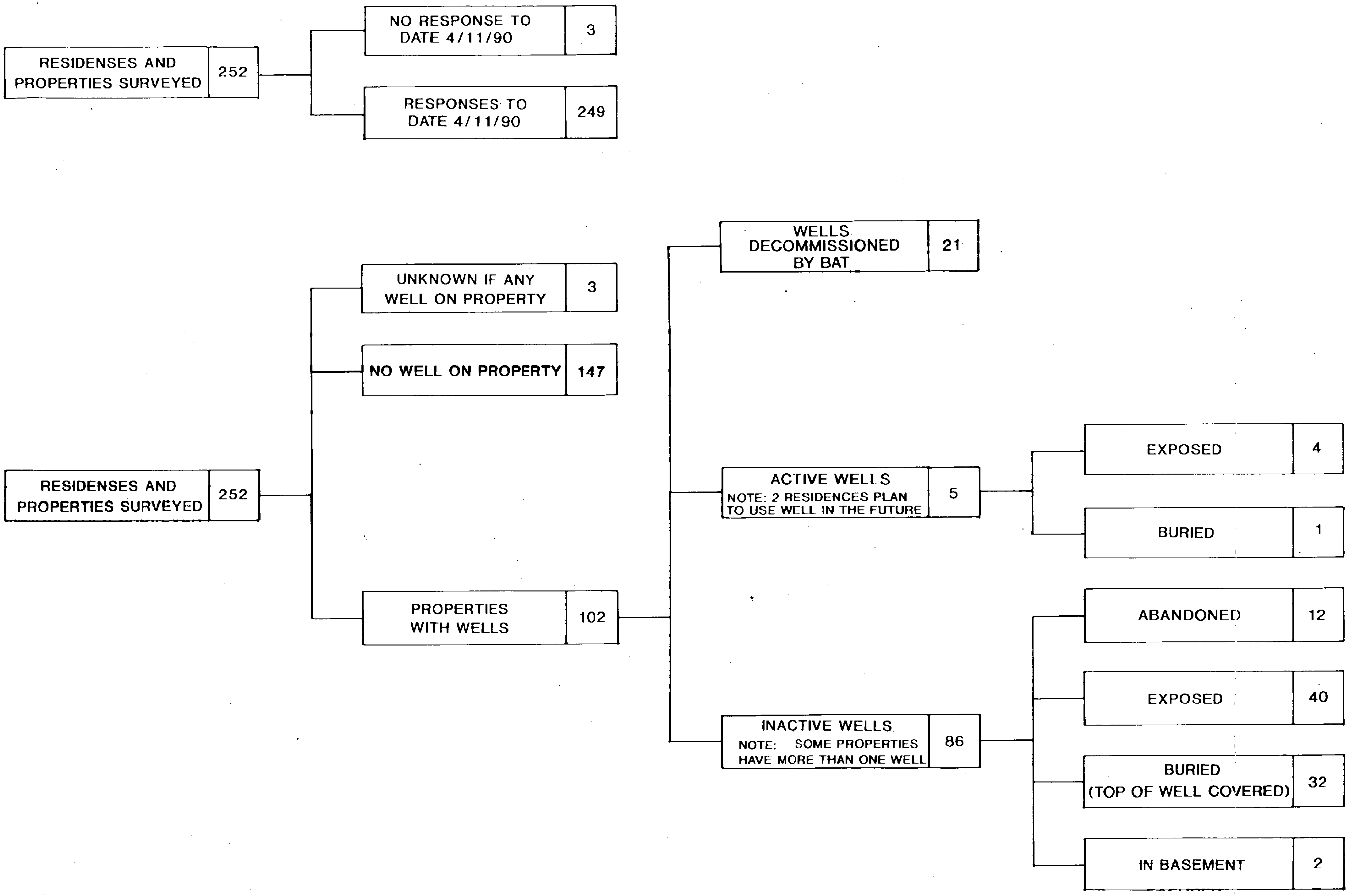
570 —— INTERPRETED GROUNDWATER CONTOURS

REFERENCE:

TAKEN FROM USGS 7 1/2 MINUTE TOPOGRAPHIC QUADRANGLE MAP, TONAWANDA WEST, N.Y., 1972, PHOTOREVISED 1980.

FEB 07 1991

OB No.:	893-6262	SCALE:	1"=2000'	INTERPRETED REGIONAL GROUNDWATER PHREATIC SURFACE IN SOIL OVERBURDEN
RAWN:	TLF	DATE:	10/05/90	
CHECKED:	RCFK	DWG. No.:	NY01-115	
Golder Associates				BELL AEROSPACE TEXTRON FIGURE 2-8



FEB 08 1991

JOB NO.	893-6262	SCALE	N/A
DRAWN	MRM	DATE	10/14/90
CHECKED	RefK	DWG. NO.	NY01-117

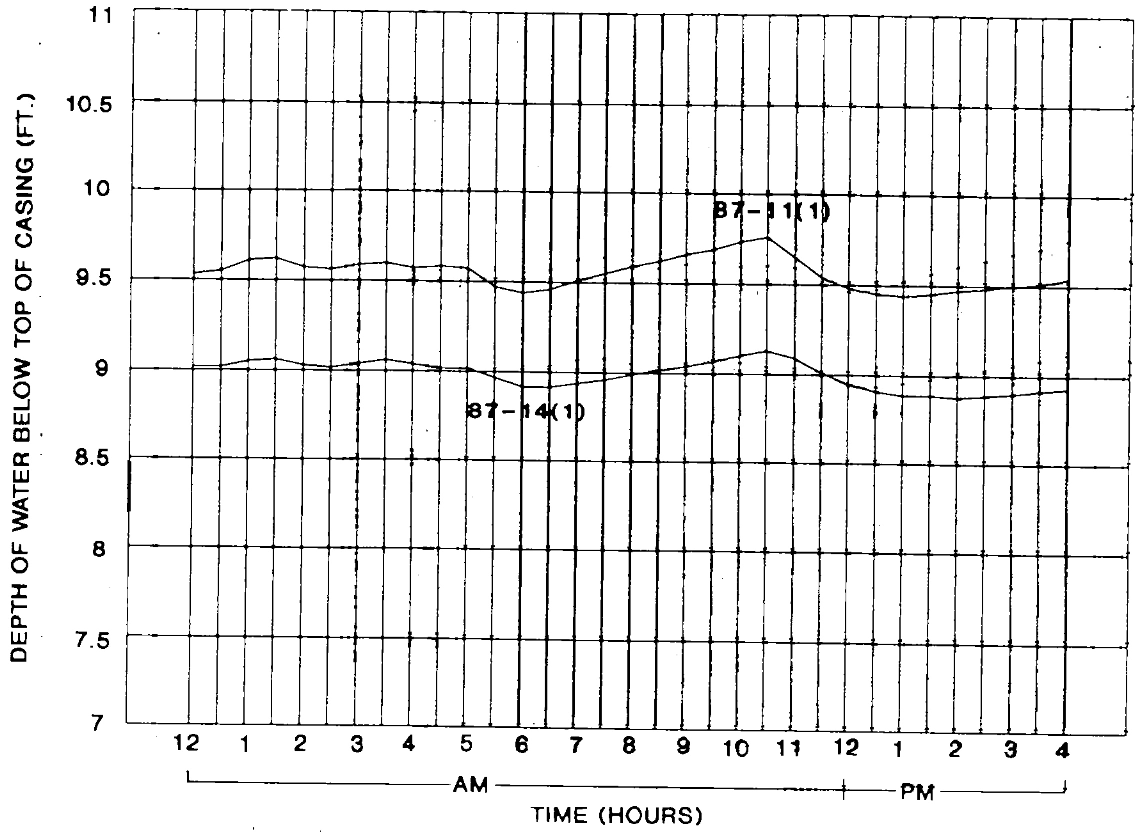
Golder Associates

SUMMARY OF WELL SURVEY RESULTS AS OF OCTOBER 1990

BELL AEROSPACE TEXTRON

FIGURE **2-10**

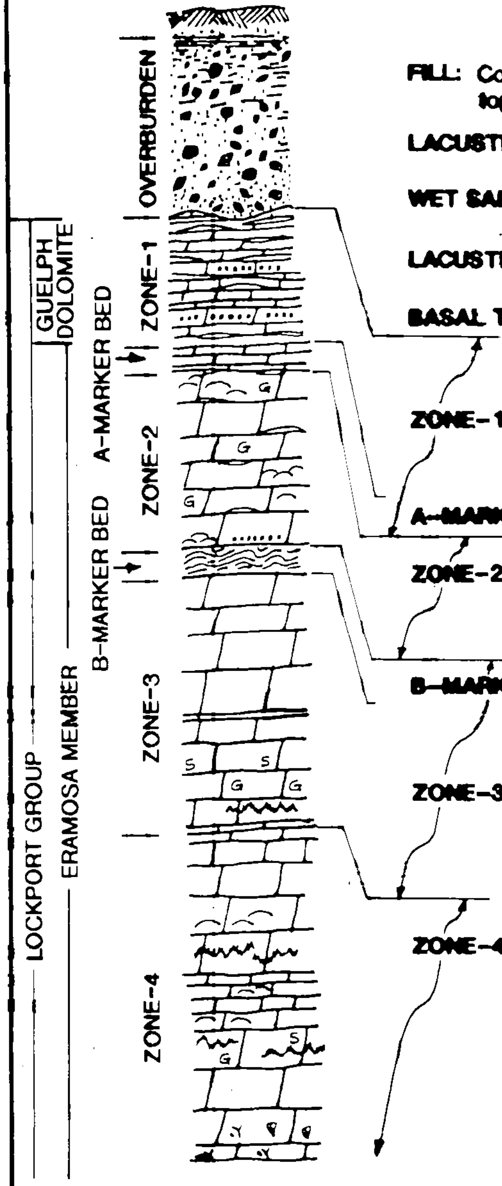
GROUNDWATER FLUCTUATION DURING THE WATER LEVEL SURVEY - 08/28/90



FEB 08 1991

No.: 893-6262	SCALE: N/A	GROUNDWATER FLUCTUATION DURING THE WATER LEVEL SURVEY-08/28/90
DRAWN: LAS	DATE: 10/12/90	
CHECKED: RCFK	DWG. No.: NY01-143	
Golder Associates		BELL AEROSPACE TEXTRON	FIGURE 4-1

COMPOSITE STRATIGRAPHIC COLUMN FOR BAT SITE



FILL: Compact, medium-brown to grey, silty-sand, some clay, gravel and occasional top soil with organic debris, slag and abundant glass fragments.

LACUSTRINE CLAY: Very stiff to hard, reddish-brown to grey, laminated silty-clay, with lenses of silt and organic debris.

WET SAND: Dense, grey-brown, fine to coarse-grained, fine-gravel; very little clay and traces of silt.

LACUSTRINE TILL: Compact to dense, reddish-brown sandy-silt to silty-sand till, some clay and gravel.

BASAL TILL: Very dense, light to medium-brown silty-sand till and occasional gravel.

ZONE-1: Moderately weathered, dark to light-grey, irregularly bedded to laminated dolomite; bedding surfaces pitted and vugged with gypsum coatings, and casts of gypsum coatings, occasional oolitic bed.

A-MARKER BED: Light to medium-grey dolomite with abundant intergranular gypsum.

ZONE-2: Brownish-grey, finely laminated, medium to thick bedded, vuggy, very coarsely grained dolomite with a few distinct beds of stylolitic, gypsiferous dolomite; occasional beds are porous and pitted.

B-MARKER BED: Light brownish-grey, fine-grained, thinly bedded to laminated dolomite; argillaceous bedding plane partings and syndepositional slump bedding structures.

ZONE-3: Weakly to moderately weathered, brownish-grey, medium to thickly bedded, moderately vuggy dolomite with patches of brownish saccaroidal dolomite, stylolitic horizons, occasional argillaceous partings; intergranular gypsum occurs in vuggy beds containing patches of sphalerite crystals; sparsely fossiliferous.

ZONE-4: Light to medium-grey, medium to fine-grained, medium to massively bedded, styolitic dolomite with occasional patches of brownish saccaroidal dolomite, gypsiferous dolomitic beds, rarely porous; lower part of zone contains abundant fossil biostromal beds with bryozoan and coral fragments.

STROMATOLITES

STYLOLITE

BEDDING PARALLEL PARTINGS

BRYOZOANS, CORALS

SLUMP-BEDDING

LAMINATED, THINLY BEDDED

G S G: GYPSUM; S: SPHALERITE

OOLITIC BED

MEDIUM BEDDED

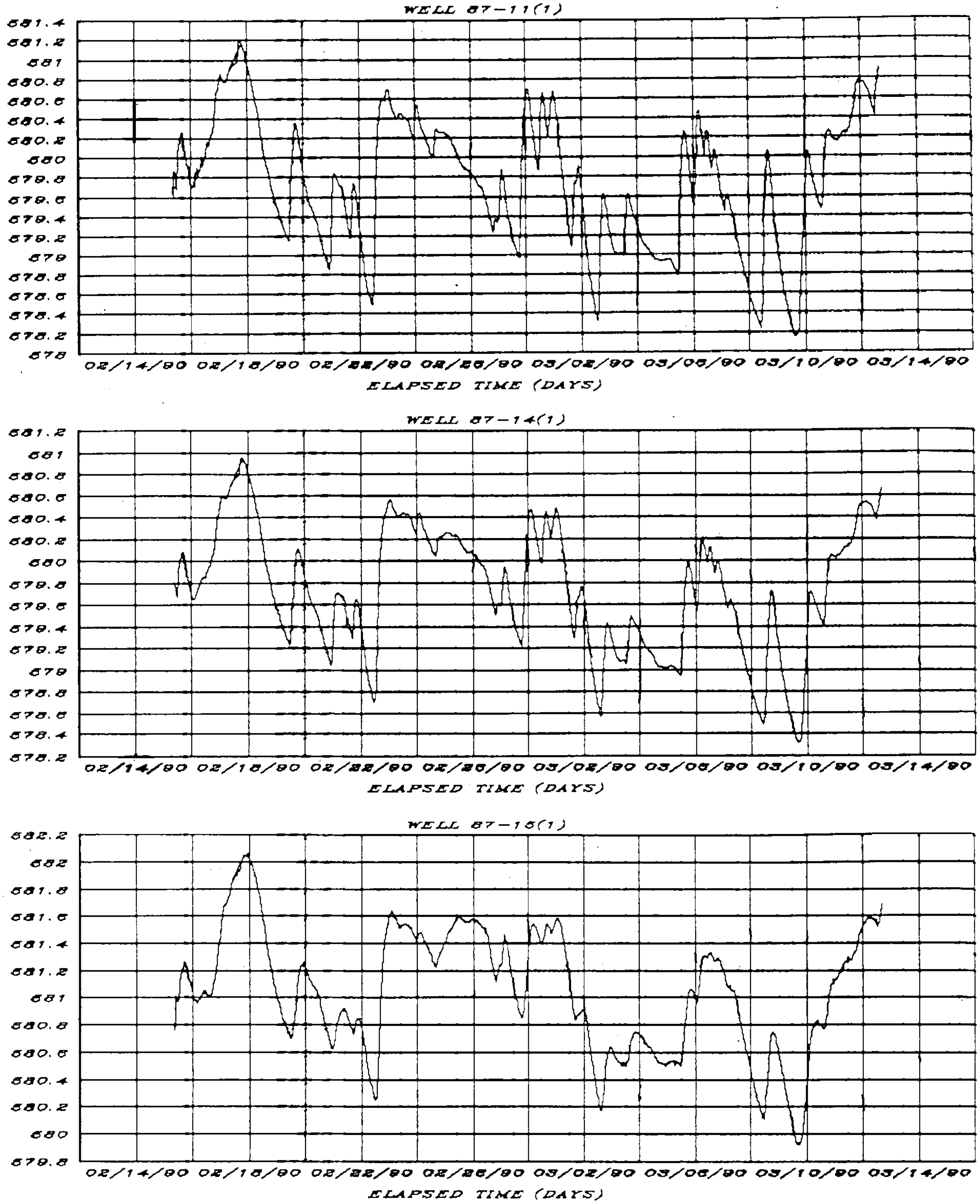
THICK, MASSIVE BEDDED

SEP 08 1991

JOB No.: 893-6262	SCALE: N/A	COMPOSITE STRATIGRAPHIC COLUMN	
DRAWN: LAS	DATE: 10/12/90		
CHECKED: RCFK	DWG. No.: NY01-121		
Golder Associates		BELL AEROSPACE TEXTRON	FIGURE 5-1

158696

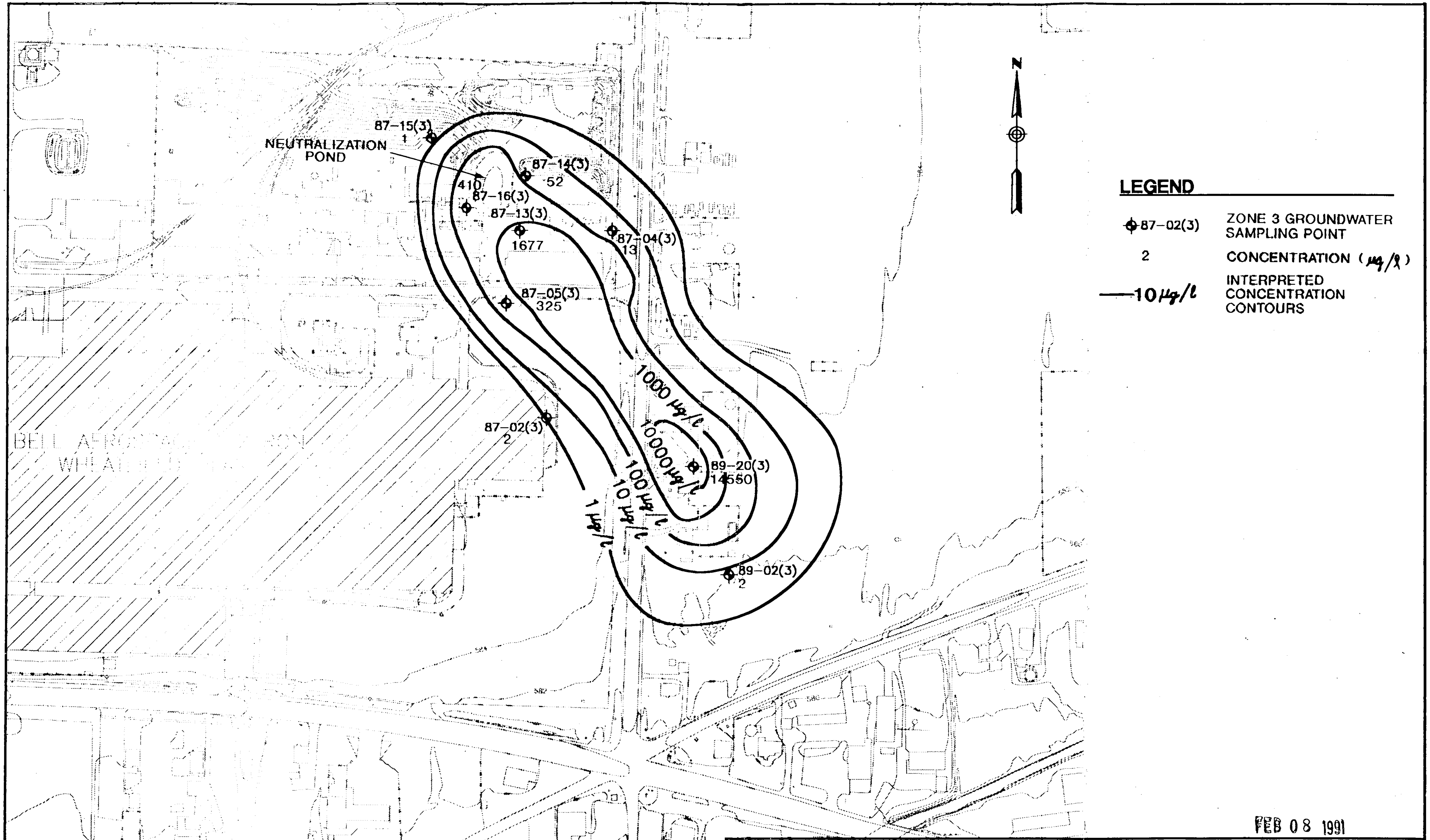
WELL HYDROGRAPH



NOTE: FLUCTUATIONS DUE TO DISCHARGE OF
WATER FROM ROCKET TESTS.

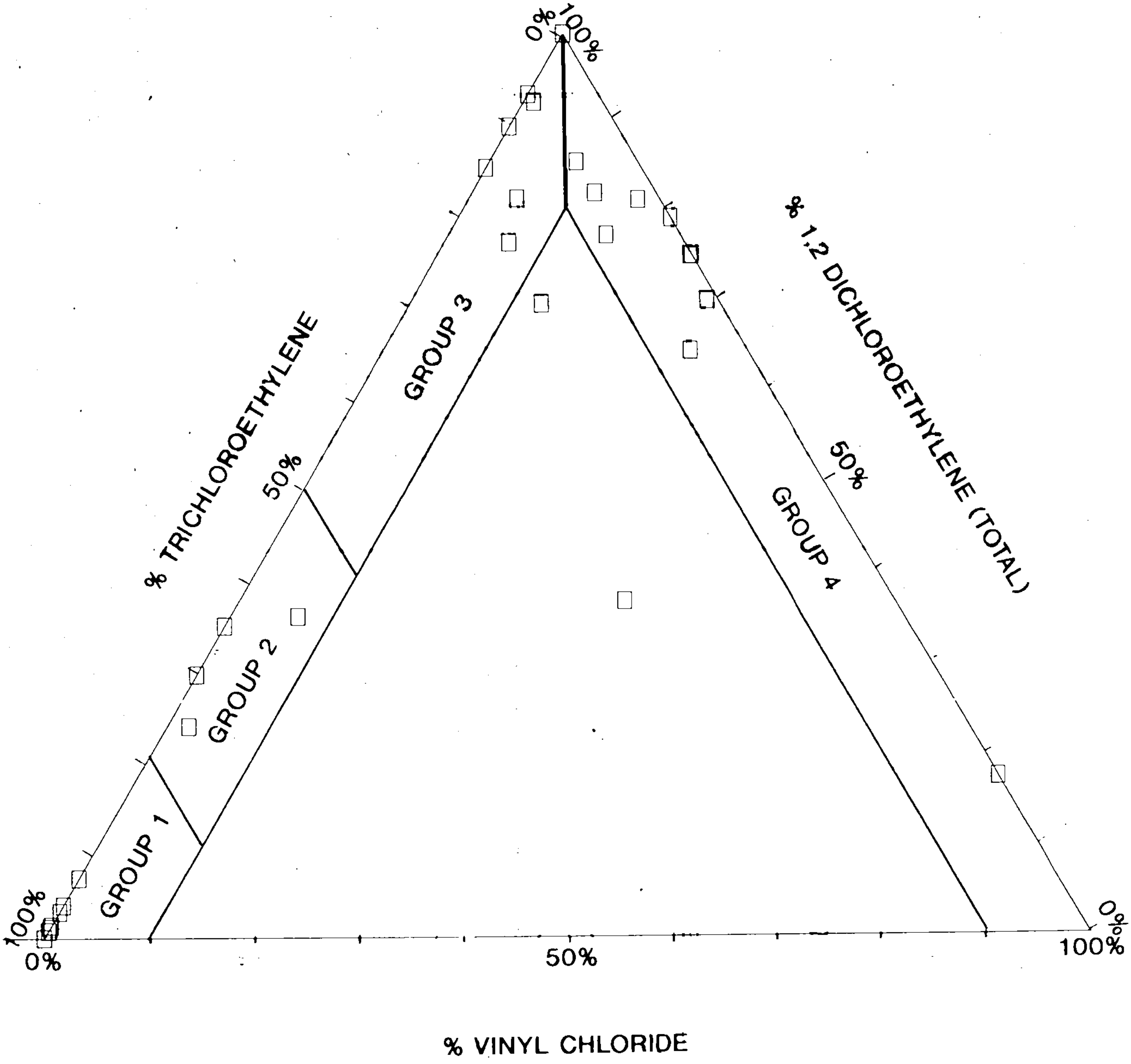
FEB 08 1991

JOB No.: 893-6262	SCALE: N/A	**ZONE 1 POTENTIOMETRIC PRESSURE FLUCTUATIONS**
DRAWN: MRM	DATE: 10/14/90	
CHECKED: Rcfk	DWG. No.: NY01-126	
Golder Associates		BELL AEROSPACE TEXTRON FIGURE **6-2**



FEB 08 1991

JOB No.:	893-6262	SCALE:	1"=200'	ISOCONCENTRATION CONTOURS TOTAL VOLATILE ORGANIC COMPOUNDS ZONE 3 AQUIFER 1990 SAMPLING EVENT
DRAWN:	CDH	DATE:	10/12/90	
CHECKED:	RCFIL	DWG. No.:	NY01-138	
Golder Associates				BELL AEROSPACE TEXTRON — FIGURE 7-12

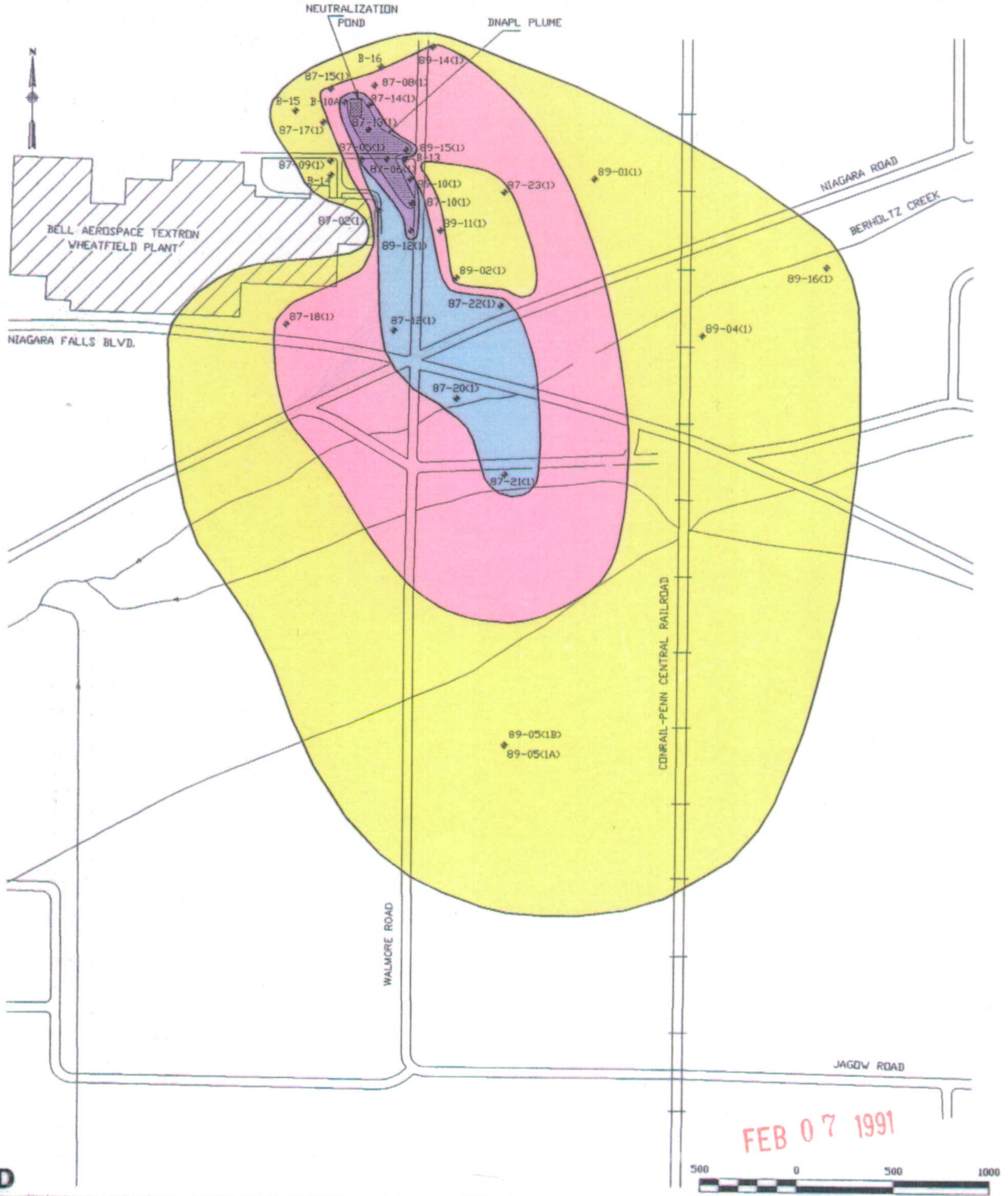


FEB 08 1991

LEGEND

GROUP 1	TRICHLOROETHYLENE	>80%
	1,2-DICHLOROETHYLENE (TOTAL)	<20%
	VINYL CHLORIDE	<10%
GROUP 2	TRICHLOROETHYLENE	80% TO 50%
	1,2-DICHLOROETHYLENE (TOTAL)	20% TO 50%
	VINYL CHLORIDE	<10%
GROUP 3	TRICHLOROETHYLENE	<20%
	1,2-DICHLOROETHYLENE (TOTAL)	50% TO 100%
	VINYL CHLORIDE	<10%
GROUP 4	TRICHLOROETHYLENE	<10%
	1,2-DICHLOROETHYLENE (TOTAL)	100% TO 0%
	VINYL CHLORIDE	0% TO 100%

JOB No.: 893-6262	SCALE: AS SHOWN	**DIAGRAM WITH PERCENTAGE OF TRICHLOROETHYLENE, 1,2-DICHLOROETHYLENE (TOTAL) AND VINYL CHLORIDE**
DRAWN: MJ	DATE: 10/15/90	
CHECKED: Rcfk	DWG. No.: NY01-139	
Golder Associates	BELL AEROSPACE TEXTRON	FIGURE **7-13**



LEGEND

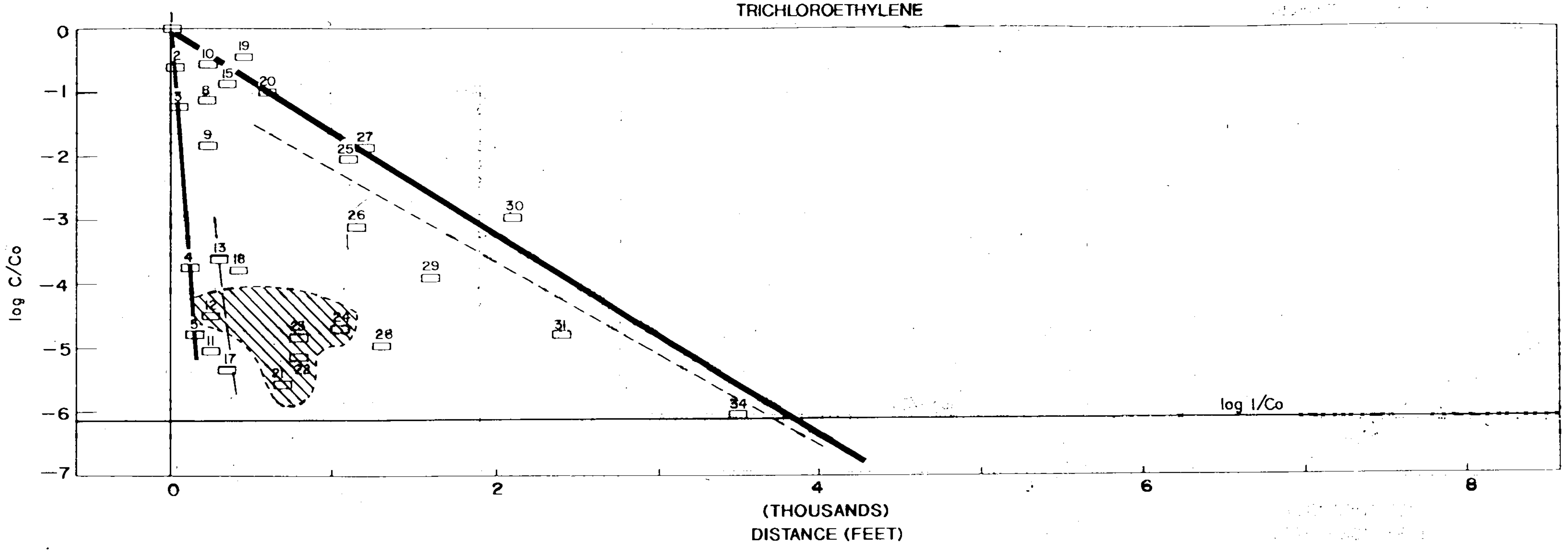
🟪	TRICHLOROETHYLENE 1,2-DICHLOROETHYLENE (TOTAL) VINYL CHLORIDE	>80% <20% <10%
🟦	TRICHLOROETHYLENE 1,2-DICHLOROETHYLENE (TOTAL) VINYL CHLORIDE	80% TO 50% 20% TO 50% <10%
🟥	TRICHLOROETHYLENE 1,2-DICHLOROETHYLENE (TOTAL) VINYL CHLORIDE	<20% 50% TO 100% <10%
🟨	TRICHLOROETHYLENE 1,2-DICHLOROETHYLENE (TOTAL) VINYL CHLORIDE	<10% 100% TO 0% 0% TO 100%

JOB NO.	893-6262	SCALE	AS SHOWN	**DISPOSITION OF PLUME COMPONENTS**
DRAWN	MJ	DATE	10/15/90	
CHECKED	RCFK	DWG. NO.	NY01-140	
Golder Associates				BELL AEROSPACE TEXTRON
				FIGURE 7-14

152978

ZONE 1 DISSOLVED PHASE PLUME, RELATIVE CONCENTRATION VERSUS DISTANCE

TRICHLOROETHYLENE

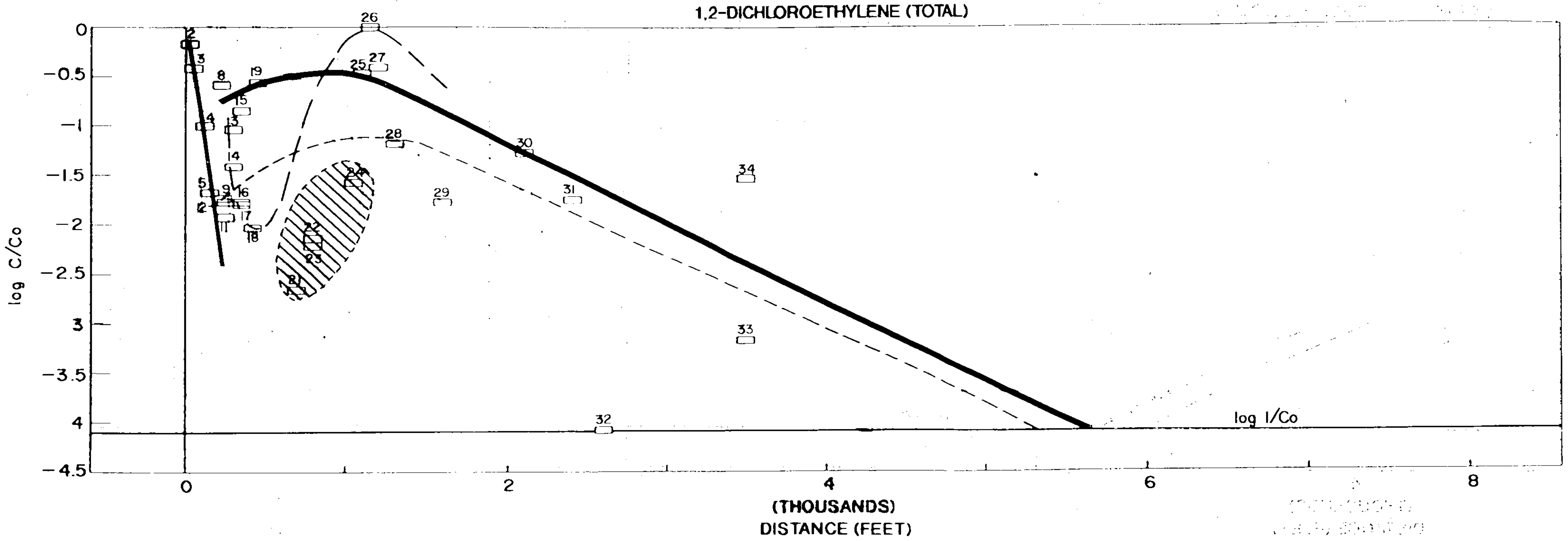


WELL REFERENCES

1	87-13 (1)	19	87-10 (1)
2	87-14 (1)	20	89-12 (1)
3	B-10A (1)	21	89-14 (1)
4	87-8 (1)	22	87-23 (1)
5	87-15 (1)	23	89-11 (1)
8	87-6 (1)	24	89-2 (1)
9	89-15 (1)	25	87-12 (1)
10	87-5 (1)	26	87-18 (1)
11	87-17 (1)	27	87-22 (1)
12	B-13 (1)	28	89-1 (1)
13	B-14 (1)	29	87-20 (1)
15	89-10 (1)	30	87-21 (1)
17	B-15 (1)	31	89-4 (1)
18	87-2 (1)	34	89-5 (1A)

ZONE 1 DISSOLVED PHASE PLUME, RELATIVE CONCENTRATION VERSUS DISTANCE

1,2-DICHLOROETHYLENE (TOTAL)



WELL REFERENCES

2	87-14 (1)	21	89-14 (1)
3	B-10 (A1)	22	87-23 (1)
4	87-8 (1)	23	89-11 (1)
5	87-5 (1)	24	89-2 (1)
8	87-6 (1)	25	87-12 (1)
9	89-15 (1)	26	87-18 (1)
11	87-17 (1)	27	87-22 (1)
12	B-13 (1)	28	89-1 (1)
13	B-14 (1)	29	87-20 (1)
14	87-9 (1)	30	87-21 (1)
15	89-10 (1)	31	89-4 (1)
16	B-16 (1)	32	89-16 (1)
17	B-15 (1)	33	89-5 (1B)
18	87-2 (1)	34	89-5 (1A)
19	87-10 (1)		

LEGEND

———	- WELLS LOCATED IN THE IMMEDIATE VICINITY OF THE NEUTRALIZATION POND
━━━	- WELLS LOCATED ALONG THE MAIN DIRECTION OF GROUNDWATER FLOW (NORTH - SOUTH)
- - - - - -	- WELLS LOCATED ALONG THE EASTERN COMPONENT OF THE GROUNDWATER FLOW
— — — —	- WELLS LOCATED ALONG THE WESTERN COMPONENT OF THE GROUNDWATER FLOW
▨	- LOW CONCENTRATION ANOMALY AREA OF RELATIVELY RETARDED GROUNDWATER

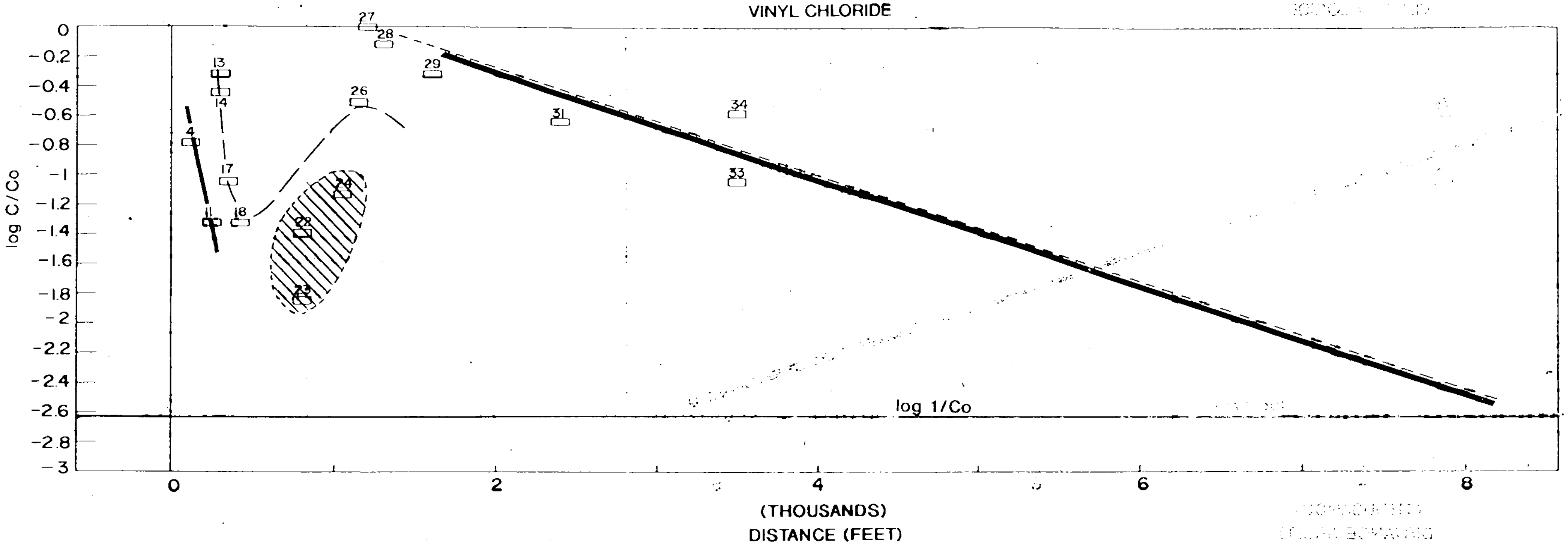
FEB 08 1991

JOB NO 893-6262	SCALE AS SHOWN	ZONE 1 DISSOLVED PHASE PLUME, RELATIVE CONCENTRATION VS. DISTANCE TRICHLOROETHYLENE AND 1,2-DICHLOROETHYLENE (TOTAL)
DRAWN FG	DATE 10/14/90	
CHECKED RCRK	DWG. NO. NY01-141	
Golder Associates		BELL AEROSPACE TEXTRON
		FIGURE 7-15

152110

ZONE 1 DISSOLVED PHASE PLUME RELATIVE CONCENTRATION VERSUS DISTANCE

VINYL CHLORIDE

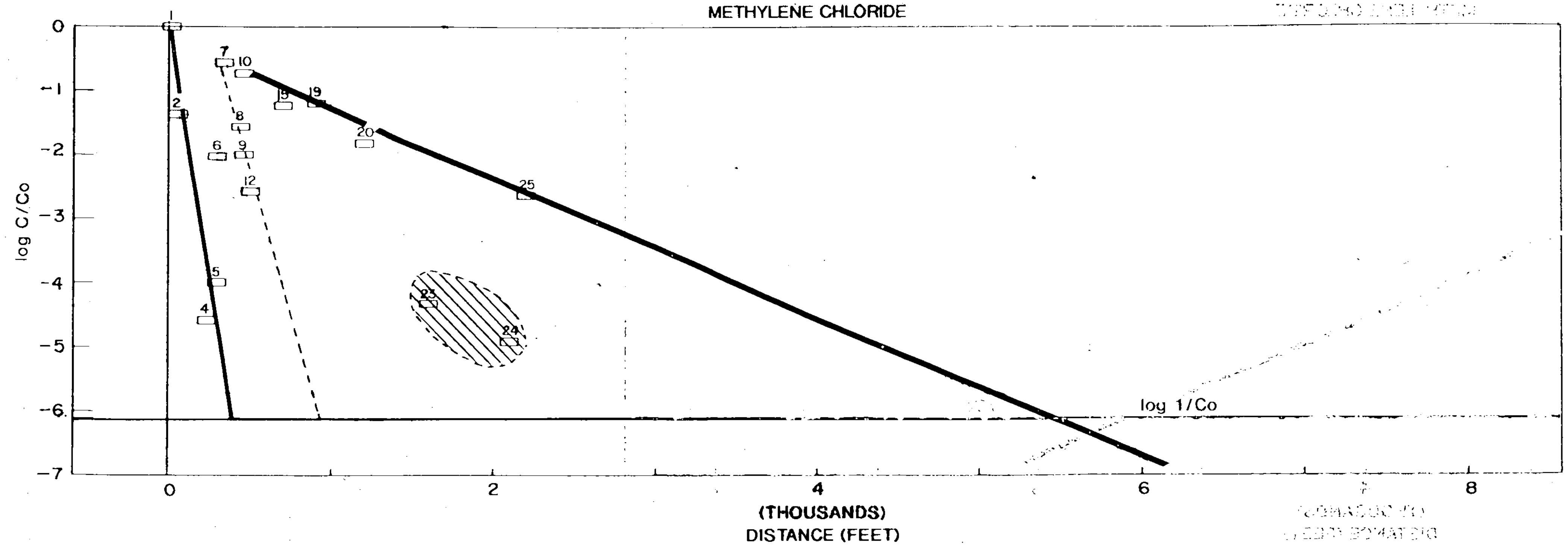


WELL REFERENCES

4	87-8 (1)
11	87-17 (1)
13	B-14 (1)
14	87-9 (1)
17	B-15 (1)
18	87-2 (1)
22	87-23 (1)
23	89-11 (1)
24	89-2 (1)
27	87-22 (1)
28	89-1 (1)
29	87-20 (1)
31	89-4 (1)
33	87-5 (1B)
34	89-5 (1A)

ZONE 1 DISSOLVED PHASE PLUME RELATIVE CONCENTRATION VERSUS DISTANCE

METHYLENE CHLORIDE



WELL REFERENCES

1	87-13 (1)
2	87-14 (1)
4	87-8 (1)
5	87-15 (1)
6	87-14 (1)
7	87-11 (1)
8	87-6 (1)
9	89-15 (1)
10	87-5 (1)
12	B-13 (1)
15	89-10 (1)
19	87-10 (1)
20	89-12 (1)
23	89-11 (1)
24	89-2 (1)
25	87-12 (1)

LEGEND

━━━ - WELLS LOCATED IN THE IMMEDIATE VICINITY OF THE NEUTRALIZATION POND
▬▬▬ - WELLS LOCATED ALONG THE MAIN DIRECTION OF GROUNDWATER FLOW (NORTH - SOUTH)
- - - - - WELLS LOCATED ALONG THE EASTERN COMPONENT OF THE GROUNDWATER FLOW
— — — - WELLS LOCATED ALONG THE WESTERN COMPONENT OF THE GROUNDWATER FLOW
▨ - LOW CONCENTRATION ANOMALY AREA OF RELATIVELY RETARDED GROUNDWATER

FEB 08 1991

JOB NO. 893-6262	SCALE AS SHOWN	**ZONE 1 DISSOLVED PHASE PLUME, RELATIVE CONCENTRATION VS. DISTANCE VINYL CHLORIDE & METHYLENE CHLORIDE**		
DRAWN FG	DATE 10/14/90			
CHECKED RCFK	DWG. NO. NY01-142			
Golder Associates		BELL AEROSPACE TEXTRON	FIGURE 7-16	

182110