REMEDIAL INVESTIGATION
XEROX BUILDING 801
HENRIETTA, NEW YORK
SITE ID #828069
VOLUME I OF II

by

H&A of New York
Rochester, New York

for

Xerox Corporation
Webster, New York

File No. 70290-41
November 1993
Final Revisions: August 1994

Geotechnical Engineers &
Environmental Consultants

22 September 1994
File No. 70290-66

Xerox Corporation
800 Phillips Road
Building 304-13S
Webster, New York 14580

Attention: Mr. Al Mancini

Subject: Remedial Investigation Report - Final
Xerox Building 801
Henrietta, New York

Dear Al:

We are pleased to submit this report entitled, "Remedial Investigation, Xerox Building 801, Henrietta, New York" which incorporate the final revisions from discussions with NYSDEC.

The Remedial Investigation report is presented in two volumes, with Volume I containing text, tables, and figures, and Volume II containing appendices. As requested by Todd Caffoe, NYSDEC, this submittal consists of Volume I and the revised pages from Volume II.

Please do not hesitate to call with questions concerning this report, or any other aspect of the ongoing project.

Sincerely yours,
H&A OF NEW YORK

Wayne Hardison

Wayne C. Hardison, P.E.
Senior Engineer

Stanley E. Walker, P.E.
Vice President

TABLE OF CONTENTS

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

LIST OF TABLES

LIST OF FIGURES

LIST OF FIGURES
(Continued)

LIST OF FIGURES
(Continued)

I. INTRODUCTION

This report describes and presents the findings of a remedial investigation (RI) of the Xerox Corporation (Xerox) Building 801 facility located at 1350 Jefferson Road in Henrietta, New York. The investigation was planned and conducted in conformance with the United States Environmental Protection Agency (USEPA) document "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" dated October 1988. The work was performed in accordance with the Revised Work Plan for Remedial Investigation and Feasibility Study at Xerox Building 801 (ES, 1991c), and the Remedial Investigation and Feasibility Study Work Plan Addendum (H&A of New York, 1992).

1-01. PURPOSE OF THE INVESTIGATION

The RI was conducted on behalf of Xerox Corporation to fulfill requirements of its Administrative Order on Consent with the New York State Department of Environmental Conservation (NYSDEC) dated 16 March 1990.

The RI was performed to further determine the nature and extent of contaminants previously detected in surface water, groundwater, soil and sediments at the site. The contaminants which exist at the site are related to parts cleaning and solvent storage operations conducted at the facility during the 1970s. This report summarizes:

- the scope and findings of previous site investigations;
- scope and quality assurance procedures for this investigation;
- data collected as part of the RI;
- the findings of the RI;
- the findings of the baseline risk assessment; and
- the fish and wildlife impact analysis.

This RI report presents the basis for the forthcoming feasibility study (FS), as described in the above-mentioned work plan and addendum.

1-02. SITE LOCATION AND DESCRIPTION

Building 801 occupies a portion of the Xerox property located at 1350 Jefferson Road, approximately one half mile west of the intersection of Jefferson and Winton Roads in the Town of Henrietta, Monroe County, New York. The Xerox property is shown on the Project Locus (Figure 1). The property is bounded by undeveloped land on the north, undeveloped and commercial properties on the east and west, and Jefferson Road on the south.

The Xerox property is an irregularly shaped parcel of approximately 86.6 acres comprised of the 50.4-acre original site and 36.2 acres acquired in 1993 which is located to the north of the original site. The main building on the property covers approximately 12 acres and is located on the southern half of the property. Outside the building, the majority of the ground surface is covered by paved parking areas and roadways. The general features of the property are shown in Figure 2.

The subject area of this investigation is comprised of the following areas (see Figure 2):

Northeast Corner -	The parts-cleaning and solvent-use area located in the northeast corner of Building 801, Area C.
Lawn Area -	The grassy area located north of the paved drive adjacent to the Northeast Corner, bounded on the west by the fire water tank and by the original property lines on the north and east.
Northern Area -	The undeveloped area north of the Lawn Area which is located on the parcel acquired in 1993.
North-South Ditch -	A drainageway which extends from the Lawn Area north through the Northern Area.
Western North-South Stream -	A north south stream located to the west of the North-South Ditch which receives effluent from the storm water collection system.

1-03. SITE HISTORY

Xerox Corporation refurbished photocopy machines in Building 801 between 1972 and 1978. Machine parts were cleaned in the Northeast Corner of the building using mixtures of chlorinated and non-chlorinated solvents. The solvent mixtures were made up of petroleum distillates with varying proportions of 1,1,1-trichloroethane, tetrachloroethene, methylene chloride and trichloroethene. The cleaning processes included the use of spray booths, a cabinet washer and recycling pump for wash materials and solvents, two turbulators, each with a tank and pit for batch cleaning, a solvent storage room, a paint shop and various solvent and waste solvent storage tanks. All of these facilities were situated within the subject area and have been regarded as possible sources for the subsurface contaminants which currently exist at the site. Figure 3 illustrates the locations of the former process and storage areas.

The refurbishing operation included two 8,000-gallon solvent storage tanks, two 1,000-gallon tanks, one 500-gallon overflow tank, and one 500-gallon spill crock. The storage tanks were removed from the site after refurbishing operations were discontinued in 1978. Since 1978, activities in Building 801 have been limited to research and development, laboratory work and administrative activities.

Table 1 for a list of related ES documents. H&A documents are listed in the References Section.

1-04. SUMMARY OF PREVIOUS INVESTIGATIONS

Xerox began its investigation of the Building 801 site in the autumn of 1986. Table 1 is a chronological list of the work plans and reports prepared for Xerox by ES for each phase of work.

ES began the initial investigation in late 1986 (ES, 1987a, 1987b). It included a review of existing background information, performance of a soil-vapor survey, installation of monitoring wells, collection and laboratory analysis of samples from various media. The results of this investigation indicated the presence of VOCs in soil, groundwater, surface water and sediment in several areas on the site.

ES conducted a second remedial investigation in 1988 (ES, 1989a, 1989b). The investigation consisted of a soil-vapor survey, the installation of monitoring wells, collection and laboratory analysis of samples from various media. VOCs were detected in soil and groundwater samples from the Northern Area.

ES conducted a third investigation from December through March 1989 to determine if previous activities associated with Building 801 Northeast Corner had resulted in soil contamination (ES, 1990). Soil borings were drilled to a depth of 6 feet at 30 locations inside and directly north of Building 801. Soil samples were collected and analyzed for VOCs, which were detected in soil samples obtained from each of the areas sampled.

These investigations are discussed in greater detail in Section 2-01 of this RI report.

1-05. INTERIM REMEDIAL MEASURES

ES developed plans for interim remediation during 1989. Those efforts are documented in a remedial action alternatives report (ES, 1989c), a work plan (ES, 1989d), and an IRM plan (ES, 1989f). The interim remedial measures which included groundwater pumping and treatment, and runoff control measures, as described below, were implemented in early 1990.

1.5.1 Recovery Wells and Piezometers

Five recovery wells were installed to recover contaminated groundwater and to inhibit northward migration of contaminated groundwater. Three of the five recovery wells (RW-3, RW-4, RW-5) had been installed as monitoring wells during previous site investigations. Recovery wells RW-1 and RW-2 were installed in April 1990 as part of the IRM. The locations of the five recovery wells are shown in Figure 4.

A documented release occurred at the site in the spring of 1977 which was related to the spill crock located in the Lawn Area. Memoranda and letters obtained from DEC files documenting the event report the following sequence of events:

- solvents spilled from the spill crock located in the Lawn Area

- solvents pooled near the crock and entered the North-South Ditch

- solvents formed globules of dense brown liquid and flowed about 100 ft. downstream from the northern edge of the Lawn Area

- solvent coated the grass near the ditches, and a sheen was seen on the water in the ditch

- Xerox excavated soil from the ditch, and dammed the ditch near its confluence with Allen Creek

- A heavy rainfall occurred causing the dammed North-South Ditch to fill and overtop its banks, flooding portions of the land adjacent to the ditch with contaminated water

The spilled liquid was referred to as "waste perc", but no documentation has been found of subsequent analysis.

In the autumn of 1986, Xerox Corporation initiated investigations at the Building 801 site to evaluate environmental conditions as they related to former copier machine refurbishing operations. The investigations identified an area near the northeast corner of Building 801 Area C that may have been affected by solvents. Based on these findings, Xerox Corporation entered into an Order on Consent with NYSDEC on 16 March 1990. The order stipulated that Xerox: 1) undertake an Interim Remedial Measures (IRM) Program to prevent the further northward migration of affected groundwater and surface water and 2) perform a Remedial Investigation/Feasibility Study (RI/FS) to quantify potential problems and identify remedial technologies appropriate for site restoration.

The IRM Program, implemented in the spring of 1990, consists primarily of two measures: 1) pumping of affected groundwater from five recovery wells to an activated carbon treatment system, and 2) diversion of clean surface water and runoff away from areas where volatile organic chemicals (VOCs) or petroleum distillates were known to be present in the soil. The groundwater pumping and treatment system has been operating since March 1990.

The IRM program is described further in Section 1-05 of this report. A complete description of the IRM system can be found in the "Construction Completion Report, Interim Remediation at Xerox Building 801, Henrietta, New York" (ES, 1991d).

The RI was initiated in the autumn of 1986. As discussed in Section 1-01, the purpose of the RI is to further characterize the nature and extent of the site compounds of concern detected in soil, sediment, surface water and groundwater. Numerous studies have been conducted by Engineering Science Corporation (ES) and H&A of New York (H&A) towards this goal. See

Each recovery well was equipped with a dedicated submersible air-driven pump connected to a flow controller and an air compressor. A fiberglass enclosure surrounds each well. The recovery wells continue to operate.

Additionally, six piezometers (P-1 to P-6) were installed to measure water levels at three different vertical intervals in the overburden and quantify the drawdown resulting from the recovery operation. Three piezometers were installed in a single borehole at two separate cluster locations. These piezometer cluster locations are shown in Figure 4.

1.5.2 Groundwater Treatment

Groundwater is pumped from the five recovery wells located in the Lawn Area and paved drive north of Building 801's Northeast Corner and transferred to Building 801 by piping. The piping is buried below the frost line and protected within HDPE conduit. The system delivers groundwater to the activated carbon treatment facility in Building 801.

The treatment system consists of bag filters, a 500-gallon storage tank, three liquid-phase carbon canisters, and a vapor-phase carbon canister. Treated water is routed to the municipal sanitary sewer system. A vapor-phase carbon canister treats vapors from above the water in the 500-gallon storage tank. The liquid-phase carbon canisters used in the treatment facility have been replaced periodically to retain their effectiveness.

1.5.3 Surface Run-off Control Measures

Runoff control measures were constructed in the Lawn Area north of Building 801. The following measures were used to divert runoff from the Lawn Area and minimize erosion of contaminated soil.

- An earthen berm was constructed in the Lawn Area to contain precipitation, thus, reducing the potential for topsoil erosion and providing more surface water for infiltration. This was found to be an impractical measure. The low infiltration rate of the lawn area soil caused ponding within and upstream of the Lawn Area as water was backed up by the berm. The berm was subsequently breached at the northern perimeter to allow storm water to drain.

- Two stormwater separator boxes, located northwest of the Lawn Area, were closed in-place to reduce the potential for future discharge of sediments which had accumulated in the separator boxes.

- A manhole was installed at the east end of a storm sewer line to eliminate (block) discharge of storm water to the North-South Ditch. The stormwater now flows westward then northward and does not come in contact with contaminated soils. However, contaminated groundwater can infiltrate into the sewer system under certain conditions as discussed in Section 3-04.

- An HDPE drain pipe was installed beneath the Lawn Area berm to replace a portion of a drainage ditch which transversed the northern portion of the Lawn Area from east to west. This pipe was installed to inhibit contact of surface water draining from upstream with the Lawn Area soils.

- A concrete drainage channel was installed adjacent to the pump house to the northeast to divert weekly discharges from the fire protection water tank away from the Lawn Area in a northeasterly direction.

1.5.4 Quarterly Reporting

Quarterly reporting requirements are described in the 5 February 1990 addendum to the "Work Plan for Interim Remediation" (ES, 1989g). Quarterly monitoring activities include: IRM system operational checks and maintenance, treatment system influent and effluent sampling and analysis, and groundwater/surface water monitoring.

IRM system operational checks and maintenance were performed on a daily basis throughout. Xerox personnel performed routine procedures as described in the "Operations and Maintenance Manual, Carbon Treatment System, Xerox Building 801 Interim Remediation" (ES, 1991). The daily maintenance schedule includes a check of all systems within the treatment room, and of equipment located in each individual recovery well enclosure.

Daily maintenance tasks associated with the treatment system included; verifying operation of the various functions of the automated data recorder, checking the integrity of the holding tank, piping and carbon canisters, confirming operation of the transfer pump and inspecting sediment filters. Tasks associated with recovery system maintenance include; checking the operation of environmental controls (light, exhaust fan, heater, etc.) and pumping equipment (compressor, bubbler, pump controller, sediment filter etc.).

Treatment system influent and effluent samples are collected monthly and analyzed in accordance with the discharge permit requirements. Effluent samples are also collected monthly from each carbon canister to determine when breakthrough has occurred in the second (#2) canister and when replacement of the canisters is necessary.

Quarterly groundwater monitoring requirements include measuring water levels, checking for the presence of light and dense non-aqueous phase liquid prior to purging and collecting samples for laboratory analyses from all monitoring wells. The first three quarterly reports were prepared by ES beginning with the second quarter of 1991. The quarterly reports for 1992 and thereafter have been prepared by H&A.

II. STUDY AREA INVESTIGATION

2-01. INVESTIGATIONS CONDUCTED BY ENGINEERING SCIENCE

Engineering Science (ES) began remedial investigations of the Building 801 facility in 1986. The purpose of the investigations was to evaluate the site history, and to determine the extent of contamination.

2.1.1 Initial Investigation

The initial investigation consisted of a review of existing background information, performance of a soil vapor survey inside Building 801 and around the northern building perimeter, installation of 13 monitoring wells, and collection of soil, groundwater, surface water, sanitary sewer water, and sediment samples.

The soil vapor survey found VOCs in soil in several areas on the site. The highest VOC concentrations in soil were measured in the vicinity of the spill crock and former solvent storage tank area north of Building 801. Another area of elevated VOC concentrations was detected inside and immediately outside the northern building wall in the vicinity of the former solvent storage room and machine parts cleaning area.

The chlorinated volatile organic compounds tetrachloroethene (PCE), trichloroethene (TCE), 1,1,1-trichloroethane (1,1,1-TCA) and methylene chloride, were the primary compounds detected in soil samples from test borings located immediately north of Building 801. These compounds were typically detected within the upper 10 feet of overburden.

Three rounds of groundwater sampling were performed on the 13 monitoring wells installed by ES. Methylene chloride, detected in all monitoring wells during the first round of sampling, was subsequently confirmed to be present in two wells immediately north of Building 801 (MW-3 and MW-4) with lower concentrations in several of the outlying, downgradient wells.

The following compounds were detected in groundwater samples from MW-3 and MW-4 in each of the three sampling rounds: Methylene chloride, 1,1,1-TCA, TCE, PCE, 1,1-dichloroethane (1,1-DCA), 1,1-dichloroethene (1,1-DCE), 1,2-dichloroethane (1,2-DCA), 1,2-dichloroethene (1,2-DCE), vinyl chloride and mineral spirits.

Surface water and sediment samples were collected on two occasions at the Building 801 site. Initially, four surface water and sediment samples were collected from surface water drainage pitches which discharge to Allen Creek, and two samples were collected from Allen Creek. During the second round of sampling, the first six sampling locations were resampled (both sediments and surface water) and four additional sediment and surface water samples were collected upstream of the Building 801 facility.

The sampling locations are shown on Figure 5. The analytical results indicated the presence of VOCs, specifically mineral spirits, 1,2-DCE, 1,1,1-TCA, 1,1-DCA, TCE, methylene chloride, chloroethane, toluene, PCE, chloroform and ethylbenzene, in sediment samples collected from the stone ditch, immediately north of Building 801.

Surface water samples collected from the stone ditch also contained VOCs (1,1,1-TCA, TCE, 1,2-DCE, PCE, methylene chloride, 1,1-DCA, 1,1-DCE, vinyl chloride, mineral spirits and toluene). 1,2-DCE and TCE were also detected in surface water samples collected from a drainage ditch located immediately east of Building 801.

Sanitary sewer water samples were collected by General Testing Corporation on 23 December 1986 to assess the potential for sanitary sewers being an upgradient contaminant source. Samples were obtained from seven locations along the sanitary system along Jefferson Road south of the Building 801 facility. Compounds detected in the sewer water samples are as follows: methylene chloride, mineral spirits, chloroform, PCE, 1,2-DCE, 1,2-DCA, 1,1,1-TCA, TCE, toluene and ethylbenzene. An upgradient sample taken west of Building 801 contained generally lower levels of similar contaminants. Benzene was only detected in the upgradient sample.

Based upon the findings of the investigation, ES identified the following potential sources of contamination:

- former area of machine parts cleaning operations in Building 801 and

- former 8,000-gallon solvent storage tank and 500-gallon spill crock.

The locations of these areas are shown on Figure 3. E-S also located other possible sources of contamination in the stone ditch, immediately north of Building 801 and the sanitary sewer system south of Building 801 along Jefferson Road.

As a result of this investigation, recommendations for additional investigative activities were made:

- to determine the nature and extent of groundwater contamination in the Northern Area by the installation and sampling of additional monitoring wells and performance of soil-vapor survey;

- to resample surface water, sediment and sanitary sewer sampling points, and expansion of the sanitary sewer sampling program;

- to initiate a feasibility study; and

- to evaluate interim, short-term, source-control remedial measures.

Subsequent investigations, as described below, were developed to address these recommendations.

2.1.2 Second Investigation

In April 1987, ES initiated a remedial investigation for the Building 801 site (ES, 1989a, 1989b) for the Northern Area. The objectives of the investigation were to:

- determine local groundwater flow conditions;
- determine the potential for contamination of groundwater and soil; and
- assess the extent of contamination in the surface water and sediments in the drainage ditch and Allen Creek north of the Xerox property.

The investigation included a soil-vapor survey performed north of the Building 801 (see Figure 6, Test Borings Conducted by Engineering Science), collection of soil samples, installation of ten monitoring wells, sediment and surface water sampling, groundwater sampling of newly installed and previously existing monitoring wells.

The findings of the investigation of the Northern Area indicated:

- the highest concentrations of VOCs detected in soil were located along the North-South Ditch.
- VOCs were detected in ditch sediment samples, with concentrations decreasing with distance from the Lawn Area boundary to non-detectable levels approximately 100 feet from the ditch's entry into Allen Creek.
- VOCs were detected in two monitoring wells (MW-10 and MW-13S).
- three potential mechanisms contributing to migration of contaminants were identified: 1) surface water transport, 2) groundwater recharge from the drainage ditch and 3) groundwater transport from on-site areas.

Based on the findings of the investigation, ES recommended the following:

- complete two additional borings and install a shallow monitoring well to further define the extent of soils and groundwater contamination in the Northern Area.
- re-sample groundwater at MW-15D to confirm the presence or absence of VOC contamination at that well.
- develop and implement an interim remedial design to prevent further transport of contamination and eliminate the potential for contaminating Allen Creek.

2.1.3 Third Investigation - Inside Building 801

ES conducted its third investigation to evaluate whether previous activities in the building resulted in soil contamination beneath the floor of Building 801, Area C, (ES, 1990). Soil borings were conducted during December 1989 to March 1990 to a depth of 6 feet at 30 locations inside and to the north of Building 801, Area C. Soil samples were collected at two depth intervals: from 0 to 3 feet and from 3 to 6 feet. Non-aqueous phase liquid (NAPL) was encountered in several borings. Additionally, the following VOCs were detected in the soil samples: 1,1,1-TCA, TCE, PCE, toluene, 1,2-DCA, 1,2 and 1,4-dichlorobenzene, chloroethene, chloroform, 1,1-DCE, 1,1-DCA, 1,2-DCE, and mineral spirits.

The findings of this investigation indicated the following:

- VOC concentrations in soil samples obtained beneath Building 801 are greater than in soil samples obtained north of the building.

- VOC concentrations in soil samples taken from beneath Building 801 were highest at depths of 3 to 6 feet.

- VOC concentrations in soil samples obtained from the area north of Building 801 were highest at depths of 0 to 3 feet below ground surface.

- The evidence did not indicate the existence of a distinct, single source contaminant plume. Rather three or more separate potential source areas may exist corresponding roughly to several previously identified potential sources. The greatest VOC concentrations occur in the area east and northwest of the former solvent storage tank pad in the Lawn Area.

2-02. INVESTIGATIONS CONDUCTED BY H&A OF NEW YORK

H&A continued the RI initiated by ES in the spring of 1992. The following sections describe the details of H&A's investigations in the Building 801 study area.

2.2.1 Surface Features Mapping

Bergmann Associates, P.C. of Rochester, New York produced a new, detailed site map to be used for H&A's work associated with this RI. The map includes general topography downgradient of Building 801, measuring point elevations for all monitoring wells,recovery wells and piezometers, storm sewer locations and manhole inverts downgradient of Building 801, stream channel center lines and the surface water elevation-monitoring points (steel rods) installed by H&A.

2.2.2 Investigation of Areas of Concern

The previous site investigations conducted by ES identified the areas of concern at the site to include areas northeast of Building 801 and beneath the northeast portion of Building 801, which were believed to have been impacted by the following potential source areas:

- Northeast Corner of Building 801 (Area C) which formerly housed a photocopy-machine-parts-cleaning operation,
- Lawn Area north of Building 801, where former solvent storage tanks were located and
- the former solvent-storage tank area located along the northern wall of Building 801.

The locations of these areas of concern are shown in Figure 3.

H&A's investigations included: surface water and sediment sampling conducted along tributaries to Allen Creek; conducting soil borings; performing soil sampling and analysis; installing monitoring wells and obtaining groundwater samples for laboratory analysis. The results are summarized below.

2.2.3 Surface Water and Sediment Sampling

Quarterly surface water monitoring is required by the February 1990 addendum to the "Work Plan for Interim Remediation" (ES, 1989f). In accordance with the quarterly groundwater sampling and analysis program for Building 801, surface water samples were collected starting in March 1992 at eight locations in the stream channels as shown in Figure 5. All quarterly surface water samples were analyzed for VOCs using either EPA Method 8240 or Method 524.2 (modified 8240 with lower method detection limits). All quarterly sampling and analyses were performed by General Testing Corporation (GTC) of Rochester, New York. Surface water elevations were measured during the quarterly monitoring program at several stream elevation gauging points installed by H&A. The location of these stream gauging points are shown in Figure 5. The stream gauging points are steel rods that have been driven into the stream bed. The elevation of the top of each rod was surveyed to provide a measuring point using the same datum as that used for the monitoring wells.

The results from the quarterly surface water sampling program were used to characterize the nature and extent of contaminants detected in the surface water for this RI. The specific locations sampled and analyses performed during each quarter are summarized in Table 2.

Surface water samples were collected from the eight locations in the stream channels during the first quarter of 1992 on 3 and 4 March 1992. In addition to the routine quarterly analyses performed for surface water samples, surface water samples were analyzed for mineral spirits and for Target Compound List (TCL) metals.

Surface water samples were collected from the eight stream channel locations during subsequent quarters on the following dates:

- Second Quarter 1992 - June 1992
- Third Quarter 1992 - September 1992
- Fourth Quarter 1992 - December 1992
- First Quarter 1993 - March 1993
- Second Quarter 1993 - June 1993
- Third Quarter 1993 - September 1993

Routine quarterly analyses performed on surface water samples collected beginning the second quarter of 1992 consisted of TCL volatiles by Method 8240 for all sampling locations and two of the monitoring locations (SW-28 and SW-35) were analyzed for mineral spirits.

Additional sampling was conducted on 5 and 6 April 1993. H&A of New York personnel collected sediment samples from six locations along the North-South Ditch from the Lawn Area to Allen Creek which had been previously sampled by Engineering Science in September 1988. At five locations (SEDI - SEDV) samples were collected using a 3-in I.D. stainless steel hand auger at depths of 0-2 ft. and 2-3 ft. from the east right bank, west left bank, and center of the ditch. At location SEDVI sediment samples were collected from the center of the ditch at 0-2 ft. and 2-3 ft. All samples collected from the center of the ditch from 0-2 ft. were analyzed for total volatile organics using Method 8240 and mineral spirits using analytical Method 8015. All other sediment samples were collected and analyzed for total volatile organics using Method 8240. Sample location and total volatiles concentrations are shown in Table 3.

Water from the diversion manhole installed as part of the IRM program was sampled and analyzed for TCL volatiles by Method 8240. As described in Section 1-05, this manhole was installed at the end of an east-west drainage ditch re-routing surface water drainage from coming in contact with contaminated soils in the Lawn Area northeast of Building 801.

2.2.4 Soil Boring and Monitoring Well Installation

Three phases of drilling were conducted by H&A at the site to investigate the areas downgradient from and within apparent contaminant source areas (areas of concern), as described below.

The twenty-six test borings installed during the three phases of drilling (B120 to B132, B201 to B208, P13 and VE-1A) were drilled during period of 12 June through 10 November 1992 in accordance with test boring procedures described in the RI/FS Work Plan Addendum (H&A, 1992). The location of these test borings are shown in Figures 11, 12 and 13. Test borings were completed by Nothnagle Drilling to depths ranging from 8.0 to 40.8 feet below ground surface. Nothnagle Drilling used skid-mounted Diedrich D-25 and truck-mounted CME-75 rotary drill rigs with hollow-stem-auger casing to advance the test borings. The drill rig and equipment were steamed-cleaned prior to entering the site, between each test boring, and prior to leaving the site.

Split-spoon samplers were cleaned by hand between uses following the decontamination sequence provided in the Work Plan.

Soil samples were obtained with standard split spoon samplers (2.0-in. O.D., 1.375-in. I.D.), in accordance with ASTM Specification D-1586. Field measurements of in-situ soil conditions consisted of the Standard Penetration Test (SPT). The Standard Penetration Resistance (N) (defined as the number of blows required to drive the standard split spoon sampler 1.0 ft. into undisturbed soil with a 140-pound weight falling freely for 30 inches) was recorded on test boring logs as drilling progressed. The soil samples were logged and described in the field by an H&A geologist. H&A's soil descriptions are based on the Unified and Burmister soil classification systems. Descriptions of the subsurface conditions encountered at each test boring location are in the test boring reports presented in Appendix B.

Each soil sample recovered was immediately screened for the presence of volatile organic compounds using an organic vapor analyzer (OVA). The OVA reading was recorded on the test boring report form. If appropriate, samples were kept for chemical or geotechnical laboratory analysis. In some borings, shelby tubes were used to collected undisturbed soil samples for geotechnical analysis.

Soil samples obtained for laboratory analysis were removed from the split-spoon samplers, placed in sample containers, stored in coolers to preserve by chilling to approximately 4°C and shipped to General Testing Corporation (GTC). Sample handling procedures were followed in accordance with the Sampling and Analysis Plan previously submitted to NYSDEC.

All drill cuttings from borings conducted downgradient of and within suspected contaminant source areas were stored on-site in a roll-off container. Upon completion, each test boring was either backfilled with cement/bentonite grout or completed as a monitoring well, as described below.

Nine monitoring wells, seven piezometers, and two vapor extraction wells were installed in completed test borings during the three phases of drilling. Well installation details are summarized in Table 4. Installation diagrams are included with the test boring reports in Appendix B.

The wells were constructed with either 1.0 or 2.0-inch I.D. Schedule 40 PVC well screen and riser. A 10-foot length of No. 10 (0.010 in.) machine-slotted PVC well screen was used. A sand (filter) pack consisting of #3 QRok or equivalent grain-size sand was placed in the well annulus to approximately 2 feet above the top of well screen. A minimum 2-foot thick bentonite seal was placed above the filter pack and the remainder of the annulus was backfilled using cement/bentonite grout.

Wells constructed inside Building 801 and outdoors within paved areas were completed using flush-mounted roadway boxes. Protective steel casings were used to complete all other wells. Well construction details are shown in Figures 7 through 10.

2.2.4.1 Phase I Drilling

Thirteen test borings (B120 through B132) were conducted during Phase I of this RI to investigate the areas in and downgradient from suspected contaminant source areas. See Figure 11. Seven of the thirteen test borings were completed as monitoring wells. Two of the test borings were completed as piezometers. The remaining four test borings were plugged and abandoned.

The test borings were conducted to accomplish the following objectives:

- o Provide geotechnical (potential for settlements) and hydrogeologic information for the confined aquifer in areas upgradient and crossgradient from the suspected contaminant source area.
- o Provide groundwater quality data in suspected contaminant source areas.
- o Monitor water levels during or provide air inlet for a vapor extraction system pilot test.
- o Conduct a test of the lower aquifer in an area outside of the suspected contaminant source area.
- o Evaluate the North-South Ditch which flows into Allen Creek as a potential contaminant source area.

2.2.4.2 Phase II Drilling

Phase II test borings were conducted to acquire additional information in specific areas determined during the Phase I drilling program. The Phase II drilling program included nine test borings. See Figure 12. Four piezometers were installed at two test boring locations, two monitoring wells were installed in completed test borings and the remaining five test borings were plugged and abandoned.

The test borings were conducted to accomplish the following objectives:

- o Investigate the potential contaminant source areas inside Building 801 by collecting soil samples and submitting them for laboratory analysis.
- o Install a shallow well to provide an accurate elevation measuring point for groundwater elevations.
- o Investigate the potential contaminant source area outside of Building 801 by collecting soil and groundwater samples and submitting them for laboratory analysis.

2.2.4.3 Phase III Drilling

Phase III of the drilling program was conducted to install extraction wells and monitoring points for use in performing a 2-PHASE Extraction system (VES) and recovery system pilot test.

Phase III of the drilling program included conducting five test borings. A piezometer was installed in the first, a 2-PHASE extraction well was installed in the second, and the remaining three were backfilled. A second 2-PHASE extraction well was installed in an untested boring adjacent to one of the above sampled and tested borings.

2.2.5 Geotechnical Testing

Geotechnical testing was performed on samples obtained from the RI test borings to evaluate the likelihood of significant floor and structure settlements resulting from the proposed operation of a 2-PHASE Extraction system. The results of this testing and H&A's evaluation of the potential effects of the VES operation on Building 801 were initially presented in a separate report submitted to Xerox by H&A (H&A, 1993).

Geotechnical laboratory testing was conducted on selected soil samples obtained from six of the RI test borings. The six test borings from which samples were obtained for geotechnical testing were B-120, B-121, B-122, B-125, B-126, B-131. These test borings were conducted in the area that may be impacted by the vacuum extraction system in Building 801. The laboratory tests performed included moisture content, Atterberg Limits, grain size, density and permeability. The results of the laboratory tests are presented in Appendix C and summarized in Table 5.

The test results were used to confirm the visual classification of the soil samples. These soil classifications were incorporated in the soil descriptions contained in the test boring reports (Appendix B). Visual classifications for the samples tested vary from gravelly coarse to fine sand to silty clay.

Permeability tests were performed on six samples taken with a lined split-spoon sampler from test borings B-125, B-126, and B-131. The samples were tested in a flexible-wall permeameter by Empire Soils Investigations in September 1992. H&A of New York selected the samples to be submitted for testing and provided direction for the testing.

The permeability tests indicated the in-situ soils have coefficients of permeability in the order of 2×10^{-6} to 2×10^{-8} cm/sec (see Appendix C).

The results of this geotechnical evaluation indicated the following:

- The fill unit, which is generally the most permeable, is potentially the most susceptible to settlement.

- o The tests indicated that the native site soils likely to be affected by the proposed vacuum extraction system are the upper portions of the lacustrine deposits which have relatively low permeability and are medium dense to dense. They are not considered susceptible to significant settlements.

2.2.6 Groundwater Sampling

Quarterly groundwater monitoring is required by the February 1990 addendum to the "Work Plan for Interim Remediation" (ES, 1989f). The results from the quarterly groundwater sampling program were used to characterize the nature and extent of contamination in the groundwater for this RI. In accordance with the quarterly groundwater sampling and analyses program for Building 801, all site recovery wells and monitoring wells will be sampled annually during the first quarter of each year. During the other three quarters, the recovery wells and a selected group of monitoring wells are sampled. QA/QC samples were also collected including trip blanks, equipment blanks and blind duplicates.

All quarterly groundwater samples were analyzed for VOCs using either EPA Method 8240 or Method 524.2 (Modified 8240 with lower method detection limits). All quarterly sampling and analyses were performed by GTC. Groundwater sampling and laboratory analyses were conducted by GTC following USEPA SW846 protocols with modifications as specified in the Quality Assurance Project Plan.

In addition to quarterly groundwater sampling performed, groundwater elevations in all site wells and/or piezometers are being measured by GTC immediately prior to performing the quarterly sampling. Measurements were obtained twice weekly throughout the quarter by Xerox personnel. The semi-weekly monitoring by Xerox personnel include 13 wells and/or piezometers in the immediate vicinity of the IRM recovery network on Mondays and in 26 downgradient wells and/or piezometers (including the 13 above) on Thursdays.

First Quarter 1992 Groundwater Sampling - Groundwater samples were collected from all site monitoring wells and recovery wells during the first quarter of 1992 on 3 and 4 March 1992. The wells sampled and analyses performed are summarized in Table 6.

In addition to the routine quarterly analyses performed on groundwater samples, samples from the five recovery wells and upgradient well MW-1S were analyzed for Target Compound List (TCL) metals. Groundwater samples from the IRM five recovery wells (RW-1) were also analyzed for cyanides. Groundwater samples from recovery well RW-1 were also analyzed for TCL semi-volatile compounds (EPA Method 8270) and pesticides and PCBs.

Second Quarter 1992 Groundwater Sampling - During the second quarter of 1992 a selected group of monitoring wells and the recovery wells identified were sampled. Groundwater samples were collected from this group of wells on 3 and 4 June 1992. In addition to the routine quarterly analyses performed selected samples were also analyzed for mineral spirits.

Third Quarter 1992 Groundwater Sampling - During the third quarter of 1992, a selected group of monitoring wells and piezometers along with the recovery wells identified in Table 6 were sampled. Groundwater samples were collected from the selected group of wells on 9 and 10 September 1992. In addition to the routine quarterly analyses, selected samples were also analyzed for mineral spirits.

Fourth Quarter 1992 Groundwater Sampling - Groundwater samples were collected from recovery wells and selected site monitoring wells and piezometers on 10 and 11 December 1992. A new monitoring well and vacuum extraction well were also sampled during the fourth quarter of 1992. The wells sampled and analyses performed are summarized in Table 6. In addition to the routine quarterly analyses performed, selected samples were also analyzed for mineral spirits.

First Quarter 1993 Groundwater Sampling - During the first quarter of 1993 all site monitoring wells and recovery wells were sampled on 2,3 and 31 March 1993. The wells sampled and analyses performed are summarized in Table 6.

Second Quarter 1993 Groundwater Sampling - During the second quarter 1993 a selected group of monitoring wells and the recovery wells identified in Table 6 were sampled. Groundwater samples were collected from this group of wells on 2 and 3 June 1993. In addition to the routine quarterly analyses performed, selected samples were also analyzed for mineral spirits.

Third Quarter 1993 Groundwater Sampling - During the third quarter 1993 a selected group of monitoring wells and the recovery wells identified in Table 6 were sampled. Groundwater samples were collected from this group of wells on 1 and 2 September 1993. In addition to routine quarterly analyses performed, selected samples were also analyzed for mineral spirits.

Analytical results are included in Quarterly Reports 4 through 10. Reports 4 through 7 cover 1992, and reports 8 through 10 cover the first three quarters of 1993. All quarterly reports have been submitted to NYSDEC by Xerox.

2-03. PUMPING TESTS

H&A conducted a pumping test on monitoring well MW-25D in the lawn area north of Building 801 on 19 November 1992, to determine the hydrogeologic characteristics of the lower aquifer.

The test was performed using a submersible pump. Between 19 November 1992, 1200 hrs, and 20 November 1992, 1550 hrs., water levels were recorded using dataloggers and pressure transducers at MW-23D, MW-25D and MW-26D and manually at all other surrounding wells. Rounds of water levels were taken prior to the test start-up and during the pumping test. Water levels in the P1 - P3 cluster, in the upper aquifer near MW-25D, showed no change during the pumping test. This indicated a lack of hydraulic connection between the upper and lower aquifers. Figure 14 shows well hydrographs for MW-25D (lower aquifer) and P1-P3 (upper aquifer).

The flow from MW-25D was measured using a totalizing flow meter and was discharged into the drainage ditch. A sample of the groundwater from MW-25D was analyzed by General Testing Corporation on 3 November 1992, prior to the start of the pumping test, and was found to contain no detectable levels of volatile organic compounds allowing for direct discharge of the pumped effluent into the ditch.

The pumping test analysis and computed aquifer parameters are presented in Appendix D.

ES also conducted groundwater pumping tests on four shallow aquifer wells during September and October 1988. MW-2, MW-5 (currently RW-5), MW-7 and MW-10 were pumped for both short durations (4 hours) and long durations (96 hours) to estimate pumping yields and to determine aquifer parameters. Only the long duration tests will be considered in this report because they are more indicative of the site conditions. Groundwater was pumped using compressor-driven bladder pumps. For each pumping test, water level measurements were recorded with dataloggers/transducers in each pumping well and one monitoring well. Other water levels were measured manually. Discharge water was collected in 55-gallon drums and disposed of at an off-site facility. See Appendix D for pumping test analysis and aquifer parameters (ES, 1989c).

2-04. WATER BUDGET CALCULATIONS

H&A calculated a water budget for the site to evaluate general hydrologic conditions. A water budget is a calculation of the balance between groundwater recharge and discharge from a site. It includes the natural rate of groundwater underflow, infiltration from streams and rainfall, discharges to streams and evapotranspiration losses. The water budget was calculated by determining the upper, lower, and lateral boundaries of the site, and estimating values for all the water flows across those boundaries.

Appendix I presents the calculations and results for water budget inflows and outflows. Inflows and outflows were calculated for the original 50.2-acre Xerox property, the areas of concern on the original property and the area of concern for the 36.2-acre parcel. In general these budgets indicate that rainfall and evapotranspiration are many orders of magnitude larger than the natural rate of groundwater underflow, as is typical for the area.

Water budgets have the limitation that many of the inflow and outflow values can only be approximated very roughly. This is especially true for some of the largest input and outflow values such as evapotranspiration. This makes water budgets useful for determining general relationships for the interaction of the flows at a site, but not for yielding numerical or exact values for the unknown flow (Linsley, Kohler, and Paulhus, 1982).

2-05. GROUNDWATER MODELING

H&A assembled and tested a numerical groundwater model to simulate groundwater flow at the site. The purpose of modeling was to further clarify understanding of the site's groundwater flow regime. The model was also completed so that it could be used as a tool to predict groundwater response to pumping strategies in the FS.

2-07. ECOLOGICAL INVESTIGATION

An ecological investigation was conducted by Thomas P. Connare, biologist of TPC Environmental Consulting. Identification of predominant cover types and fish and wildlife resources in the study area was done by Mr. Connare during a two-day on-site field investigation on October 22 and 23, 1992. The results of this investigation are presented in a report entitled "Fish and Wildlife Impact Analysis for the Xerox Building 801 Study Area". This report is presented in its entirety in Appendix E.

Mr. Connare found various upland and wetland vegetation cover types. Most of these cover type areas are undergoing ecological succession from farmland to the characteristic climax vegetative community. Normal fish and wildlife populations were found, but drainage ditches were found to have low dissolved oxygen, and creek substrates were not suitable for aquatic organisms.

2.7.1 AQUATIC PATHWAY ANALYSIS

Allen Creek and adjoining drainage ditches provide the only aquatic habitat which could be affected by site contaminants. However, Mr. Connare concluded that due to the low flow and shallow depth of Allen Creek in the vicinity of the study area, suitable habitats for aquatic organisms are not likely to be present. Further, surface water sampling locations within Allen Creek, downstream from confluent drainageways from the study area have not exhibited detectable concentrations of site contaminants during the four quarterly sampling events conducted as part of the RI.

Based on these findings, an aquatic pathway to Allen Creek of surface water and/or subsurface contaminants does not appear to exist at the site. Therefore, a minimal impact from site specific contaminants on aquatic organisms can be expected. Additional evaluation including criteria-specific toxicological effects analysis is not warranted (NYSDEC DFW, 1991).

2.7.2 TERRESTRIAL PATHWAY ANALYSIS

The ecological study indicated that several terrestrial biota potentially exist at the site including white-tailed deer, red fox, eastern cottontail, muskrat, woodchuck, raccoon, meadow vole and leopard frog. The primary habitat for the anticipated terrestrial biota include old field, shrubland, and secondary growth forest (meadow vole), mature forested and riparian forests (white-tailed deer, raccoon, eastern cottontail), forested and riparian wetlands (muskrat, woodchuck, leopard frog). No evidence has been observed that would indicate any of these habitats has been affected by site contaminants. Surface sediment sampling conducted as part of the RI indicated that site contaminants existed only within an isolated portion of the drainage way immediately north of the fire system water discharge pipe. The extent of contaminants present within this area would be expected to have minimal effect on the existing terrestrial biota. Based on site observations, the biota most likely to be affected, meadow vole appear to thrive throughout the study area. Given these observations and the limited extent of surface sediment contamination at the site, the impact on the wildlife resources in the study area appears to be minimal and does not warrant further evaluation.

A numerical groundwater model is a set of mathematical equations, initial conditions, and flow boundary conditions used to simulate the flow of groundwater. H&A modeled site groundwater flow using the United States Geological Survey's Modular Three-Dimensional Finite Difference Groundwater Flow Model (MODFLOW).

The model input includes establishing the number of hydrostratigraphic units present; the type and location of hydraulic boundaries at the site; and hydraulic parameters such as hydraulic conductivity, saturated thickness, storage coefficient, recharge and vertical leakance.

For this site, MODFLOW was run using a single layer to simulate the upper aquifer because the previously described aquifer test indicated the upper and lower aquifer are hydraulically separate. An average hydraulic conductivity (K) value was used based on slug tests on all wells within the modeled zone. The upper aquifer (water table aquifer) is unconfined.

The area to be modeled was chosen in part to allow the model boundaries to coincide with actual hydraulic boundaries present at the site. The northern boundary coincides with Allen Creek, which was modeled as a constant head boundary. The east and west model boundaries are parallel to groundwater flow with little or no groundwater flow across them and were modeled as no flow boundaries. The southern boundary receives groundwater underflow and was modeled as a constant flux boundary. The model was set up with a 10 ft. by 10 ft. nodal grid in the area of investigation.

The model was calibrated and verified using the results of previous on-site pumping events. The model was calibrated by making minor adjustments in aquifer parameters so that the model response to IRM pumping matched the actual aquifer response. The model was then verified by inputting the pumping rate of the test on well VE-2 and verifying that model response agreed with aquifer response.

Documentation of the modeling effort is contained in Appendix I. This appendix contains figures and tables of model grids and parameters, printouts of model results, and a narrative description of the modeling.

2-06. HUMAN POPULATION SURVEYS

Human population surveys performed by H&A for this investigation consisted of: 1) reviewing Town of Henrietta zoning maps, 2) obtaining information regarding the number of people employed at and hours of occupation of the Xerox Building 801 facility and 3) obtaining information regarding traffic in and around the Building 801 facility. The results at these surveys are discussed in Section 3-05 of this report.

Zoning adjacent to the site is industrial and commercial. The closest residential areas are about 1/3 mile from the site. Population surveys found that of the thousands of Xerox employees working at Building 801, some percentage is present at the building at odd hours including weekends, evenings, and holidays. It was also determined that Hofstra Road, a major on-site thoroughfare, cuts across the contaminated portion of the site.

2-08. DATA EVALUATION

The findings of this investigation have been based on interpretations of the data gathered and presented in this and the previous studies cited in Section 2-01 through 2-07 of this report. The majority of the data were the results of direct observations and measurements made at the Building 801 site or in analytical laboratories on samples gathered at the site and transferred under documented custody to the state-qualified laboratories. Other supporting data and information have been drawn from published documents, which have been cited in this report.

2.8.1 Data Source Assessment

The primary data have been acquired following modern, accepted methods and protocols, in accordance with the requirements of the approved RI/FS work plan, amended as of 15 May 1992. The reports in which these data have been presented provide adequate traceability to the original observations, sampling, and measurement.

Comparison of the data gathered by the original site investigators (Engineering Science) and surveyors indicate consistency with observation, sampling, and measurements made by or under the supervision of H&A of New York. Based on the comparison, H&A of New York believes the data utilized in completing this investigation are adequately representative and accurate measurements of the conditions of the site to form the basis for remediation planning and design.

2.8.2 Data Validation

The validity of the environmental sampling and analyses conducted under H&A's supervision, since 15 May 1992, has been reviewed in detail by Denis M. Conley, a NYSDEC approved data validator. The results of the data validation review are presented in Appendix F.

The sample analytical data generated during the collection and analysis of environmental samples collected from June to November 1992, as part of the remedial investigation at Xerox Building 801 in Henrietta, New York is contained within seven data packages. Each data package comprises the field and laboratory analysis data and documentation of each sample-delivery-group (SDG) received by the contract laboratory during the investigation.

The remedial investigation was conducted in three phases. Phase I included the collection and analysis of 31 soils and two equipment blank and trip blank samples. The analytical data for Phase I is contained in SDGs BE002, BF003 and BL015. Phase II included the collection of 32 soil and two trip blank samples. The analytical data for Phase II is contained in three SDGs: BR003, B0131 and BN012. Phase III included the collection and analysis of ten soils, one equipment blank, and one trip blank sample. The analytical data for Phase III is contained in SDG BS001. Attachment 1 of Appendix F presents each SDG with project sample field and laboratory identification for each phase of the remedial investigation.

The validation report is comprised of two sections: organic analyses and inorganic analyses. Each section is divided into subsections for each validation criterion as defined by the "Functional Guidelines for Evaluating Organic and Inorganic Analyses", USEPA, February and July 1988.

The report incorporates the review of each SDG within each data validation criterion. Any deviation from NYSDEC ASP 89 requirements is designated by the SDG number in which the deviation was noted and the associated project samples affected.

III. PHYSICAL CHARACTERISTICS OF THE STUDY AREA

3-01. REGIONAL GEOLOGY AND HYDROGEOLOGY

This section describes the geology and hydrogeology of western New York, specifically the Erie-Ontario Lowlands physiographic province. The region is characterized by broad plains of low relief underlain by gently dipping sedimentary rocks of Lower Paleozoic Age. More resistant dolomites, limestones and sandstones comprise the caprock for a series of east-west trending eroded escarpments.

The regional topography has been modified by glacial erosion and deposition during the Pleistocene, and the unconsolidated sediments which mantle the region are dominated by glacially derived materials.

Paleozoic age sedimentary rocks comprise the bedrock in western New York State. The rock units strike east-west and dip to the south-southeast at approximately 50 to 80 feet per mile (dip angle of 1° - 2°) forming wide, east-west trending outcrop or subcrop belts. The bedrock units range in age from the Upper Ordovician Queenston formation outcropping along the Lake Ontario shoreline to the Upper Devonian shales of the Allegheny Plateau region in southern New York State. The individual rock units are correlatable over large geographical areas and are persistent in the subsurface throughout the stratigraphic sequence of sedimentary rocks. The sedimentary rocks unconformable overlie metamorphosed rocks comprising the Precambrian basement complex.

The only major, large scale structural feature identified in western New York is the Clarendon-Linden Fault system, which extends north-south in the subsurface from Lake Ontario to Allegheny County.

Regional bedrock joint systems are believed to have been formed in different stress conditions at different times. The predominant northwest trending compressive stress applied to the sedimentary rock section during late Paleozoic Appalachian deformation may have formed orthogonal, nearly vertical fractures.

The bedrock joint-strikes appears to be reflected in topographic lineaments developed by the erosion of overlying glacial deposits (Faukundiny and Pomeroy, 1978) and possibly reflected in linear drainage or tonal features noted on aerial photographs.

Unconsolidated sediments in the area are the result of Wisconsonian Stage glacial deposition and recent sedimentary processes. As this ice advanced and ultimately retreated from the region, various unconsolidated materials were deposited. The glacial deposits may include a mantle of glacial lodgement till and a variety of sand, gravel, silt and clay deposits resulting from glacial meltwater, ice marginal, or glacial lacustrine (lake) processes. Preglacial lakes formed between the glacial ice margin and the bedrock escarpments or moraines to the south during deglaciation of the region. Well defined beaches or erosional features may correlate to several lake levels or relatively catastrophic lake discharge events regionally (Muller, et. al., 1988). Sand and gravel outwash deposits may be associated with outlet or discharge channels for the preglacial lakes.

Recent sediments have been deposited in the area as a result of post-glacial sedimentary processes. Figure 15 shows the surficial geology associated with the Xerox Building 801 area.

Groundwater flow across the region occurs both in bedrock and the overlying unconsolidated deposits.

For the most part, groundwater flow through bedrock occurs within the secondary pores, a network of interconnected joints and fractures, as well as solution channels. In general, the secondary porosity and flow is greatest near the bedrock-overburden interface where weathering and stress relief following removal of glacial ice have broken down the bedrock. Fracture frequency and degree of interconnection typically decreases with depth and the amount of groundwater flow correspondingly decreases. In some areas of the region bedrock groundwater flow is confined below fine-grained glacial deposits.

Figure 17 presents a conceptual profile of regional groundwater flow within a portion of the Allen Creek subbasin. The water table mirrors the topography and represents the shallow overburden groundwater regime. The bedrock potentiometric surface was mapped in Monroe County by Young, 1980. This map was used to develop Figure 17 which shows regional groundwater flow in the bedrock. Although this map depicted generalized groundwater flow in the overburden, many of the wells used as data points to construct this map may be screened at the bedrock/overburden interface and reflect groundwater flow in the bedrock. Regional groundwater flow is to the north-northeast generally following the bedrock surface topography. At the Vernon-Lockport contact, groundwater flow appears to be directed along this contact to recharge the deeper bedrock aquifer system.

Figure 17 shows that the generalized overburden potentiometric surface intersects the ground surface in the vicinity of the site indicating flowing artisan conditions and/or discharge in and to the north of the Building 801 site. Artisan conditions are encountered at the site from wells screened at the bedrock/overburden interface.

Bedrock geology and hydrogeology have little impact on the site. Bedrock is well below the contaminated zone. Regional glacial deposits are the basis for the subsurface environment at the site.

Flow regimes within unconsolidated deposits are highly variable, because the grain-size distribution, degree of sorting, and degree of compaction of glacial deposits are highly variable.

Regionally Lake Ontario forms the hydrologic base level. Groundwater throughout the region generally flows toward the lake, or toward major river channels. The hydraulic gradient for bedrock groundwater slopes toward the north, so groundwater within the bedrock flows generally toward the north. Local bedrock groundwater may flow toward the northeast or northwest, dictated by the orientation of bedrock fractures at a particular location.

Groundwater flow within the overburden is also generally toward the north, but locally its direction is much more variable than in the bedrock. Normally, overburden groundwater will flow toward any local stream, tributary, pumping well, or other groundwater discharge point.

3-02. SITE GEOLOGY

Bedrock at the site has been identified as shale from the Vernon Formation. The bedrock surface is highly to completely weathered. The rock weathers to brown to green mottled clay with rock fragments of various sizes. Competent bedrock was encountered between 30 and 40 feet below ground surface. It is described as a red-brown to green-gray, mottled, fractured shale. Thirteen borings were drilled to a refusal depth which is believed to be the top of rock.

Overburden deposits consist of lodgement and/or ablation till above the bedrock, glaciolacustrine deposits above the till, and fill material above the glaciolacustrine deposits.

The lowest of the glacial till deposits at the site appear to be lodgement till, deposited at the base of the Wisconsonian glacier. The lodgement till deposits overlie the shale bedrock and vary from 5 feet thick in the northern portion of the site, where an intervening lacustrine clay separates the till deposits, to approximately 18 feet thick in the southern portion of the site as observed in test boring B-127. The till composition ranges from very dense gray-brown silty sand and dense clayey silt to very stiff brown silty clay, with varying amounts of sand and gravel.

Lodgement till is deposited at the base of a glacier during glacial advance. The lower deposits of till at the site have been identified as lodgement till due to its very dense or very stiff condition. Lodgement till has this characteristic because it is compacted by the great weight of the overriding glacier (Ritter, 1978).

An intervening glaciolacustrine deposit was found within the till deposits. This lower lacustrine unit consists of very stiff brown gray to maroon clay with little silt with an average thickness of 4 to 5 feet. This unit appears to have been formed during a temporary retreat of the glacier. Additional till was deposited above this lower lacustrine unit either as a lodgement or ablation till during a later stage of the local glaciation.

The layer above the till consists of glaciolacustrine deposits. The glaciolacustrine unit is approximately 7 to 10 feet thick, but may thin throughout different portions of the site. Medium to dense, sandy to clayey silt, dense fine sand and occasional stiff silty clay comprise the majority of soils found in the unit. The lacustrine unit thins and pinches out south of Building 801. It also thickens to 13 feet to the east along the north edge of Building 801 as observed in test boring B-123.

During retreat of a glacier, meltwater flowing from a glacier may form temporary preglacial lakes. These lakes are formed when water is impounded between the ice front to the north and the higher ground to the south (H&A, 1990). During some preglacial lake stages the site was under water. During this time period the site's glaciolacustrine deposits were formed. These deposits form as fine-grained sediments supplied by the melting glaciers or streams settle to the bottom of the lake.

The existence of the preglacial lakes implies that there must have been lakeshore deposits associated with the lake margins. Lake margin deposits would consist of sorted sandy deposits similar to those found along the present lake margins. Lakeshore deposits would be found at elevations which represent elevations of long term lake levels. Lakeshore deposits in southern Monroe County are found at elevations of 700, 460, and 425 feet above sea level (Fairchild, 1928; Young, 1980). Such shoreline deposits have been found in a north-south band just over a mile west of the site.

In general, the glacial geologic deposits found at the site are complex. The till deposits contain a layer of lacustrine deposit. It is also possible that some till material may have been reworked during periods when the lakeshore fluctuated and may have transversed the site. Also, isolated, small-scale coarse grained deposits that appear to be buried, isolated stream bed (glacio-fluvial) deposits have been identified in site test borings.

The origin of the coarse grained deposits is not certain, but a number of possible explanations exist. It is possible that there were periods when ablation till was deposited. Ablation till is till let down as the glacier wastes or melts. It is usually somewhat washed, with the fines being winnowed from the mass (Ritter, 1978). Coarse sediment may also have been deposited as a small kame at the surface or base of the ice, or as outwash form a small stream or delta. It is also possible that small scale slumping or flowing or coarser grained deposits occurred. H&A has not found coarse grained deposits to correlate between boreholes; they are most likely to be isolated deposits.

Fill material, a somewhat random mixture of coarse and fine-grained soils, was placed over much of the site to raise the surface grade prior to construction of Building 801. The fill material is encountered in all areas at the site except the Northern Area. The maximum fill thickness encountered is about 8 feet in test boring B-126.

Fill material also was used to backfill excavations. Coarse grained fill was probably used to backfill trenches for pipelines and all other buried utilities at the site, and probably used to backfill excavations made during the construction of Area C of Building 801. This presence of backfilled interconnected trenches and upper fill layer probably plays a significant role in mobility of fluids below the site.

Cross-sections showing H&A's interpretation of the site stratigraphy are presented as Figures 17 through 20. The locations and orientations of these profiles are indicated on Figure 21.

3-03. SITE SURFACE WATER AND DRAINAGE

3.3.1 Allen Creek

Allen Creek is the primary surface water feature in the site vicinity. The main channel of Allen Creek is located north of the site and is classified as a Class "B" water by the NYSDEC (ES, 1987a, 1987b). This classification allows for primary contact recreation, swimming, fishing and boating. However Allen Creek's recreational uses are limited due to its small size. Surface water in Allen Creek is not used for domestic or municipal water supplies.

Stream gauges have been established along Allen Creek and its tributaries on-site. Stream gauge locations are shown in Figure 5. Stream gauge measurements have been made quarterly as part of the established quarterly surface water monitoring program for the Building 801 facility.

Surface water elevations were measured at several stream elevation gauging points installed by H&A of New York. The stream gauging points are steel rods that have been driven into the stream bed. The elevation of the top of each rod was surveyed to provide a measuring point, utilizing the same datum as that used for the monitoring wells. These surface water elevations are also collected during the week of the quarterly sampling.

3.3.2 Site Drainage

Surface water at the site drains to the north through storm sewer lines, storm drainage ditches and overland flow to discharge points along Allen Creek. There are four major surface drainage features at the site:

- drainage ditch south of Building 801 and north of Jefferson Road
- Western North-South Stream
- the North-South Ditch including the drainage ditch receiving pump house discharge water
- Allen Creek, including the eastern branch

These site surface drainage features are shown in Figure 5. Lacustrine sediments are the parent materials or much of the surface soils at the site including Niagara, Lakemont and Cayuga silt loams. These soils are generally poorly drained and promote surface ponding of water and rapid run-off of precipitation. The areas of the site that have not received fill material are swampy, indicating the poor drainage characteristics of the soil.

Soils derived from glacial till deposits are Hilton, Callamer and Appleton loams which are found interfingering with the lacustrine derived soils at the site.

3.3.3 Historical Site Drainage

The drainage patterns throughout the Building 801 site have changed over the years. The following items were reviewed in reference to establishing historical site drainage patterns:

- 1938 Soil Survey of Monroe County, New York.
- 1951 Aerial Photograph from the Monroe County Soil Conservation District.
- U.S.G.S. Pittsford 7-1/2 minute topographic quadrangle maps.

- Current site plans

The 1938 Soil Survey of Monroe County used a topographic map as a base map for indicating soil types within Monroe County. The significant difference in site drainage noted on this topographic map is that the main branch of Allen Creek was shown to be due west of Building 801. The current northwestern branch of Allen Creek is not shown on the 1938 maps.

The 1951 aerial photograph and the U.S.G.S. topographic maps show this branch to be present. Additionally, a branch of Allen Creek is shown immediately west of Building 801. This branch appears to have been re-directed to follow the property boundary west of Building 801.

A significant drainage feature in the 1951 aerial photograph is what appears to be a drainage ditch extending north-south through cultivated fields beneath what is currently Area "C" of Building 801. This drainage feature (i.e. the North-South Ditch) extends slightly to the northeast from the current northern edge of Building 801 and intersects the eastern branch of Allen Creek.

Surface water at the site drains northward to Allen Creek. Drainage ditches, located around major facility features at the site, control surface water runoff and direct it to Allen Creek.

3-04. SITE HYDROGEOLOGY

The local hydrogeologic setting of the Xerox Building 801 site consists of two distinct hydrogeologic units: an upper aquifer, the unconfined water-bearing unit or water-table zone, and a lower aquifer which is confined by a lacustrine clay aquitard. The northern portion of the site is a discharge zone, where the groundwater table intersects the ground surface. Two main hydrogeologic conditions exist at the site: an upward vertical gradient and low flow rates through the contaminated portion of the site.

The upper aquifer does not fall under the common definition of an aquifer, in that it does not yield appreciable amounts of water to a well, and could not be used to supply water.

The lower aquifer is overlain by a lacustrine clay aquitard and exists under confined conditions. The lower aquifer encompasses the top of rock and the lower till unit; the lower till is locally absent southeast of Building 801. Groundwater flow in the lower aquifer is in a generally northerly direction with groundwater elevations lying close to 500 feet above mean sea level across the entire site. Seasonal fluctuations in the groundwater elevations are less than one foot for each well, with the high elevations occurring in winter. Figures 22 and 23 show the piezometric surface of the lower aquifer during the summer and winter of 1992, respectively.

Hydrogeologic conditions within the lower aquifer have been assessed based on measured conductivity values, vertical and horizontal gradients, groundwater flow rates and recharge conditions.

A mean horizontal hydraulic conductivity value of 6×10^{-3} cm/sec has been calculated based on a groundwater pump test conducted on monitoring well MW-25D by H&A of New York on 19 November, 1992. See Table 7. No other known permeability testing has been done on the lower aquifer. Horizontal hydraulic gradients across the site are approximately 0.001 ft./ft. and vary little more than 0.0005 ft./ft. seasonally.

These values can be used to calculate a groundwater velocity for the lower aquifer using the following equation:

$$V_{max} = K_{max} I_{max}/n_{min}.$$

where:

K_{max} = 6×10^{-3} cm/sec, mean hydraulic conductivity,
I_{max} = 0.001 ft/ft, maximum horizontal gradient,
n_{min} = 0.01, minimum effective porosity in fractured shale bedrock, and till with varied composition

a maximum horizontal groundwater flow velocity through the lower aquifer is approximately 6×10^{-4} cm/sec, or 1.7 feet/day. This should be viewed as a maximum velocity, and not as the most probable velocity for lower aquifer groundwater. The groundwater underflow passing through the site within the lower aquifer is about 22,000 gallons per day, using $Q = K_{max} I_{max} A$ where K_{max} and I_{max} are as described above and the cross-sectional area A is the product of the lower aquifer thickness and the maximum site width. Again, this should be viewed as a maximum horizontal underflow, and not as the most probable underflow. (Hydraulic conductivities used here have been corrected for water table elevations within the screened interval).

Strong upward components to groundwater flow are revealed by the presence of vertical gradients, indicating groundwater flow toward the overlying shallow aquifer. Maximum upward vertical gradients were calculated to be 0.42 ft./ft. These values vary with both location across the site and time of year. Higher upward vertical gradients occur in the northeastern portion of the site during the summer months. They are lowest to non-existent in the southeast where the confining clay layer, and thus confined-aquifer conditions, are absent. Examination of hydrographs for all well clusters in or laterally downgradient from the contaminated zone indicate that the vertical gradient is always upward.

Based on a mean vertical hydraulic conductivity of 3×10^{-8} cm/s for the confining lacustrine clay (ES, 1987a, 1987b) and a maximum upward vertical gradient of 0.42 ft./ft., the maximum vertical leakage through the clay layer is estimated to be 2.5×10^{-4} gallons per day per square foot of aquifer area. Based on the average vertical gradient of 0.18 ft./ft. and an area of 30,000 ft.^{2}, the leakage upward into the shallow aquifer within the lawn area is estimated to be approximately 3 gpd.

Recharge in the form of surface infiltration does not contribute to flow in portions of the lower aquifer north of Building 801 due to the upward vertical gradients. While recharge of the lower aquifer is expected to be precluded directly beneath Building 801, recharge may occur just south of Building 801, as well as south of Jefferson Road where the till deposits are exposed in areas of higher elevation.

The upper aquifer exists in the upper till unit and the upper lacustrine silts/sand unit, as well as in the surficial fill material. It is bounded at its base by the lacustrine clay aquitard and, by the progressively more dense and less permeable upper till.

Groundwater levels in the upper aquifer usually lie within 5 to 10 feet of ground surface, but vary seasonally. Normal groundwater elevations are between 485 and 500 feet above mean sea level, with elevations being several feet higher in the winter than in the summer. The direction of groundwater flow across the site is generally to the north, and toward stream channels. Figures 24 and 25 show the water-table elevations in the shallow, upper aquifer during the summer and winter of 1992, respectively.

Influences on the upper aquifer groundwater flow include stream drainages, the five pumping wells and several underground utilities. The pumping wells, due to their low pumping rates and the low hydraulic conductivity of the upper aquifer soils, capture groundwater from only a very limited areal extent, as little as 10 feet or less from the wells. See Figures 26 and 27.

The influence of the streams and underground utilities is evidenced when viewed from a seasonal perspective. The groundwater table is at a low during the summer/autumn months and usually fall below the stream elevations and the fluid levels in the utility sewer lines. This results in a flow of water from the streams and sewer into the surrounding aquifer. However, during winter/spring months, when the water table is high and above the stream and sewer water levels, groundwater may flow into the storm sewer and/or stream.

Hydrogeologic conditions within the upper aquifer are more complex than in the lower aquifer. The upper till and the upper lacustrine silts/sands have different hydraulic conductivities, as shown on Table 7. Slug tests have determined that the upper till has a conductivity of approximately 10^{-6} to 10^{-7} cm/s, whereas the lacustrine silts/sands has a 10^{-4} to 10^{-5} cm/s conductivity value. As was previously mentioned, the extremely low conductivity of the upper till may cause it to act, along with the lacustrine clay layer, as a partially confining layer, for the lower lacustrine unit.

Horizontal gradients within the upper aquifer normally range from 0.001 to 0.046 ft./ft., and vary both seasonally and with location. The highest observed gradient within the contaminated area of the upper aquifer is 0.023 ft./ft. Water table contour maps for the summer and winter are shown in Figures 24 and 25, respectively. The highest gradients usually exist southeast of Building 801 and northeast of the Lawn Area. Vertical gradients within the upper aquifer are also present. Upward vertical gradients, as measured in piezometer clusters P1-P3 and P4-P6, range between 0.01 and 0.25 feet/foot. The higher vertical gradients exist in summer months.

Groundwater flow velocity in the upper aquifer is estimated using Darcy's Law, using measurements of hydraulic conductivity and hydraulic gradient, and estimates for effective porosity. Because such estimations are based on parameters associated with natural variability and measurement uncertainty, a range of calculated possible values for groundwater velocity will be given.

Hydraulic conductivities of upper aquifer sediments screened by P3, P5, P6, P7, P8, MW-2, MW-7 range from a minimum value of 9.4×10^{-6} cm/s toa maximum value of 3.9×10^{-4} cm/s, with a collective geometric mean value of 5.3×10^{-5} cm/s. These values are calculated from rising/falling test data assessed using method G of Hvorslev for a piezometer with an interval open to an uniform soil (Hvorslev, 1951). The slope $[\ln(H_1/H_2)]/(t_2-t_1)$ is evaluated for the portion of the graph representative of actual soil conditions, i.e., away from the bore. Corrections are made to account for water levels falling below the top of the screen/sandpack interval where this occurred. Hydraulic conductivity values in the subsurface are most often lognormally distributed, so a geometric mean value (μ) of hydraulic conductivity is typically used to calculate an ensemble mean groundwater velocity (Domenico and Schwartz, 1990; Fetter, 1993). The parameter μ is calculated as:

$$\mu = 10\hat{}\ [(\Sigma \log K_i)/m]$$

where m is the number of samples.

The characteristic hydraulic gradient at the site is 0.02 ft/ft. Assuming an average effective porosity of the upper aquifer material in the range of 10%, the calculated potential groundwater velocities range from less than 2×10^0 to 8×10^1 ft/yr (2 to 80 ft/yr). The geometric mean value is 1×10^1 ft/yr (10 ft/yr). Although H&A has not found obvious high-permeability sediments in either lacustrine or till deposits to be correlated between boreholes at the site, it is possible that layers of comparatively high hydraulic conductivity, however thin, could exist and function as conduits of flow and as pathways of contaminant migration. For this reason, calculations based on estimated site groundwater velocities should consider both the geometric mean value and the range of potential extreme values.

In assessing potential contaminant transport rates, the range of velocity values given above should be considered along with apparent dispersion and retardation of solute movement, the latter caused by sorption of VOCs onto sediments. Apparent dispersion caused by velocity variations in porous media of differing permeabilities can cause a fraction of solute molecules to migrate hydraulically downgradient faster than the ensemble mean groundwater velocity calculated for an entire stratigraphic interval.

3-05. DEMOGRAPHY AND LAND USE

3.5.1 Zoning

According to the current zoning map for the Town of Henrietta, the site and most of the area immediately adjacent to the to the site is zoned "industrial". Some property adjacent to the Xerox 801 facility to the east is zoned "commercial B-1". Facilities that exist in this area can be described as stores, restaurants, and entertainment facilities.

Areas south of Jefferson Road along Castle Road and east of Winton Road approximately 1/3 mile from the Xerox 801 facility are zoned "Residential". Although property north of the facility is zoned industrial, a considerable amount of vacant land occurs between the Xerox 801 facility and Brighton-Henrietta Town Line Road.

3.5.2 Human Population Survey

As indicated above, the closest residences are located approximately 1/3 mile from and upgradient of the Xerox 801 facility. There is no indication of human occupation or use of the Northern Area. Therefore the population within the study area to be considered are the employees working at the Xerox 801 facility and those employed at existing local businesses.

The Xerox 801 facility currently employs several hundred people. H&A has observed that the facility is occupied by some personnel all hours of the day, including weekends.

Jefferson Road, an east-west route, forms the sites southern boundary. It is a major four-lane state route (Rt. 252). Hofstra Road, located north and east of Building 801, serves as an access route for vehicles and pedestrians to portions of the Xerox facility. Hofstra Road runs east-west through the contaminated portion of the site.

3.5.3 Xerox Building 801 Facility

The original Building 801 site encompasses 50.4 acres (2,200,000 square feet) and includes a building that occupies 535,000 square feet, or 24% of the site. Paved parking areas occupy approximately 1,000,000 square feet of the site. Approximately 70% of the original site area is paved or covered by buildings. The 1993 acquisition added 36.2 acres of undeveloped area.

The original building on the site occupies the southwest portion of the site and was constructed in 1951. Additions to the original building were constructed in 1967 and 1971, extending the building eastward on the site. Several site features, including a cafeteria, a propane storage tank area and water storage tank, are located north of Building 801.

3.5.4 Public Utilities

Several public utilities service and have easements across the Xerox 801 site. The site is serviced by Rochester Gas and Electric (RG&E), Rochester Telephone Company and the Town of Henrietta sanitary sewer and water supply services. Water is supplied to the site by the Monroe County Water Authority. However, all water and sewer lines are owned and maintained by the Town of Henrietta. The approximate locations of these utilities are shown in Figure 28. These utilities enter the site from Jefferson Road. RG&E has an easement extending northward along the western property boundary from Jefferson Road. Two sanitary sewer lines cross the southeast corner of the Xerox 801 property. One of these lines, which crosses the Xerox property north of Jefferson Road, has been abandoned. ES had analyzed water samples from these sanitary sewers.

3.5.5 Xerox Building 801 Private Utilities

Utilities owned and maintained by Xerox Corporation at the Building 801 facility include numerous underground storm sewers, sanitary sewers, and electric lines that service the facility. Sanitary sewer lines from the facility ultimately discharge to the Town of Henrietta-owned sanitary sewers along Jefferson Road.

Storm sewers at the Building 801 facility are located approximately as shown in Figure 28. The storm sewers direct surface water drainage to surface drainage ditches that ultimately drain to Allen Creek. Concrete surface drains collect runoff from precipitation in the asphalt parking area on the east side of Building 801 as shown in Figure 28.

IV. NATURE AND EXTENT OF CONTAMINATION

4-01. BACKGROUND

The nature and extent of contamination at the site has been determined during the RI through site investigations and a review of site history information. Locations of the former solvent storage, transfer and usage facilities are shown on Figure 3. Cleaning facilities where solvents were used were located along the north wall of the Northeast Corner of Building 801. Tanks holding virgin and used solvents were located just outside the building and across Hofstra Road within the Lawn Area. Investigations have indicated that these solvent storage, transfer, and usage facilities contributed to the environmental contamination now found at the site. As identified in Section 1-03, Site History, a documented release occurred at the site in 1977.

No records of the quantities and types of chemicals used at the facility are available. It is possible that the chemicals used were solvent blends. These could have been supplied by the Inland Chemical Company and could have been designated AP-66, AP-67, AP-71 and AP-72. These blends contained chlorinated solvents mixed with a mineral spirits carrier. The constituents of these blends are listed in Table 8.

Floating product layers have been found in wells RW-1, RW-3 and VE-1A. The chemistry and physical parameters of these products are found in Table 9. The Table 9 values, represent the best characterization of the solvents as they exist today. However these values would not be representative of the original blends. The chemistry and physical parameters of hydrocarbon products change over time due to volatilization, selective adsorption and microbial decay.

The chemicals making up the floating product layers, as well as the contaminants found in groundwater, soil, surface water and sediment samples consist of mineral spirits and volatile organic compounds. The compounds include:

Original Constituents	Breakdown Products
Methylene Chloride	1,1-Dichloroethene
1,1,1-Trichloroethane	1,2-Dichloroethene
Trichloroethene	1,1-Dichloroethane
Tetrachloroethene	Vinyl Chloride
Acetone	1,2-Dichloroethane
2-Butanone (MEK)	

The compounds listed in the left column may have been original constituents of the solvent blends, or were on the parts being cleaned. The compounds in the right column are secondary chemicals formed by the breakdown of the original constituents.

4.02 OCCURRENCE OF CONTAMINATION

The concentration and distribution of the compounds found in the subsurface at the site indicate they originally existed as non-aqueous phase liquids (NAPL). After the NAPL entered the subsurface environment it became partitioned among free-phase, adsorbed, dissolved and gaseous states. The compounds now probably exist as:

- Layers or lenses of NAPL floating on the groundwater
- residual droplets or ganglia of NAPL held in the soil by capillary forces (McWhorter, 1991)
- NAPL, absorbed into soil particles or adsorbed onto particle surfaces
- solute dissolved in unsaturated zone water
- solute dissolved in unsaturated zone air
- solute dissolved in groundwater
- residual bubbles or ganglia held in pores below the water table
- adsorbed to sediment in surface water drainageways
- solute dissolved in surface water
- solute dissolved in atmosphere

The chemicals in the various conditions listed above are in a state of dynamic equilibrium. Molecules of these compounds transfer through condensation, evaporation, dissolution, or adsorption. There is also movement within each condition caused by advection of groundwater, soil vapor, soil water, surface water, or erosion and transport of stream sediment.

4.2.1 Non-Aqueous-Phase Liquid

Non-aqueous-phase liquids (NAPLs) have been found at the site. They are made up of a mixture of undissolved mineral spirits, unidentified hydrocarbons, and chlorinated volatile organic chemicals. Chemical and physical analyses of the NAPLs are contained in Appendix G and summarized on Table 9. The NAPL found on site is lighter and more viscous than water, and contains chlorinated VOCs in the percent range. The lower density of the NAPL causes it to float on the groundwater, and the relatively high viscosity and high interfacial tension with water cause it to be relatively immobile.

Floating NAPL has been found at wells RW-1 and RW-3 outside the building and VE-1A inside the building. Levels of groundwater contamination at RW-4, and soil samples at a number of borings indicate that NAPL may be near well RW-4. The thickness of the NAPL layer is known within wells RW-1, RW-3, and VE-1A (as shown below) and is assumed to thin out with distance from these wells. The thickness of the NAPL layers within the upper aquifer and outside of the wells is unknown. Theory suggests that the NAPL layer in the aquifer will be thinner than the layer measured in the wells (Fetter, 1993). NAPL thickness within the wellbores of the pumping wells also varies, depending on groundwater level elevation, (i.e. pumping/non-pumping) as shown in Table 10.

Well	Maximum NAPL Thickness
RW-1	2.7 ft.
RW-3	1.6 ft.
VE-1A	0.8 ft.

Available site data indicates that the NAPL lens has been slow moving. One indication for the slow movement is that NAPL has never been detected except at the three wells listed above. Also, the NAPL's presence near pumping wells indicates that if it were to move it would be down the cone of depression towards the pumping wells. If the NAPL does move, its most probable path would be within the trenches linking the recovery wells near RW-1 and RW-3.

H&A collected NAPL samples from RW-1 and RW-3 on 5 March 1992, and from VE-1A on 20 January 1993. Results of analyses are shown in Table 9. Appendix G also contains the analytical results of the NAPL samples. Differing chemistries and physical characteristics were encountered at the three locations. The variations may be the result of differing degradation conditions near the three wells.

NAPL detected at the Building 801 site contains less than 20% chlorinated VOCs (Table 9). Much of the remaining solvent mixture appears to consist of the saturated hydrocarbons n-nonane, n-heptane and n-decane, according to results from a GC/MS library search of TCL volatile analytes. The saturated hydrocarbons together function as a solvent for the VOCs (Weast, 1976). Because the hydrocarbons are less dense than water, and form most of the solvent mixture, the entire mixture behaves as an LNAPL.

The maximum aqueous solubility of a VOC component dissolved in an organic mixture is proportional to the mole fraction of that component in the mixture (Schwarzenbach et al., 1993). Because the total VOC fraction in the mixture is less than 20%, individual VOC solubilities in groundwater near the mixture would be much lower than maximum aqueous solubilities of the respective pure compounds. The entire NAPL mixture should be environmentally stable (Howard, 1990).

4.2.2 Soil

More than 100 soil borings have been drilled at the Xerox Building 801 site. Nearly all of these have extended to below the contaminated zone. Chemical analyses of soil samples from these boreholes have allowed the development of an understanding of the horizontal and vertical distribution of chemicals on the site. Results of chemical analyses of soil samples collected by H&A are tabulated in Appendix A.

Figures 29 through 33 show total volatile organic compound concentrations in soil at various depths. Each figure depicts a different depth range, with Figure 29 showing concentrations from 0-4 ft. below ground surface through Figure 33 showing concentrations below 16 ft. The soil plume (defined as soil contaminant levels greater than one milligram per kilogram) appears to cover less than 1.5 acres. The plume was not found to extend deeper than 14 feet in any of the explorations.

VOC concentrations in the 0-4 ft. interval are highest in the Lawn Area, centered around and extending northward from the former solvent storage tank area. Elevated levels are also found adjacent to the building near the former solvent storage pad. A narrow contaminated area extends northward along the North-South Ditch. Soils may originally have been contaminated by separate spills of solvent in various use and storage areas, but the plumes have coalesced and are not now distinguishable.

Figures 29 through 33 indicate the limited extent of contamination. Very low levels of contamination are found below 12 ft. This is probably because the soil is fine-grained at depth and does not allow for downward chemical migration.

4.2.3 Groundwater

Groundwater chemistry has been monitored at numerous locations across the site. The well network includes 26 monitoring wells, 5 recovery wells, 2 vacuum extraction wells, and 12 piezometers. Groundwater chemistry has been analyzed at least once at nearly all of these locations, and at multiple times at the majority of the wells.

The groundwater samples have been analyzed for volatile organic chemicals, mineral spirits, TCL metals, cyanide, TCL semivolatiles, TCL pesticides, and TCL polychlorinated biphenyls. Only volatile organic chemicals and mineral spirits have been found at elevated concentrations. The results of the 1993 annual round of groundwater sampling and analyses are included in Appendix A.

The lateral distribution of total volatile organic chemical concentration in the groundwater is shown in plan view on Figure 34. This figure shows that the highest concentrations are found in the central portion of the Lawn Area. Groundwater contaminants in the central portion of the plume consist primarily of methylene chloride, 1,1,1-trichloroethane (1,1,1-TCA), and trichloroethene (TCE). Minor concentrations have also been detected of cis 1,2-dichloroethene (1,2-DCE), tetrachloroethene (perc), vinyl chloride, and 1,2-dichloroethane (1,2-DCA).

Concentrations decrease logarithmically with distance from the center of the Lawn Area. Methylene Chloride is much less prevalent outside of the Lawn Area.

Groundwater contamination also exists below a small portion of Area C in Building 801, and in a thin band extending northward along the North-South Ditch. Contamination below the building source area is approximately an order of magnitude lower than in the center of the Lawn Area. Groundwater contaminant concentrations in the Northern Area are many orders of magnitude lower than in the central part of the Lawn Area.

No VOC's have been detected in groundwater outside of the area shown in Figure 34.

4.2.4 Surface Water

Surface water sample have been collected from 35 sampling locations. The sampling locations cover upstream and downstream areas, as well as drainage ways within the study area. Surface water sampling locations are shown on Figure 5.

Sampling locations were established by ES, and initial rounds of surface water samples were collected in 1986 and 1987. The surface water samples were analyzed for volatile organic chemicals.

Results of the initial sampling rounds indicated the following:

- o Eastern upgradient branch (SW-9 through SW-16) non-detectable levels of VOCs.
- o Central upgradient branch (SW-7, SW-8, SW-22, Grab-2) non-detectable levels up to 2 ppb VOCs.
- o Western upgradient branch (SW-19 through SW-21) non-detectable levels of VOCs.
- o Upgradient Allen Creek (SW-17, SED-32, SW-6) low levels of VOC's, up to 25 ppb.
- o Sanitary sewer outfall (SW-3, Grab-4, SW-35) moderate levels of VOC's, up to 45 ppb.
- o Downgradient drainage ditch (SW-2, Grab-3, SW-24 through SW-29) VOC levels up to 2,500 ppb.
- o Downgradient drainages and Allen Creek (SW-5, SED-33, SED-34, SED-VIII) non-detectable levels of VOCs.

These results indicate that the only significant surface water contamination was found within the downgradient drainage ditch, and that moderate levels were found at the storm sewer outfall.

An abbreviated number of surface samples are currently collected on a quarterly basis. They confirm the original findings of significant contaminant levels found only in the North-South Ditch. A tabulation of results of surface water sampling and analysis is included in Appendix A.

4.2.5 Air Pathway Analysis

The Air Pathway Analysis (APA) conducted as part of the RI was performed with guidance provided from "Air Pathway Analysis during Remedial Investigations" (NYSDEC, 1991). The APA utilized existing air quality monitoring data (ES, 1990; H&A, 1992) collected during field activities to assess ambient air conditions within and adjacent to the contaminated areas of the site.

Potential annual emission rates (Ei) were determined by applying the Shen Model (Appendix H, Attachment 3). The Ei of each primary site contaminant was evaluated for compliance with the Annual Guideline Concentration (AGC) as listed within the "DRAFT" Air Guide I (NYSDEC, 1991).

Air monitoring was performed during each round of boring installation, excavation, and sampling. Air quality data is summarized in Appendix J. Air quality measurements were conducted using pre-calibrated handheld organic vapor analyzers. Air monitoring instruments utilized either flame ionization detectors (Foxboro Model 128GC OVA) or photo-ionization detectors (Photovac Microtip) with detection limits of less than 1.0 parts per million by volume (ppmV) of total volatile compounds.

VOCs have been detected in air samples collected downwind from excavations, soil piles, and auger holes during well installation activities. Air samples from background locations have not had detectable concentrations of VOCs. Air monitoring within the lawn area and the potential indoor source area have also exhibited non-detectable levels of VOCs. Although VOCs were not detected within the potential source areas, subsurface soil contamination determined during the well installation program was used to estimate ambient air quality at the Xerox Building 801 site.

Air impact analysis was conducted by determining an emission rate (Ei) for each VOC of concern at the Xerox site. Site specific VOCs of concern were determined using risk assessment guidance procedures (USEPA, 1989). The VOCs of concern detected in the site soils included vinyl chloride, methylene chloride, 1,2-dichloroethene, 1,1,1-trichloroethane, trichloroethene and tetrachloroethene. Emission rates (Ei) were calculated for each VOC of concern detected in soil borings in the potential source area between the building and the lawn area using the Shen Model (USEPA 1989). Appendix H presents the sample calculation for the determination of the VOC emission rate (Ei).

The calculated VOC emission rates were used to establish an area source emission rate (Qa) and a maximum Actual Annual Impact (Ca) within the source area (NYSDEC, 1991). Since the Qa did not exceed the uncontrolled emission source criteria (6NYSDEC Part 212), the Ca values were compared with annual guideline concentrations (AGC) provided by the "DRAFT" Air Guide I (NYSDEC, 1991). No VOCs were determined to exceed the published AGCs. Table 11 presents the calculated Qa, Ca and AGC values for each VOC of concern evaluated for the Building 801 site.

The Ca values were also utilized in the evaluation of potential health risks following risk assessment guidance (USEPA, 1989). Attachment 2 of Appendix H presents the calculation of the baseline risk to the health of on-site workers from inhalation of vapors potentially emanating from the subsurface soils. The calculated risk exceeds the threshold acceptance of 1.0E-6 recognized by the NYSDOH.

The air pathway analysis incorporates several conservative assumptions. The Ca values were derived from the Qa and Ei emission rates which utilized the highest soil concentrations of the VOCs of concern detected during the RI. The risk assessment determination further uses the established Ca values in conjunction with conservative ambient air consumption, exposure scenarios, and risk factors. The results of the air pathway analysis indicate that the ambient air at the site is not a potentially contaminated medium. The calculated values are low, below detection limits of a PID, and are therefore consistent with the measured lack of detectable concentrations of VOCs in and around the potential sources during field activities. The existing soil horizon at the site may also be effectively inhibiting the evolution of contaminated soil vapor.

4-03. ORIGIN OF CONTAMINATION

Although the exact mechanism and timing of release is unknown, investigations have indicated there are two primary source areas. One is the parts cleaning area in the Northeast Corner. The other is the spill crock and storage tank facility in the Lawn Area. As indicated in Section 1-03, Site History, a documented release occurred at the site in 1977. The extent of the release as documented in DEC files coincides well with the observed distribution of contaminant identified during the RI.

V. CONTAMINANT FATE AND TRANSPORT

5-01. CONTAMINANT MIGRATION

Contaminants could potentially migrate from the source area dissolved in groundwater, air, or surface water, or as undissolved NAPL. The investigation findings described in Section 4-02 indicate that air at the site is uncontaminated, and that undissolved contaminants, have undergone only limited migration from that source area. There is evidence of some migration of the dissolved aqueous phase compounds from the original source areas along surface drainageways and within zones of previous subsurface construction. Figure 35 shows potential contaminant migration pathways which have resulted from subsurface construction activities.

5.1.1 Groundwater

Groundwater in the contaminated upper aquifer migrates to the north. There is an upward hydraulic gradient from the lower aquifer which the available records indicate is always present, so there is little likelihood of downward groundwater migration of dissolved phase contaminants.

The horizontal migration of groundwater and contaminants in the upper aquifer is based on estimated groundwater velocities in the range of 2×10^0 to 8×10^1 ft/yr (2 to 80 ft/yr). The ensemble geometric mean value estimated for groundwater velocity is 1×10^1 ft/yr (10 ft/yr). Apparent dispersion due to velocity differences in different interconnected porous media undoubtedly cause a fraction of the groundwater molecules to travel faster, and some to travel more slowly, than the ensemble mean groundwater velocity.

Some of the contaminants of concern at the site could migrate at appreciably lower rates than that of ensemble mean groundwater velocity, due to sorption onto, and desorption from, sediments during subsurface contaminant transport. The retardation factor, R, defined as the velocity of groundwater divided by the velocity of a linearly sorbing contaminant, is given as (Fetter, 1993)

$$R = 1+\rho_s\,[(1-n)/n]\ K_d$$

where ρ_s is the solid density, n is the porosity and K_d is the sediment-water partition coefficient. Nonpolar hydrophobic organic compounds (HOCs), such as the VOCs of interest at the site, tend to sorb linearly (that is, proportional to the aqueous-phase concentration) at concentrations up to their aqueous solubility, with essentially no competition between different HOCs that may be present (Schwarzenbach et al., 1993). Assuming ρ_s equals 2.65 g/cm^3, n equals 50%, and f_{oc}, the natural fractional organic carbon content of the sediment, equals 1%, then calculated retardation factors for PCE, TCE, 1,1,1-TCA, methylene chloride, 1,2-DCE and 1,2-DCA are 18, 7.1 1.8, 1.9 4.8 and 2.2, respectively, based on fairly reliable correlations by Schwarzenbach et al., 1993. As with most environmental calculations, however, the results of these calculations must be viewed as having some degree of uncertainty. Actual values at the site would depend not only on porosity, density, and fractional organic carbon content, but may also depend on specific surface area, all of which may vary from location to location. Because VOC sorption is reversible when aqueous-phase concentrations decline, contaminants may be removed over time from sediments through appropriate remedial processes.

Experimental data show that, at the low groundwater velocities found at the site, pore-scale (velocity-dependent) dispersion should be minimal, of the same order of magnitude as diffusion (Fetter, 1993). Neither should be a significant process affecting large-scale site contaminant transport. However, apparent dispersion due to flow through thin high-permeability beds, flowline refraction at boundaries between sediments of differing hydraulic conductivity or other forms of macrodispersion attributable to field scale variations in hydraulic conductivity and porosity may contribute to contaminant advance and/or lateral spreading along mean flow paths.

Natural biological degradation of site contaminants is also anticipated to be negligible, since chlorinated solvents are not typically biodegraded at significant rates under the generally aerobic conditions expected for near-surface sediments at the site. Bacteria in local anaerobic zones, however, may produce small quantities of breakdown products, which may also be formed through abiotic processes.

The 2-PHASE Extraction well operated in the Lawn Area has demonstrated capture of contaminated groundwater in the vicinity of the Lawn Area. Contaminants in other portions of the groundwater system are migrating primarily toward the north at rates governed mainly by advection and sorption in different porous media of varying permeability and sorptive potential. However, flow of water as groundwater per se is expected to be limited by conditions at the discharge zone in the Northern Area of the site, where water moves from the upper aquifer to the ground surface. Additional 2-PHASE Extraction wells installed as part of the IRM upgrade will eliminate significant northward transport in the future.

Groundwater concentration data plots are presented in Appendix A. Contaminant levels generally decrease with lower pumping rates as seasonal groundwater level drops below the water bearing zone.

5.1.2 Surface Water

Contaminated surface water migrates northward in the two channels previously identified as having contaminated water. Both of these drainage ways lead northward and eventually empty into Allen Creek. Although water in the northward flowing drainageways is contaminated, Allen Creek downgradient from their confluence has been found to be free from volatile organics.

Northward flow occurs weekly during testing of the fire suppression system, but the ditch usually contains stagnant water when the fire suppression system is not being tested. This occurs because the ditch channel was over excavated as a result of the 1977 spill.

VI. BASELINE RISK ASSESSMENT

The baseline risk assessment conducted as part of the Building 801 remedial investigation utilized current USEPA Risk Assessment Guidance (RAG) documents in accordance with the recommendations of the NYSDOH Bureau of Toxic Substances Assessment. The entire baseline risk assessment is contained in Appendix H of this report. The baseline risk assessment incorporated the four components of a human health risk evaluation as prescribed by the USEPA RAG documents.

- Identification of Compounds of Concern
- An Exposure Assessment
- A Toxicity Assessment
- A Risk Characterization based on several Reasonable Maximum Exposure Scenarios.

The following compounds were identified and evaluated as compounds of concern:

Surface/Subsurface Soils and Sediments (beneath floor, roadway, drainageways, and Lawn Area)

- Vinyl Chloride
- Methylene Chloride
- 1,1,1-Trichloroethane
- Trichloroethene
- Tetrachloroethene

Surface water (Sample location SW-35)

- 1,1,1-Trichloroethane
- 1,2-Dichloroethane
- Trichloroethene
- Tetrachloroethene

Ambient Air conditions (above the impacted site soils and sediments)

- Vinyl Chloride
- Methylene Chloride
- Tetrachloroethene
- Trichloroethene
- 1,1,1-Trichloroethane

Groundwater is not currently used as a drinking water resource in or within 0.5 miles of the study area. Future use of the groundwater in or around the study area is not anticipated to include human consumption or contact. Public water is supplied to people in the entire area near the site. Based on this conclusion and planned remediation activities, groundwater ingestion or absorption exposure scenarios were not included in this assessment of baseline risk.

Validated data from the IRM and RI was used to select the compounds of concern for the exposure and toxicity assessment and risk characterization.

Three exposure scenarios were evaluated as part of the Risk Assessment.

1. On-site worker exposure to potentially contaminated surface soils through ingestion.

2. On-site worker exposure to potentially contaminated soil vapor migrating above the affected soils.

3. Off-site resident exposure to potentially contaminated surface water migrating from the site by way of Allen Creek.

Each exposure scenario utilized the upper 95% confidence interval based on the arithmetic mean of compounds of concern. Exposure scenario 1 used contaminants detected in the 0-4 ft. interval of site soils in and around the lawn area adjacent to Hofstra Road. Exposure scenario 2 used contaminant concentrations in the 0-4 ft. interval as input to the Shen equation, which simulates gas emission from a landfill without internal gas concentration (USEPA, 1988). This allowed estimation of the ambient air concentrations. Scenario 3 used the surface water concentration detected at location SW-35 which has historically had the highest detectable concentrations of the compounds of concern.

The risk characterization used the absorb dose of each compound of concern determined by calculations prescribed in the USEPA RAG. Each calculation performed is provided as an Attachment to Appendix H of this report. The determined absorbed dose was multiplied by the reference dose (Rfd) for evaluating non-carcinogenic effects or the inhalation/ingestion slope factor (where appropriate) for calculating carcinogenic effects provided from either the Integrated Risk Information Service (IRIS) (1993) database summary tables or Health Effects Assessment Summary Table (HEAST) for fiscal year 1991.

Results of the assessment indicate non-carcinogenic risks to be two to three orders of magnitude less than the threshold risk hazard index (HI) of 1 recognized by the USEPA. Carcinogenic risks are estimated at 3.3×10^{-5} to 1.0×10^{-6}, values which are within the acceptable risk range of 10^{-4} to 10^{-6} recognized by the USEPA.

Each potential exposure scenario calculated carcinogenic risk is greater than or equal to the baseline threshold of 1.0×10^{-6} recognized by the New York State Department of Health (NYSDOH) in conjunction with other factors in selecting site cleanup levels.

VII. SUMMARY AND CONCLUSIONS

7-01. NATURE AND EXTENT OF CONTAMINATION

Soil, sediment, surface water and groundwater are contaminated beneath portions of the Xerox Building 801 site. The site contaminants are the chlorinated solvents methylene chloride, 1,1-dichloroethene, 1,1-dichloroethane, 1,2-dichloroethene, 1,2-dichloroethane, 1,1,1-trichloroethane, trichloroethene, tetrachloroethene, vinyl chloride, and mineral spirits.

The possible sources of contamination were the solvent storage and use facilities previously in the Lawn Area and Northeast Corner.

Contaminated soils are found below the previous solvent use areas within the building, in soils north of the building, in soils below the ditch, and in the Lawn Area. Only insignificant contaminant concentrations are found below 12 ft. deep, and the most contaminated soils are found at a depth less than 8 feet.

Contaminated sediments are found in the North-South Ditch extending from the northern section of the Lawn Area. Sediment contamination extends approximately 200 ft. north from the Lawn Area. 1,1,2,2-PCE (Perc) is the most prevalent contaminant found in the site sediments. Perc is most likely the prevalent contaminant because the release which occurred in the spring of 1977 was reported to be waste perc (see Section 1-03, Site History). Globules of brown liquid were reported moving downstream along the stream bed.

Mineral spirits and chlorinated volatile organic compounds have been found in the groundwater beneath the solvent handling areas of the buildings and the Lawn Area, and beneath a portion of land extending northward along the North-South Ditch. The groundwater plume is made up of the dissolved chemicals listed in Section IV.

High dissolved-chemical concentrations are found in the center of the groundwater plume, in the central part of the Lawn Area. Concentrations decrease logarithmically with distance from the center. It is likely that the major distribution of contaminants at the site occurred contemporaneously with the spill in the spring of 1977. This spill included ponding in the Lawn Area, transport and seepage of undissolved phase product in the ditch, overbank flow of highly contaminated water from the ditch to the Northern Area, and infiltration of NAPL into the subsurface.

7-02. FATE AND TRANSPORT OF CONTAMINANTS

Site contaminants are attracted to and sorbed onto particles as well as trapped in pores of soil or sediment at the site. A small fraction of the contaminant mass is dissolved in groundwater and subject to some movement over time. Groundwater at the site flows slowly (in the range of 2 to 80 ft/year with an ensemble geometric mean of 10 ft/yr) and thus migration of groundwater borne compounds is also slow. This slow rate of migration is substantiated by the fact that the contaminated groundwater plume does not appear to have migrated downward and has only migrated slowly northward in the 15 to 20 years since the release(s) occurred.

Contaminated surface water has been found to be migrating away from the site in the North-South Ditch, and in the Western North-South Stream at surface water sampling point, SW-35.

Contamination in the Western North-South Stream appears to have resulted from the discharge of contaminated water from the storm sewer, which has an inlet adjacent to the Lawn Area near RW-1. This section of the storm sewer was sealed with a pneumatic plug at the manhole in August 1993 to prevent future surface water contamination.

Contaminated surface water has been found in the North-South Ditch extending from the Lawn Area. This is the widened, flat-sloped channel which is filled with water from testing of the fire suppression system on a weekly basis. The contaminants may enter the stagnant water from the sediments below the ditch.

7-03. RISK ASSESSMENT

The baseline Health Risk Assessment was performed for the Remedial Investigation of Building 801 by evaluating the compounds detected as present, the media in which they were detected, the range of concentrations detected in those media, and potential exposure routes by which humans may be exposed to these materials. USEPA Risk Assessment guidance dictates that compounds known to be associated with site activities be included in the risk assessment, as well as other detected compounds that may be associated with anthropogenic point and non-point sources. Therefore, health risks reported for this site result from both chemical compounds that may have been associated with activities at Building 801, as well as from compounds that may be from other anthropogenic sources.

The potential Reasonable Maximum Exposure (RME) scenarios for the study area: (1) ingestion of site soils by on-site workers which may contain adsorbed VOCs (2) inhalation of VOC vapors by on-site workers (3) dermal absorption of VOC dissolved in surface water off-site by local child residents. Results of the assessment indicate non-carcinogenic risks to be two to three orders of magnitude less then the risk hazard index (HI) of 1 recognized by the USEPA. Carcinogenic risks are estimated at 3.3×10^{-5} to 1.0×10^{-6}, values which are within the acceptable risk range of 10^{-4} to 10^{-6} recognized by the USEPA. However, these values exceed the NYSDOH accepted threshold of 1.0×10^{-6} used in conjunction with other factors in the selection of site cleanup goals.

REFERENCES

Agency for Toxic Substances and Disease Registry (ATSDR), 1988, 1989, Toxicological Profiles for Compounds Listed in Hazard Identification.

Bergmann Associates Drawing 1392 issued on 20 January 1992 "Site Topography and Details" for Xerox Bldg. 801.

Domenico, P.A. and Schwartz, F.W., 1990, Physical and Chemical Hydrogeology, John Wiley and Sons, Inc.

Fairchild, H.L., 1928. Geologic Story of the Genesee Valley and Western New York, (Henderson-Mosher, Inc., Rochester, New York), 215 p.

Faukundiny, R.H., and Pomeroy, P.W., Pferd, J.W., Nowak, T.A., Jr., and Myers, J.T., 1978. "Structural Instability Features in the Vicinity of the Clarendon-Linden Fault System, Western New York and Lake Ontario", Seis. Studies, Vol. 13, p. 121-178.

Fetter, C.W., 1993, Contaminant Hydrogeology, McMillan Publishers.

H&A of New York, 1990, Report on Regional Geology and Hydrogeology of the Greater Rochester Area.

H&A of New York, 1992, Remedial Investigation and Feasibility Study Work Plan Addendum.

H&A of New York, 1993, Evaluation of Potential Floor and Structure Settlements.

Howard,P., et.al., 1990, "Handbook of Fate and Exposure Data For Organic Chemicals", Lewis Publishers, 1990.

Hvorslev, M.S., 1951, "Time Lag and Soil Permeability in Ground - Water Observations", U.S. Army Corps of Engineers.

Linsley, R.K., Kohler, M.A., Paulhus, J.L.H., 1982, "Hydrology for Engineers", McGraw-Hill Book Company.

McWhorter, D.B., 1991. DNAPL in Fractured Rock, a Presentation to Eastman Kodak and Consultants, NYSDEC, USEPA, August 22, 1991.

Monroe County Soil Conservation District 1951 Aerial Photograph.

Muller, E.H., Braun, D.D., Young, R.A., and Wilson, M.P., 1988. "Morphogenesis of the Genesee Valley", Northeastern Geology, Vol. 10, No. 2, p. 112-133.

New York State Department of Environmental Conservation, 1990, Administrative Order on Consent.

NYSDEC, 1991, Air Pathway Analysis during Remedial Investigations, Division of Hazardous Waste Remediation.

NYSDEC, 1991, Draft New York State Air Guide-1, Guidelines for the Control of Toxic Ambient Air Contaminant NYSDEC Division of Air Resources, 1991, p. B-11.

NYSDEC, 1991, Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites, Division of Fish and Wildlife.

Parmeggiani, L. (editor), 1983, Encyclopedia of Occupational Health and Safety Volume 2, International Labour Organization, Geneva, Switzerland.

Ritter, D.F., 1978, "Process Geomorphology", William C. Brown Publishing.

United States Geolgical Survey, Pittsford 7-1/2 minute topographic quadrangle maps.

Schwarzenbach, R., et.al., 1993, "Environmental Organic Chemistry", Wiley Interscience, New York.

United States Department of Agriculture, Soil Conservation Services, 1938. Soil Survey of Monroe County, New York.

United States Geological Survey, 1991. Water-Data Report NY-91-3, Water Resources Data, New York, Water Year 1991

USEPA, 1989, Risk Assessment Guidance for Superfund Volume I, Part A Human Health Evaluation Manual, Part B Environmental Evaluation Manual, Interim Final.

USEPA, 1986, Superfund Public Health Evaluation Manual, Office of Emergency and Remedial Response.

USEPA, 1986, Superfund Exposure Assessment Manual. EPA/540/1-88/00i, October 1986.

USEPA, 1986, USEPA Carcinogenicity Evaluation Guidelines, Federal Register, 51: 33992-34012, September 22, 1986.

USEPA, 1990, Air/Superfund National Technical Guidance Study Series, Vol. II, Estimation of Baseline Air Emissions at Superfund Sites. EPA-450/1-89-002a, August 1990.

USEPA, 1992, Integrated Risk Information Service (IRIS) Computer Database Search.

USEPA, 1988, "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA".

USEPA, 1988, "Functional Guidelines for Evaluating Organic and Inorganic Analyses.

USEPA, 1988, Exposure Assessment Manual.

USEPA, 1989, Health Effects Assessment Summary Tables, FY 1991.

USEPA, 1989, Exposure Factors Handbook, Office of Health and Environmental Assessment.

USEPA, 1985, Chemical, Physical and Biological Properties of Compounds Present at Hazardous Waste Sites, Prepared by Clement Association, Inc.

Weast R.(Editor),"Handbook of Chemistry and Physics", 56th Edition 1975-76, CRC Press.

Young, R.A., 1980. Subsurface Bedrock Contour Maps, Generalized Groundwater Contour Maps and Overburden Thickness Maps, Monroe County, (Young, R.A., Consulting Geologist), 25 p., 6 sh.

sew:702909-41:referenc

TABLE 1
ENGINEERING SCIENCE DOCUMENT LIST
XEROX BUILDING 801
HENRIETTA, NEW YORK

Date	Reference Number	Document Title
June 1987	ES, 1987a	Remedial Investigation at Building 801, Henrietta, New York, Volume I - Report
June 1987	ES, 1987b	Remedial Investigation at Building 801, Henrietta, New York, Volume II - Appendices
February 1989	ES, 1989a	Off-Site Remedial Investigation Building 801, Henrietta, New York, Volume I - Report
February 1989	ES, 1989b	Off-Site Remedial Investigation Building 801, Henrietta, New York, Volume II - Appendices
March 1989	ES,1989c	Interim Remedial Alternative Evaluation Building 801, Henrietta, New York
May 1989	ES, 1989d	Remedial Investigation at Building 801, Henrietta, New York, Volume III - Data Update
July 1989	ES, 1989e	Additional Off-Site Subsurface Data Xerox Building 801 (Henrietta, New York) - Letter Report
September 1989	ES, 1989f	Work Plan for Interim Remediation At Xerox Building 801, Henrietta, New York
November 1989	ES, 1989g	Design Plans for Interim Remediation at Xerox Building 801, November 1989
June 1990	ES, 1990	Contamination Assessment Report for Inside Building 801, Henrietta, New York
March 1991	ES, 1991a	Groundwater Data and Geologic Cross Sections for Xerox Building 801
May 1991	ES, 1991b	Environmental Laboratory Audit and Data Validation Summary for Xerox Building 801
July 1991	ES, 1991c	Revised Work Plan for Remedial Investigation and Feasibility Study at Xerox Building 801
November 1991	ES, 1991d	Construction Completion Report. Interim Remediation at Xerox Building 801

sew:70290-41:Tab1

TABLE 2
SUMMARY OF QUARTERLY SURFACE WATER MONITORING
XEROX BUILDING 801
HENRIETTA, NEW YORK

FIRST QUARTER 1992

Surface Water Monitoring Location	8240	8015 (Modified)	TCL Metals	Total Cyanide	TCL Volatiles	TCL Semi-Vols	TCL Pest. & PCB's
SW28	X	X	X				
SW29	X	X	X				
SW30	X	X	X				
SW31	X	X	X				
SW32	X	X	X				
SW33	X	X	X				
SW34	X	X	X				
SW35	X	X	X				

SECOND, THIRD AND FOURTH QUARTER 1992; FIRST, SECOND AND THIRD QUARTER 1993

Surface Water Monitoring Location	8240	8015 (Modified)
SW-28	X	X
SW-29	X	
SW-30	X	
SW-31	X	
SW-32	X	
SW-33	X	
SW-34	X	
SW-35	X	X

sew:70290-41:Table4A

TABLE 3
SEDIMENT SAMPLING TOTAL VOLATILES CONCENTRATIONS
XEROX BUILDING 801
HENRIETTA, NEW YORK

Sample Location	Depth Range	Relative Position to Stream at Sample Location (Looking North)		
		Left	Center	Right
SED I	0 - 2 ft.	ND	ND	12
	2 - 3 ft.	ND	ND	ND
SED II	0 - 2 ft.	1,223	1,102	41
	2 - 3 ft.	1,789	27,400	628
	4 - 6 ft.	4,230	---	---
	6 - 8 ft.	1,224	---	---
SED III	0 - 2 ft.	2,680	310	32
	2 - 3 ft.	12,380	280	59
	4 - 6 ft.	395	---	---
	6 - 8 ft.	1,029	---	---
	8 - 10 ft.	78	---	---
SED IV	0 - 2 ft.	30	22	ND
	2 - 3 ft.	49	ND	ND
SED V	0 - 2 ft.	ND	10	ND
	2 - 3 ft.	230	86	19
SED VI	0 - 1 ft.	---	44	---
	1 - 2 ft.	---	15	---

Notes:

1. All values are in ug/kg.
2. ND - no volatiles detected.
3. Samples taken 6 April 1993 and 20 August 1993 by H&A of New York.
4. "---" Indicates no samples were taken.

sew:70290-41:Table3

TABLE 4
GROUNDWATER MONITORING WELL CONSTRUCTION INFORMATION
XEROX BUILDING 801
HENRIETTA, NEW YORK

Monitoring Well I.D.	Measuring Point Elevation	Ground Surface Elevation	Screened Interval Elevation
MW-1S (1)	503.30	500.6	492.6 - 486.6
MW-1D (1)	502.24	500.3	480.3 - 466.3
MW-2	498.49	496.5	489.5 - 474.5
RW-1	500.02	499.7	490.6 - 475.6
RW-2	498.12	497.5	491.0 - 476.0
RW-3 (2)	501.04	500.6	493.1 - 478.1
RW-4 (2)	498.84	498.5	490.5 - 475.5
RW-5 (2)	497.93	497.0	490.0 - 475.0
MW-6	500.50	498.5	491.5 - 476.5
MW-7	499.09	496.4	489.4 - 478.4
MW-8S	498.04	496.1	488.1 - 474.1
MW-8D	498.48	495.9	465.9(3) - 450.9(3)
MW-9S	501.84	499.9	491.9 - 476.9
MW-9D	502.22	499.6	470.6 - 460.6
MW-10	498.45	496.1	490.1 - 475.1
MW-11	503.68	501.7	493.7 - 488.7
MW-12	499.50	496.7	487.7 - 472.7
MW-13S	498.35	496.1	488.1 - 478.1
MW-13D	498.46	496.0	471.7 - 461.7
MW-14S	499.48	496.7	486.8 - 476.8
MW-14D	499.46	496.8	473.2 - 463.2
MW-15S	499.32	496.7	491.7 - 481.7
MW-15D	499.38	496.7	476.7 - 463.7
MW-16	498.83	496.1	486.1 - 476.1
MW-17S	501.81	499.1	488.6 - 473.6
MW-17D	501.68	499.0	466.8 - 456.8
MW-18S	498.81	496.4	484.4 - 474.4
MW-18D	498.04	495.2	468.3 - 458.3
MW-19	498.53	496.4	493.4 - 482.4
MW-20	502.47	502.6	484.4 - 494.4

TABLE 4
(Continued)

Monitoring Well I.D.	Measuring Point Elevation	Ground Surface Elevation	Screened Interval Elevation
MW-21	502.42	502.6	482.6 - 492.6
MW-22D	499.59	499.8	459.8 - 469.8
MW-23D	499.94	500.3	462.3 - 472.3
MW-24S	503.44	500.8	485.8 - 495.8
MW-24D	503.20	501.0	470.0 - 480.0
MW-25D	500.51	498.8	462.8 - 470.8
MW-26D	500.10	497.7	463.2 - 471.2
MW-27	498.81	491.1	482.1 - 492.1
VE-1	---	502.7	490.7 - 499.7
VE-1A	---	502.7	491.2 - 500.2
P-1	500.08	498.6	477.2 - 475.2
P-2	500.08	498.6	485.6 - 483.6
P-3	499.80	498.4	491.8 - 489.8
P-4	498.33	497.0	476.4 - 474.4
P-5	498.68	497.0	484.95 - 483.2
P-6	498.34	496.5	490.0 - 488.0
P-7	498.46	496.3	486.3 - 491.3
P-8	499.47	497.3	482.3 - 489.3
P-9	502.41	502.7	483.0 - 485.0
P-10	502.35	502.7	491.7 - 493.7
P-11	502.33	502.7	487.7 - 489.7
P-12	502.36	502.7	492.7 - 494.7
P-13	499.77	500.3	491.3 - 488.3

Notes:
Ground surface and TOR elevations were surveyed by Bergmann Associates, in November 1990 as feet above Mean Sea Level. Screen and zone monitored elevations were obtained by subtracting depths on drilling logs from ground surface elevations.

(1) Abandoned June 1992.
(2) Recovery Wells RW-3, RW-4, and RW-5 were formerly MW-3, MW-4, and MW-5.
(3) MW-8D may not have been measured to its full depth due to possible obstruction noted during field measurements.

TABLE 5
LABORATORY GEOTECHNICAL TEST RESULTS SUMMARY SHEET
XEROX BUILDING 801
HENRIETTA, NEW YORK

BORING	SAMPLE	DEPTH (ft)	DATE SAMPLED	TYPE OF SAMPLE	Wn (%)	DRY DENSITY (pcf)	e	k (cm/sec)	GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)	LL	PL	PI
B-120	S-1	1.25	6/12&13/92	SS	10.6	---	---	---	---	---	---	---	---	---	---
B-120	S-2	3.0	6/12&13/92	SS	12.2	---	---	---	8.0	78.0	(14)	---	---	---	---
B-120	S-6	11.0	6/12&13/92	SS	12.1	---	---	---	1.0	48.0	42.0	9.0	NP	NP	NP
B-121	S-1	1.25	6/13/92	SS	6.2	---	---	---	---	---	---	---	---	---	---
B-121	S-2	2.5	6/13/92	SS	12.0	---	---	---	3.0	66.0	(31)	---	---	---	---
B-121	S-4	7.0	6/13/92	SS	23.2	---	---	---	---	---	---	---	---	---	---
B-121	S-5	9.0	6/13/92	SS	23.2	---	---	---	0.0	4.0	62.0	24.0	28.0	17.2	10.8
B-121	S-7	13.0	6/13/92	SS	21.2	---	---	---	---	---	---	---	---	---	---
B-121	S-8	15.0	6/13/92	SS	11.1	---	---	---	13.0	35.0	41.0	11.0	14.5	12.9	1.6
B-122	S-1	2.0	6/14/92	SS	12.9	---	---	---	5.0	81.0	(14)	---	---	---	---
B-122	S-6	10.0	6/14/92	SS	23.3	---	---	---	0.0	0.0	56.0	44.0	30.1	17.6	12.5
B-125	L-2	4.0	6/17-19/92	LS	2.8	---	---	---	42.0	48.0	10.0	0.0	NP	NP	NP
B-125	L-2a	4.0	6/17-19/92	LS	13.7	122.9	0.371	2E-06	---	---	---	---	---	---	---
B-125	L-4	8.0	6/17-19/92	LS	17.8	---	---	---	0.0	0.5	42.5	57.0	33.4	17.4	16.0
B-125	L-4a	8.0	6/17-19/92	LS	23.1	107.5	0.567	7E-08	---	---	---	---	---	---	---
B-126	L-2	4.0	6/18-19/92	LS	13.4	---	---	---	25.0	50.0	25.0	0.0	---	---	---
B-126	L-2a	4.0	6/18-19/92	LS	14	119.7	0.408	2E-08	---	---	---	---	---	---	---
B-126	L-5	10.0	6/18-19/92	LS	9.2	---	---	---	5.0	37.0	46.0	12.0	NP	NP	NP
B-126	L-5a	10.0	6/18-19/92	LS	10.3	137.7	0.224	9E-08	---	---	---	---	---	---	---
B-131	L-4	7.0	6/26/92	LS	23.1	---	---	---	0.0	0.5	39.5	60.0	34.1	19.2	14.9
B-131	L-4a	7.0	6/26/92	LS	24.4	103.3	0.631	4E-08	---	---	---	---	---	---	---
B-131	L-5	9.0	6/26/92	LS	12.5	---	---	---	0.0	20.0	57.0	23.0	17.6	14.1	3.5
B-131	L-5a	9.0	6/26/92	LS	22.5	108.9	0.547	5E-08	---	---	---	---	---	---	---

Notes:

1. Sample Number with an "a" indicates it was tested by Huntingdon Labs.
2. Sample Depth taken as average depth.
3. Sample type of: S = Split Spoon, L = Lined Split Spoon.
4. Void ratio (e) calculated based upon a density of 2.70 g/cc of the solids.
5. A percentage of (xx) for the silt content indicates a combination of silt and clay.

TABLE 6
SUMMARY OF QUARTERLY GROUNDWATER MONITORING
XEROX BUILDING 801
HENRIETTA, NEW YORK

FIRST QUARTER 1992

Well	8240	8240** (Modified)	8015 (Modified)	TCL Metals	Total Cyanide	TCL Semi-Vols	TCL Pest. & PCB's
RW-1	X		X	X	X	X	X
RW-2	X		X	X	X		
RW-3	X		X	X	X		
RW-4	X		X	X	X		
RW-5	X		X	X	X		
MW1S		X	X	X	X		
MW1D		X	X				
MW2		X	X				
MW6	X		X				
MW7		X	X				
MW8S	X		X				
MW8D	X		X				
MW9S	X		X				
MW9D	X		X				
MW10	X		X				
MW11	X		X				
MW12	X		X				
MW13S	X		X				
MW13D		X	X				
MW14S		X	X				
MW14D		X	X				
MW15S	X		X				
MW15D	X		X				
MW16		X	X				
MW17S	X		X				
MW17D	X		X				
MW18S		X	X				
MW18D		X	X				
MW19	X		X				

TABLE 6
(Continued)

SECOND QUARTER 1992

Well	Volatiles 8240	Volatiles (Modified 8240)**	Mineral Spirits (Modified 8015)
RW-1	X		X
RW-2	X		X
RW-3	X		X
RW-4	X		X
RW-5	X		X
MW1S*			
MW1D*			
MW2		X	
MW6*			
MW7		X	X
MW8S		X	X
MW8D*			
MW9S*			
MW9D*			
MW10	X		
MW11*			
MW12*			
MW13S	X		
MW13D		X	
MW14S		X	
MW14D		X	
MW15S*			
MW15D*			
MW16		X	
MW17S*			
MW17D*			
MW18S		X	
MW18D*			
MW19	X		X

70290-41

TABLE 6
(Continued)

THIRD QUARTER 1992

Well	Volatiles 8240	Volatiles (Modified 8240)**	Mineral Spirits (Modified 8015)
RW-1	X		X
RW-2	X		X
RW-3	X		X
RW-4	X		X
RW-5	X		X
MW2		X	
MW7		X	X
MW10	X		
MW13S	X		
MW13D		X	
MW14S		X	
MW14D		X	
MW16		X	
MW18S		X	
MW19	X		X
P-1	X		
P-2	X		
P-3	X		
P-4	X		
P-5	X		
P-6	X		
P-8	X		

TABLE 6
(Continued)

FOURTH QUARTER 1992

Well	Volatiles 8240	Volatiles (Modified 8240)**	Mineral Spirits (Modified 8015)
RW-1	X		X
RW-2	X		X
RW-3	X		X
RW-4	X		X
RW-5	X		X
MW2		X	
MW7		X	X
MW10	X		
MW13S	X		
MW13D		X	
MW14S		X	
MW14D		X	
MW16		X	
MW18S		X	
MW19	X		X
MW-27	X		
VE-1	X		X

TABLE 6
(Continued)

FIRST QUARTER 1993

Well	Volatiles 8240	Volatiles (Modified 8240)**	Mineral Spirits (Modified 8015)
RW-1	X		X
RW-2	X		X
RW-3	X		X
RW-4	X		X
RW-5	X		X
MW2		X	X
MW6	X		X
MW7		X	X
MW8S		X	X
MW8D		X	
MW9S		X	
MW9D		X	
MW10	X		
MW11		X	
MW12		X	
MW13S	X		
MW13D		X	
MW14S		X	
MW14D		X	
MW15S		X	
MW15D		X	
MW16		X	
MW17S		X	
MW17D		X	
MW18S		X	
MW18D		X	
MW19	X		
MW24S		X	
MW24D		X	
MW27	X		

TABLE 6
(Continued)

SECOND QUARTER 1993

Well	Volatiles 8240	Volatiles (Modified 8240)**	Mineral Spirits (Modified 8015)
RW-1	X		X
RW-2	X		X
RW-3	X		X
RW-4	X		X
RW-5	X		X
MW2		X	X
MW7		X	X
MW13S	X		
MW14S		X	
MW14D		X	
MW16		X	
MW18S		X	
MW19	X		
MW27	X		

TABLE 6
(Continued)

THIRD QUARTER 1993

Well	Volatiles 8240	Volatiles (Modified 8240)**	Mineral Spirits (Modified 8015)
RW-1	X		X
RW-2	X		X
RW-3	X		X
RW-4	X		X
RW-5	X		X
MW2		X	X
MW7		X	X
MW10	X		
MW13S	X		
MW13D		X	
MW14S		X	
MW14D		X	
MW16		X	
MW18S		X	
MW19	X		
MW-27	X		
VE-2	X		X

Notes:

* Well sampled sampled annually, during first quarter only, as approved by NYSDEC.
** Analysis by Method 8240 using low-level MDL's.

sew:70290-41:Table4

TABLE 7
HYDRAULIC CONDUCTIVITY RESULTS
XEROX BUILDING 801
HENRIETTA, NEW YORK

MONITORING INTERVAL UNIT(S)	WELL ID	TEST INTERVAL DEPTH (ft)	TEST INTERVAL ELEVATION (ft)	HYDRAULIC CONDUCTIVITY (cm/sec)
UPPER LACUSTRINE	P-3	5.6 - 8.6	492.8 - 489.8	3.9E-04
UPPER LACUSTRINE	P-6	5.6 - 8.5	490.9 - 488.0	2.4E-05
UPPER LACUSTRINE	P-7	7.0 - 10.0	489.3 - 486.3	7.4E-05
UPPER LACUSTRINE	P-8	7.0 - 10.0	490.3 - 487.3	3.1E-05
UPPER LACUSTRINE	MW-11	6.0 - 13.0	488.4 - 495.4	2.4E-05
UPPER TILL	MW-16	8.5 - 20.0	475.7 - 487.2	9.1E-07
UPPER TILL	P-2	12.2 - 15.0	486.4 - 483.6	2.1E-07
UPPER TILL	P-4	17.3 - 22.6	479.7 - 474.4	1.2E-06
UPPER TILL	P-1	19.3 - 23.4	479.3 - 475.2	3.7E-07
UPPER LAC./UPPER TILL	MW-15S	4.0 - 15.0	481.4 - 492.4	2.0E-05
UPPER LAC./UPPER TILL	P-5	11.4 - 13.8	485.6 - 483.2	1.2E-04
UPPER LAC./UPPER TILL	MW-13S	7.0 - 18.0	477.8 - 488.8	7.2E-05
UPPER LAC./UPPER TILL	MW-10	5.0 - 21.0	475.1 - 491.1	2.7E-05
UPPER LAC./UPPER TILL	MW-10	5.0 - 21.0	475.1 - 491.1	2.2E-05 #
UPPER LAC./UPPER TILL	MW-2	5.0 - 22.0	474.0 - 491.0	9.4E-06
UPPER LAC./UPPER TILL	MW-2	5.0 - 22.0	474.0 - 491.0	8.3E-06 #
UPPER LAC./UPPER TILL	MW-5	5.0 - 22.0	474.2 - 491.2	4.3E-05
UPPER LAC./UPPER TILL	MW-5	5.0 - 22.0	474.2 - 491.2	3.0E-05 #
UPPER LAC./UPPER TILL	MW-7	5.0 - 20.0	476.4 - 491.4	5.1E-05
UPPER LAC./UPPER TILL	MW-7	5.0 - 20.0	476.4 - 491.4	1.6E-05 #
UPPER LAC./UPPER TILL	MW-14S	8.0 - 20.0	476.4 - 488.4	1.7E-05
UPPER LAC./UPPER TILL	MW-4	6.0 - 23.0	473.1 - 490.1	1.5E-05
UPPER LAC./UPPER TILL	MW-9S	6.0 - 23.0	473.4 - 490.4	7.3E-05
UPPER LAC./UPPER TILL	MW-12	7.0 - 24.0	472.5 - 489.5	6.5E-06
UPPER LAC./UPPER TILL	MW-18S	10.0 - 22.0	473.5 - 485.5	6.7E-06
UPPER LAC./UPPER TILL	MW-17S	8.5 - 25.5	473.2 - 490.2	1.5E-05
LACUSTRINE CLAY	MW-2	20.0 - 22.0	474.0 - 476.0	2.3E-08 *
LACUSTRINE CLAY	MW-5	22.0 - 24.0	472.2 - 474.2	3.1E-08 *
LOWER TILL/TOR	MW-25D	27.0 - 36.0	463.3 - 472.3	6.0E-03 #

NOTES:

1. All conductivity values are horizontal permeabilities obtained from slug test analysis except * and #.
2. * indicates vertical permeability obtained from laboratory permeameter testing.
3. # indicates horizontal permeability obtained from pump test analysis.

TABLE 8
INLAND CHEMICAL SOLVENT BLENDS
XEROX BUILDING 801
HENRIETTA, NEW YORK

AP-66	
1,1,1-Trichloroethane	58%
Aliphatic Hydrocarbons	29%
Perchloroethylene	7%
Trichloroethylene	6%
AP-67	
Aliphatic Hydrocarbons	50%
1,1,1-Trichloroethane	20%
Trichloroethylene	15%
Perchloroethylene	10%
Methylene Chloride	5%
AP-71	
Aliphatic Hydrocarbons	65%
Perchloroethylene	25%
Trichloroethylene	5%
Methylene Chloride	5%
AP-72	
Aliphatic Hydrocarbons	60%
Perchloroethylene	5%
Trichloroethylene	5%
1,1,1-Trichloroethane	5%
Methylene Chloride	12.5%
n-Heptane	12.5%

sew:70290-41:Table7

TABLE 9
NAPL PROPERTIES AND CHEMISTRY
XEROX BUILDING 801
HENRIETTA, NEW YORK

Analyte	RW-1	RW-3	VE-1A
Volatiles:			
Acetone	0.4%	ND	ND
1,1,1-Trichloroethane	2.0%	7.2%	ND
Trichloroethene	1.1%	6.2%	ND
Tetrachloroethene	8.9%	6.7%	0.6%
Total Volatiles	12.3%	20.1%	0.6%
Mineral Spirits:	75%	53%	66%
Unknown Hydrocarbons:	24%	39.3%	38.6%

Analysis	RW-1	RW-3	VE-1A
Viscosity	1.15	2.15	3.17
Specific Gravity	1.010	0.786	0.860

Notes:

1. ND - Not detected.
2. All percentages are expressed in wet weight percent.
3. Percentage of unknown hydrcarbons is estimated.
4. Only compounds detected are listed in table.
5. Viscosity is expressed in Centistokes (CS).

sew:70290-41:Table8

70290-41

TABLE 10
LNAPL THICKNESS VARIATION WITH GROUNDWATER ELEVATIONS
XEROX BUILDING 801
HENRIETTA, NEW YORK

	Well RW-1		Well RW-3		Well VE-1A	
	Approx. GW Elev. (ft.)	LNAPL Thickness (ft.)	Approx. GW Elev. (ft.)	LNAPL Thickness (ft.)	Approx. GW Elev. (ft.)	LNAPL Thickness (ft.)
Non-Pumping	495	2.69	497	1.56	498	0.12
	495	2.73	497	1.57	498	0.21
	495	2.75	497	1.57	498	0.29
					498	0.41
					498	0.62
					497	0.75
Pumping	483	0.39	486	0.04		
	484	0.41	486	0.12		
	483	0.51	486	0.21		
	483	0.56	486	0.26		
	483	1.11	486	0.31		
	483	1.44	484	1.02		

sew:70290-41:Table9

TABLE 11

AIR PATHWAY ANALYSIS
ESTIMATED AMBIENT AIR CONCENTRATIONS
VOCs OF CONCERN

XEROX BUILDING 801
HENRIETTA, NEW YORK

Compound	QA ($lb/hr-ft^2$)	Ca (ug/m^3)	AGC (ug/m^3)
Vinyl Chloride	7.3×10^{-7}	0.012	0.02
Methylene Chloride	2.3×10^{-7}	0.0043	27.0
1,2-Dichloroethene	1.27×10^{-7}	0.0021	1900
Trichloroethene	1.65×10^{-7}	0.0028	0.45
Tetrachloroethene	9.2×10^{-8}	0.0016	0.075
1,1,1-Trichloroethane	1.5×10^{-5}	2.45	1000.0

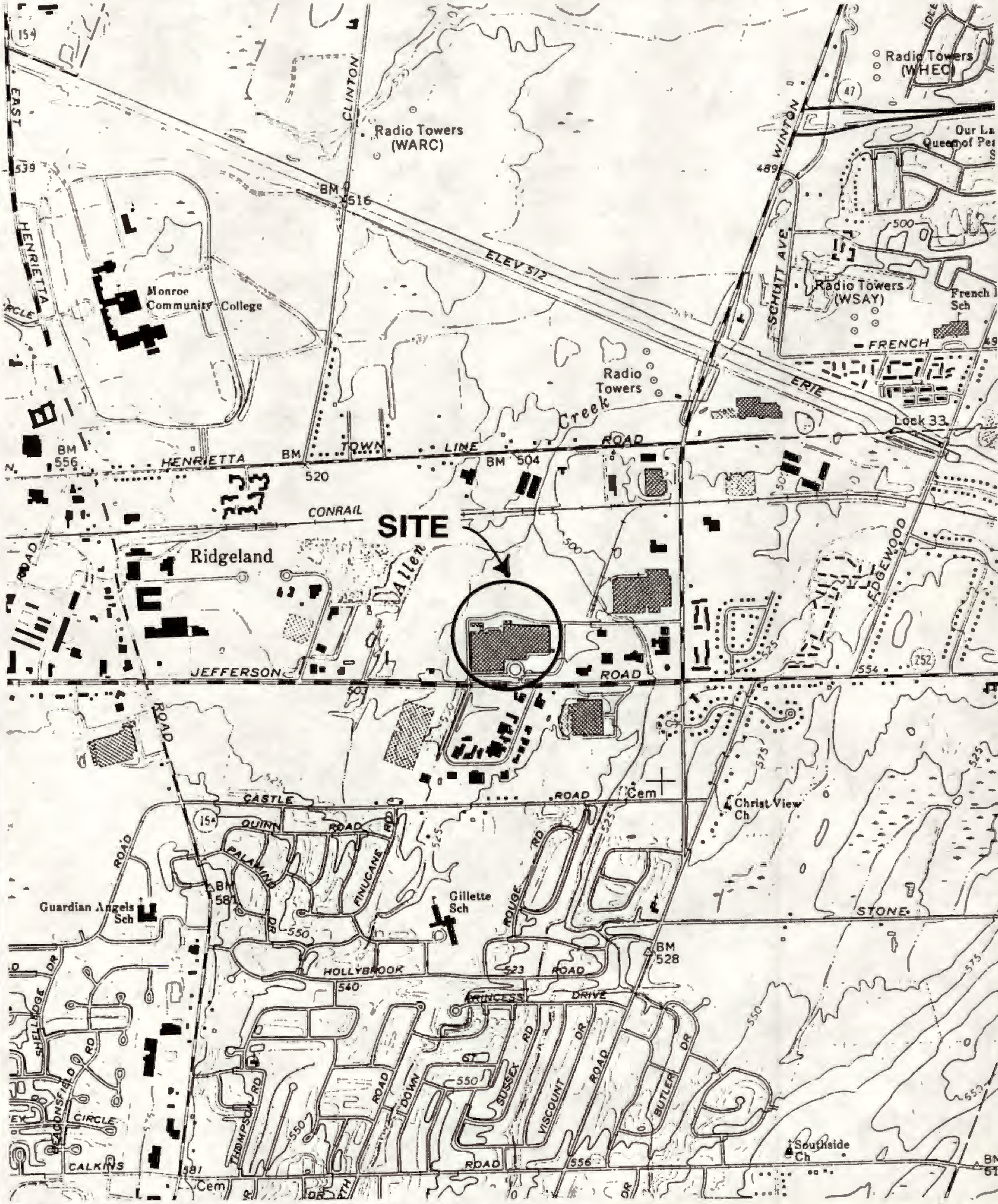
Notes:

1. QA - Emission rate of VOCs of concern as calculated by the Shen Model (USEPA 1989) Ei converted to units of $lb/hr-ft^2$.

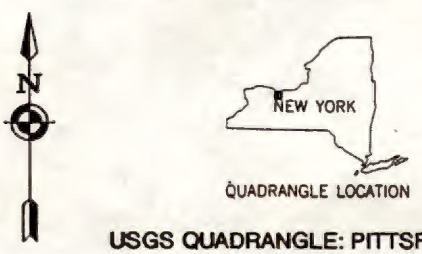
2. Source area for VOCs of concern emission is approximately 2500 ft^2.

3. Ca - Actual annual impact calculated using Air Guide-1 Alternate Area Source Method, NYSDEC 1991.

4. AGC - Annual guideline concentration given by Air Guide-1, NYSDEC 1989.



LATITUDE: 43° 05' 20"N LONGITUDE: 77° 35' 30"W



USGS QUADRANGLE: PITTSFORD, N.Y.

H & A of New York
Consulting Geotechnical Engineers, Geologists and Hydrogeologists

XEROX CORPORATION
BUILDING 801 SITE
HENRIETTA, NEW YORK

PROJECT LOCUS

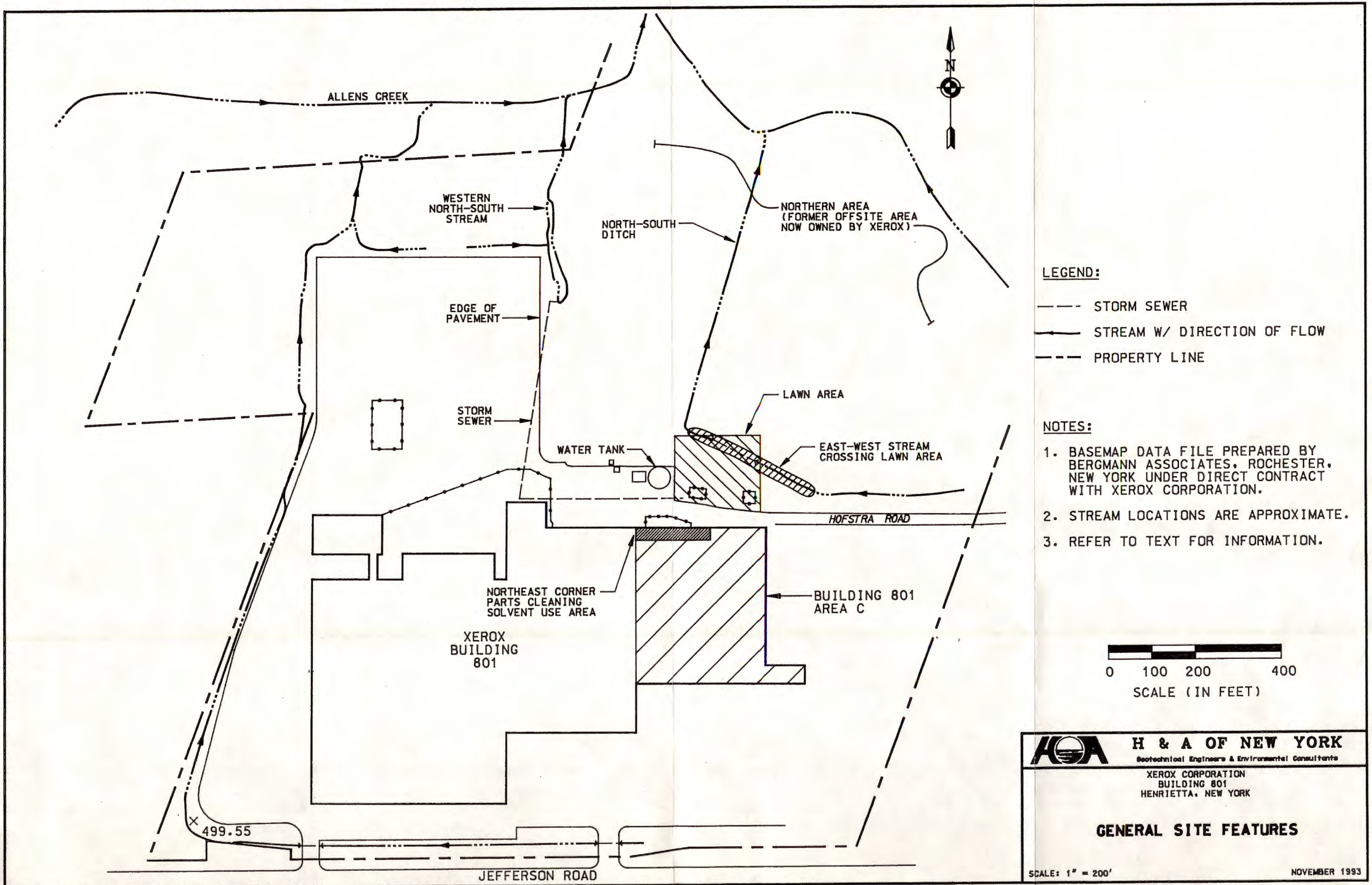
SCALE: 1 IN. = 2000 FT.

NOVEMBER 1993

FILE NO. 70290-41

CHARRETTE

FIGURE 1



H & A OF NEW YORK
Geotechnical Engineers & Environmental Consultants

XEROX CORPORATION
BUILDING 801
HENRIETTA, NEW YORK

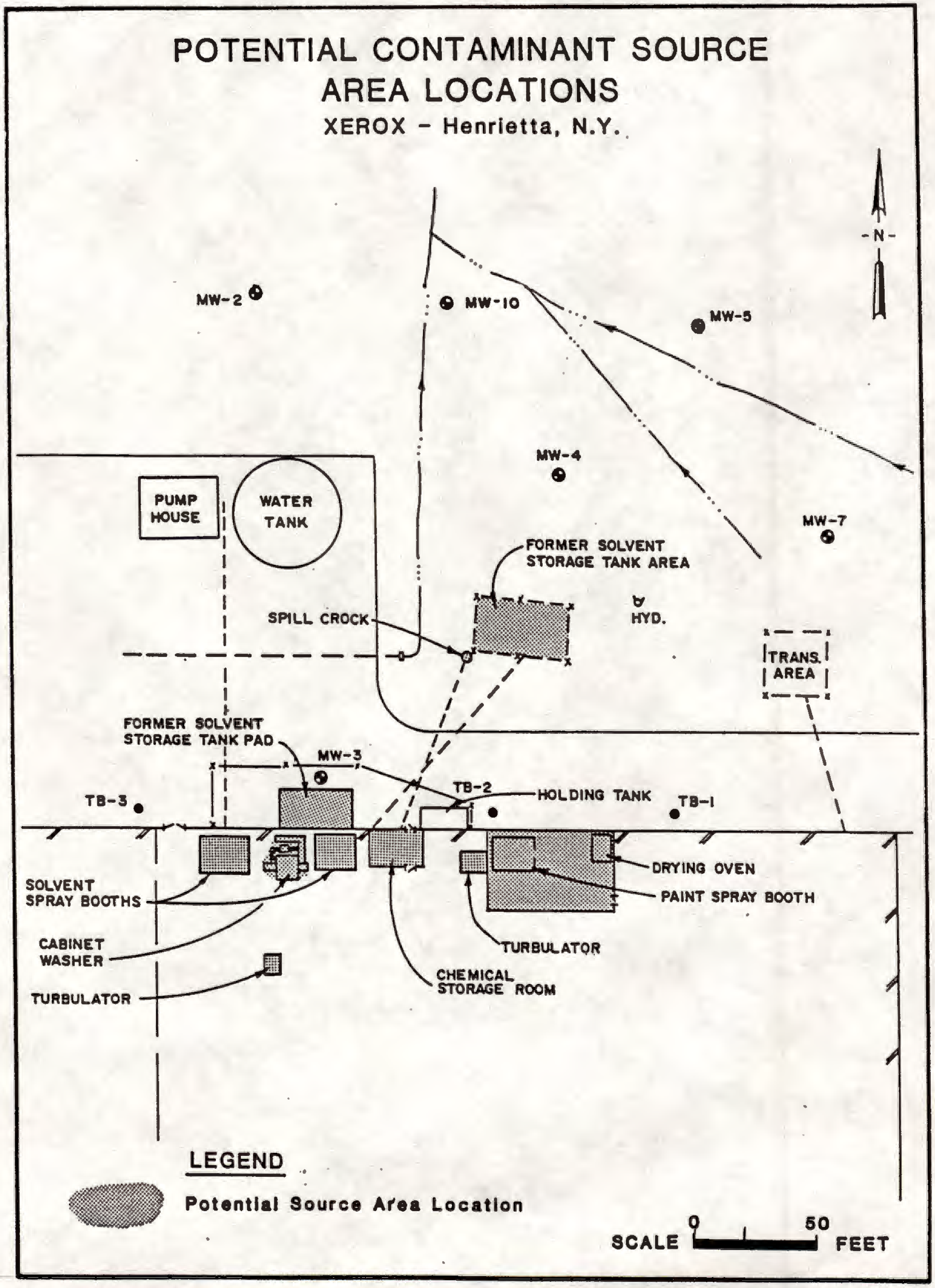
GENERAL SITE FEATURES

SCALE: 1" = 200'
NOVEMBER 1993

FILENAME: FIG2.DGN

FIGURE 2

FILE No. 70290-41



169669

NOTES:

1. THIS FIGURE IS TAKEN FROM ENGINEERING-SCIENCE, JUNE 1987, "REMEDIAL INVESTIGATION AT BUILDING 801, HENRIETTA, NEW YORK.

2. SOLVENT STORAGE AND USE AREAS DEPICTED ARE THOSE THAT EXISTED IN THE 1972 TO 1978 TIME PERIOD.

H & A OF NEW YORK

Geotechnical Engineers & Environmental Consultants

XEROX CORPORATION
BUILDING 801
HENRIETTA, NEW YORK

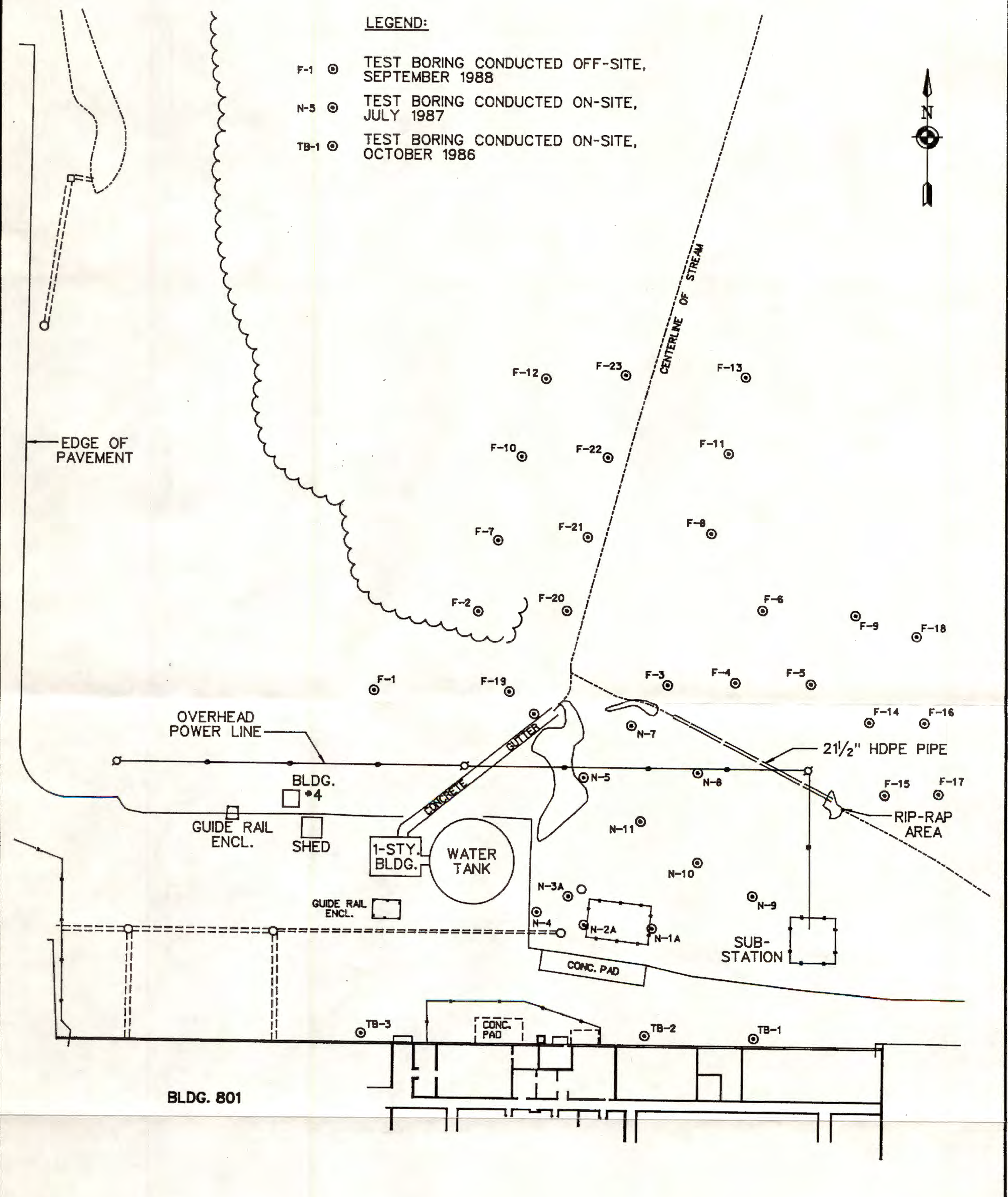
POTENTIAL CONTAMINANT SOURCE AREA LOCATIONS AS OF JUNE 1987

NOVEMBER 1993

FILE NO. 70290-41

MAKEPEACE

FIGURE 3



H & A OF NEW YORK
Geotechnical Engineers & Environmental Consultants

XEROX CORPORATION
BUILDING 801
HENRIETTA, NEW YORK

TEST BORINGS CONDUCTED BY ENGINEERING & SCIENCE

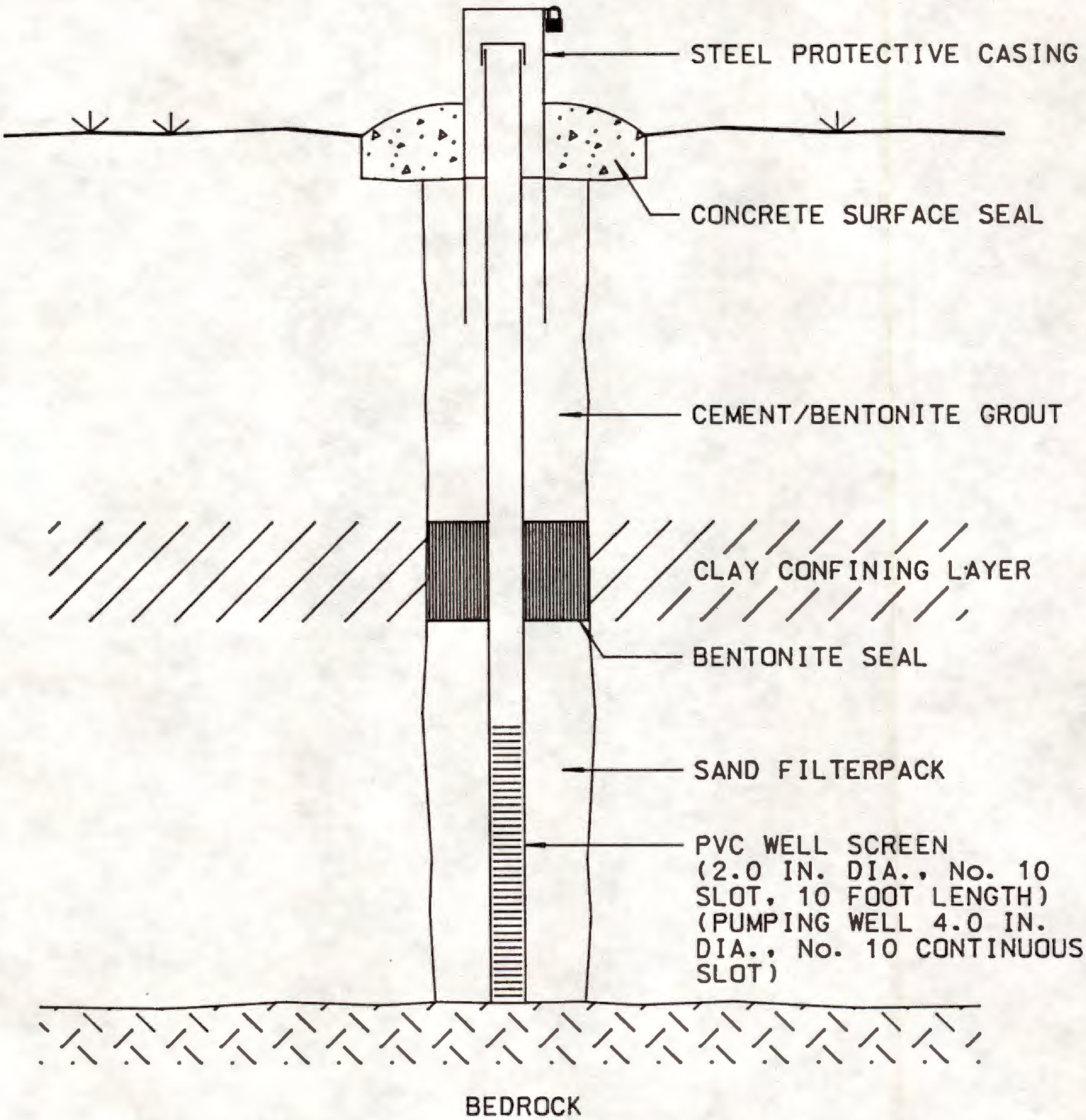
SCALE: 1" = 60'

NOVEMBER 1993

FILENAME: ENG-SCI.DGN

FIGURE 6

FILE No. 70290-41



H & A OF NEW YORK

Geotechnical Engineers & Environmental Consultants

XEROX CORPORATION
BUILDING 801

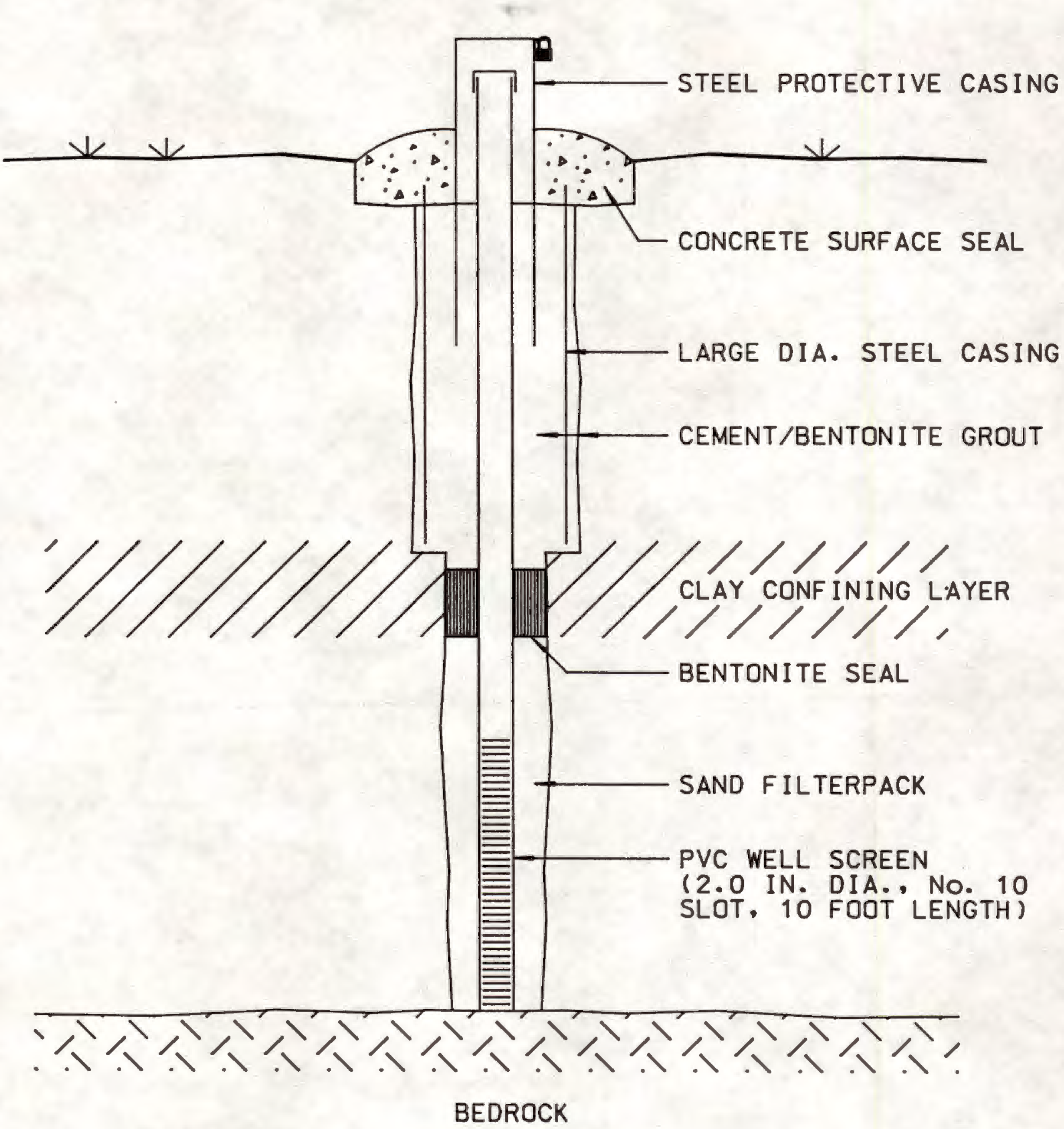
SCHEMATIC DIAGRAM
DEEP OBSERVATION/PUMPING WELLS

NO SCALE

NOVEMBER 1993

FIGURE 7

FILE No. 70290-41



H & A OF NEW YORK

Geotechnical Engineers & Environmental Consultants

XEROX CORPORATION
BUILDING 801

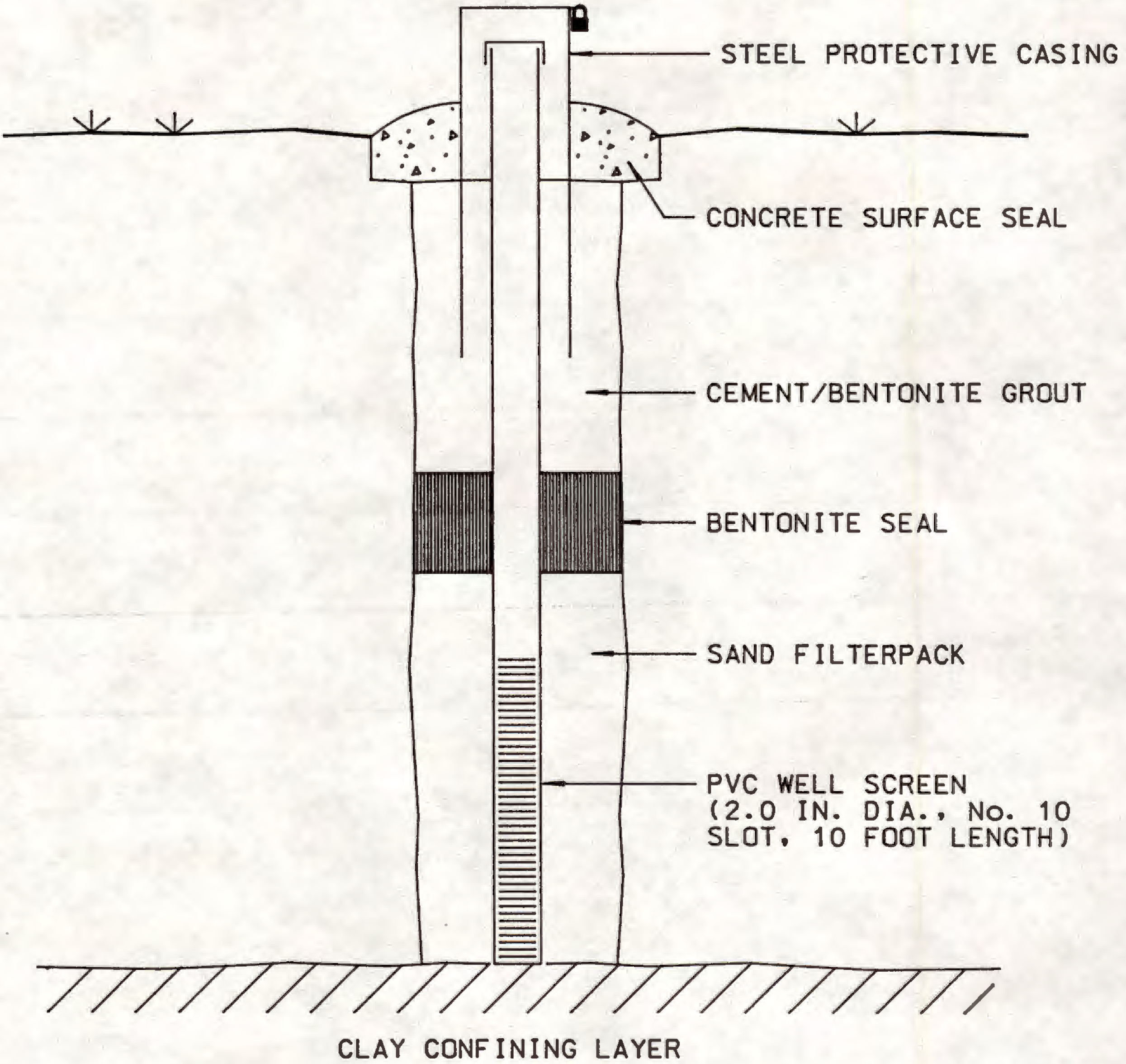
SCHEMATIC DIAGRAM
DEEP OBSERVATION WELL
(SOURCE AREA)

NO SCALE

NOVEMBER 1993

FIGURE 8

FILE No. 70290-41



H & A OF NEW YORK
Geotechnical Engineers & Environmental Consultants

XEROX CORPORATION
BUILDING 801

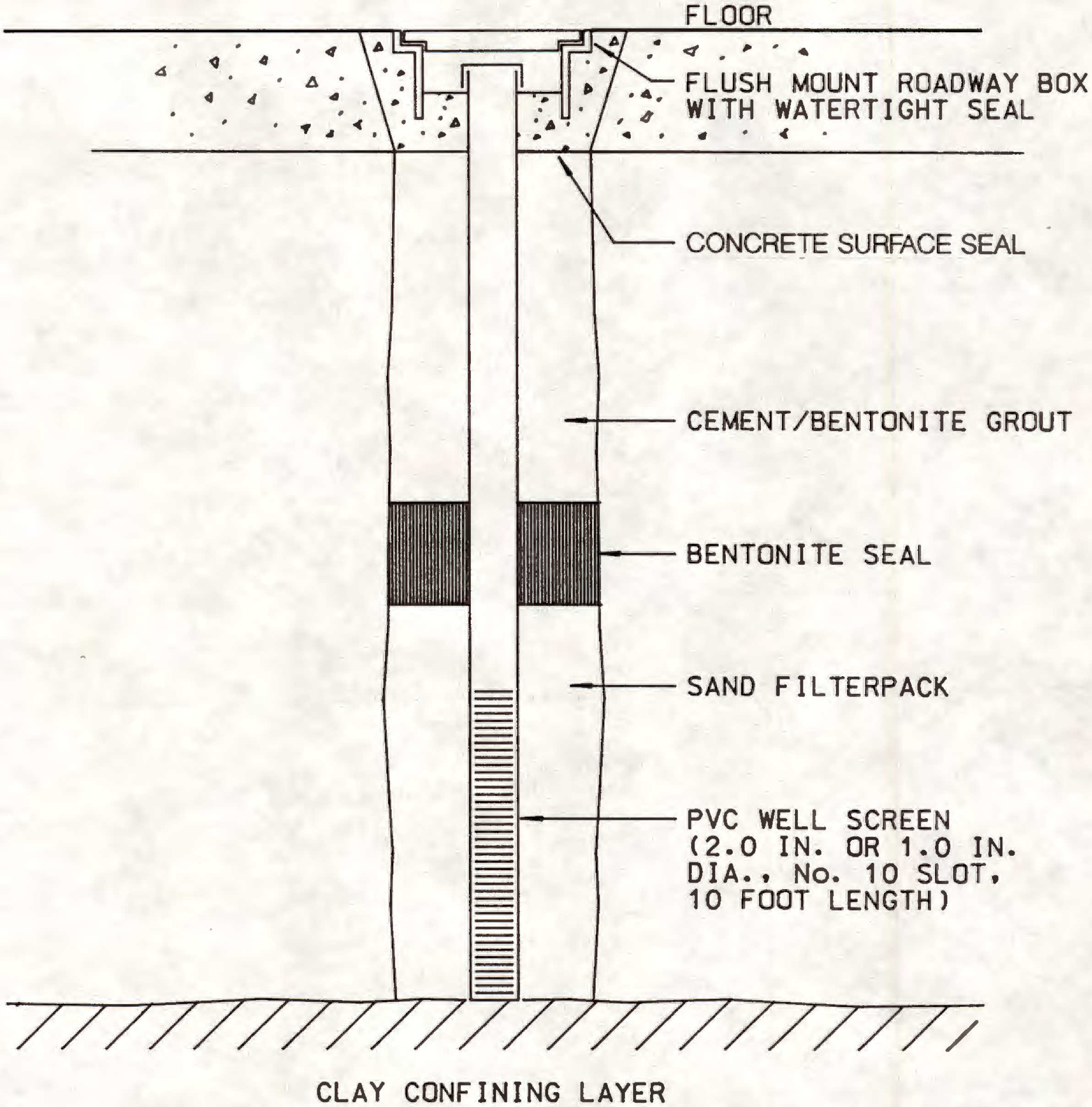
SCHEMATIC DIAGRAM
OUTDOOR SHALLOW OBSERVATION WELL

NO SCALE

NOVEMBER 1993

FIGURE 9

FILE No. 70290-41



H & A OF NEW YORK

Geotechnical Engineers & Environmental Consultants

XEROX CORPORATION
BUILDING 801

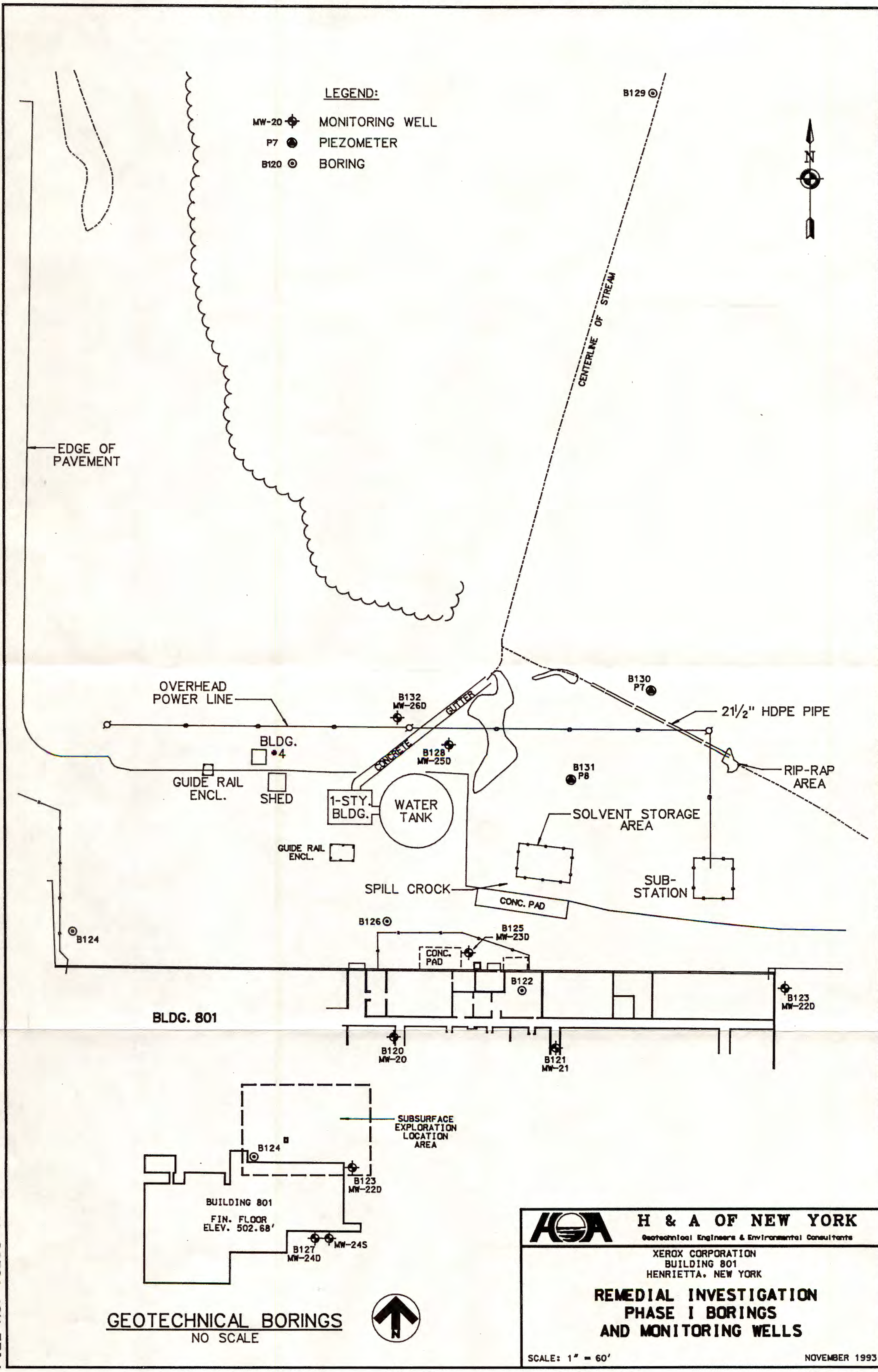
SCHEMATIC DIAGRAM
INDOOR SHALLOW OBSERVATION WELL

NO SCALE

NOVEMBER 1993

FIGURE 10

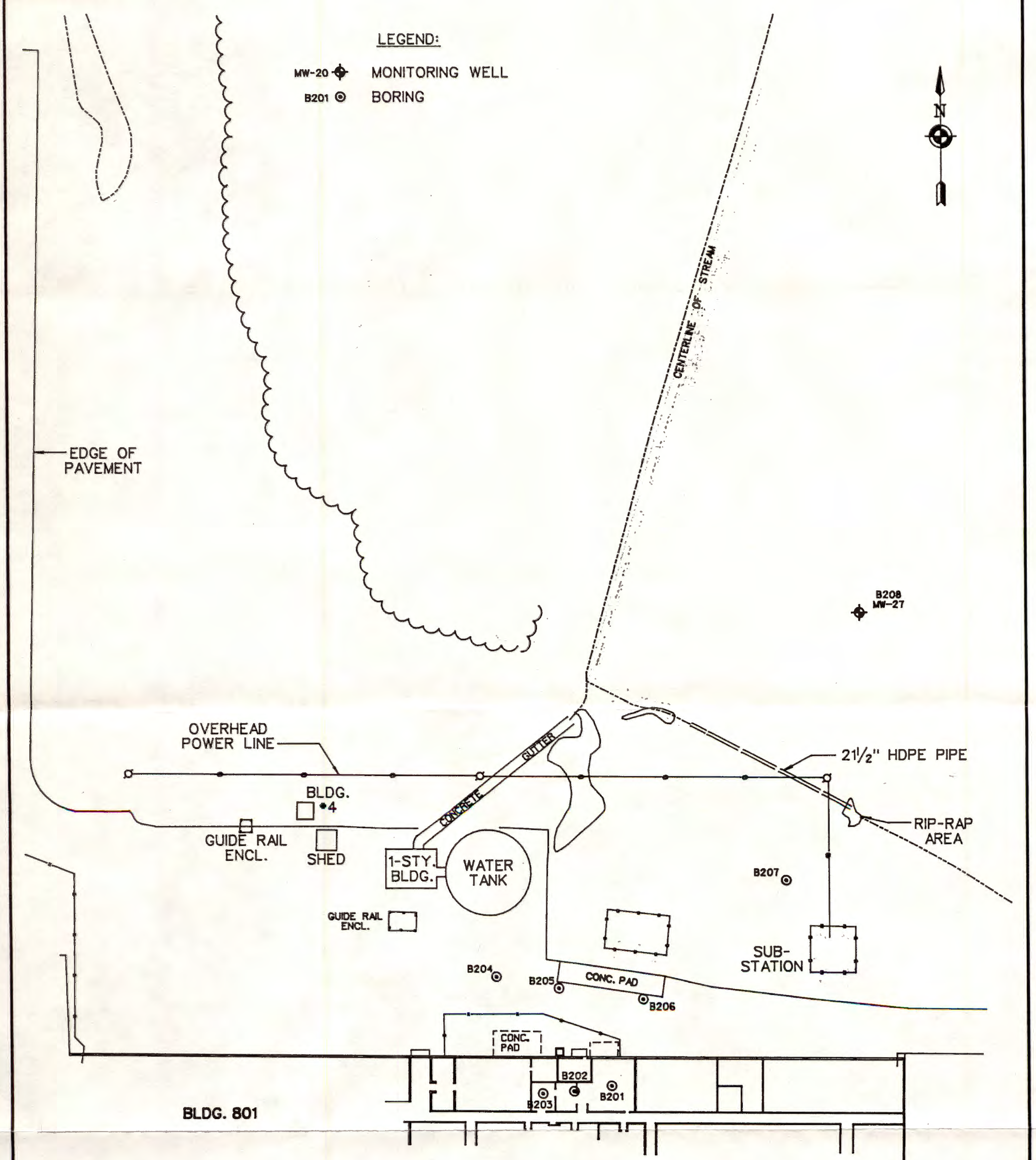
FILE No. 70290-41



FILE No. 70290-41

FILENAME: PHASE1.DGN

FIGURE 11



H & A OF NEW YORK

Geotechnical Engineers & Environmental Consultants

XEROX CORPORATION
BUILDING 801
HENRIETTA, NEW YORK

REMEDIAL INVESTIGATION
PHASE II BORINGS
AND MONITORING WELLS

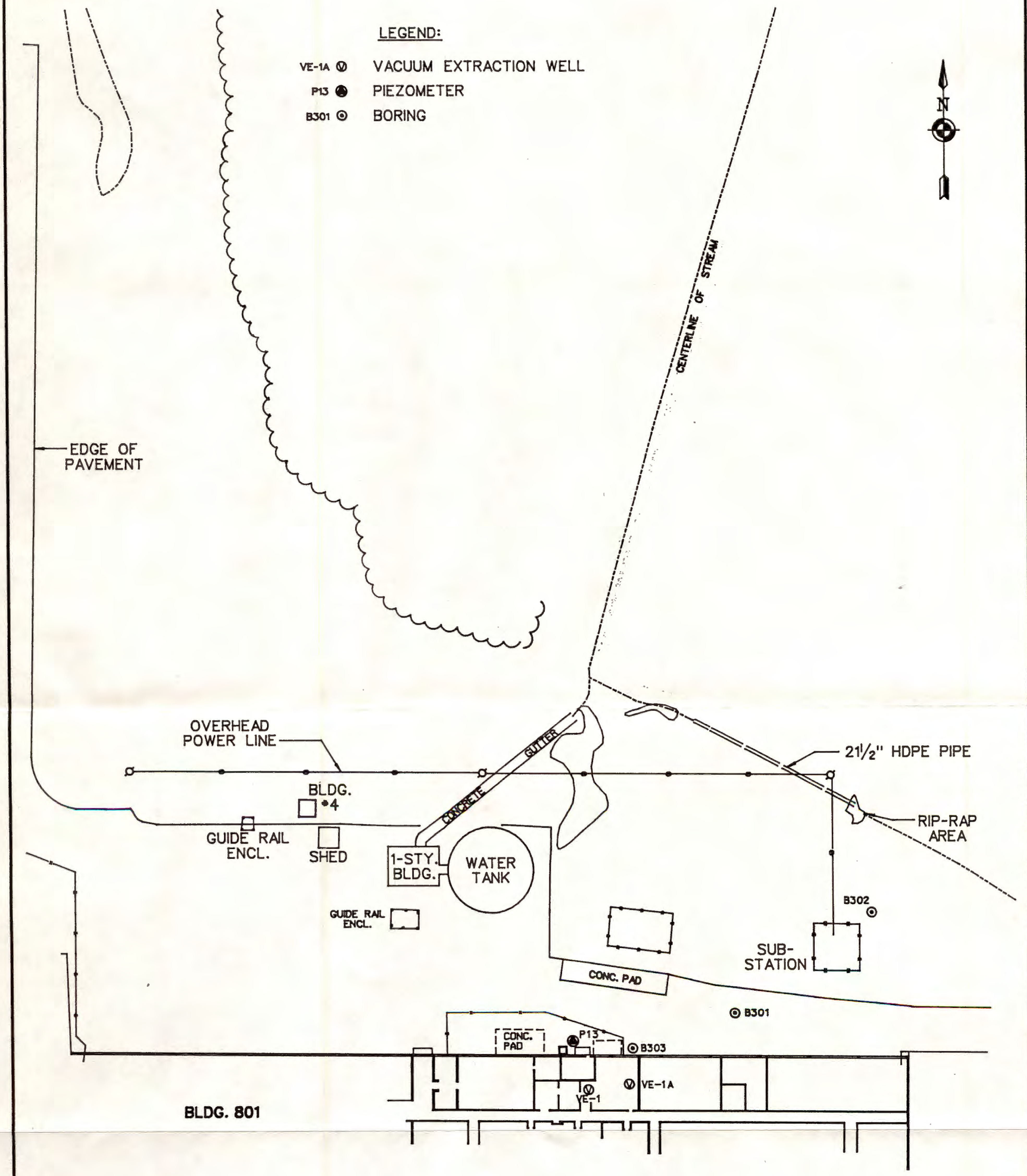
SCALE: 1" = 60'

NOVEMBER 1993

FILENAME: PHASE2.DGN

FIGURE 12

FILE No. 70290-41



H & A OF NEW YORK

Geotechnical Engineers & Environmental Consultants

XEROX CORPORATION
BUILDING 801
HENRIETTA, NEW YORK

REMEDIAL INVESTIGATION PHASE III BORINGS AND MONITORING WELLS

SCALE: 1" = 60'

NOVEMBER 1993

FILENAME: PHASE3.DGN

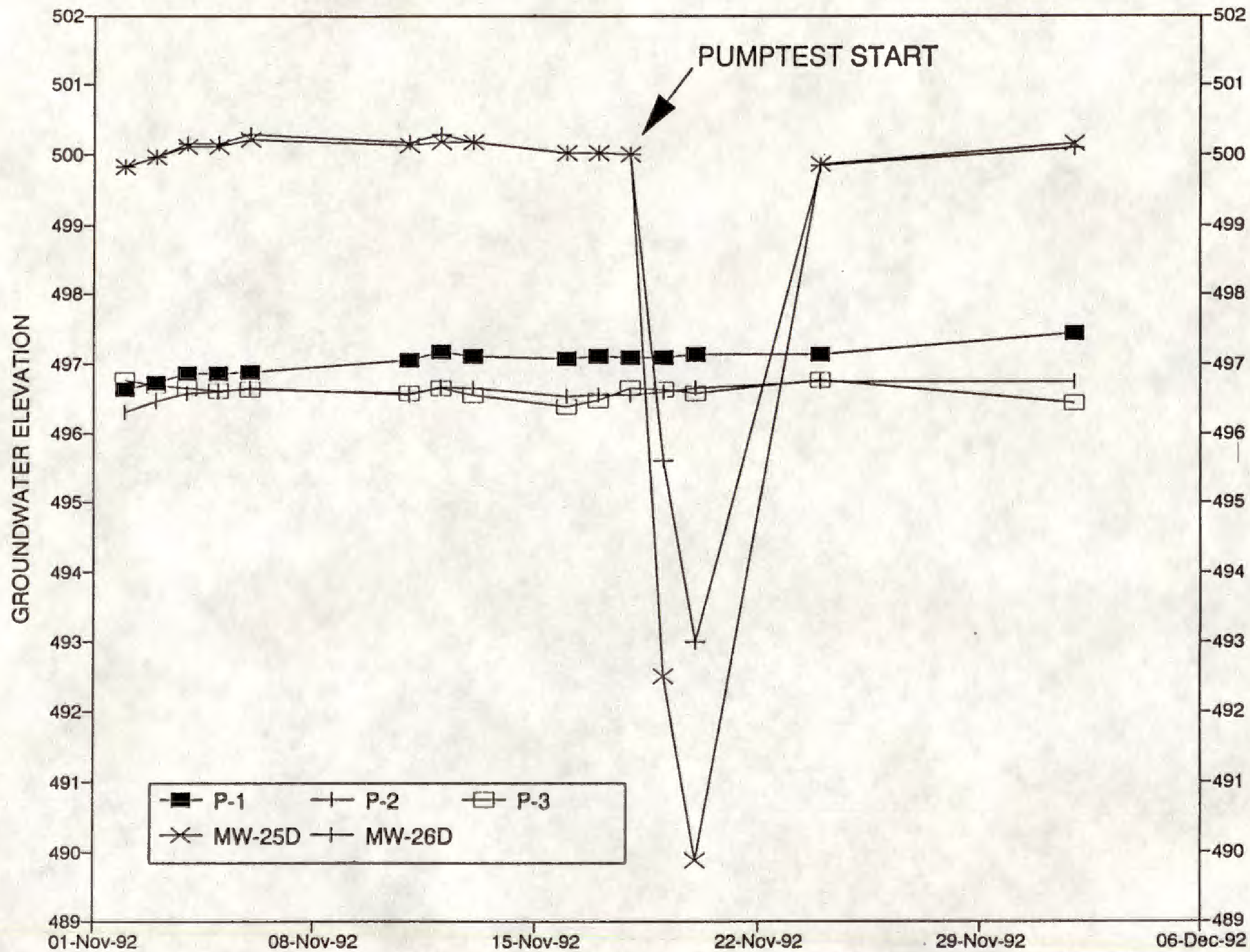
FIGURE 13

FILE No. 70290-41

FILE NO. 70290-41

169669

MAKEPEACE



NOTES:

1. PUMPING TEST CONDUCTED BY H&A ON 19-20 NOV 1992.

H & A OF NEW YORK

Geotechnical Engineers & Environmental Consultants

XEROX CORPORATION
BUILDING 801
HENRIETTA, NEW YORK

PUMPING TEST WATER LEVELS
NOVEMBER 1992

NOVEMBER 1993

FIGURE 14

LEGEND:

lsc - LACUSTRINE CLAY & SILT

pm - MARSH DEPOSITS

tp - GLACIAL TILL

NOTE: THIS FIGURE IS TAKEN FROM ENGINEERING-SCIENCE, JUNE 1987, "REMEDIAL INVESTIGATION AT BUILDING 801, HENRIETTA, NEW YORK".

H & A OF NEW YORK

Geotechnical Engineers & Environmental Consultants

XEROX CORPORATION
BUILDING 801
HENRIETTA, NEW YORK

SURFICIAL GEOLOGY

SCALE: 1 IN. = 2000 FT.

NOVEMBER 1993

FILE NO. 70290-41

MAKEPEACE

FIGURE 15

LEGEND:

IRONDEQUOIT CREEK WATERSHED BOUNDARY

ALLEN CREEK SUBASIN APPROXIMATE

▲ ALLEN CREEK U.S.G.S. GAUGING STATION

NOTE: THIS FIGURE IS TAKEN FROM O'BRIEN & GERE, APRIL 1983, "NATIONAL URBAN RUNOFF PROGRAM, IRONDEQUOIT BASIN STUDY FINAL REPORT" SUBMITTED TO THE MONROE COUNTY DEPARTMENT OF ENGINEERING, MONROE COUNTY, NEW YORK.

H & A OF NEW YORK

Geotechnical Engineers & Environmental Consultants

XEROX CORPORATION
BUILDING 801
HENRIETTA, NEW YORK

IRONDEQUOIT CREEK WATERSHED
ALLEN CREEK SUBASIN

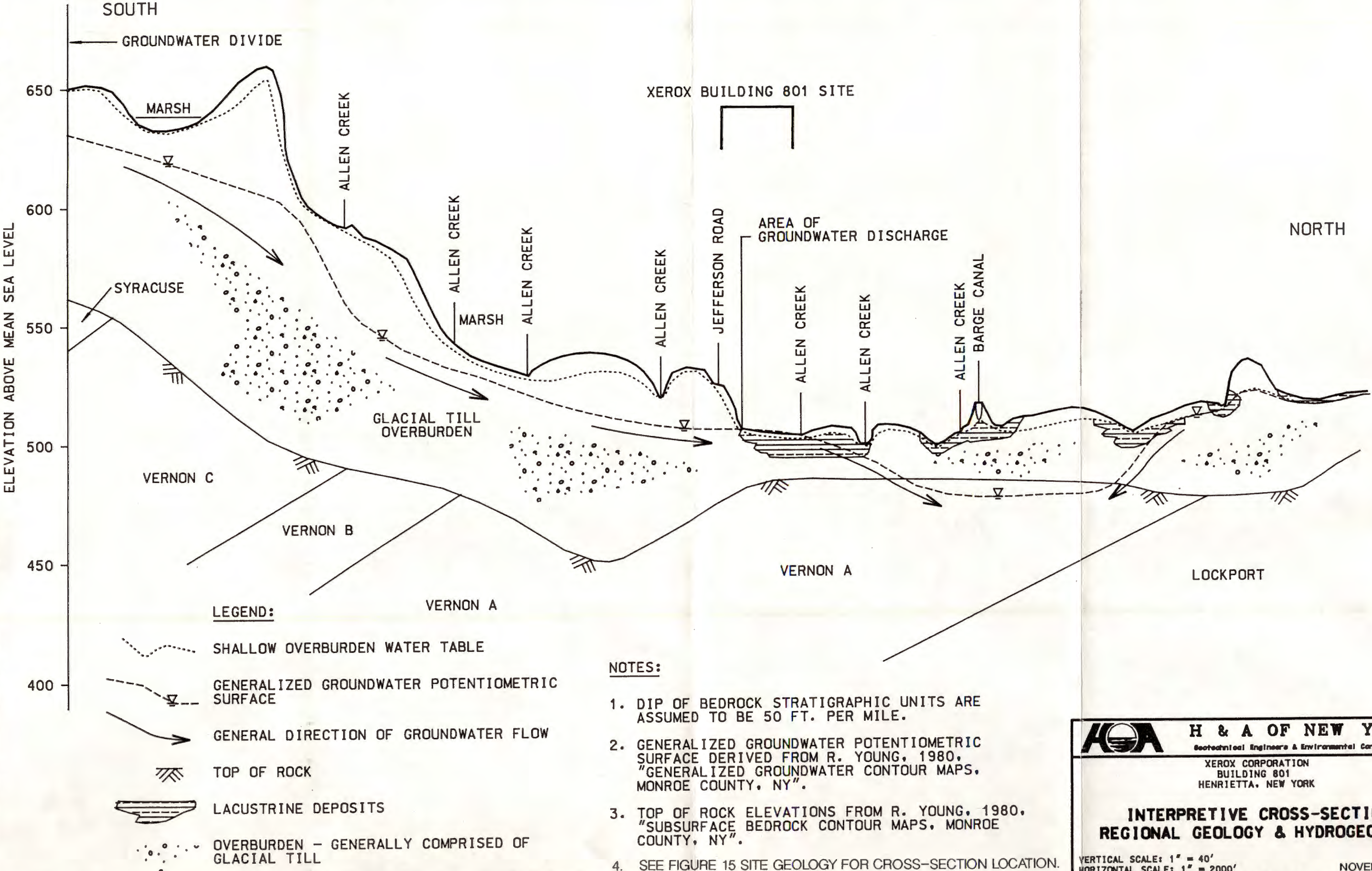
SCALE AS SHOWN — NOVEMBER 1993

FILE NO. 70290-41

MAKEPEACE

FIGURE 16

169669



NOTES:

1. DIP OF BEDROCK STRATIGRAPHIC UNITS ARE ASSUMED TO BE 50 FT. PER MILE.
2. GENERALIZED GROUNDWATER POTENTIOMETRIC SURFACE DERIVED FROM R. YOUNG, 1980, "GENERALIZED GROUNDWATER CONTOUR MAPS, MONROE COUNTY, NY".
3. TOP OF ROCK ELEVATIONS FROM R. YOUNG, 1980, "SUBSURFACE BEDROCK CONTOUR MAPS, MONROE COUNTY, NY".
4. SEE FIGURE 15 SITE GEOLOGY FOR CROSS-SECTION LOCATION.

H & A OF NEW YORK
Geotechnical Engineers & Environmental Consultants

XEROX CORPORATION
BUILDING 801
HENRIETTA, NEW YORK

INTERPRETIVE CROSS-SECTION
REGIONAL GEOLOGY & HYDROGEOLOGY

VERTICAL SCALE: 1" = 40'
HORIZONTAL SCALE: 1" = 2000'

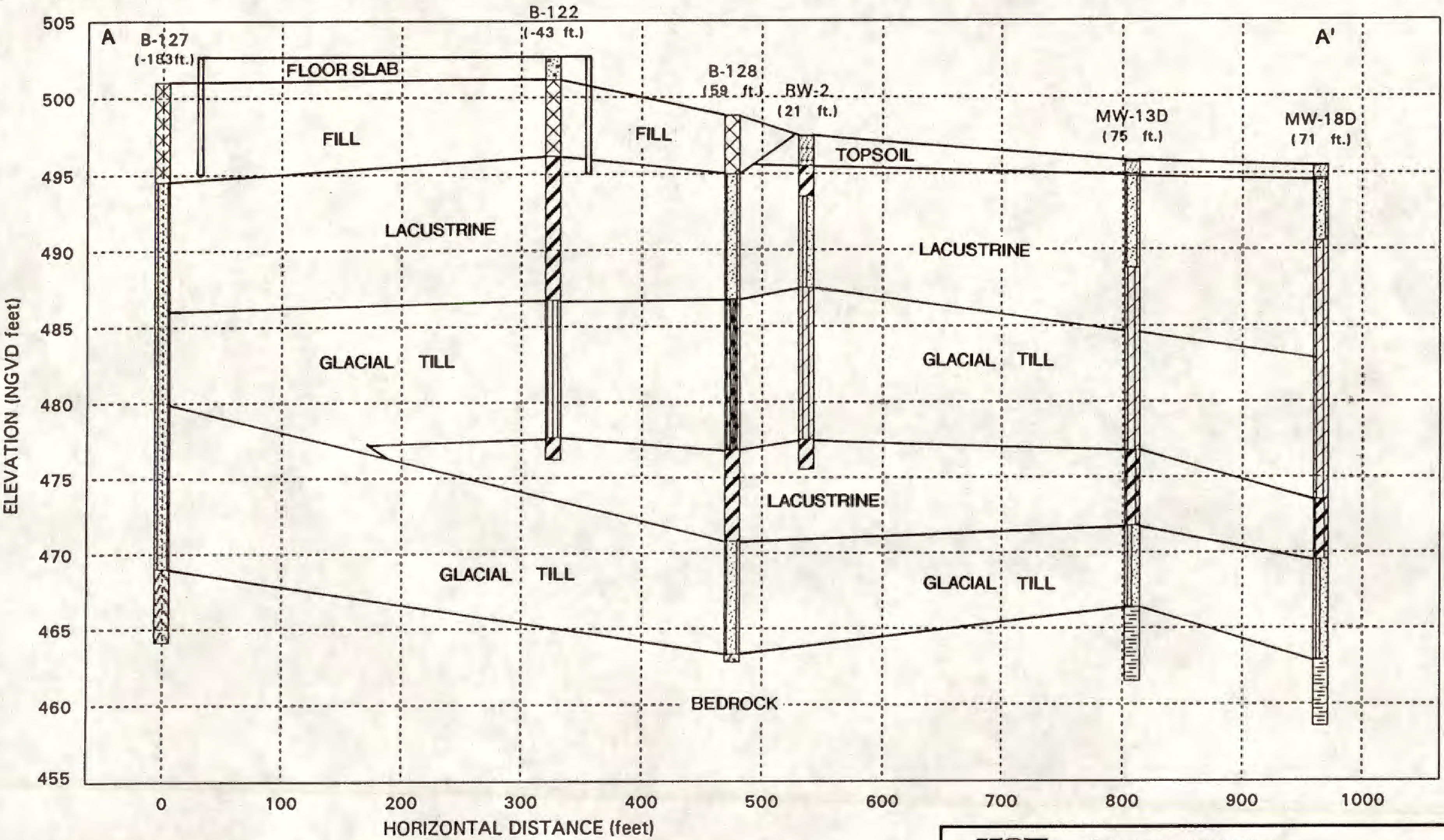
NOVEMBER 1993

FILENAME: GEO-HY.DGN

FIGURE 17

FILE No. 70290-41

FILE NO. 70290-41



LEGEND:

B-122	BORING NAME
(7 ft.)	NORTH OFFSET FROM PROFILE LINE
	MATERIAL SYMBOL
	WELL CONSTRUCTION SYMBOL (if applicable)

NOTES:

1. SEE FIGURE 21 BORING LOCATION PLAN, FOR PROFILE LINE LOCATION.
2. SEE BORING LOGS IN APPENDIX B FOR BORING AND WELL CONSTRUCTION DETAILS.
3. SEE SUBSURFACE KEY FOR MATERIAL SYMBOL AND WELL CONSTRUCTION SYMBOL KEYS.

H & A OF NEW YORK
Geotechnical Engineers & Environmental Consultants

XEROX CORPORATION
BUILDING 801
HENRIETTA, NEW YORK

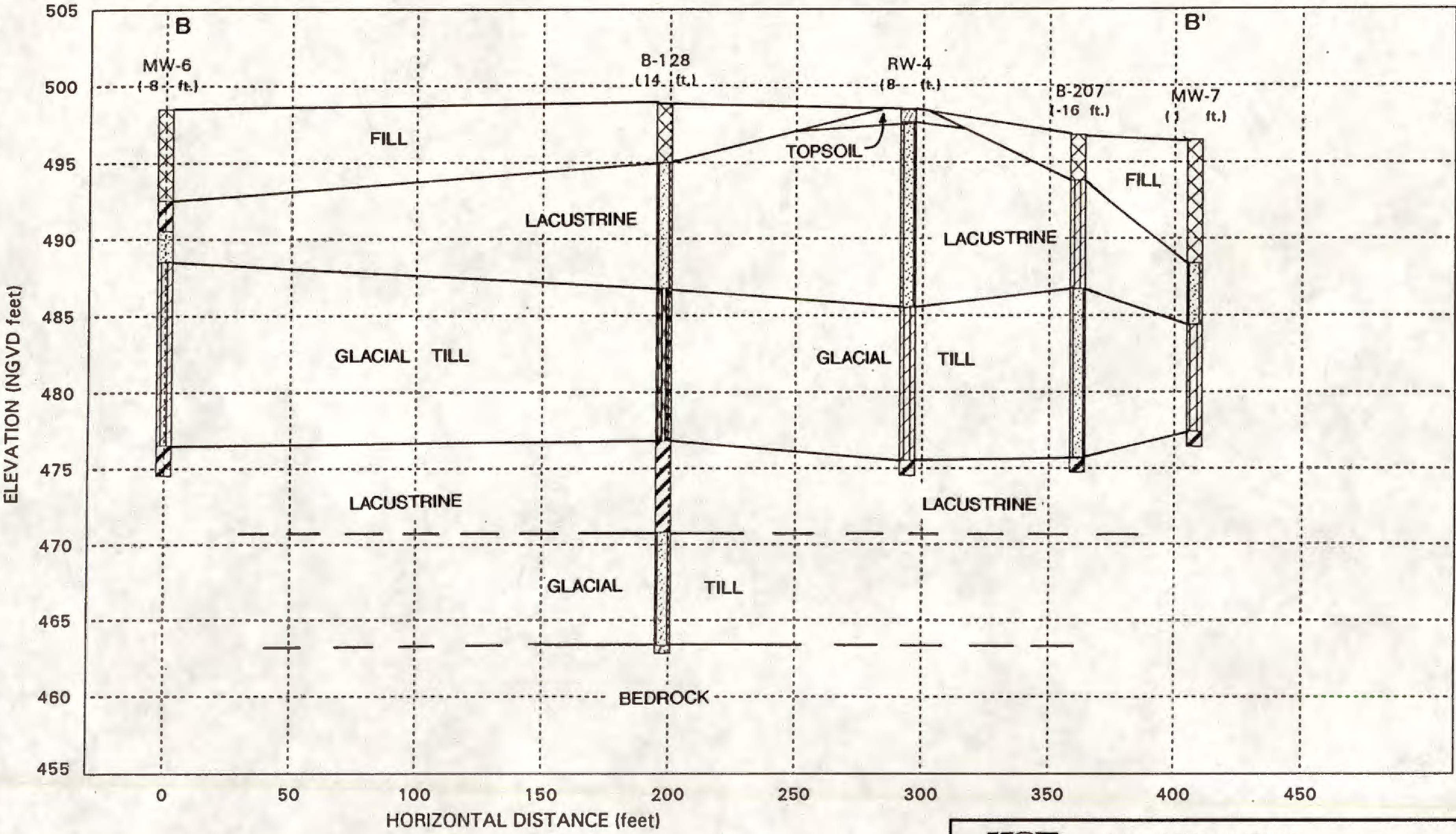
GEOLOGIC PROFILE A–A"

Scale: 1 in. = 125 ft. (Horiz.)
1 in. = 10 ft. (Vert.)

NOVEMBER 1993

FIGURE 18

FILE NO. 70290-41



LEGEND:

B-128	BORING NAME
(7 ft.)	NORTH OFFSET FROM PROFILE LINE
	MATERIAL SYMBOL
	WELL CONSTRUCTION SYMBOL (if applicable)

NOTES:

1. SEE FIGURE 21 BORING LOCATION PLAN, FOR PROFILE LINE LOCATION.
2. SEE BORING LOGS IN APPENDIX B FOR BORING AND WELL CONSTRUCTION DETAILS.
3. SEE SUBSURFACE KEY FOR MATERIAL SYMBOL AND WELL CONSTRUCTION SYMBOL KEYS.

H & A OF NEW YORK
Geotechnical Engineers & Environmental Consultants

XEROX CORPORATION
BUILDING 801
HENRIETTA, NEW YORK

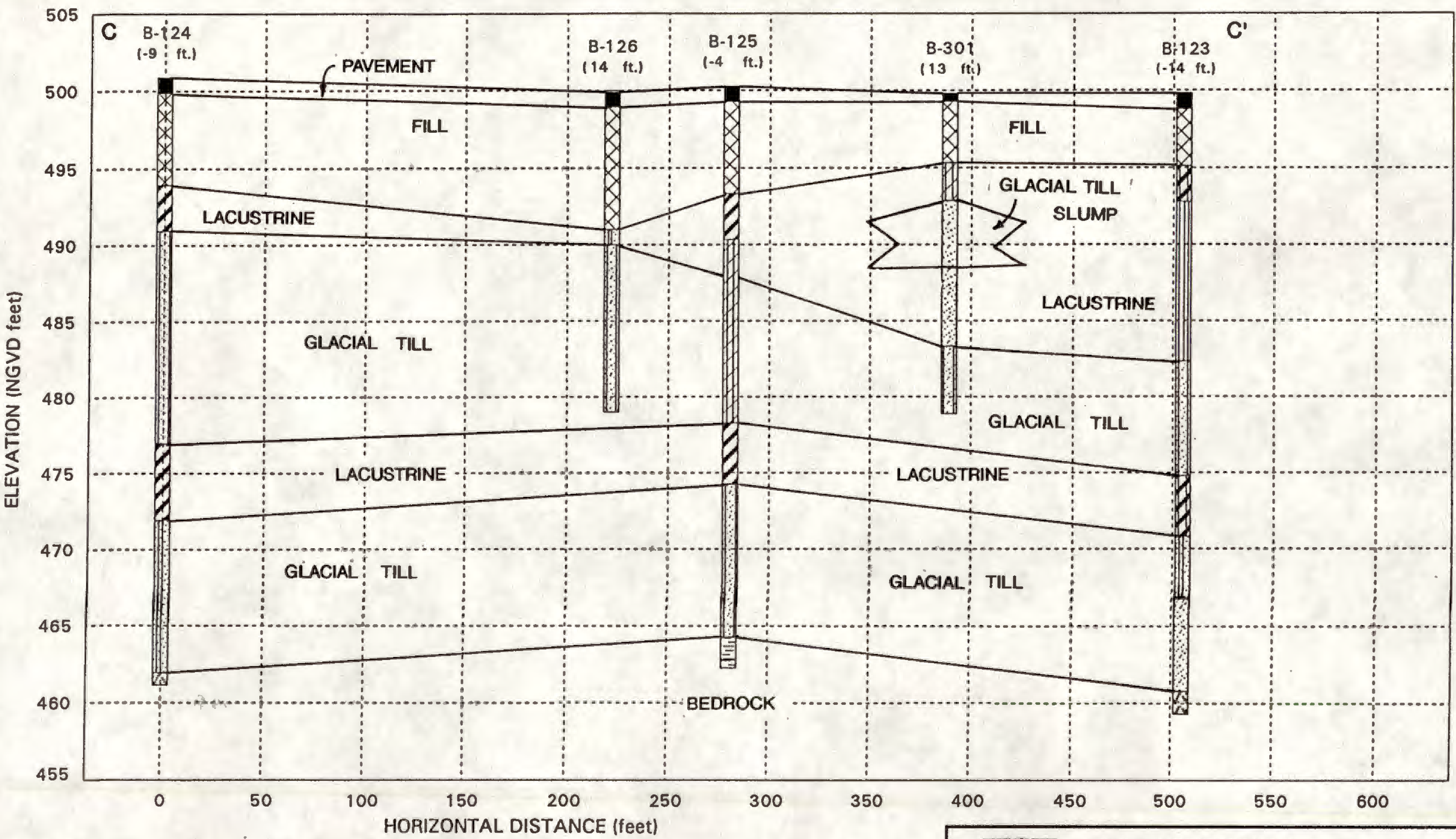
GEOLOGIC PROFILE B–B"

Scale: 1 in. = 60 ft. (Horiz.)
1 in. = 10 ft. (Vert.)

NOVEMBER 1993

FIGURE 19

FILE NO. 70290-41



LEGEND:

B-123 BORING NAME

(7 ft.) NORTH OFFSET FROM PROFILE LINE

MATERIAL SYMBOL

WELL CONSTRUCTION SYMBOL (if applicable)

NOTES:

1. SEE FIGURE 21 BORING LOCATION PLAN, FOR PROFILE LINE LOCATION.
2. SEE BORING LOGS IN APPENDIX B FOR BORING AND WELL CONSTRUCTION DETAILS.
3. SEE SUBSURFACE KEY FOR MATERIAL SYMBOL AND WELL CONSTRUCTION SYMBOL KEYS.

H & A OF NEW YORK
Geotechnical Engineers & Environmental Consultants

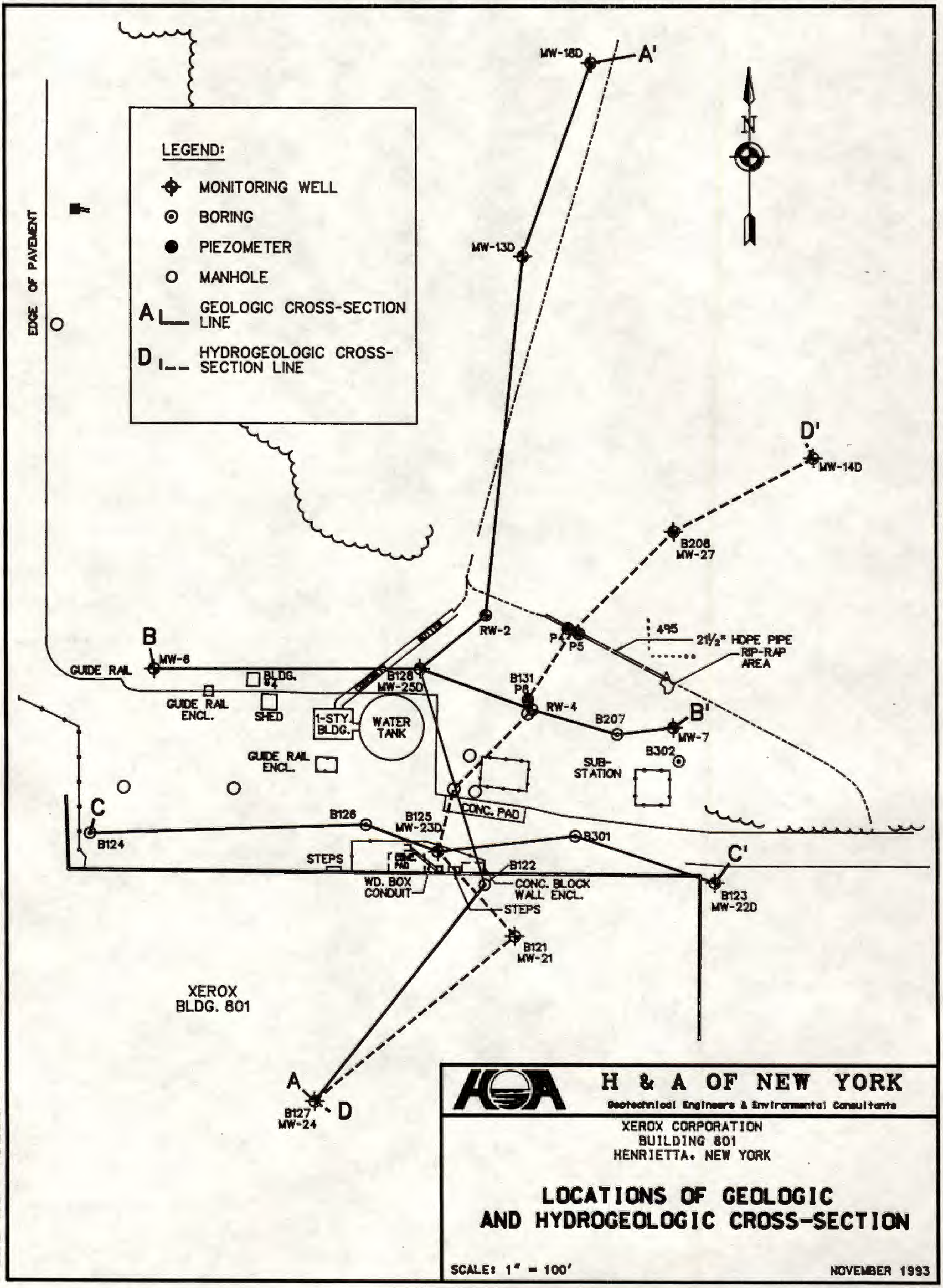
XEROX CORPORATION
BUILDING 801
HENRIETTA, NEW YORK

GEOLOGIC PROFILE C–C"

Scale: 1 in. = 75 ft. (Horiz.)
1 in. = 10 ft. (Vert.)

NOVEMBER 1993

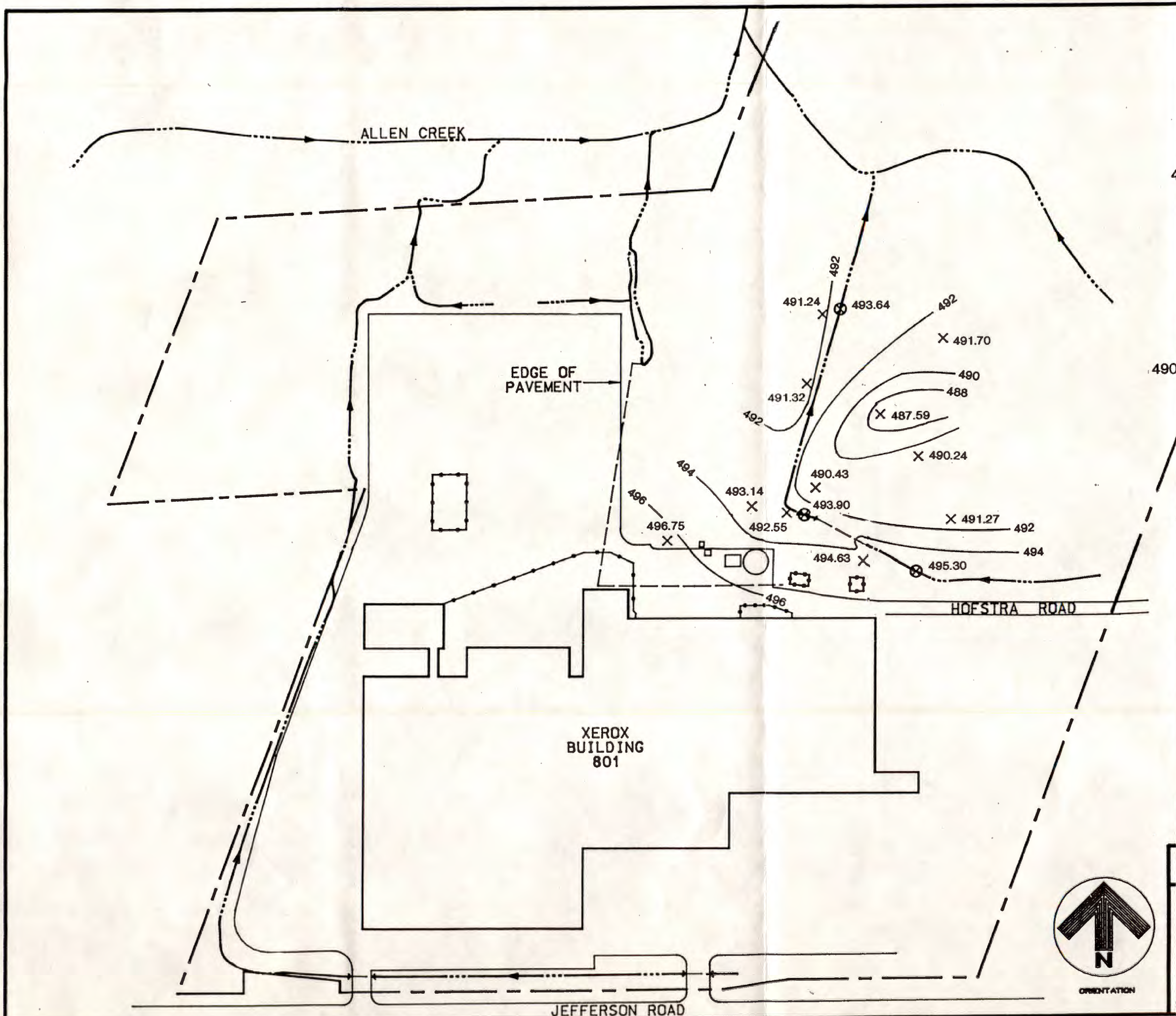
FIGURE 20



FILENAME: GEOHYCS.DGN

FIGURE 21

FILE No. 70290-41



LEGEND:

494.56 × GROUNDWATER ELEVATION MEASURED 27 JUNE 1991 IN SHALLOW GROUNDWATER MONITORING WELLS

⊗ STREAM ELEVATION MEASURED 26 AUGUST 1992

STORM SEWER

STREAM W/ DIRECTION OF FLOW

PROPERTY LINE

490 GROUNDWATER CONTOUR ELEVATION

NOTES:

1. BASEMAP DATA FILE PREPARED BY BERGMANN ASSOCIATES, ROCHESTER, NEW YORK UNDER DIRECT CONTRACT WITH XEROX CORPORATION.
2. STREAM LOCATIONS ARE APPROXIMATE.
3. REFER TO TEXT FOR INFORMATION.

CONTOUR INTERVAL = 2 FT.

H & A OF NEW YORK
Geotechnical Engineers & Environmental Consultants

XEROX CORPORATION
BUILDING 801
HENRIETTA, NEW YORK

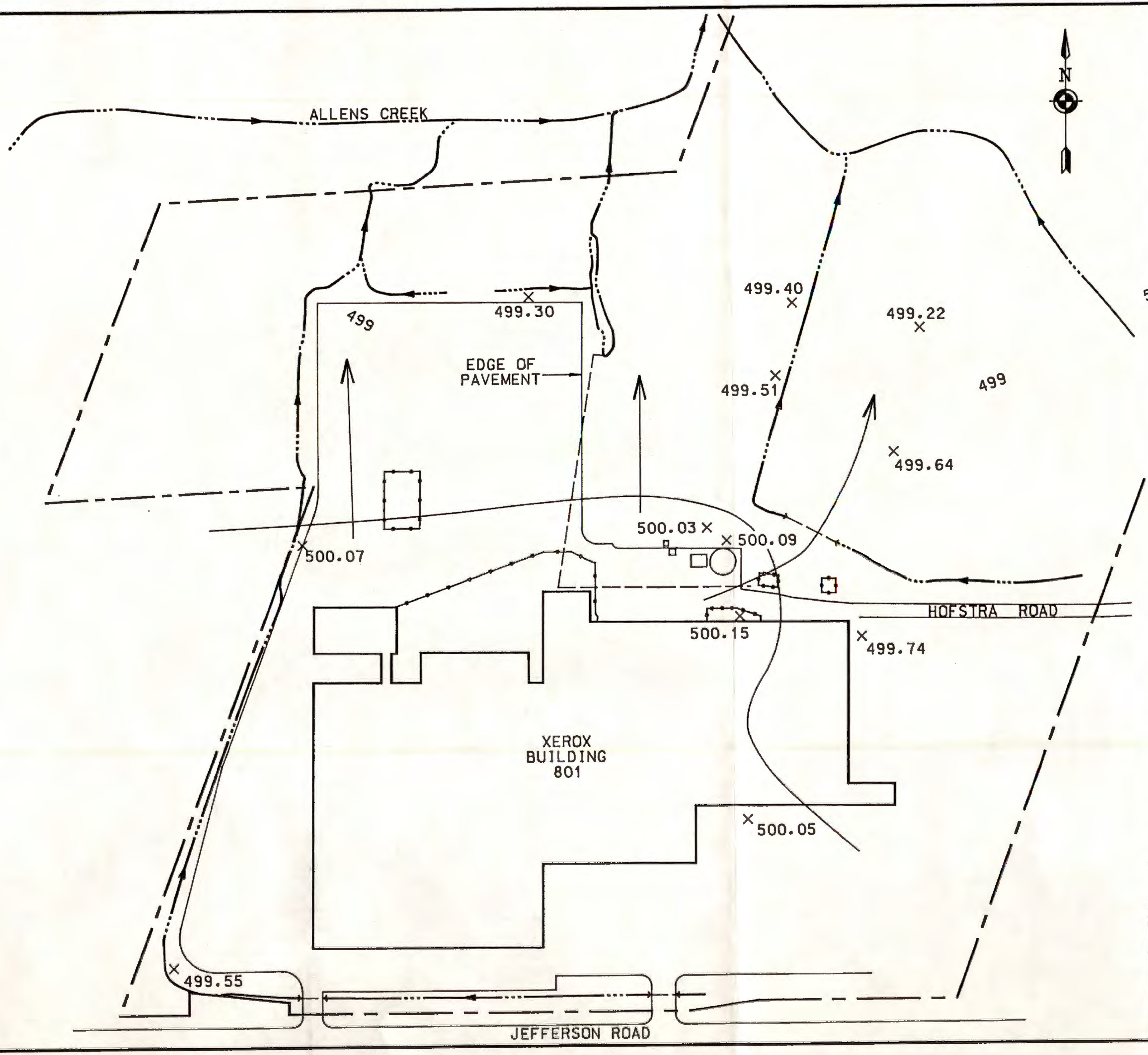
SHALLOW AQUIFER
GROUNDWATER CONTOURS PLAN
SUMMER 1991

SCALE: 1" = 200'

NOVEMBER 1993

FIGURE 24

FILE No. 70290-41



LEGEND:

499.50 GROUNDWATER ELEVATION MEASURED 2 JUNE 1993 IN DEEP GROUNDWATER MONITORING WELLS

STORM SEWER

STREAM W/ DIRECTION OF FLOW

PROPERTY LINE

500 GROUNDWATER CONTOUR ELEVATION

APPROXIMATE DIRECTION OF GROUNDWATER FLOW

NOTES:

1. BASEMAP DATA FILE PREPARED BY BERGMANN ASSOCIATES, ROCHESTER, NEW YORK UNDER DIRECT CONTRACT WITH XEROX CORPORATION.
2. STREAM LOCATIONS ARE APPROXIMATE.
3. REFER TO TEXT FOR INFORMATION.

0 100 200 400

SCALE (IN FEET)

H & A OF NEW YORK

Geotechnical Engineers & Environmental Consultants

XEROX CORPORATION
BUILDING 801
HENRIETTA, NEW YORK

DEEP AQUIFER GROUNDWATER CONTOURS PLAN WINTER 1992

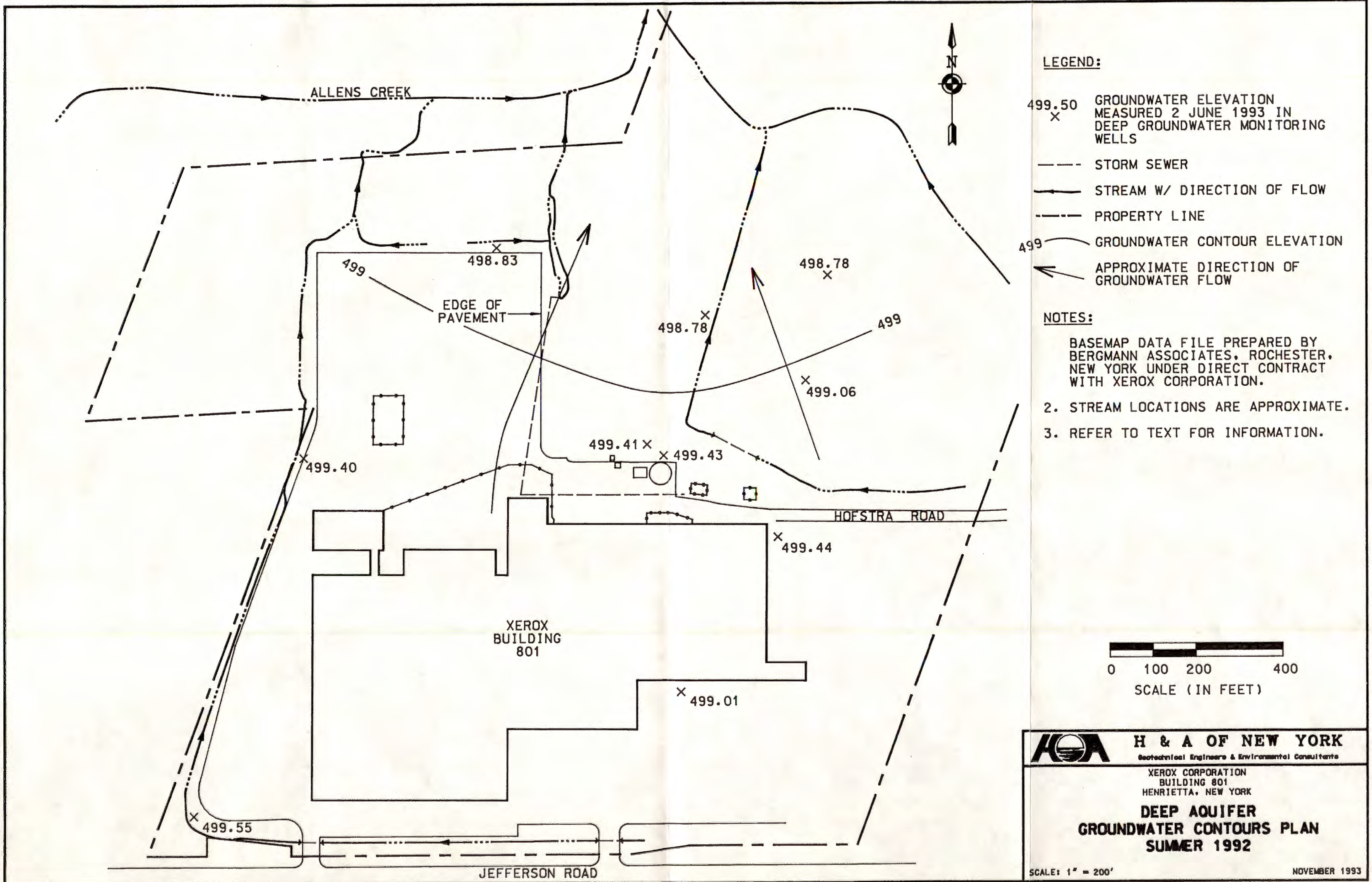
SCALE: 1" = 200'

NOVEMBER 1993

FILENAME: FIG23.DGN

FIGURE 23

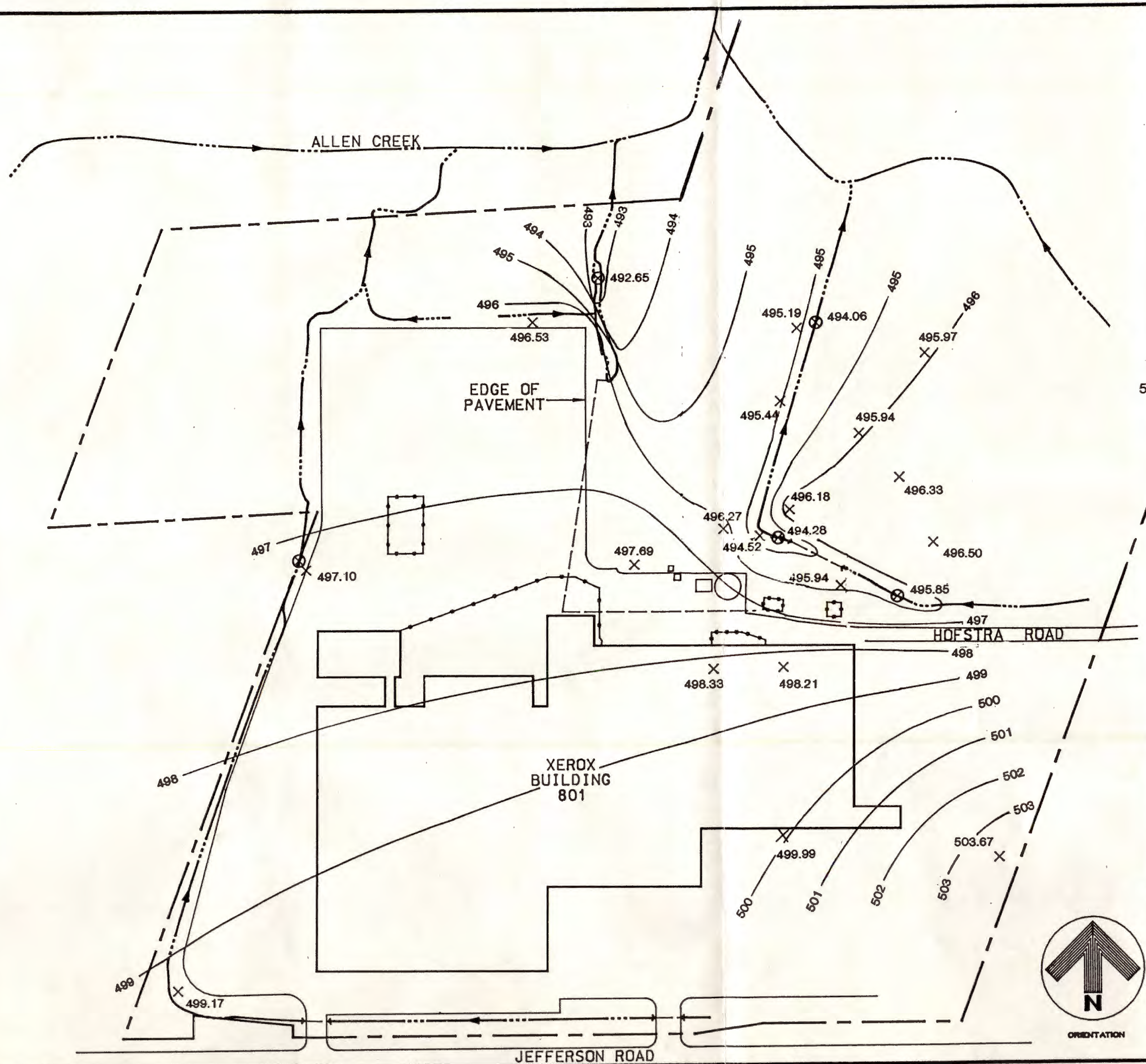
FILE No. 70290-41



FILENAME: FIG22.DGN

FIGURE 22

FILE No. 70290-41



LEGEND:

494.56 × GROUNDWATER ELEVATION MEASURED 30 DECEMBER 1992 IN SHALLOW GROUNDWATER MONITORING WELLS

⊗ STREAM ELEVATION MEASURED 30 DECEMBER 1992

STORM SEWER

STREAM W/ DIRECTION OF FLOW

PROPERTY LINE

500 GROUNDWATER CONTOUR ELEVATION

NOTES:

1. BASEMAP DATA FILE PREPARED BY BERGMANN ASSOCIATES, ROCHESTER, NEW YORK UNDER DIRECT CONTRACT WITH XEROX CORPORATION.
2. STREAM LOCATIONS ARE APPROXIMATE.
3. REFER TO TEXT FOR INFORMATION.

CONTOUR INTERVAL = 1 FT.

H & A OF NEW YORK
Geotechnical Engineers & Environmental Consultants

XEROX CORPORATION
BUILDING 801
HENRIETTA, NEW YORK

SHALLOW AQUIFER
GROUNDWATER CONTOURS PLAN
WINTER 1992

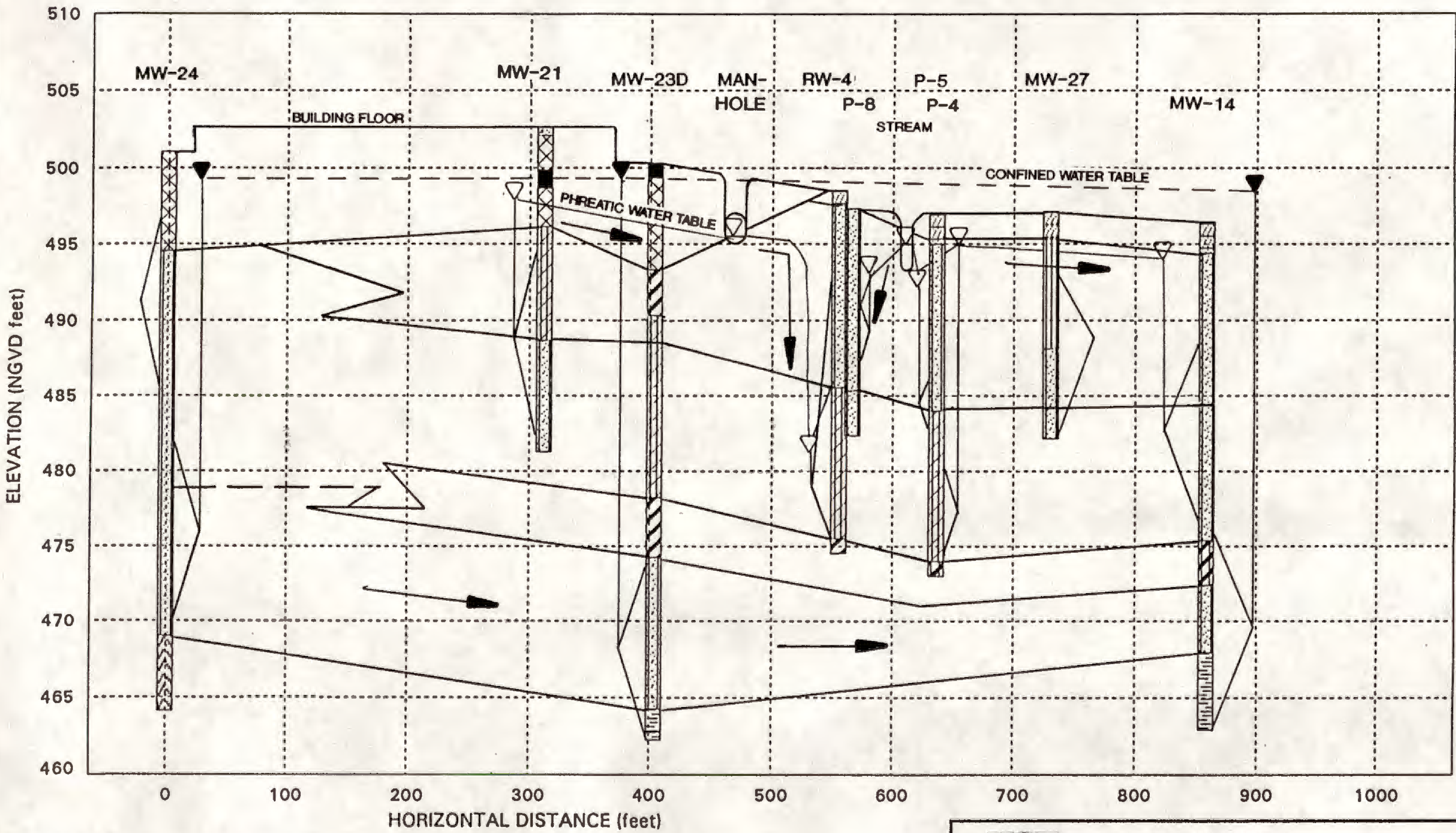
SCALE: 1" = 200'

NOVEMBER 1993

FIGURE 25

FILE No. 70290-41

FILE NO.- 70290-41



LEGEND:

B-121 BORING NAME

(7 ft.) NORTH OFFSET FROM PROFILE LINE

MATERIAL SYMBOL

WELL CONSTRUCTION SYMBOL (if applicable)

APPROXIMATE WATER LEVEL ELEVATION

(FILLED TRIANGLE = DEEP AQUIFER)

APPARENT DIRECTION OF GROUNDWATER FLOW

NOTES:

1. SEE FIGURE 21 BORING LOCATION PLAN, FOR PROFILE LINE LOCATION.
2. SEE BORING LOGS IN APPENDIX B FOR BORING AND WELL CONSTRUCTION DETAILS.
3. SEE SUBSURFACE KEY FOR MATERIAL SYMBOL AND WELL CONSTRUCTION SYMBOL KEYS.
4. WATER LEVELS TAKEN 26-AUG-92.
5. BRACKETS INDICATE MONITORED INTERVAL.

H & A OF NEW YORK
Geotechnical Engineers & Environmental Consultants

XEROX CORPORATION
BUILDING 801
HENRIETTA, NEW YORK

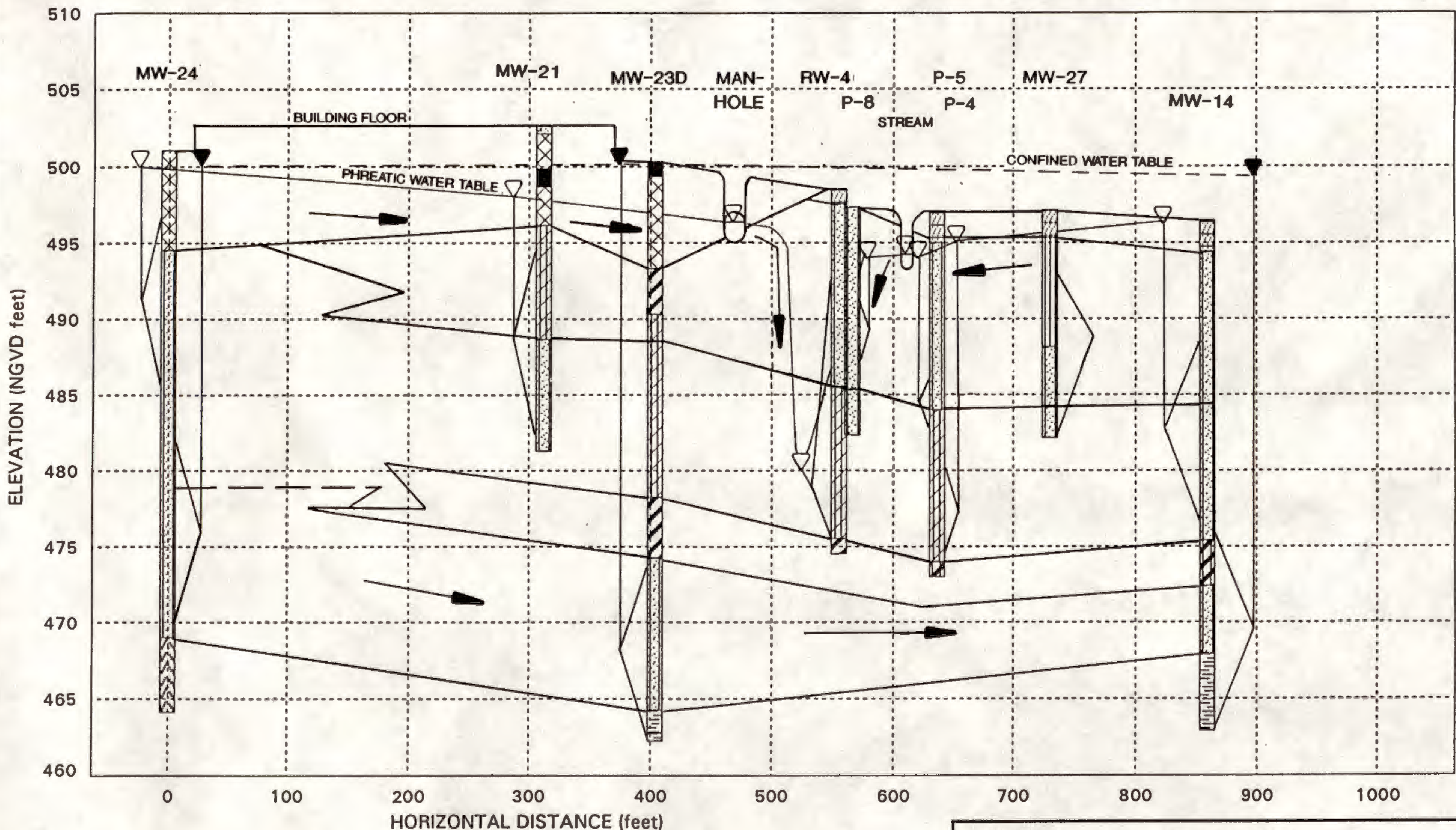
HYDROGEOLOGIC PROFILE D-D'
SUMMER 1992

Scale: 1 in. = 125 ft. (Horiz.)
1 in. = 10 ft. (Vert.)

NOVEMBER 1993

FIGURE 26

FILE NO.- 70290-41



LEGEND:

B-121	BORING NAME
(7 ft.)	NORTH OFFSET FROM PROFILE LINE
	MATERIAL SYMBOL
	WELL CONSTRUCTION SYMBOL (if applicable)
	APPROXIMATE WATER LEVEL ELEVATION
	(FILLED TRIANGLE = DEEP AQUIFER)
	APPARENT DIRECTION OF GROUNDWATER FLOW

NOTES:

1. SEE FIGURE 21 BORING LOCATION PLAN, FOR PROFILE LINE LOCATION.
2. SEE BORING LOGS IN APPENDIX B FOR BORING AND WELL CONSTRUCTION DETAILS.
3. SEE SUBSURFACE KEY FOR MATERIAL SYMBOL AND WELL CONSTRUCTION SYMBOL KEYS.
4. WATER LEVELS TAKEN 30-DEC-92
5. BRACKETS INDICATE MONITORED INTERVAL.

H & A OF NEW YORK
Geotechnical Engineers & Environmental Consultants

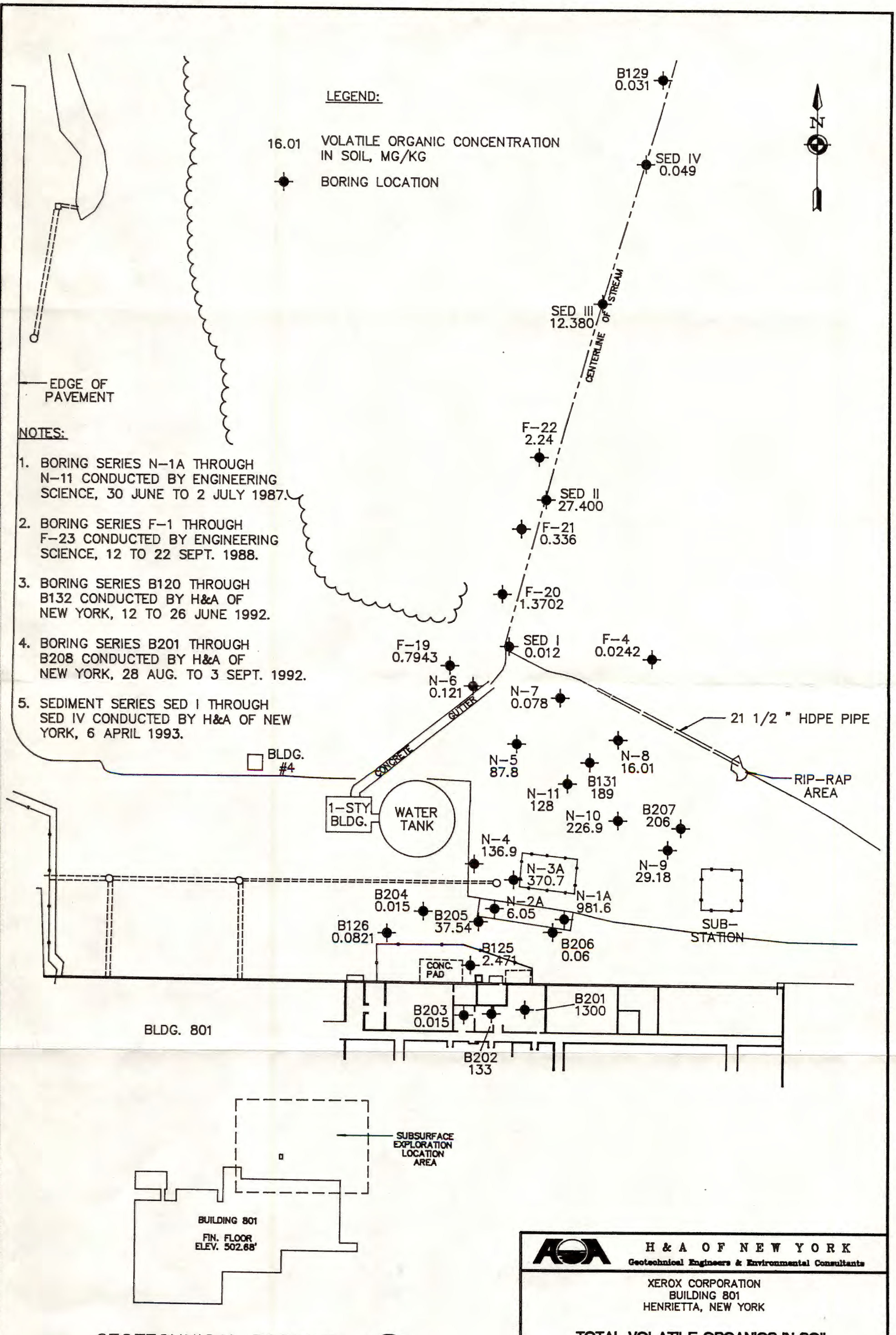
XEROX CORPORATION
BUILDING 801
HENRIETTA, NEW YORK

HYDROGEOLOGIC PROFILE D–D'
WINTER 1992

Scale: 1 in. = 125 ft. (Horiz.)
1 in. = 10 ft. (Vert.)

NOVEMBER 1993

FIGURE 27



H & A OF NEW YORK
Geotechnical Engineers & Environmental Consultants

XEROX CORPORATION
BUILDING 801
HENRIETTA, NEW YORK

TOTAL VOLATILE ORGANICS IN SOIL 0-4 FEET

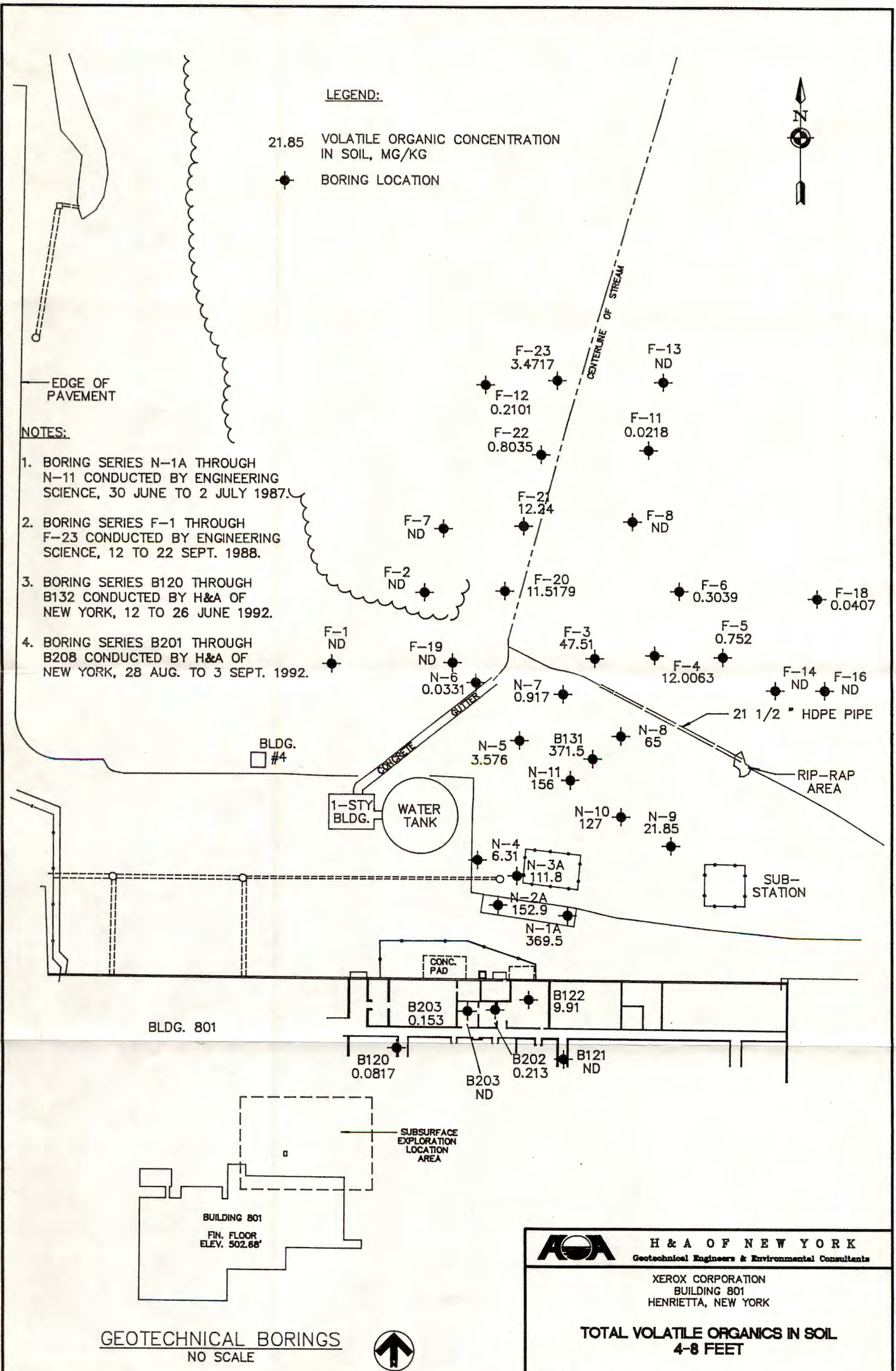
SCALE: 1" = 60'

NOVEMBER 1993

FILE NO. 70290-41

X:\ACAD\70290-41\CAT1.DWG

FIGURE 29



H & A OF NEW YORK
Geotechnical Engineers & Environmental Consultants

XEROX CORPORATION
BUILDING 801
HENRIETTA, NEW YORK

TOTAL VOLATILE ORGANICS IN SOIL 4-8 FEET

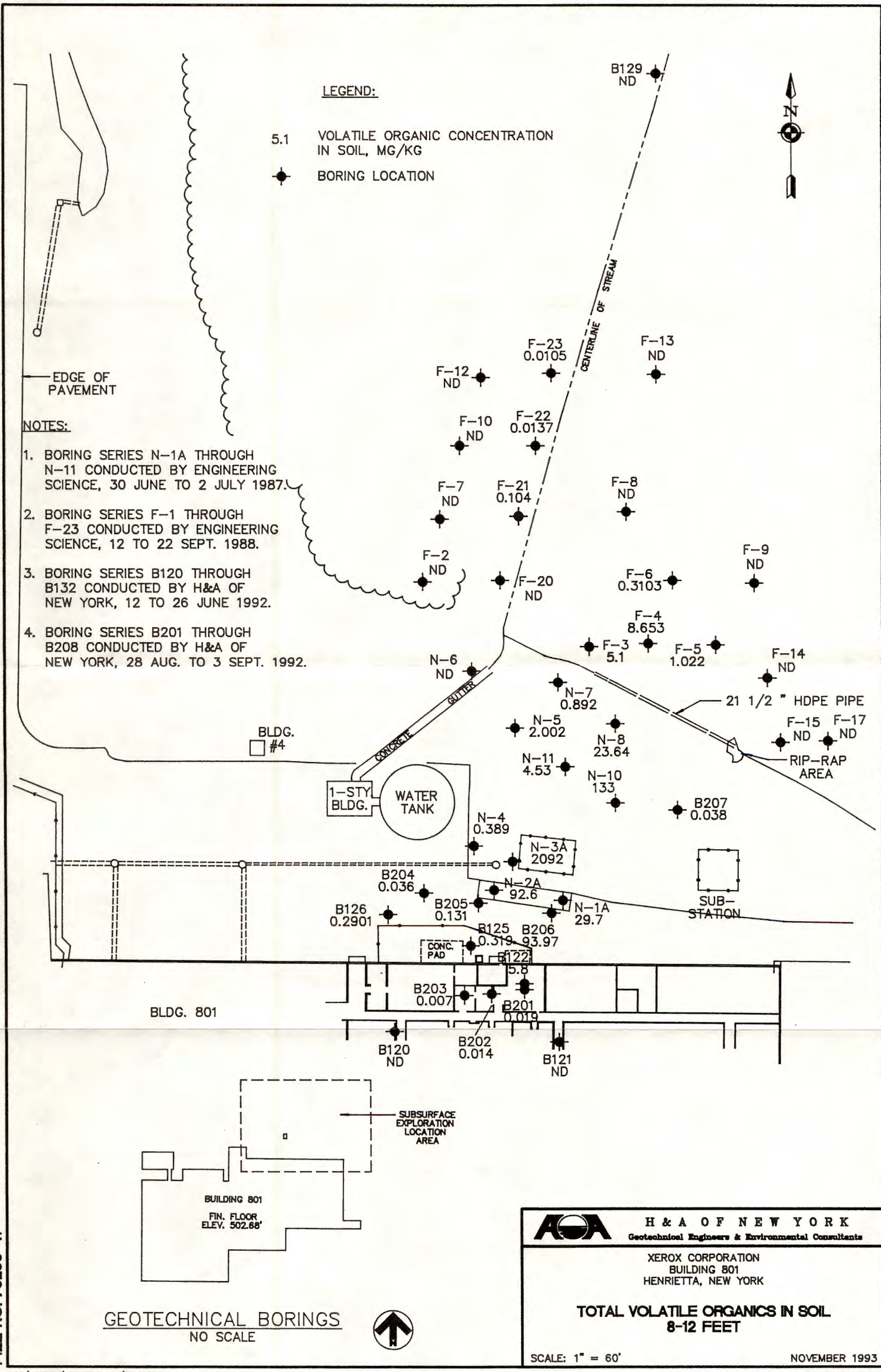
SCALE: 1" = 60'

NOVEMBER 1993

FILE NO. 70290-41

X: \ACAD\70290-41\CAT2.DWG

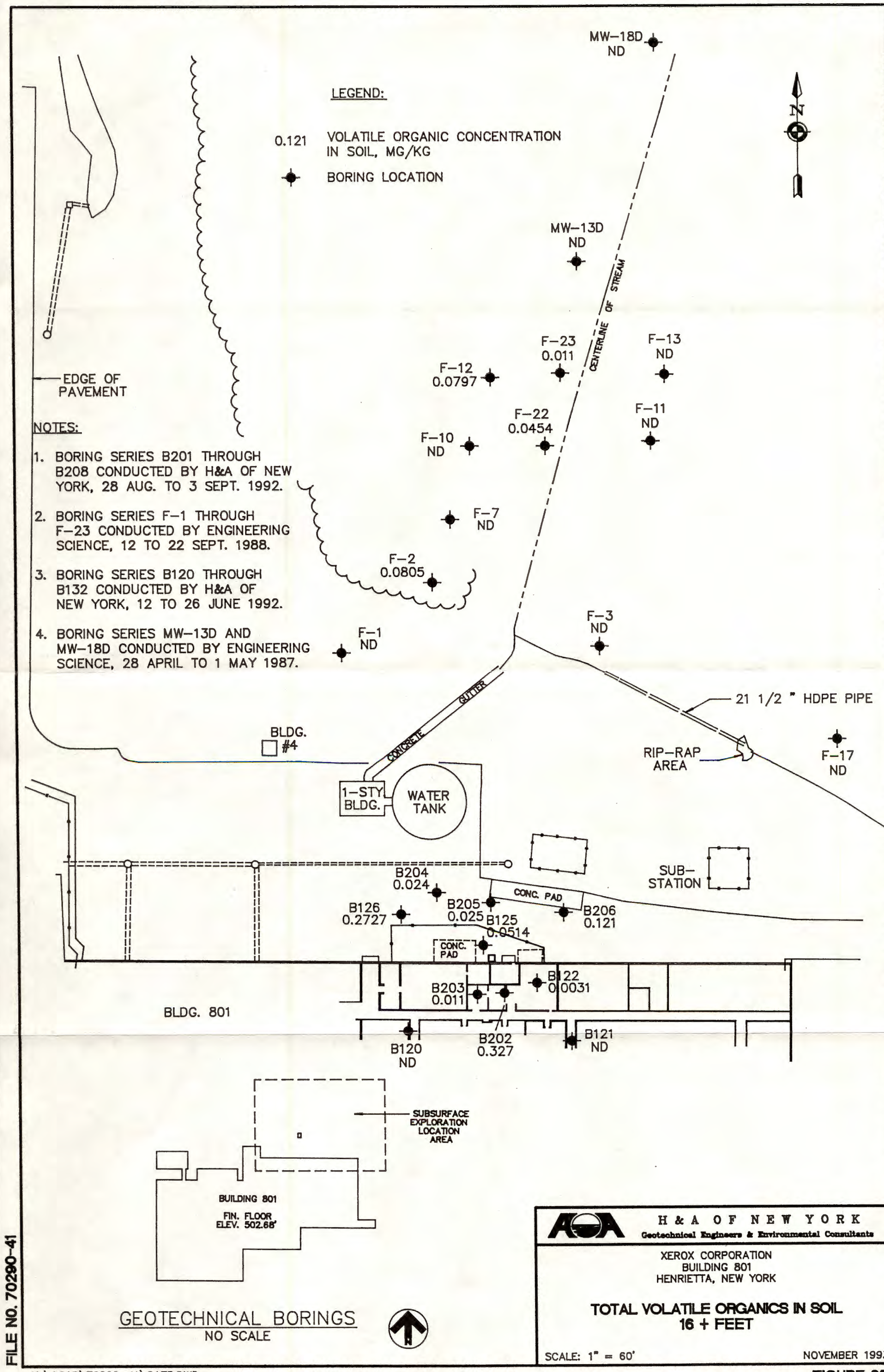
FIGURE 30



FILE NO. 70290-41

X:\ACAD\70290-41\CAT3.DWG

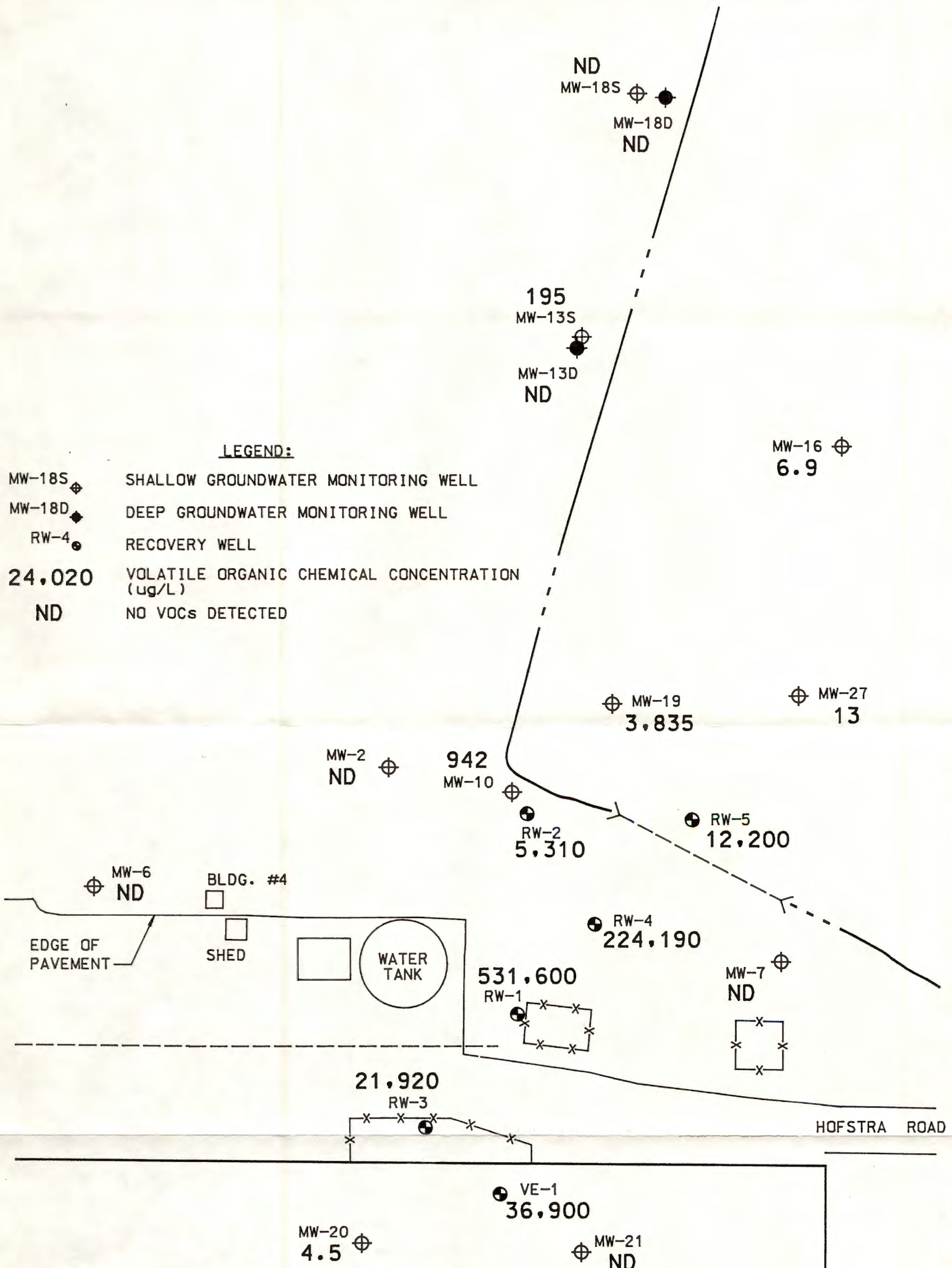
FIGURE 31



FILE NO. 70290-41

X: \ACAD\70290-41\CAT5.DWG

FIGURE 33



LEGEND:

MW-18S	SHALLOW GROUNDWATER MONITORING WELL
MW-18D	DEEP GROUNDWATER MONITORING WELL
RW-4	RECOVERY WELL
24,020	VOLATILE ORGANIC CHEMICAL CONCENTRATION (ug/L)
ND	NO VOCs DETECTED

NOTES:

1. BASEMAP DATA FILE PREPARED BY BERGMANN ASSOCIATES, ROCHESTER, NEW YORK UNDER DIRECT CONTRACT WITH XEROX CORPORATION.
2. VOLATILE ORGANIC CHEMICAL VALUES SHOWN REFLECT THE RESULTS OF FIRST QUARTER 1993 SAMPLING ROUND, MARCH 1993. EXCEPT VE-1, WHICH WAS SAMPLED DECEMBER 1992.
3. STREAM LOCATIONS ARE APPROXIMATE.
4. NO VOCs WERE DETECTED IN WELLS OUTSIDE THIS MAP AREA.
5. REFER TO TEXT FOR ADDITIONAL INFORMATION.

H & A OF NEW YORK
Geotechnical Engineers & Environmental Consultants

XEROX CORPORATION
BUILDING 801
HENRIETTA, NEW YORK

TOTAL VOLATILE ORGANIC CHEMICAL CONCENTRATIONS IN GROUNDWATER

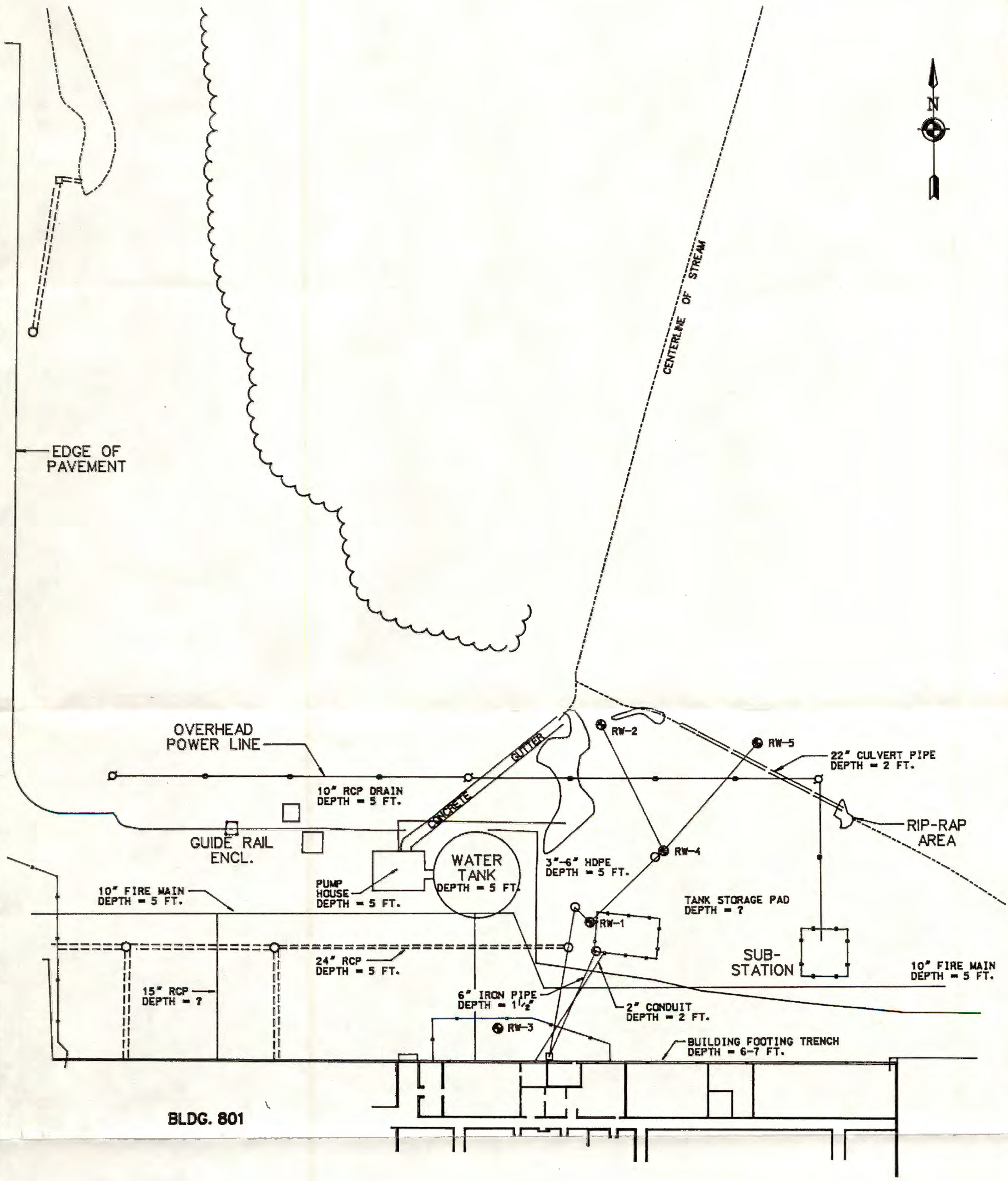
SCALE: 1" = 60'

NOVEMBER 1993

FILENAME: FIG34.DGN

FIGURE 34

FILE No. 70290-41



LEGEND:

⊗ RECOVERY WELL AND COLLECTION LINE

NOTES:

1. BASE MAP DATA FILE PREPARED BY BERGMANN ASSOCIATES, ROCHESTER, NEW YORK UNDER DIRECT CONTRACT WITH XEROX CORPORATION.
2. REFER TO TEXT FOR ADDITIONAL INFORMATION.

H & A OF NEW YORK
Geotechnical Engineers & Environmental Consultants

XEROX CORPORATION
BUILDING 801
HENRIETTA, NEW YORK

SUBSURFACE UTILITIES AND CONSTRUCTION EXCAVATIONS NEAR SOURCE AREA

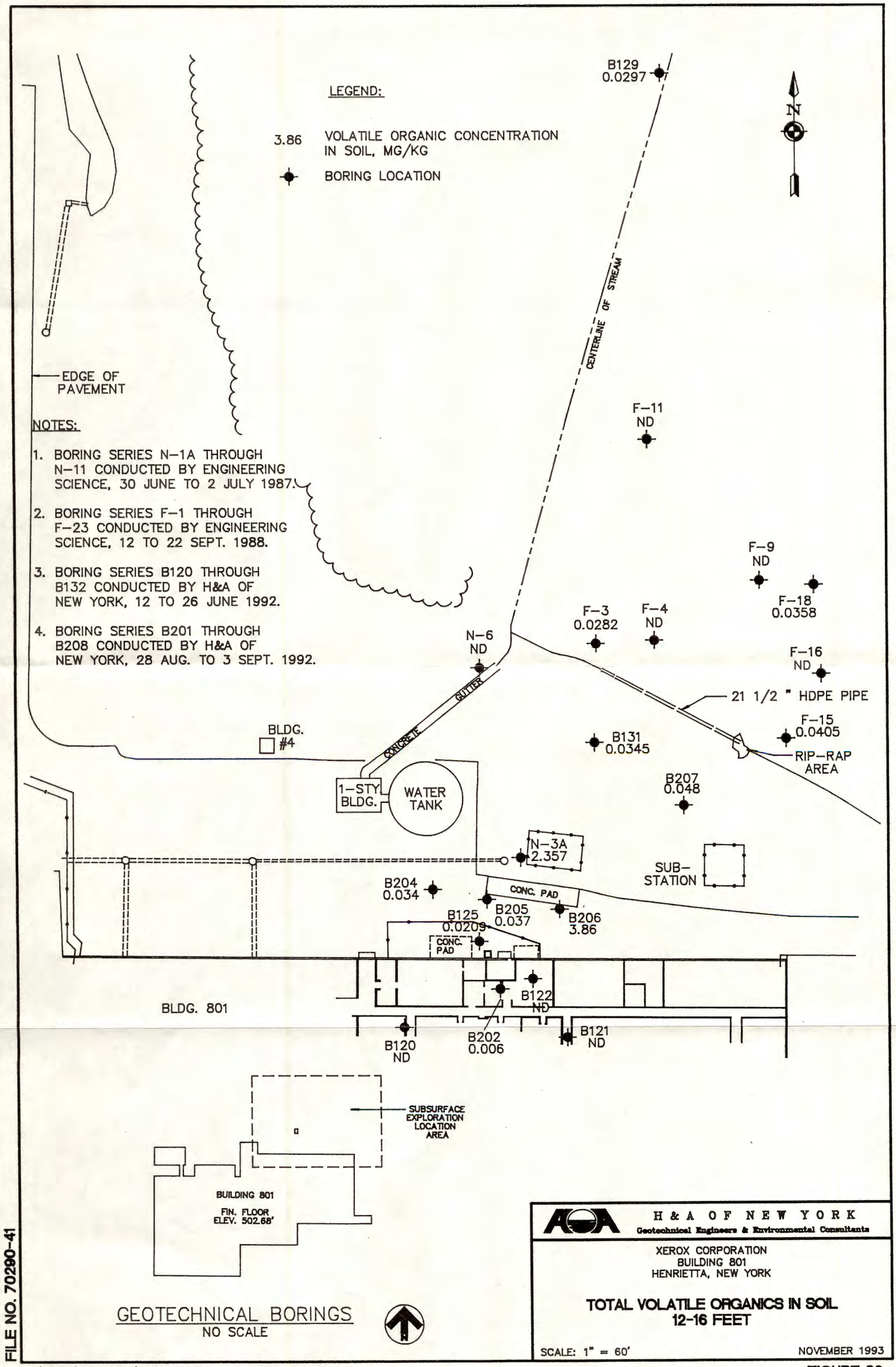
SCALE: 1" = 60'

NOVEMBER 1993

FILENAME: UTILITY.DGN

FIGURE 35

FILE No. 70290-41



FILE NO. 70290-41

X:\ACAD\70290-41\CAT4.DWG

FIGURE 32