REMEDIAL INVESTIGATION OF THE FORMER ALLIED SPECIALTY CHEMICAL SITE NYDEC SITE # 9-15-003-B TONAWANDA, NEW YORK

Prepared for:

ALLIED-SIGNAL INCORPORATED

Manmohan Bhatla
Project Director

Joseph Tomalavage
Project Manager

James G. Spratt
Project Geologist

January 1990

Prepared By:

Roy F. Weston, Inc.
Weston Way
West Chester, Pennsylvania 19380

PROJECT PARTICIPANTS

The following members of Roy F. Weston, Inc. have participated in the planning and execution of this project and preparation of this report.

Manmohan Bhatla
Project Director

Joseph Tomalavage
Project Manager

James G. Spratt
Project Geologist

Noreen Powers
Project Soil Scientist

Edward Mozer
Staff Geophysicist

Sabina Strautman
Geologist

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

LIST OF APPENDICES

LIST OF TABLES

LIST OF TABLES (CONTINUED)

LIST OF TABLES (CONTINUED)

LIST OF FIGURES

EXECUTIVE SUMMARY

Roy F. Weston, Inc. (WESTON) conducted a Remedial Investigation of subsurface soil and groundwater conditions at the Allied Specialty Chemical Site in Tonawanda, New York. The investigation was conducted in response to a New York State Department of Environmental Conservation (NYDEC) Administrative Consent Order, requiring Allied Signal Inc. (ALLIED) to evaluate the former disposal pit on the property where magnesium chromate catalyst was disposed (NYDEC site # 9-15-003-B). The purpose of the investigation was to determine the horizontal and vertical extent of possible contamination in the vicinity of the disposal pit, and to assess the potential for contaminant migration from the pit through surface and subsurface pathways.

The extent of the disposal pit was delineated and soil and groundwater quality determined. Based on the results of the field activities the following conclusions have been reached:

- A geophysical survey defined the pit boundaries, located the storm sewer line and an additional pipe believed to be connected to the main storm sewer line.

- The analysis of groundwater samples on site indicated that metals of concern, total chromium, hexavalent chromium, and lead were not detected or were present below Safe Drinking Water Act standards with the exception of MW-01 where total chromium was found at a concentration of 117 parts per billion.

- The analyses of groundwater samples for Hazardous Substance List compounds indicated that with the exception of MW-01 organic compounds were generally not detected or detected in trace amounts. MW-041, a duplicated of MW-04, had a trichloroethene concentration of 17 ug/l while MW-04 had a trichloroethene concentration below the quantitation limit. The filtered portion of the sample MW-041 had an antimony concentration (72 ug/l) that exceeded the NYDEC regulatory standard (3 ug/l). This result may be spurious since neither the unfiltered portion of MW-041 nor

the filtered/unfiltered portions of MW-04 had detectable antimony concentrations. Cyanide was detected in concentrations above the NYDEC regulatory standard for drinking water in all monitor wells.

- The higher relative concentrations of analytical parameters detected in monitor well MW-01, which is upgradient of the former disposal pit, may be related to offsite sources. A spill was documented at the adjacent tank farm approximately 11 years ago.

- The analysis of surface water samples collected from the storm sewer line indicated that for the metals of concern, the regulatory standards established by the NYDEC for effluent waters discharging into drinking-quality water bodies, such as the Niagara River were not exceeded. The storm sewer line effluent discharges into an intermittent stream which drains into the Niagara River approximately 1500 feet west of the site.

- The analyses of soils from outside the pit including subsurface soils, surface soils and sediment samples collected from the storm sewer were generally similar in their concentrations of metals. These metals concentrations, with a few exceptions, such as sediment sample SD-02, are generally within the range for concentrations of metals in the Tonawanda area.

- Relative to the other soil samples, SD-02 had elevated concentrations of copper, lead and zinc. These concentrations are higher than the concentrations in the upgradient sediment sample SD-01, or the downgradient sediment SD-03. The sediment may be localized to the sewer manhole from which SD-02 was collected.

- Analysis of subsurface soils within the former disposal pit indicated the presence of elevated concentrations of total chromium. However, the chromium is insoluble under natural environmental conditions at the site. EP toxicity results on soil samples from the disposal pit showed that concentrations of soluble chromium in the leachate did not exceed the regulatory standard. Since the

EP toxicity laboratory test is performed using a leaching solution with a pH of 4.8, the EP toxicity results represent a worst case scenario. Based on these results it is unlikely that chromium would leach out of the soils under field conditions.

- The analysis of two soil samples (SB03-04 and TP-1-8), from the pit for EP Toxicity indicated that subsurface soils analyzed were non-hazardous. It should be noted that samples SB04-4, 5 and 6, also from the disposal pit, contained lead and total chromium concentrations one to two orders of magnitude higher than the samples from SB03-04, which were used for the EP toxicity analysis.

SECTION 1

INTRODUCTION

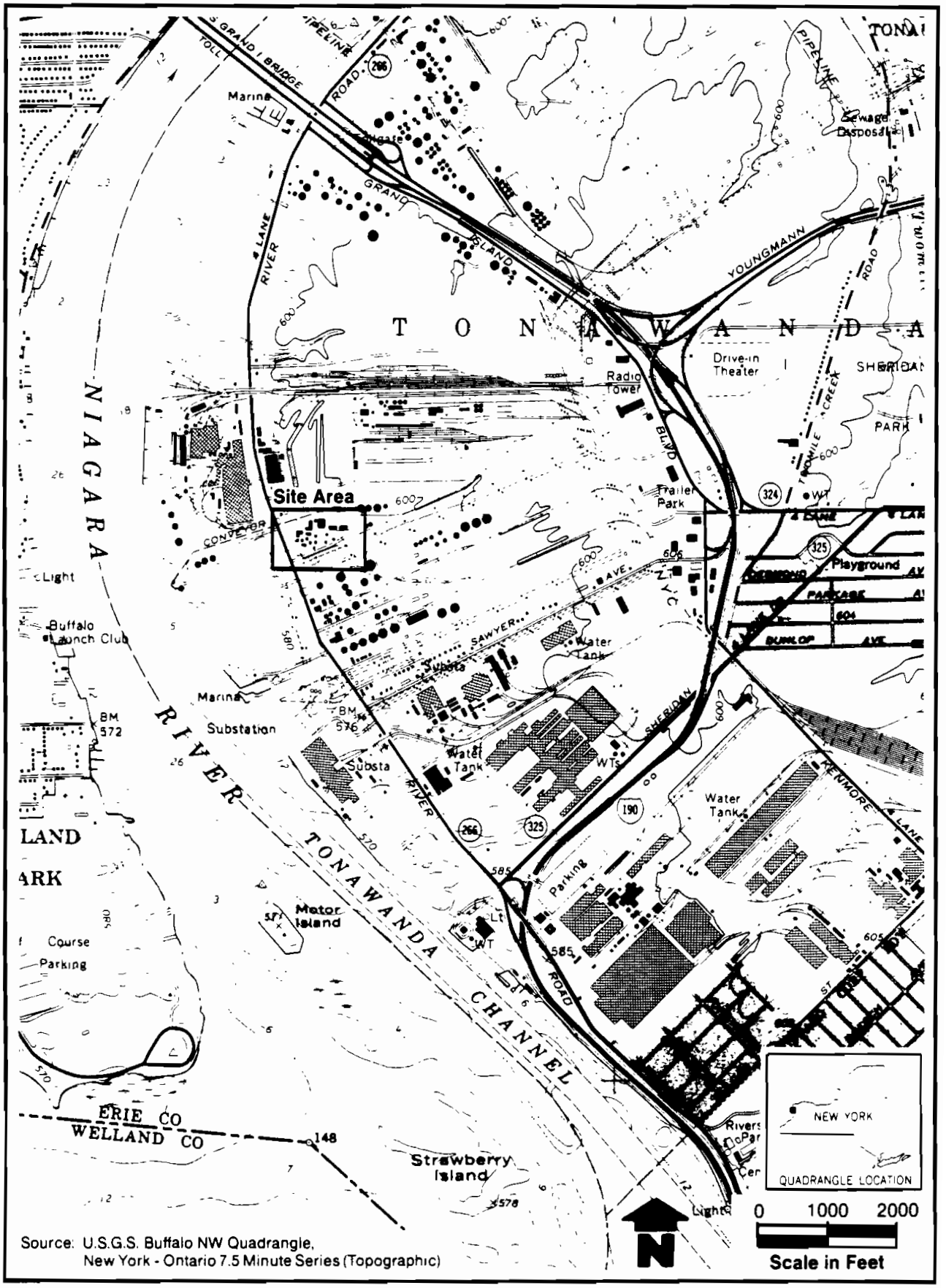
1.1 BACKGROUND

Due to the classification of the former disposal pit (NYDEC site #9-15-003-B) Allied Specialty Chemical plant in Tonawanda, New York as an inactive hazardous waste disposal site under the New York State Environmental Conservation Law Section 27-1301(2), Allied Signal Inc. (ALLIED) signed an Administrative Consent Order (ACO) with the New York Department of Environmental Conservation (NYDEC) to implement a Remedial Investigation. Wastes generated during research and development studies at the Tonawanda Facility were disposed of in the pit. These wastes included polyethylene, chlorinated polyethylene and chromium compounds. ALLIED retained the services of Roy F. Weston, Inc. (WESTON) to fulfill the obligations required by the ACO.

On 22 March 1988 ALLIED, WESTON, and NYDEC representatives met to discuss the work plan for the Remedial Investigation at the Tonawanda, New York facility. The NYDEC comments were incorporated to the work plan on 9 May 1988. On 22 September 1988 ALLIED entered into the Consent Order with the NYDEC to identify the extent and levels of environmental contamination resulting from disposal activities at the Tonawanda plant (NYDEC site # 9-15-003-B). This report documents the tasks and associated results of the Remedial Investigation.

1.2 SITE DESCRIPTION

The location of the former Allied Specialty Chemical Corporation Facility is 3821 River Road, Tonawanda, New York. (Refer to Figure 1-1 for the site location). The former disposal pit (NYDEC site # 9-15-003-B) was utilized for the disposal of wastes generated during research and development studies at the Allied Tonawanda facility. The pit area is located on the western side of the property and was estimated by ALLIED personnel and plant records to be 30 feet x 30 feet x 6 feet deep. To the west of the pit is a storm sewer that transects the site.



Source: U.S.G.S. Buffalo NW Quadrangle, New York - Ontario 7.5 Minute Series (Topographic)

FIGURE 1-1 REGIONAL LOCATION MAP OF ALLIED PLANT TONAWANDA, NEW YORK

1.3 SITE HISTORY AND OPERATIONS

A historical air photo from 1959 shows the location of the disposal pit excavation. The pit was initially excavated sometime in 1958. Plant records indicate scrap polyethylene, chlorinated polyethylene, and spent catalyst containing chromium compounds were disposed of in the pit.

The catalyst was made up in 12 to 25 lb. batches containing approximately 2 to 3 percent magnesium chromate ($MgCrO_4 7H_2O$) on a silica/alumina support system. As a catalyst the magnesium chromate would be chemically unchanged during the reaction process. Bad batches of catalyst (those having poor activity) were disposed of in the pit. A former research and development employee estimated that hundreds of pounds of catalyst waste were disposed of in the waste pit. The pit is believed to have been filled in by 1962 and the research and development operation permanently closed down in 1965.

In 1982, the U.S. Geological Survey (USGS) in cooperation with the U.S. Environmental Protection Agency (U.S. EPA) and the NYSDEC, began a preliminary hydrogeologic investigation of toxic waste disposal sites along the Niagara River.

1.4 PURPOSE AND SCOPE OF STUDY

The purpose of this investigation is to define the area and vertical extent of possible contamination of the unconsolidated materials in the vicinity of the former disposal pit (NYDEC site # 9-15-0003-B) and to assess the potential for contaminant migration from the pit area. The field activities for this investigation consisted of the following:

- A Geophysical survey to define the horizontal and vertical extent of the disposal pit and to delineate the location of the storm sewer to the west of the pit.
- Installation of shallow monitor wells to determine shallow groundwater flow direction. Soil samples were collected during the installation of the wells to characterize subsurface geologic conditions.
- Collection of groundwater samples to assess groundwater quality.

- Rising head slug tests of monitor wells to quantitatively assess the hydraulic conductivity of the unconsolidated sediment in the vicinity of the waste pit.

- Collection and chemical analysis of surface soil samples to identify and quantify the nature of possible surface contamination.

- Collection and chemical analysis of subsurface soil samples to identify and quantify the extent of possible subsurface contamination, and to confirm the geophysical data for the size of the disposal pit.

- Collection and analysis of surface water and sediment samples from the storm sewer to evaluate this potential contaminant migration pathway.

SECTION 2

ENVIRONMENTAL SETTING

2.1 PHYSICAL SETTING

The Allied Specialty Chemical site (NYDEC #9-15-003-B) is located in Erie County, New York in the Central Lowland physiographic province. This area is characterized by level plains and flat alluvial valleys. Based on the USGS 7.5 Minute topographic quadrangle map for Buffalo NW, N.Y. - ONT, relief on the site ranges from 590 to 600 feet above mean sea level. The site is in a heavily industrialized section of Tonawanda, New York, along the Niagara River.

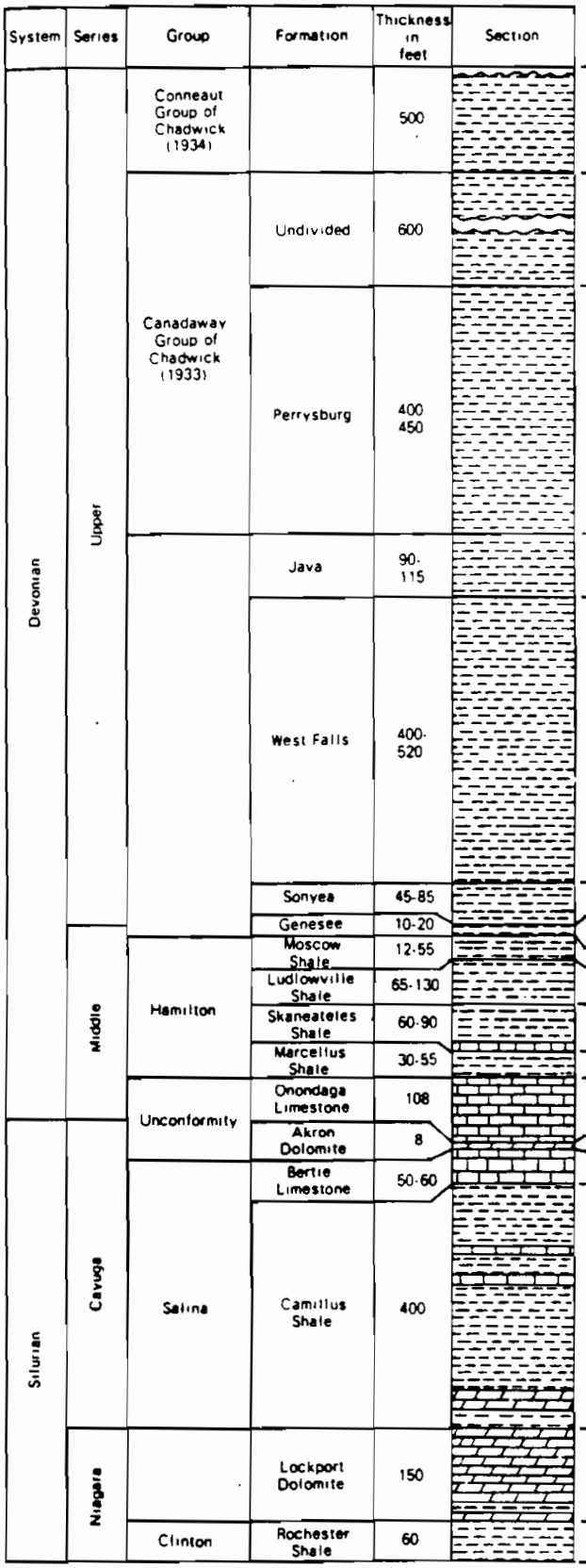
The Allied site lies in the Erie-Niagara drainage Basin. This basin extends from the Cattaraugus Creek basin in the south to the Tonawanda Creek basin in the north (La Sala 1969). The direction of groundwater movement in the area is generally towards major surface-water bodies such as the Tonawanda Creek and the Niagara River (EPA 1985). Surface drainage tends to be poor due to the low permeability of the surface deposits. Water table discharge occurs into areas of low topography.

2.2 REGIONAL GEOLOGY

The Erie-Niagara Basin is underlain by a thick sequence of sandstone, shale, limestone and dolomites. These sedimentary bedrock formations were deposited in seas during the Silurian and Devonian Periods and generally are overlain by unconsolidated Quaternary glacial deposits. Refer to Figure 2-1 for descriptions of bedrock units.

In the Tonawanda area the stratigraphic sequence consists of Silurian Camillus Shale overlain by unconsolidated glacial deposits. The Camillus Formation is a gray shale with interbedded limestone, dolomite, and gypsum. The formation dips southward at approximately 40 ft/mile (La Sala 1969).

Overlying the Camillus Shale is a Pleistocene till; an unstratified glacial deposit of various sediment textures. Conformably overlying the till is a sequence of glacial lacustrine clays which are generally encountered within six feet of the surface. The clays are overlain locally by Pleistocene fluvial sands and gravels, and glaciolacustrine silts (Recra Research, in 1980 Durez Investigation).



Source: La Sala, 1969

FIGURE 2-1 BEDROCK UNITS OF THE ERIE-NIAGARA BASIN

2.3 REGIONAL HYDROGEOLOGY

The primary water-bearing formations in the Erie-Niagara Basin consist of unconsolidated glacial material, the Camillus Shale, and a limestone unit which is made up of the Onandaga Limestone, Akron Dolomite, Bertie Limestone, and Lockport Dolomite (La Sala 1969). The hydrologic characteristics of the glacial materials is determined by their environment of deposition. Well sorted outwash sands and gravels have high hydraulic conductivities. Conversely, poorly sorted tills and dense lacustrine clays exhibit low hydraulic conductivities. The hydrologic properties of the till and clay units may vary locally where small outwash deposits are present. Thick outwash deposits in former valleys generally offer excellent sites for high yield wells. These units, however, are not always uniform in areal extent.

Fractures, joints and solution cavities are the major features influencing groundwater movement in the bedrock. The limestone and dolomite units are soluble bedrock formation which transmit water through solution enlarged fractures. The Camillus Shale is not soluble but contains a large proportion of gypsum which is soluble. The carbonate units yield low to moderate (10-50 gpm) groundwater supplies but the quality is marked by high hardness. In the Buffalo and Tonawanda area the Camillus Shale yields from 400-1200 gallons per minute (La Sala 1969).

The chemical quality of groundwater from the Camillus Shale is poor due to the high gypsum content. Gypsum, a carbonate sulfate, causes unacceptable levels of sulfate and total dissolved solids in water supplies.

SECTION 3

FIELD INVESTIGATION

3.1 SITE RECONNAISSANCE

On 22 February 1988 Allied and WESTON representatives met with NYDEC personnel at the former Allied Tonawanda site to discuss field activities for the site investigation. During the site reconnaissance the location of the former disposal pit was identified and locations for soil borings, soil, sediment, and surface water samples were selected (Plate 1). Monitor well locations were based on an assessment of known regional and local groundwater conditions which indicated groundwater flow to the northwest.

3.2 GEOPHYSICAL SURVEY

WESTON performed a geophysical investigation using ground penetrating radar (GPR) at the Allied-Tonawanda facility from 12 through 14 September 1988. The purpose of the geophysical investigation was to delineate the boundaries of the former disposal pit and to locate the storm sewer to the west of the pit. The primary area of interest was a 100 foot by 100 foot area encompassing the disposal pit (Plate 1). This survey area was chosen based on historical air photographs which showed the excavated pit area.

WESTON personnel used a Nikon level to survey a 10 foot by 10 foot grid over the 100 ~~foot~~ by 100 square area of investigation. Prior to the GPR survey, grid nodes were marked using fluorescent paint. After the GPR survey, the corner points were staked with steel rods, flagged, and labeled based on the site specific coordinate system established for the survey.

Two of the corner points (N0, W0, and N100, W0) were triangulated from nearby fixed structures. This was done so that the coordinate system could be reconstructed for boring locations during the sampling phase of the investigation.

Four additional lines were surveyed; three in the northern end of the site and one south of the primary grid area. The lines were oriented approximately east-west and were 100 feet long. These four lines plus the two lines from the primary grid were used to locate the north-south oriented drain pipe located west of the disposal pit area.

A graphic recorder ~~is~~ used in conjunction with the GPR to display reflected radar images in time (nanoseconds). In order to convert the radar pulse travel time to depth, a time/depth calibration was performed. A section of the drain pipe near the northern manway was used to perform the time/depth calibration because the depth to the top of the drain pipe (4.75 feet) could be measured manually through the manway.

Travel time to the drain pipe was measured to be 25 nanoseconds. Since 25 nanoseconds was the time it took for the radar pulse to travel down the pipe and back to the antenna, the pulse reached the pipe in half that time or 12.5 nanoseconds. Therefore, the velocity of propagation in the soils of the Tonawanda site was calculated to be 0.38 feet/nanoseconds (4.75 feet/12.5 ns). This velocity was used to convert travel time to depth for other reflected radar images recorded during the GPR survey.

3.3 SURFACE WATER AND SEDIMENT SAMPLING

The surface water and sediment sampling program was conducted on 27 September and 2 December 1988. The purpose of this sampling was to determine what the environmental condition of water and sediment entering and exiting the storm sewer which traverses the site. Sampling location are shown in Plate 1.

Sediment and surface water samples were collected from each of three sample locations in the storm sewer located directly west of the disposal pit. These sample locations were identified in concurrence with the NYDEC representatives during the initial site visit on 22 February 1988. Sample location SD/SW-01 is upstream of the pit area. Sample locations SD/SW-2 and SD-SW-03 are located downstream of the pit area. Access to the sampling locations in the storm sewer was through culverts or manholes.

Samples were collected from the downstream locations first to minimize cross-contamination. Surface water samples were collected by submerging the sample jar into the drainage channel. Unpreserved bottles were used to transfer the sample water to bottles with preservatives. Since these surface water samples were unfiltered any sediment entrained in the water could contribute to the total concentrations of the parameters analyzed. Sediment samples were collected with dedicated stainless steel spatulas and placed in the appropriate container.

Samples were labeled "SD" for sediment and "SW" for surface water followed by the sample location. A duplicate sample was collected for a surface water and a sediment sample. A total of eight samples were collected (3 surface water and duplicate; 3 sediment and duplicate) half of which were analyzed for the complete list of Hazardous Substance List (HSL) compounds. The remaining samples were analyzed for priority pollutant metals.

One modification to the work plan was the elimination of priority pollutant metals analysis for those samples analyzed for HSL metals. This change was justified because priority pollutant metals are contained within the metals analyzed for in the HSL metals analysis.

Surface water and sediment samples were properly labeled and packed in iced coolers with completed chain of custody documentation. The samples were shipped to WESTON Analytics for analysis.

All sampling equipment was decontaminated using an Alconox wash deionized water rinse, methonal rinse, de-ionized rinse and then allowed to dry.

3.4 SURFACE SOIL SAMPLING

On 27 September 1989, six surface soil samples were collected from the area surrounding the waste pit. These locations were identified in concurrence with NYDEC during the initial site visit on 22 February 1988. Refer to Plate 1 for sample locations.

Samples were collected from the first foot of soil using dedicated stainless steel trowels. The soil was transferred to the appropriate sample containers and logged on chain of custody forms. Samples were labeled "SS" for surface soil followed by the sample location. Surface soil samples were analyzed for lead, chromium and nickel. The surface soil samples were properly labeled and packed in iced coolers with chain of custody documentation. The samples were shipped to WESTON ANALYTICS for analysis.

All sampling equipment was decontaminated using an Alconox wash, de-ionized water rinse, methanol rinse, de-ionized rinse and then allowed to air dry.

3.5. Soil Boring Program

The soil boring investigation at the Allied Specialty Chemical site was conducted between 27 and 30 September 1988. The purpose of the soil boring program was to confirm

the pit boundaries identified during the geophysical investigation and to define the vertical extent of contamination within the pit. A total of four borings were completed, one of which was completed as a monitor well (MW-02/SB-02). The borings not completed as monitor wells were tremie grouted to the surface with a bentonite slurry. Two soil borings were located within the pit boundary and one boring was located outside the pit. Soil boring SB-02 was completed as monitor well MW-02. Locations of soil borings are shown in Plate 1.

The soil borings were drilled by Empire Soils using a hollow stem auger rig. Soil samples were collected continuously using a 2 inch diameter, 24 inch long split spoon sampler. The split spoon was driven ahead of the augers into undisturbed soil by a 140 lb. hammer. The number of blows required to drive the spoon 24 inches is recorded on the logs as blow counts. Soil samples were documented as "SB" followed by the boring number and the sample number. The soil samples were described by a WESTON geologist and logged in reference to color, texture and moisture content. Soil borings SB-01, SB-03 and SB-04 were advanced to a depth of 16 feet below ground surface. Soil boring SB-02 advanced to a depth of 14 feet below ground surface. Soil boring SB-02 was backfilled with bentonite pellets and completed as a well with a total depth of 9.5 feet below ground surface. Soil borings SB-03 and SB-04 were drilled in the pit boundaries.

Soil samples were collected at the site for chemical analysis and also for geotechnical testing.

A total number of 34 soil boring samples and one test pit sample were submitted to WESTON's laboratory for the following chemical analysis:

- 2 soil samples (SB03-05 and SB03-08) were analyzed for Hazardous Substance List (HSL), volatile organic compounds (VOC), pesticides/PCB, metals, and base neutral and acid extractables (BNA's).
- 34 soil samples analyzed for lead (Pb), nickel (Ni), chromium (total), chromium (hexavalent).
- Soil boring sample SB03-04, from within the pit was analyzed for EP Toxicity List of metals, pesticides, reactivity corrosivity and ignitability. Based on the initial analytical results, a second soil sample TP-1-8 was collected for confirmatory analysis.

Soil samples were collected using a stainless steel scoopula and were placed in laboratory prepared jars. Samples to be analyzed for volatile organic compounds were collected immediately after the split spoon was opened to minimize volatilizing any possible contaminants. All sampling equipment, such as stainless steel scoopulas and split spoons were decontaminated with Alconox detergent wash, de-ionized water rinse, methanol rinse, and final de-ionized water rinse and then allowed to air dry. All drilling equipment including augers and split spoons were steam cleaned prior to drilling and steam cleaned again between borings to prevent cross-contamination.

Quality control samples were collected and analyzed during the soil boring investigation to ensure that no contaminants were introduced to the sample during the sampling process.

Two duplicate samples (SB02-04 and SB04-04) were collected at the time of initial sampling to document reproducibility of the analytical results. One field blank was collected during the soil boring program to determine the effectiveness of the decontamination procedure. The field blank is prepared by pouring deionized water over the decontaminated sampling equipment and into the appropriate laboratory jars. One trip blank was analyzed for VOCs during the soil boring program. The trip blanks were prepared by the laboratory prior to the field investigation and then kept with the field collected samples. The trip blanks are used to show that the integrity of the samples is maintained during transportation.

The soil samples and the quality control samples were individually sealed in plastic bags and placed in a thermal cooler. Vermiculite was packed around the samples as a cushion during shipping. Ice was kept in the cooler during sampling and shipping to keep the temperature at 4 ^{o}C.

A chain of custody was completed for each shipment as documentation of sample numbers and the required analysis. Chain of custody forms are included with the analytical data packages in Appendices D through F. Samples were shipped to WESTON ANALYTICS in Lionville, Pennsylvania.

3.6 GROUND WATER INVESTIGATION

3.6.1 Well Installation

Four monitor wells were installed in the vicinity of the former disposal pit area. The purpose of these wells was to evaluate groundwater quality and to determine groundwater flow direction. The EPA 1985 report states the expected

groundwater flow direction is towards the Niagara river. Based on the anticipated groundwater flow direction, and the pit boundaries as identified by historical air photos and the GPR survey, the wells were located as shown in Plate 1. The well locations were identified by WESTON and agreed upon by the NYDEC representative during the initial site visit.

All wells were constructed of 4-inch diameter schedule 40 polyvinyl chloride (PVC) flush threaded screen and riser casing. The well screens were commercially prepared 5 foot sections with slot openings of 0.010 inch. All four wells, MW-01, MW-02, MW-03 and MW-04 were installed using hollow stem auger drilling techniques.

During well installation a 24 inch split spoon sampler was advanced into undisturbed soil ahead of the augers in accordance with ASTM D-1586-84 guidelines. One split spoon soil sample per well was collected to evaluate site subsurface conditions for placement of the monitor well screen. All soil samples were described by the WESTON site geologist and logged in reference to color, texture and moisture content.

Based on subsurface conditions encountered while drilling, the WESTON geologist determined the proper interval to set the screen. When the desired depth was reached the 4 inch diameter screen and riser casing were installed inside the 6 1/4 inch diameter hollow stem augers. The augers were then removed from the borehole as a #4 sand was placed in the annular space. The sand pack was placed to a height approximately 1 foot above the top of the screen. The annular space above the sand pack was sealed with a 1 foot thick plug of bentonite pellets. The well was then grouted to ground surface with a Portland cement and bentonite grout. Finally, all wells were fitted with caps for the inner casing and a 6 inch diameter, steel, outer protective casing.

The final well construction specifications were altered from those proposed in the work plan due to site conditions. This was due to the fact that during drilling, the uppermost groundwater yielding zone was determined to be 4 to 9 feet below ground surface. Monitor wells were therefore constructed using only 5 feet of well screen rather than the 10 feet originally proposed. Similarly, the linear footage of gravel pack and bentonite seal were reduced in each well due to the shallow well construction. All well construction modifications were approved by the NYDEC site representative.

3.6.1.1 Geotechnical Samples

A soil sample was collected from within the screened interval of each monitor well and submitted to WESTON's Environmental Technology laboratory. Each sample was analyzed for the following:

Test	Method
Grain size analysis	(ASTM Method 421/422)
Moisture content	(ASTM Method D2216)
Plastic limit	(ASTM Method D4318)

Due to the limited soil recovered in split spoons through the "fill" type material on site, there was insufficient sample quantity to determine liquid limits on all four samples or plastic limits on MW-02.

3.6.1.2 Well Development

The purpose of well development is to insure the well will produce sediment free water which is representative of the screened water-bearing zone. All wells were initially developed using a submersible pump, however due to the low yield from each well, development by pumping was impossible so development was completed by hand bailing. Development water was containerized in 55 gallon drums on site. A copy of the development and pre-sample purging records are attached in Appendix A.

3.6.2 Slug Testing

On 3 November 1988 rising head slug testing was conducted in wells MW-01 and MW-04. Due to insufficient quantities of water, wells MW-02 and MW-03 were not tested. The purpose of slug testing was to determine hydraulic conductivity values for the unconsolidated deposits in the vicinity of the former disposal pit.

The slug test was conducted by first placing a pressure transducer, capable of recording changes in water levels to an accuracy of 0.001 feet, into the screened section of the 4 inch monitor well. A slug (a device used to displace a known volume of water) is then instantaneously lowered into the well. An In-Situ model SE 2000 computer-based data logging unit, programmed for the test, was used in conjunction with the transducers to collect water level data when the slug was added to the water column. Once the slug was introduced, depth to water measurements were collected for one hour at each well to insure equilibrium with the water bearing zone had been reached. The slug test results were analyzed according to the Bouwer and Rice method (1976).

3.6.3 Ground Water Sampling

WESTON conducted the groundwater sampling program from 12/1 through 12/2/1988 and on 1/17/89. WESTON was unable to complete the sampling program during the December visit due to insufficient water yield from monitor wells MW-02 and MW-03. The purpose of the groundwater sampling was to determine the quality of groundwater in the vicinity of the former disposal pit.

Water levels were measured in each well and the water volume was calculated. Wells were purged of three volumes of water or to dryness before sampling. Following purging, MW-01 was sampled, however, MW-02, MW-03 and MW-04 were allowed to recharge prior to sampling. After 12 hours of recharge, MW-04 contained sufficient water volume and was sampled. After two days of recharge, however, MW-02 and MW-03 failed to provide the required volume of sample. The full volume of sample for these two wells were obtained from both the December and January sampling visits. All purge water was containerized in a 55 gallon drum and stored on site. No floating product was noted during purging of the wells.

Four wells (MW-01, MW-02, MW-03 and MW-04) were sampled for full hazardous waste list parameters using a teflon bailer. Samples for volatile organic compounds (VOC) were collected first, then samples for total and soluble HSL metal analyses were collected. Samples for total metal analyses were not filtered, therefore analytical results for total metals would represent soluble and suspended metals. Samples for soluble metal analyses were filtered through 0.45 micron filter paper in order to remove suspended material. Samples collected from each well were measured in the field for pH, specific conductivity and temperature.

In order to prevent cross-contamination between wells all augers, drilling rods, split spoons and associated drilling equipment were steam cleaned upon arrival and between each well. All sampling equipment such as split spoons, and stainless steel scoopulas were decontaminated by the following procedure:

- Alconox detergent wash.
- De-ionized water rinse.
- Methanol rinse.
- De-ionized water rinse.
- Air dry.

Bailers were decontamianted before samples were collected and between each well.

The decontamination procedure for the teflon bailers used in groundwater sampling was as follows:

- Alconox wash.
- Potable water rinse.
- De-ionized water rinse.
- 10% Reagent-grade Nitric Acid to remove metals contamination.
- De-ionized water rinse.
- Methanol rinse.
- De-ionized water rinse.

3.7 Site Survey

Monitor wells, soil borings, and surface water/sediment sample locations were surveyed for horizontal and vertical control by Krehbiel Associates. At each monitor well a reference point on the inner casing was surveyed for vertical control. All depth to water measurements were taken from these survey elevation points. All elevations were measured to the nearest 0.01 foot and were determined relative to a USGS benchmark.

SECTION 4

RESULTS OF FIELD INVESTIGATION

4.1 ANALYTICAL PROTOCOL

A total of 34 soil boring, 1 test pit sample, 7 surface soils, 4 surface water and sediment and 5 groundwater samples were collected in the vicinity of the former disposal pit (NYDEC # 915003-B). Table 4-1 summarizes the samples collected and parameters analyzed. Samples were shipped to WESTON ANALYTICS in Lionville, Pennsylvania for analysis. See Appendix D, E, F, for raw analytical data.

4.2 SITE GEOLOGY

Four monitor wells were installed and three soil borings were drilled in the vicinity of former disposal pit. The purpose of the monitor wells was to evaluate site groundwater conditions. The purpose of the soil borings was to characterize the physical and chemical conditions of the disposal pit and site. Borings completed as monitor wells and soil borings were sampled continuously with a 24-inch split spoon in accordance with ASTM guidelines. The WESTON geologist logged all split spoon samples in order to accurately describe subsurface lithology and stratigraphy. Well borehole and soil boring logs are attached in Appendix A. These logs are the basis for the following description of site geology and conditions.

Surficial geology at the Allied Chemical site is characterized by a dense, massive, reddish glaciolacustrine clay overlain by fill material, clay, sand, and gravel. Table 4-2 gives the elevation of the glaciolacustrine clay as encountered on site. The clay unit appears to be highest in elevation on the northeastern side of the area of investigation. Logs from MW-04 and MW-01 indicated clay elevations of 577 ft above mean sea level (AMSL) and 575 ft AMSL respectively. Soil boring logs from SB-01 indicated the clay was encountered at 572 ft AMSL. The elevation of the glaciolacustrine clay tends to decrease to the southwest of the former disposal pit with both MW-03 and MW-02/SB-02 exhibiting the lowest clay elevations (570 ft AMSL). Logs from SB-03 and SB-04, in the former disposal pit, indicated the clay elevation was 571 ft AMSL. As the pit excavation is believed to have been to the top of the clay unit, the clay elevations from SB-03 and SB-04 appear to follow the trend of decreasing elevations to the southwest of the former disposal pit.

TABLE 4-1
SUMMARY OF SAMPLING PARAMETERS
ALLIED CHEMICAL SITE
TONAWANDA, NEW YORK

PARAMETER			LEAD	NICKEL	CHROMIUM	CHROMIUM+6	CYANIDE	HSL METALS (1)	HSL VOC (2)	BNA (3)	PESTICIDE/PCB	PP METALS (4)	EP TOXICITY (5)
SAMPLE NO.	DATE	MATRIX											
SURFACE SOIL													
SS-01	9-27-88	SOIL	x	x	x	x							
SS-02	9-27-88	SOIL	x	x	x	x							
SS-02D	9-27-88	SOIL	x	x	x	x							
SS-03	9-27-88	SOIL	x	x	x	x							
SS-04	9-27-88	SOIL	x	x	x	x							
SS-05	9-27-88	SOIL	x	x	x	x							
SS-06	9-27-88	SOIL	x	x	x	x							
SURFACE WATER													
SW-01	9-27-88	WATER					x					x	
SW-02	9-27-88	WATER					x					x	
SW-03	9-27-88	WATER				x	x	x	x	x	x		
SW/03D	9-27-88	WATER				x	x	x		x	x		
SEDIMENT													
SD-01	9-27-88	SEDIMENT					x					x	
SD-02	9-27-88	SEDIMENT					x					x	
SD-03	9-27-88	SEDIMENT				x	x	x	x	x	x		
SD-03D	9-27-88	SEDIMENT				x	x	x		x	x		
MONITOR WELLS						F/UF		F/UF					
MW-01	12-1-88	WATER				x/x	x	x/x	x	x	x		
MW-02	12-1-88	WATER				x/x	x	x/x	x	x	x		
MW-03	12-2-88	WATER				x/x	x	x/x	x	x	x		
MW-04	12-1-88	WATER				x/x	x	x/x	x	x	x		
MW-041	12-2-88	WATER				x/x	x	x/x	x	x	x		
FIELD BLANK	12-2-88	WATER				x/x	x	x/x	x	x	x		

1-HAZARDOUS SUBSTANCE LIST METALS
2-HAZARDOUS SUBSTANCE LIST VOLATILE ORGANIC COMPOUNDS
3-BASE NEUTRAL AND ACID EXTRACTABLES
4-PRIORITY POLLUTANT METALS
F-FILTERED
UF- UNFILTERED

TABLE 4-1 (CONTINUED)
SUMMARY OF SAMPLING PARAMETERS
ALLIED CHEMICAL SITE
TONAWANDA, NEW YORK

PARAMETER			LEAD	NICKEL	CHROMIUM	CHROMIUM+6	CYANIDE	HSL METALS (1)	HSL VOC (2)	BNA (3)	PESTICIDE/PCB PP METALS (4)	EP TOXICITY (5)
SAMPLE NO.	DATE	MATRIX										
SB-01-02	9-27-88	SOIL	x	x	x	x						
SB-01-03	9-27-88	SOIL	x	x	x	x						
SB-01-04	9-27-88	SOIL	x	x	x	x						
SB-01-05	9-27-88	SOIL	x	x	x	x						
SB-01-06	9-27-88	SOIL	x	x	x	x						
SB-01-07	9-27-88	SOIL	x	x	x	x						
SB-01-08	9-27-88	SOIL	x	x	x	x						
SB-02-01	9-28-88	SOIL	x	x	x	x						
SB-02-02	9-28-88	SOIL	x	x	x	x						
SB-02-03	9-28-88	SOIL	x	x	x	x						
SB-02-04	9-28-88	SOIL	x	x	x	x						
SB-02-04D	9-28-88	SOIL	x	x	x	x						
SB-02-05	9-28-88	SOIL	x	x	x	x						
SB-02-06	9-28-88	SOIL	x	x	x	x						
SB-02-07	9-28-88	SOIL	x	x	x	x						
SB-02-08	9-28-88	SOIL	x	x	x	x						
SB-03-01	9-28-88	SOIL	x	x	x	x						
SB-03-02	9-28-88	SOIL	x	x	x	x						
SB-03-03	9-28-88	SOIL	x	x	x	x	x					
SB-03-04	9-28-88	SOIL	x	x	x	x	x					x
SB-03-05	9-28-88	SOIL	x	x	x	x	x	x	x	x	x	
SB-03-06	9-28-88	SOIL	x	x	x	x						
SB-03-07	9-28-88	SOIL	x	x	x	x						
SB-03-08	9-28-88	SOIL	x	x	x	x	x	x	x	x	x	
SB-04-01	9-28-88	SOIL	x	x	x	x						
SB-04-02	9-28-88	SOIL	x	x	x	x						
SB-04-03	9-28-88	SOIL	x	x	x	x						
SB-04-04	9-28-88	SOIL	x	x	x	x						
SB-04-04D	9-28-88	SOIL	x	x	x	x						
SB-04-05	9-28-88	SOIL	x	x	x	x						
SB-04-06	9-28-88	SOIL	x	x	x	x						
SB-04-07	9-28-88	SOIL	x	x	x	x						
SB-04-08	9-28-88	SOIL	x	x	x	x						
SB-04-09	9-28-88	WATER				x	x	x	x	x	x	
TP 1-8	6-13-89	SOIL					x					x

1-HAZARDOUS SUBSTANCE LIST METALS
2-HAZARDOUS SUBSTANCE LIST VOLATILE ORGANIC COMPOUNDS
3-BASE NEUTRAL AND ACID EXTRACTABLES
4-PRIORITY POLLUTANT METALS
5-LEACHATE SAMPLE ANALYZED FOR HERBICIDES, RCRA METALS AND PESTICIDES

Table 4-2

ELEVATION ABOVE MEAN SEA LEVEL
ALLIED CHEMICAL
TONAWANDA NEW YORK

	Top of Casing Elevation (ft)	Top of Screen Elevation	Total Depth of Well Below Ground Surface	Elevation of Glaciolustrine Clay
MW-01	585.41	579	9.0	575
MW-02	583.83	577	9.5	570
MW-03	582.55	576.5	9.0	570
MW-04	583.88	577.4	9.0	577*
	Ground Elevation (ft.)		Total Depth Below Ground Surface	
SB-01	583.62	-	16	572
SB-03	582.37	-	16	571
SB-04	582.97	-	16	571

*Note: Reddish brown clay encountered at @ 577 ft. at @ 571 ft., the clay became dense.

4.3 SITE HYDROGEOLOGY

Four shallow monitor wells MW-01, MW-02, MW-03 and MW-04 were installed in the vicinity of the former disposal pit to determine groundwater quality, flow direction, and evaluate hydraulic properties of the shallow unconsolidated material. Two wells MW-01 and MW-04 were slug tested to determine hydraulic conductivity. Wells MW-02 and MW-03 had insufficient volumes of water to slug test.

Monitor well locations were selected based on earlier studies (EPA, 1985) and regional data which indicated groundwater flow direction would follow surface drainage to the northwest. Refer to Figure 4-1 for groundwater flow direction. Following well placement, however, shallow groundwater flow direction was determined to be to the southwest, in the direction of the trend (dip) of the glaciolacustrine clay surface. Refer to Table 4-3 for a summary of groundwater elevations.

Slug tests were performed on wells MW-01 and MW-04. Results were analyzed using the Bouwer and Rice method (1976). Table 4-4 summarizes the calculated hydraulic conductivity (permeability in terms of groundwater movement) and transmissivity values for the wells tested. Slug test data is attached in Appendix B.

4.4 GEOPHYSICAL SURVEY

The dimensions of the former disposal pit as interpreted from the results of the geophysical ground penetrating (GPR) survey are shown in Figure 4-2. Figure 4-3 shows the soil boring samples in relation to the pit boundary as interpreted by the GPR survey. Refer to Plate 1 for the location of the former disposal pit as interpreted from GPR results. Based on the primary grid area and a 60 x 50 foot infill grid, the disposal pit appears to be 45 feet by 35 feet in dimension. Once the preliminary grid boundaries were determined, infill lines were acquired to provide a final 5 x 5 grid mode spacing for pit dimension delineation. The pit is interpreted to reach a maximum depth of 11.5 feet. The pit could be imaged on radar profiles because of the distinct contrast between the consolidated soil and the disturbed zone associated with backfilled unconsolidated soils. Approximately two feet of consolidated soil lies above the pit area. This consolidated soil is believed to represent compacted cover material for the former disposal pit. The disturbed zone ranges in depth from 2 to 11.5 feet below ground surface. Radar images of the pit are presented on Figures 4-4, 4-5, 4-6 and 4-7.

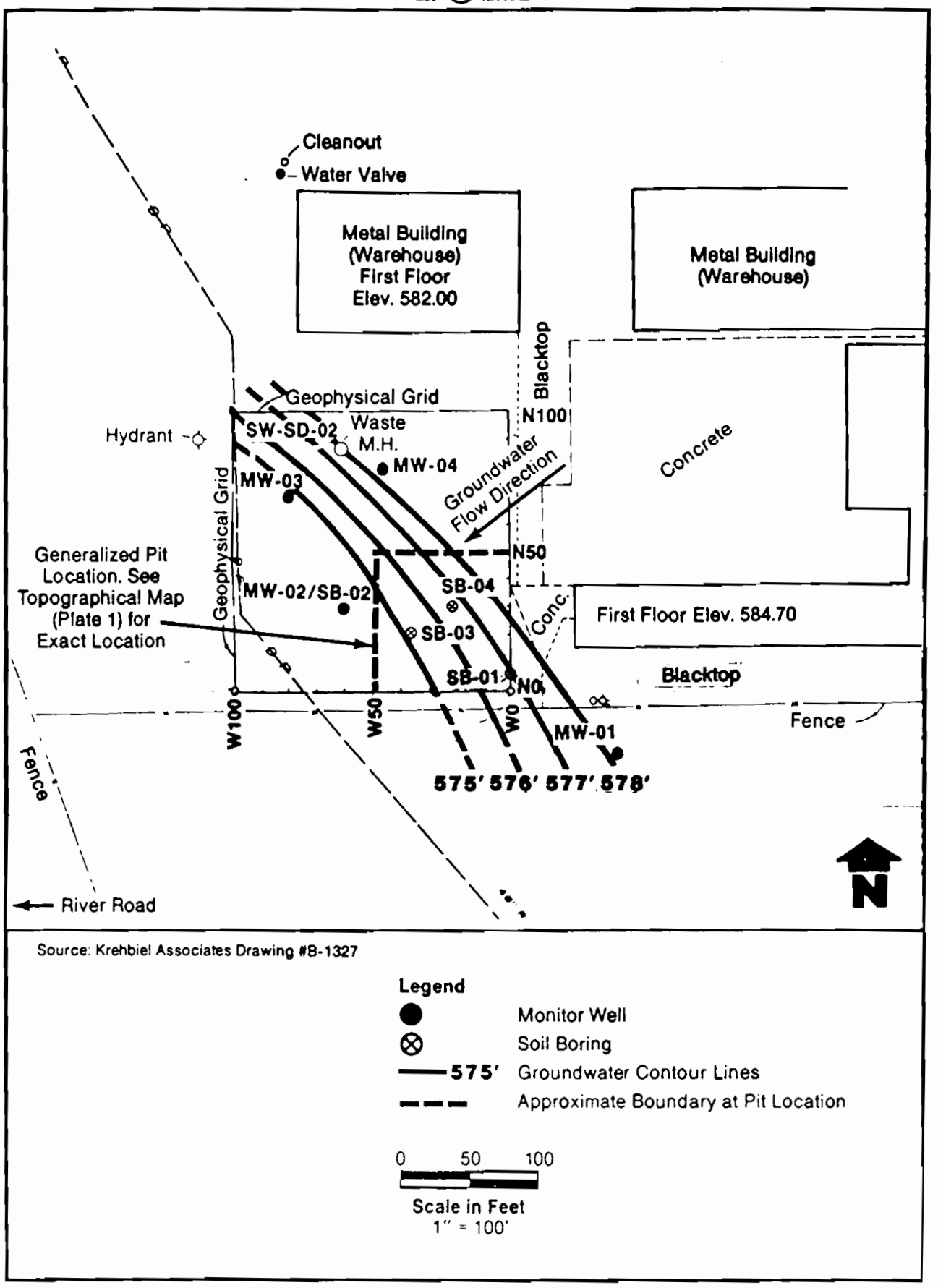


FIGURE 4-1 GROUNDWATER FLOW DIRECTION BEFORE SAMPLING
30 NOVEMBER 1988, ALLIED CHEMICAL, TONAWANDA, NEW YORK

Table 4-3

Groundwater Elevations
Observed in Monitor Wells
Allied Chemical
Tonawanda, New York

Well No.	Water Elevation 11/1/88[1]	11/4/88[2]	11/30/88[3]	1/17/89[3]
MW-01	578.75	579.62	578.61	578.18
MW-02	574.76	573.45	573.89	573.99
MW-03	575.15	571.90	575.00	576.69
MW-04	578.13	577.05	578.12	578.10

[1]Elevations before development by hand
[2]Elevations after development by hand
[3]Elevation before sampling

Table 4-4

Summary of Slug Test Data

Allied Chemical
Tonawanda, New York

Well	Hydraulic Conductivity	Transmissivity
MW-01	1.55×10^{-1} cm/sec (5.10×10^{-3} ft/sec)	2.55 X 10-2 ft^2/sec
MW-01 (duplicate)	1.26×10^{-1} cm/sec (4.12×10^{-3} ft/sec)	2.06×10^{-2} ft^2/sec
MW-04	2.3×10^{-1} cm/sec (7.70×10^{-3} ft/sec)	3.85×10^{-2} ft^2/sec

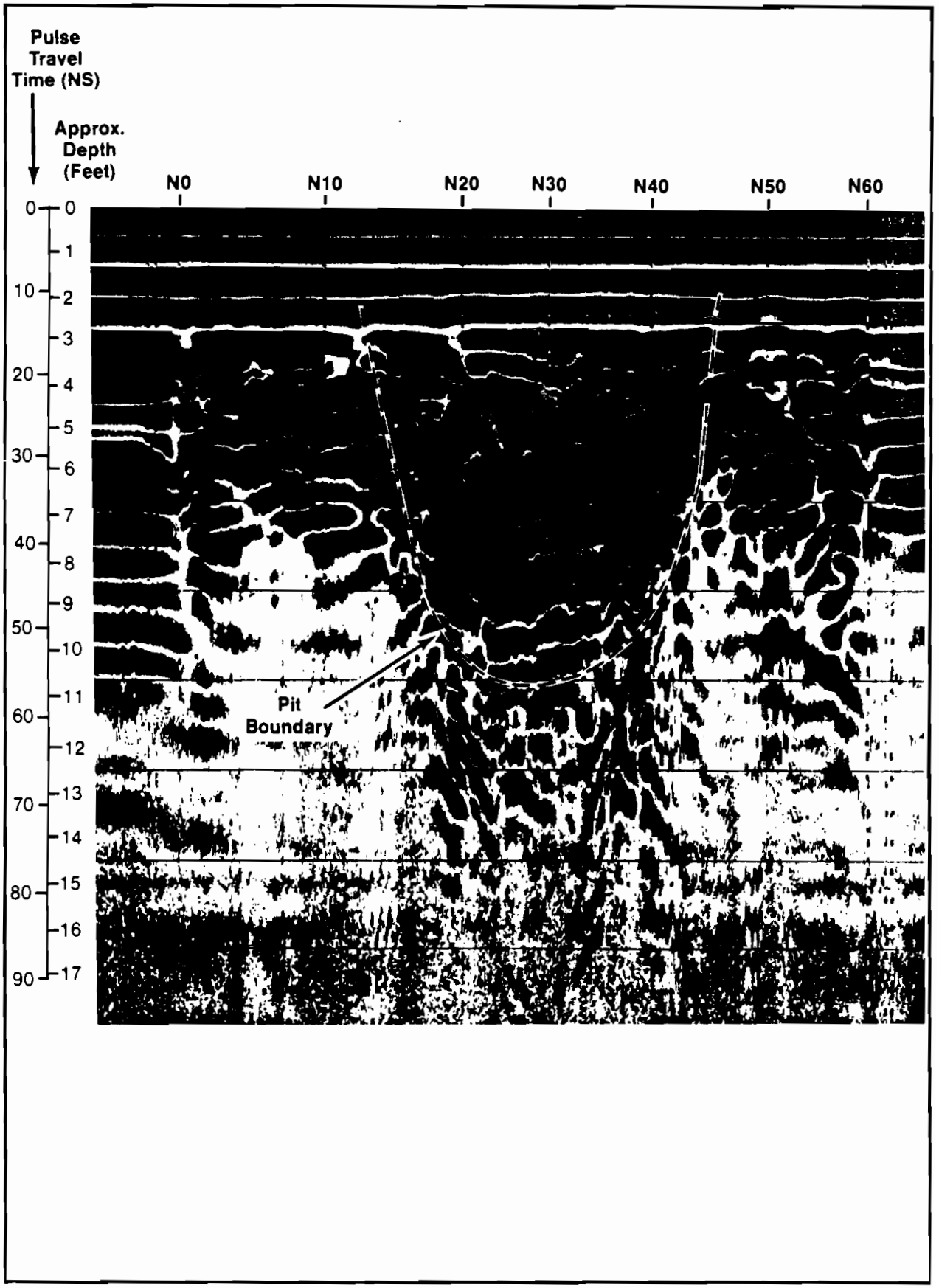


FIGURE 4-4 GPR PROFILE W25 SHOWING PIT BOUNDARY

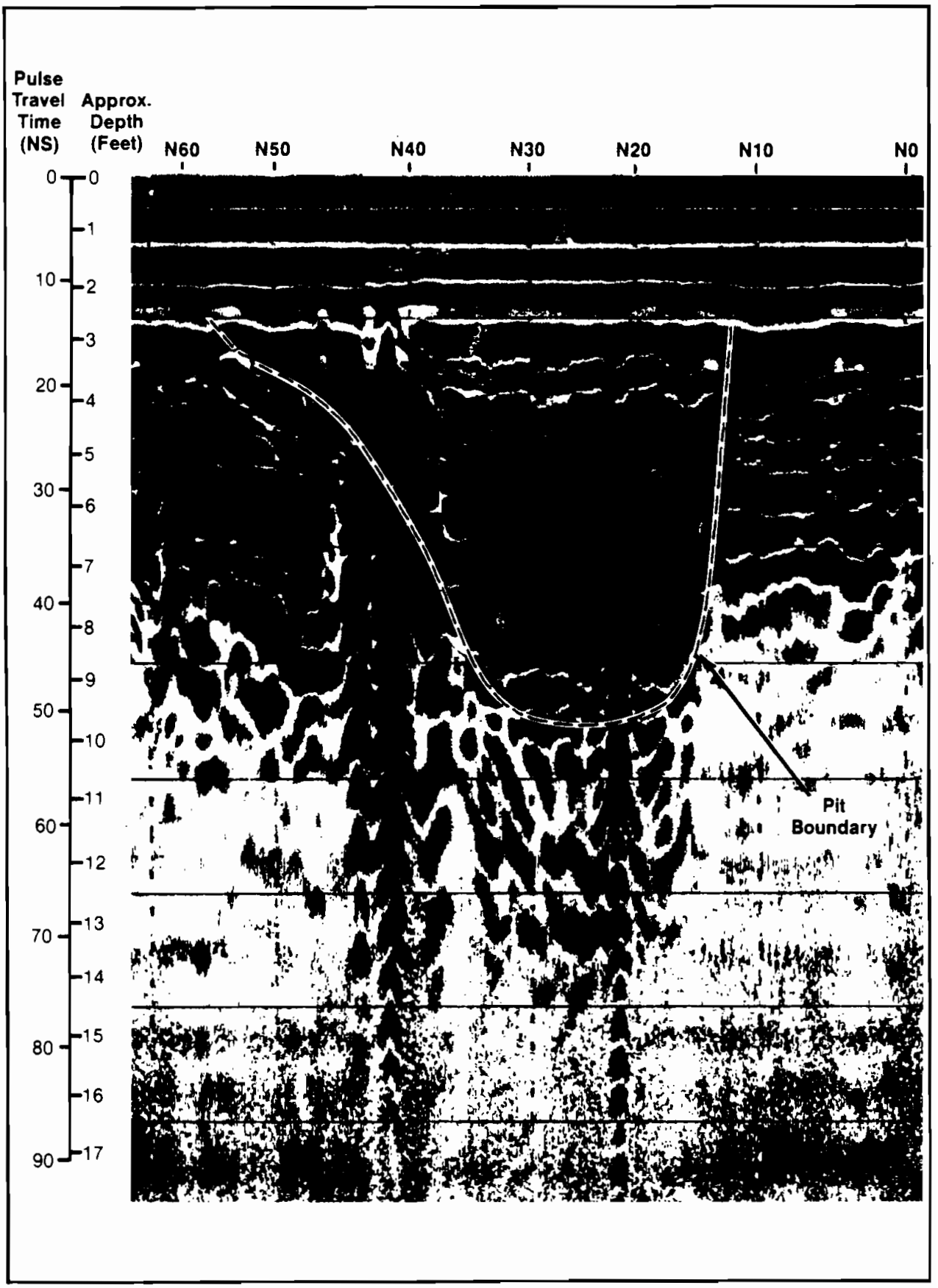


FIGURE 4-5 GPR PROFILE W35 SHOWING PIT BOUNDARY

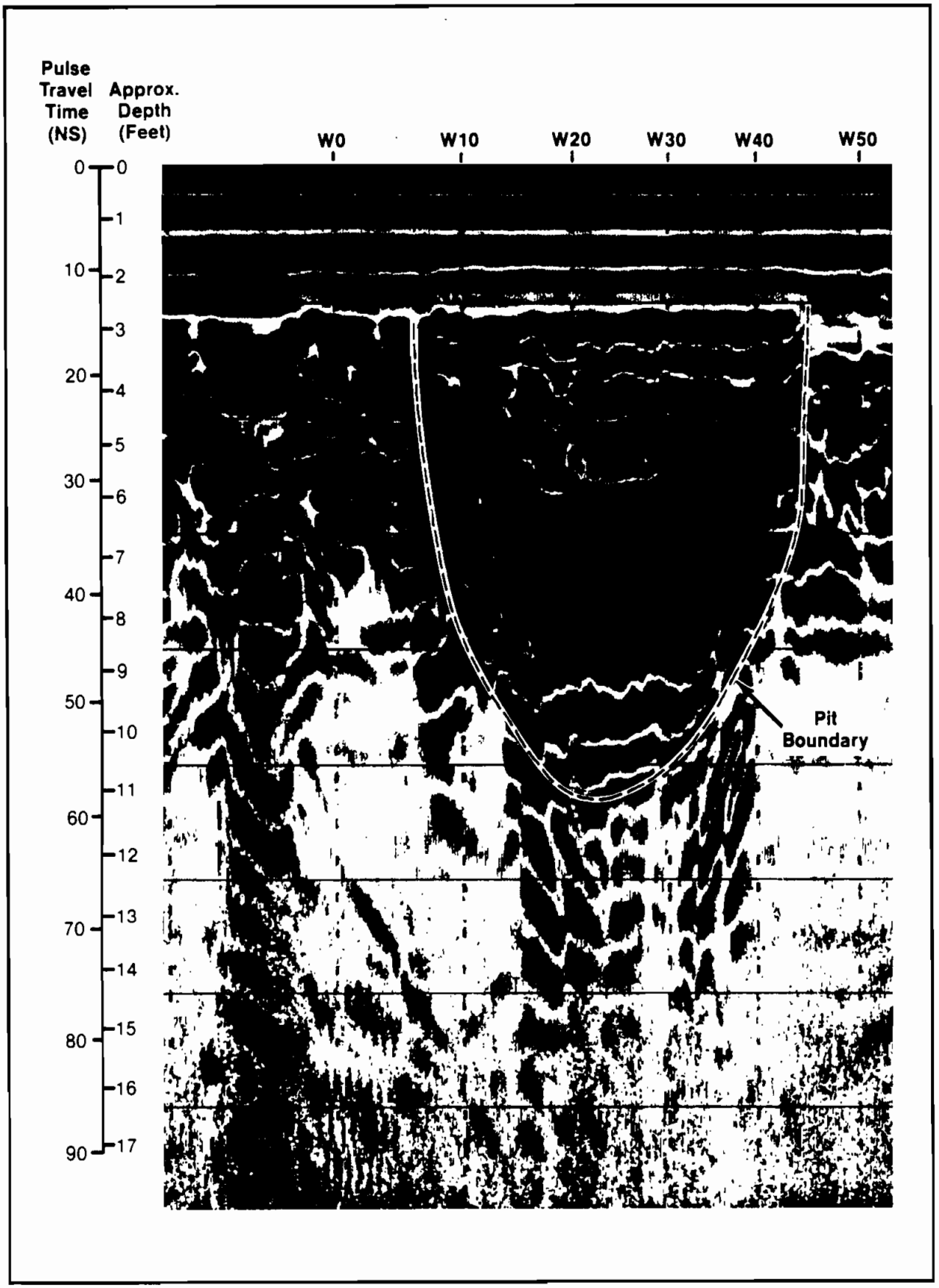


FIGURE 4-6 GPR PROFILE N25 SHOWING PIT BOUNDARY

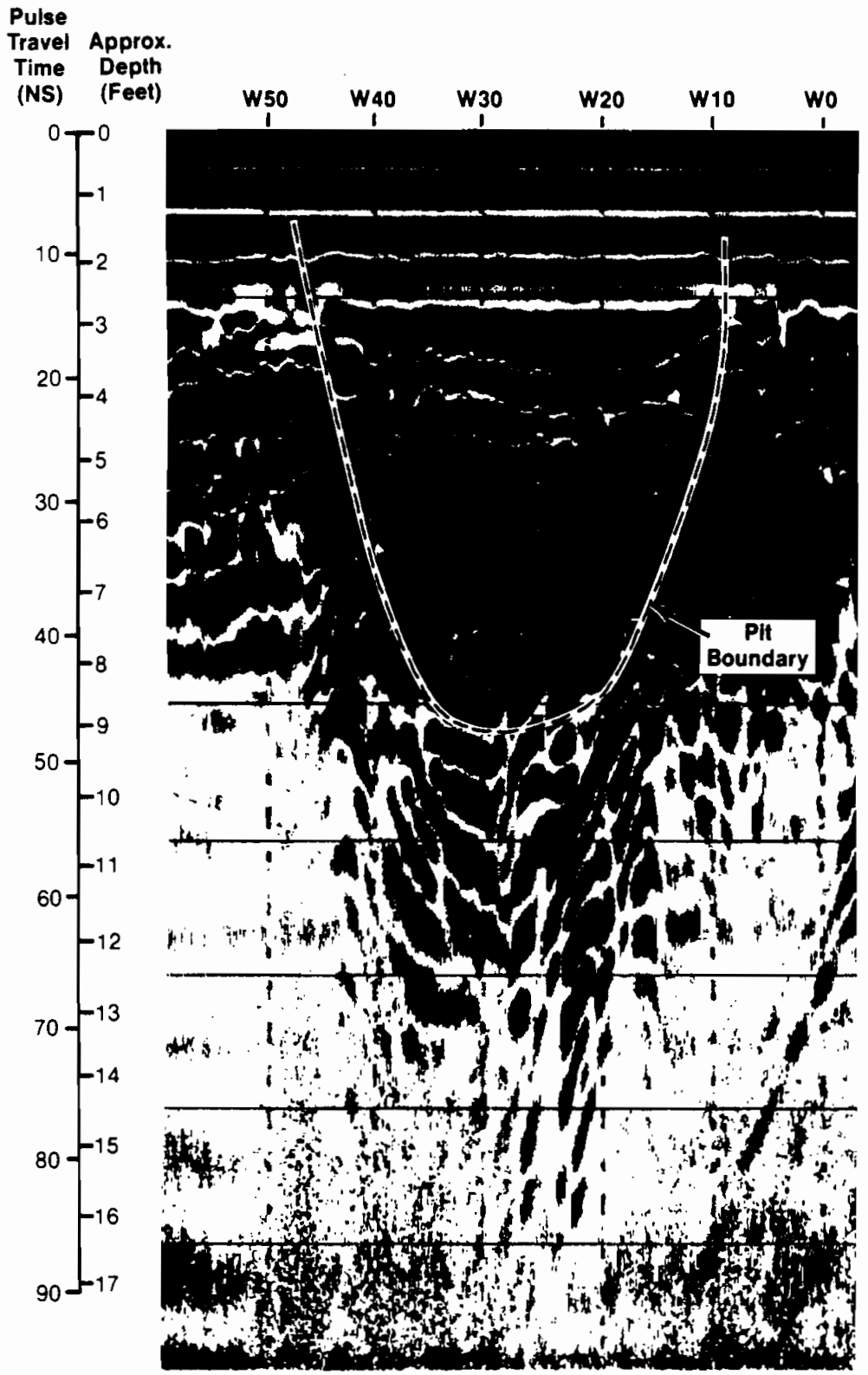


FIGURE 4-7 GPR PROFILE N35 SHOWING PIT BOUNDARY

The interpreted location of the sewer line is shown on Plate 1 as being to the west of the former disposal pit. The drain pipe, could not be identified because the disturbed zone created during pipe installation masked the radar image of the pipe. Therefore, the approximate location of the pipe was determined by identifying the associated disturbed trench zone. The geophysical survey results and visual field observations indicate an additional pipe may enter into the main storm sewer line. A 10-inch diameter pipe enters and exits the manhole where SW/SD-02 was collected. Due to interference from fill material the GPR survey was unable to determine the source or termination of this 10-inch pipe. The manhole from which samples SW/SD-02 were collected appears to drain towards the main sewer line.

4.5 SURFACE SOILS

Table 4-5 summarizes the analytical results for six surface soil samples and one duplicate sample. The surface soil samples were analyzed for total and hexavalent chromium, lead and nickel. Also shown on this table are a range of concentrations for these compounds found in undisturbed soils in Tonawanda (EPA, 1985). Hexavalent chromium, was not detected in any of the samples. Total chromium levels exceeded the concentrations for undisturbed soils for the Tonawanda area (8-20 mg/kg) (EPA, 1985). Lead concentrations were generally within the range for background soils as indicated in Table 4-5. ALLIED has a memo on file which mentions runoff from the adjacent tank farm entering the site approximately 11 years ago. A spill of leaded gasoline may account for some of the lead concentrations detected. Lead concentrations exceeded the background range (20-100 mg/kg) (EPA, 1985) at one location, SS-2 (111.0 mg/kg) and also in the duplicate sample, SS-2D (106. mg/kg) taken at that same location. The remaining samples were within the range of levels in area background samples. Nickel concentrations were also within the background ranges (20-30 mg/kg) (EPA, 1985) for all of the surface samples.

4.6 SURFACE WATER AND SEDIMENT

Four surface water and sediment samples (three samples and one duplicate) were collected from three locations along a sewer line west of the former pit location. The samples were collected at the inflow (01) and at the discharge point (03). Sample (02) was taken through a manhole entrance originally believed to be in same sewer line as samples (01) and (03). However, geophysical survey results and visual observation indicate it is not part of the main sewer line.

Table 4-5

SUMMARY OF METALS DETECTED IN
SURFACE SOIL SAMPLES (mg/kg)
ALLIED CHEMICAL, TONAWANDA, NEW YORK

Sample No.	Total Chromium (8-20ppm)[1]	Hexavalent Chromium (NA)	Lead (20-100 ppm)[1]	Nickel (20-30 ppm)[1]
SS-1	27.1	ND	18.2	7.8
SS-2	61.6	ND	111.0	19.5
SS-2D	50.9	ND	106.0	18.9
SS-3	38.4	ND	63.4	26.3
SS-4	89.9	ND	94.8	19.6
SS-5	31.2	ND	58.6	15.0
SS-6	13.0	ND	21.8	11.3

1 - (EPA, 1985) Range of background concentrations found in undisturbed soils in the Tonawanda area.

ND - Not Detected

NA - Not available

A duplicate sample was also collected from the discharge (03 dup). Sample 01 and 02 were analyzed for the priority pollutant metals and sample 03 and the duplicate were analyzed for the full HSL parameters including cyanide. Tables 4-6, 4-7, 4-8 and 4-9 summarizes the results of the surface water and sediment samples.

Included with the surface water results are the NYDEC regulatory standards for effluent discharging into drinking quality waters bodies (NYDEC, GA waters). These effluent standards were used for comparision purposes because the sewer line discharges into an intermittent stream which discharges into the Niagara River, a class GA water. No such limits are available for sediment.

Tables 4-6 and 4-7 summarize the results of surface water and sediment samples (01 and 02) which were analyzed for the priority pollutant metals (01 and 02). Of all the priority pollutant metals only lead was identified above the regulatory standard in both SW-01 and SW-02. In SW-02, lead was detected at 150 ug/l compared to the regulatory standard of 25 ug/l while in SW-01 lead was detected at 31 ug/l. All other metals were not detected or found below the detection limit in the surface water (see Table 4-6). The downgradient surface water sample (SW-03), which discharges from the property did not exceed the standard for lead or most other parameters. Results of the sediment samples showed SD-02 to have elevated concentrations of arsenic, cadmium, total chromium, copper, nickel, lead and zinc compared to the other sediment samples (01 and 03).

Table 4-8 and 4-9 summarize the results of the surface water (SW-03) and sediment samples (SD-03) which were analyzed for HSL parameters. The surface water samples are compared to the NYDEC effluent regulations (6NYCRR Part 703.5). For the parameters of concern principally total chromium, hexavalent chromium and lead the effluent standards were not exceeded. The surface water samples contained no pesticides or PCB's. Napathalene was detected in a concentration of 45 ug/l in the surface water sample, however, no regulatory level exists for this compound.

The sediment samples indicated that the concentrations of the metals of concern were lower than the concentrations found in the subsurface soils, which suggests no migration of the subsurface soils into the storm sewer.

Benzene was detected in sediment sample SD-03 at 71 ug/l. Cyanide was detected in both SD-03 and SD-03 dup at 3.6 and 2.4 mg/kg respectively. No BNA compounds nor pesticide/PCBs were detected in these samples.

TABLE 4-6

Summary of Analytical Results for the Priority Pollutant List Metals in Surface Water (ug/l)
Allied Chemical, Tonawanda, New York

Metals	NYDEC Regulatory Standard[1]	SW01	SW02
Silver	50	17.0	12.0
Arsenic	25	12.0	9.3
Beryllium	3	ND	ND
Cadmium	10	ND	ND
Chromium (total)	50	14.0	ND
Chromium (hexavalent)	50	ND	ND
Copper	200	20.0J	173.0
Mercury	2	ND	0.1J
Nickel	2,000	ND	ND
Lead	25	31.1	150.0
Antimony	3	ND	ND
Selenium	10	ND	ND
Thallium	4	ND	ND
Zinc	300	110.0	721.0

[1] NYDEC - Standards for effluent discharging into class GA waters. 1986, Title 6 Chapter X, Part 703.5.

NA = Not Available

ND = Not Detected

J = Estimated Value. Detected below the quantification level.

TABLE 4-7

Priority Pollutant List Metals
Sediment Samples (mg/kg)
Allied Chemical, Tonawanda, New York

Metals	SD-01	SD-02
Silver	10.6	13.7
Arsenic	9.3	24.2
Beryllium	1.3J	1.8 J
Cadmium	ND	14.6
Chromium (total)	25.7	87.4
Chromium (hexavalent)	ND	ND
Copper	37.7	1290
Mercury	0.3J	4.0
Nickel	14.2J	28.3
Lead	72.3	804.0
Antimony	ND	ND
Selenium	ND	ND
Thallium	ND	ND
Zinc	184.0	4280

J = Estimated value. Detected below the quantification level

ND = Not Detected

TABLE 4-8

ANALYTICAL RESULTS FOR HAZARDOUS SUBSTANCE LIST
METALS IN SURFACE WATER
(in UG/L)

HSL Metals	Maximum Allowable Concentration[1]	SW-03	SW-03 Dup	Detection Limit
Silver	50	15	22	10
Aluminum	2,000	1,170	1,000	200
Arsenic	25	ND	ND	10
Barium	1,000	131	128	200
Berylium	3	3.0J	ND	5
Calcium	NA	89,500	93,200	5000
Cadmium	10	ND	ND	5
Cobalt	NA	ND	ND	50
Chromium (total)	50	ND	ND	10
Chromium (hexavalent)	50	ND	ND	20
Copper	200	ND	ND	0
Iron	300	18,800	17,600	100
Mercury	2	0.1J	ND	0.20
Potassium	NA	5,300	5,500	5000
Magnesium	35,000*	32,700	33,600	5000
Manganese	300	1,250	1,190	15
Sodium	NA	32,200	29,900	5000
Nickel	2,000	ND	7.0J	40
Lead	25	ND	ND	5
Antimony	3	ND	ND	60
Selenium	10	ND	ND	5

TABLE 4-8 (CONTINUED)

ANALYTICAL RESULTS FOR HAZARDOUS SUBSTANCE LIST
METALS IN SURFACE WATER
(in UG/L)

HSL Metals	Maximum Allowable Concentration	SW-03	SW-03 Dup	Detection Limit
Thallium	4	ND	ND	10
Vanadium	NA	ND	ND	50
Zinc	300	49	42	20
Cyanide	100	83.5	88.7	10

HSL BNA's	Maximum Allowable Concentration	SW-03	SW-03 Dup	Detection Limit
Napthalene	10*	45	ND	10
2-Methylnapthalene	NA	4J	ND	10
HSL VOC		ND	NA	5-10
HSL Pesticide/ PCB	0.1	ND	ND	0.8-1.6

1 = NYDEC - Standards for effluent discharging into GA waters (6NYCRR Part 703.5).

NA - Not Available
ND - Not Detected
J - Estimated value. Detecte below the quantification level.

* - Guidance value rather than standard.

TABLE 4-9

Summary of Analytical Results for
Hazardous Substance List Parameters
Sediment Samples (mg/kg)

HSL Metals	SD-03	SD-03 Dup
Silver	9.3	9.9
Aluminum	25,400	19,400
Arsenic	16.4	12.4
Barium	148	142
Berrylium	1.3J	ND
Calcium	18,300	16,800
Cadmium	ND	ND
Cobalt	ND	ND
Chromium (total)	40.4	42.1
Chromium (hexavalent)	ND	ND
Copper	40.4	39.6
Iron	27,700	25,500
Mercury	0.4	0.4
Potassium	3,620	2,470
Magnesium	9,560	8,810
Manganese	491	505
Sodium	ND	286
Nickel	29.5	32.2
Lead	123	154
Antimony	ND	ND
Selenium	ND	ND
Thallium	ND	ND
Vanadium	44.6	35
Zinc	211	197
Cyanide	3.6	2.4
HSL VOC	ug/kg	ug/kg
Carbon Disulfide	3J	---
Benzene	71	---
Ethylbenzene	4J	---
HSL BNA*	ND	ND
HSL Pesticide/PCB	ND	ND

ND - Not Detected

J - Estimated value. Detected below quantification level.
--- - Not Analyzed
* - A laboratory contaminant, bis (2-Ethylhexyl) Phthalate was detected but is not believed to be site related

4.7 SOIL BORINGS

4.7.1 Hazardous Substance List Parameters

Two soil samples were collected from SB-03, one at 8-10 feet (SB03-05) and a second at 14-16 feet (SB03-08). The samples were to be analyzed for the full Hazardous Substance List (HSL) parameters which included:

- Volatile Organic Compounds (VOC's)
- Base Neutral/Acid Extractables (BNA's)
- Pesticides/PCB
- Cyanide (CN)
- Metals (including hexavalent Chromium)

One field blank sample (SB04-09) was also analyzed for the same parameters. Table 4-10 summarizes the results for the VOCs, BNAs, Pesticides/PCB and Cn and Table 4-11 summarizes the Hazardous Substance List metals results.

Results of the VOC analyses show that four compounds were identified in the sample collected from 8-10 feet. The compounds and concentrations detected are benzene (800 ug/kg), toluene (1400 ug/kg), ethylbenzene (840 ug/kg) and total xylenes (6100 ug/kg). None of these compounds or any other VOCs were detected in the 14-16 foot sample nor in the field blank. These organics may be associated with the previously mentioned fuel spill at the adjacent tank farm or other off-site sources.

Results of the BNA analyses identified eight compounds above the detection limit in the 8-10 foot sample. The compounds were naphthalene, 2-methylnaphthalene, fluorene, phenanthrene, pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene and benzo(a)pyrene. At this same depth acenaphthylene, acenapthene, anthracene, benzo(a)anthracene and chrysene were present at concentrations lower than the qualification level. Of the 8 compounds identified in the 8-10 foot sample, only pyrene (140 ug/kg) was detected above quantification limits in the 14-16 foot sample. No BNA compounds were detected in the field blank sample.

Pesticides and PCBs were not detected in either soil sample or in the field blank.

Cyanide was detected in both soil samples. The concentrations were 26.1 mg/kg in the 8-10 ft sample, and 1.9 mg/kg in the 14-16 ft. sample. Cyanide was not detected in the field blank.

TABLE 4-10

Summary of Results for Hazardous Substance List Parameters
in Soil from Soil Borings
Allied Chemical, Tonawanda, New York

	Parameters/Depth	SB0305 (8-10ft) ug/kg	SB0308 (14-16ft) ug/kg	SB04-09 field blank (water) ug/l	Detection Limit (ug/l)
	Volatile Organic Compounds				
P	Benzene	800	ND	ND	5
P	Toluene	1400	ND	ND	5
P	Ethylbenzene	840	ND	ND	5
N	Total xylenes	6100	ND	ND	5
	Base Neutral/Acid Extractables	ug/kg	ug/kg		
P	Naphthalene	E(31000)	54J	ND	370
N	2-Methylnaphthalene	3000	ND	ND	370
N	Acenaphthylene	420J	ND	ND	10
P	Acenaphthene	250J	ND	ND	10
P	Fluorene	720	ND	ND	10
P	Phenanthrene	1500	200J	ND	370
P	Anthacene	290J	ND	ND	370
P	Fluoranthene	ND	120J	ND	370
P	Pyrene	590	140	ND	370
P	Benzo(a)Anthrarene	220J	61J	ND	10
P	Chrysene	320J	76J	ND	10
P	Benzo(b)fluoranthene	200	ND	ND	10
P	Benzo(k)fluoranthene	160	ND	ND	10
P	Benzo(a)Pyrene	140	ND	ND	10
		mg/kg	mg/kg		
	Pesticides/PCB	ND	ND	ND	**
	Cyanide	26.1	1.9	ND	***

E - Detected Above Calibration Limit. Dilution Factor 11.1
ND - NOT DETECTED
J - Detected below the quantification level
* - Detection limits for volatile organic compounds for water blank. Detection limits for BNA compounds for laboratory soil blank.
** - Detection limit compound dependent.
*** - Dependent on soil moisture content

found in USGS samples collected 5-19-83

TABLE 4-11

SUMMARY OF HSL METALS DETECTED
IN SOIL BORINGS
ALLIED CHEMICAL
TONAWANDA, NEW YORK

Metals	Range in natural soil[1] mg/kg or as indicated	Range in Tonawanda[2] mg/kg	SB03-05 (8-10ft) mg/kg	SB03-08 (14-16ft) mg/kg	SB04-09 (field blank) ug/l
Silver	0.1-0.5	NA	4.0	8.2	16.0
Aluminum	1-30%	NA	26100	18900	635
Arsenic	1-50	NA	13.4	9.7J	ND
Barium	100-5000	NA	145	131	76J
Berrylium	0.1-40	NA	1.1J	0.7J	ND
Calcium	0.01-28%	NA	7380	63600	1080J
Cadmium	0.01-7.0	1-4	ND	ND	ND
Cobalt	1-40	NA	ND	11.4J	ND
Chromium (total)	1-1000	8-20	43.6	21.6	ND
Chromium (heravalent)	NA	NA	ND	ND	ND
Copper	2-299	10-20	9.2	21.6	ND
Iron	14000-42000	NA	613	1.9	48J
Mercury	0.02-0.30	0.11-0.20	0.36	0.18	ND
Potassium	0.005-3.7%	NA	1860	3030	ND
Magnesium	NA	NA	5180	17500	ND
Manganese	2-4000	NA	271	770	ND
Sodium	NA	NA	ND	ND	ND
Nickel	5-500	20-30	20.3	31.0	ND
Lead	2-2000	20-100	10.0	8.9	ND
Antimony	NA	NA	ND	ND	ND
Seleium	0.01-2.0	NA	ND	ND	ND
Thallium	5.	NA	ND	ND	ND
Vanadium	20-500	NA	29.2	30.3	ND
Zinc	10-300	47-59	84.0	78	ND

1) EPA (1983), Fuller (1977), Shacklette and Boergman (1984)
2) EPA (1985)
NA - Not Available
ND - Not Detected
J- Estimated value. Detected below the quantification level.

Results of the metals analyses are summarized on Table 4-11. Included on this table are natural concentration ranges of metals in soils (Allaway, 1968) and concentration ranges of metals found in soils in the Tonawanda area reported by the EPA (1985) as backgrounds. The results indicate that one or both of the soil samples had elevated levels of chromium, zinc, silver and/or mercury when compared to the range of natural soils and/or soils in the Tonawanda area.

4.7.2 Total and Hexavalent Chromium, Lead and Nickel

All of the 34 soil boring intervals sampled were analyzed for total chromium, hexavalent chromium, lead and nickel. Analytical results for the soil borings are summarized on Table 4-12. Also shown on the table are the concentration ranges of these metals as they naturally occur in soils (Allaway, 1968) and concentrations identified in undisturbed soils (EPA, 1985) for the Tonawanda area (background). No background information is available for hexavalent chromium. Hexavalent chromium, however, was not detected in any of the soil boring samples. Total chromium in the soil borings ranged from 15.6 mg/kg to 39400 mg/kg. The highest concentrations were found in the pit area in boring SB-04. Six of the 34 samples exceeded the range of chromium concentrations in natural soils.

Total lead in the soil borings ranged from 2.4 mg/kg to 2250 mg/kg. Total nickel concentrations ranged from non-detected to 62.3 mg/kg. As with chromium, the highest concentrations of lead and nickel were found in the pit in boring SB-04. Only one of the samples exceeded the range of lead concentrations in natural soils.

4.7.3 EP Toxicity

One soil sample from SB-03 at 6-8 feet (SB03-04) was analyzed for herbicides, pesticides and RCRA metals using the EP Toxicity extraction procedures. Table 4-13 summarizes the sample results. Herbicides and pesticides were not detected in this sample. Of the RCRA metals, arsenic, barium, selenium and silver were detected, but the concentrations were below the EP Toxicity regulatory levels listed in Table 4-13.

After the initial EP Toxicity results were reviewed, a second soil sample from the pit (TP-1-8) was collected at a depth of 8 feet for confirmatory testing for EP toxicity. One metal, selenium was present in the leachate at a concentration of 1.15 mg/l which is slightly in excess of the regulatory limit of 1.0 mg/l, no other parameters failed the EP Toxicity test.

Table 4-12
Summary Results of Total and Hexavalent Chromium, Nickel, and Lead
in Soil Boring Samples
Allied Chemical
Tonawanda, New York
(mg/kg)

Sample No.	Depth (ft)	Matrix	Date	Parameter			
				Chromium	Chromium+6	Nickel	Lead
				1-1000(1)	-	5-500(1)	2-2000(1)
				8-20 (2)	-	20-30(2)	20-100(2)
SB-01-01	0-2	Soil	9-27-88	67.1	ND	15.4	65.2
SB-01-02	2-4	Soil	9-27-88	323.0	ND	23.9	82.8
SB-01-03	4-6	Soil	9-27-88	464.0	ND	14.1	45.6
SB-01-04	6-8	Soil	9-27-88	23.8	ND	24.3	48.1
SB-01-05	8-10	Soil	9-27-88	26.7	ND	20.6	26.1
SB-01-06	10-12	Soil	9-27-88	30.4	ND	32.9	11.6
SB-01-07	12-14	Soil	9-27-88	28.9	ND	36.1	13.2
SB-01-08	14-16	Soil	9-27-88	28.9	ND	36.2	6.7
SB-02-01	0-2	Soil	9-28-88	25.4	ND	7.6	22.5
SB-02-02	2-4	Soil	9-28-88	28.7	ND	24.0	58.6
SB-02-03	4-6	Soil	9-28-88	32.8	ND	28.6	20.2
SB-02-04	6-8	Soil	9-28-88	25.1	ND	30.5	43.9
SB-02-04D	6-8	Soil	9-28-88	33.1	ND	32.5	46.1
SB-02-05	8-10	Soil	9-28-88	24.3	ND	18.3	14.6
SB-02-06	10-12	Soil	9-28-88	223.0	ND	33.8	48.1
SB-02-07	12-14	Soil	9-28-88	24.0	ND	29.5	19.9
SB-02-08	14-16	Soil	9-28-88	19.9	ND	24.6	15.6
SB-03-01	0-2	Soil	9-28-88	15.6	ND	ND	11.1
SB-03-02	2-4	Soil	9-28-88	25.1	ND	ND	2.4
SB-03-03	4-6	Soil	9-28-88	103.0	ND	ND	0.96 J
SB-03-04	6-8	Soil	9-28-88	373.0	ND	28.3	51.5
SB-03-05	8-10	Soil	9-28-88	43.6	ND	20.3	18.0
SB-03-06	10-12	Soil	9-28-88	23.8	ND	18.5	15.1
SB-03-07	12-14	Soil	9-28-88	27.5	ND	33.3	15.6
SB-03-08	14-16	Soil	9-28-88	21.6	ND	31.0	8.9
SB-04-01	0-2	Soil	9-28-88	16.2	ND	3.5 J	0.37 J
SB-04-02	2-4	Soil	9-28-88	27.1	ND	5.0	0.52 J
SB-04-03	4-6	Soil	9-28-88	2760.0	ND	2.7	12.5
SB-04-04	6-8	Soil	9-28-88	39400.0	ND	29.0	63.6
SB-04-04D	6-8	Soil	9-28-88	6480.0	ND	62.3	164.0
SB-04-05	8-10	Soil	9-28-88	9220.0	ND	49.3	2250.0
SB-04-06	10-12	Soil	9-28-88	4500.0	ND	31.0	375.0
SB-04-07	12-14	Soil	9-28-88	6950.0	ND	29.0	67.0
SB-04-08	14-16	Soil	9-28-88	605.0	ND	23.7	29.5
SB-04-09*	Field Blank	Water	9-28-88	ND	ND	ND	ND

ND - Not Detected
NA - Not Analyzed
D - Duplicate Sample
* - Data reported in ug/l
J - Compound detected in blank
(1) - Range of concentrations found in natural soils (Allaway, 1968)
(2) - Range of concentration found in undisturbedsoils in the Tonawanda area (EPA, 1985)

Table 4-13

Summary of the EP Toxicity Sample Results
Allied Chemical
Tonawanda, New York

Herbicides	Regulatory Level[1] (mg/l)	Sample No. SB-03-04 (mg/l)	Sample No. TP-1-8 (mg/l)
2,4,5-D	1.4	ND	ND
2,4,5-TP	0.14	ND	ND
2,4,5-T	5.8	ND	ND
Pesticides			
Gamma-BHC (Lindane)	0.06	ND	ND
Endrin	0.003	ND	ND
Methoxychlor	1.4	ND	ND
Toxaphene	0.07	ND	
RCRA Metals			
Arsenic	5.0	0.335	ND
Barium	100	0.0832 B	ND
Cadmium	1.0	ND	ND
Chromium	5.0	ND	0.501
Lead	5.0	ND	ND
Mercury	0.2	ND	ND
Selenium	1.0	0.0776	1.15
Silver	5.0	0.0167	ND
Ignitability[1]			
Air	--	Not Ignitable	Not Ignitable
Flame	--	Not Ignitable	Not Ignitable
Water	--	Not Ignitable	Not Ignitable
Reactivity[1]			
Sulfide	--	ND	ND
Cyanide	--	62.1	441
Corrosivity by pH[1]	--	7.4	7.8

1 EPA 40CFR 261, 271 and 302, 1986.
B - Detected in blank

4.8 GROUND WATER INVESTIGATION

WESTON conducted a groundwater sampling program at the Allied Chemical facility in Tonawanda, New York on 1 and 2 December 1988 and 17 January 1989. Refer to Table 4-1 for a summary of groundwater sampling parameters. Groundwater samples were collected from monitor wells MW-01, MW-02, MW-03 and MW-04. Due to an insufficient volume of water in wells MW-02 and MW-03 during the sampling in December 1988, an additional sampling of these two wells was required in January 1989 to complete the sampling program.

Samples were collected and analyzed for Hazardous Substance List (HSL), Volatile Organic Compounds (VOC), Base Neutral Acids (BNA), Polychlorinated Biphenyls (PCB), Metals, Hexavalent chromium, and cyanide. Field measurements were taken to determine, pH, specific conductivity and temperature. Table 4-14 summarizes published NYDEC guidelines for drinking water (Class GA waters quality) and maximum contaminant levels (MCLs) set forth by the Safe Drinking Water Act of 1974 (SDWA).

4.8.1 Well Installation

Four monitor wells were installed in the vicinity of the former disposal pit. During installation soil samples were collected continuously with a 24-inch split spoon. All soil samples were described and well construction recorded by the WESTON site geologist. Complete well construction and soil boring logs are included in Appendix A.

One sample from each of the monitor wells was collected to be analyzed for moisture content, grain size analysis and Atterburg Limits (liquid/plastic limits). This was done to quantify geotechnical parameters of the screened interval. Results of this testing is summarized on Table 4-15. Due to site conditions insufficient sample was collected to analyze liquid limits on any of the samples and the plastic limit on MW-02 sample. Complete geotechnical results are included in Appendix C.

4.8.2 Field Parameters

Groundwater from each well was field tested for pH, specific conductivity and temperature. Table 4-16 summarizes the field parameter test results.

Groundwater from wells MW-02, MW-03 and MW-04 exhibited pH values which ranged from 7.2 to 7.7. The pH values for groundwater from these wells are within the NYDEC guidelines which range from 6.5 to 8.5.

Table 4-14

PUBLISHED NYDEC DRINKING WATER STANDARDS
FOR ANALYTES DETECTED IN GROUNDWATER
AT ALLIED CHEMICAL
TONAWANDA, NEW YORK

Analyte	NYDEC Standard (ug/l)	SDWA MCL*
VOCs		
Benzene	not detectable	5
Chloroform	100	10
1,1,1 Trichloroethane	not detectable	200
Trichlorethene	10	5
Styrene	931	-
Metals		
Arsenic	25	50
Barium	1000	-
Chromium	-	50
Chromium (hexavalant)	50	-
Copper	1000	-
Iron	300	-
Lead	25	50
Manganese	300	-
Silver	50	50
Zinc	5000	-
Pesticde		
4,4, DDT	not detectable	-
pH	6.5-8.5	
Cyanide	200	-

* SDWA MCL = Safe Water Drinking Act (1974) Maximum Contaminant Level

- No guideline

TABLE 4-15

Geotechnical Sample Results For Monitor Wells
Allied Chemical, Tonawanda, New York

	MW01	MW02	MW03	MW04
% Moisture Content (1)	44.9	28.5	32.5	28.0
% Plastic Limit (2)	25.8	-	22.2	16.3
Grain Size Distribution (3)				
% Gravel (4)	4.3	0.9	13.0	7.8
% Sand (5)	45.5	22.4	14.6	41.4
% Silt (6)	35.0	48.6	41.4	26.1
% Clay (7)	15.2	28.1	31.0	24.7
Classification (8)	CL-ML	CL-ML	CL-ML	CL-ML

Description All soils were classified as silty clayey sands.

(1) ASTM D2216 Procedures
(2) ASTM 4318 Procedures
(3) ASTM 421/422 Procedures
(4) Percent greater than 4.75 mm
(5) Percent finer than 4.75 mm and greater than 0.075 mm
(6) Percent finer than 0.075 mm and greater than 0.002 mm
(7) Percent finer than 0.002 mm
(8) Unified soils Classification System

Table 4-16

Field Parameters for Groundwater

Allied Chemical
Tonawanda, New York

Well	pH	Conductivity (umhos)	Temperature (^{0}C)
MW-01	4.4	1900	11
MW-02	7.3	1200	6
MW-03	7.7	920	7.5
MW-04	7.2	1400	11

Table 4-17

Summary of HSL Volatile Organic Compounds Detected in Groundwater
Allied Chemical
Tonawanda, New York
(ug/l)

Standard		None	5	100		5	ND	5	5	5	5	5
Sample No.	Date	Carbon Disulfide	1,1-Dichloro-ethane	Chloroform	Bromodichloro-methane	Trichloro-ethene	Benzene	Tetrachloro-ethene	Toluene	Ethyl-benzene	Styrene	Total Xylenes
MW-01	12-1-88	7.0J	2.0J	1.0J	ND	2.0J	460.0	ND	170	53	85B	340
MW-02	12-1-88	ND	ND	ND	ND	ND	1.0J	ND	ND	ND	ND	ND
MW-03	12-2-88	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-04	12-1-88	ND	ND	ND	ND	4.0J	ND	1.0J	ND	ND	ND	ND
MW-041*	12-1-88	ND	ND	ND	ND	17	ND	4.0J	ND	ND	ND	ND
Trip Blank	12-2-88	ND	ND	1.0J	ND	ND	ND	ND	ND	ND	ND	ND
Trip Blank	12-1-88	ND	ND	4.0J	1.0J	ND	ND	ND	ND	5.0J	ND	ND
Field Blank	12-2-88	ND	ND	2.0J	ND	ND	ND	ND	ND	ND	ND	ND

ND - Not Detected
* - Duplicate Sample
J - Estimated value compound detected below quantification level.
B - Compound detected in method blank.

found IN U.S.G.S Soil samples collected 5-19-83.

Groundwater from MW-01 exhibited a pH of 4.4. The MW-01 sample is conspicuously lower in pH than all other wells and is outside of the NYDEC regulatory range for pH. The acidic (low pH) conditions in well MW-01 is believed responsible for the elevated concentrations of metals, and may be the result of off site spills.

Specific conductivity values for groundwater ranged from 920 to 1900 umhos. The specific conductivity value for MW-01 is elevated in comparison to other groundwater samples.

During groundwater sampling temperatures hovered around 32°F. The groundwater temperature values for MW-02 and MW-03 are artificially lower due to the long time required to obtain sufficient quantities of groundwater. Wells MW-01 and MW-04 produced significantly more water and therefore were able to be measured before the atmospheric temperature could affect the sample temperature.

4.8.3 HSL Volatile Organic Compounds

Chemical results from groundwater sampling for HSL VOCs indicated the presence of nine compounds, eight of the compounds were detected only in MW-01. Table 4-17 is a summary of HSL VOC analytical results from the groundwater sampling program conducted by WESTON.

Analytical results for groundwater samples collected at MW-01 indicated the presence of eight of nine VOCs detected at the site. The VOCs detected in MW-01 include benzene (460 ug/l), total xylenes (340 ug/l), toluene (170 ug/l), styrene (85 ug/l), ethylbenzene (53 ug/l), carbon disulfide (7 ug/l estimated value), 1,1 dichloroethane (2 ug/l estimated value), and trichloroethene (2 ug/l estimated value). Of the eight VOCs detected in MW-01, only trichloroethene and benzene are found in other wells. The presence of benzene, toluene, xylene and associated compounds may be related to past spills from the tank farm adjacent to the site.

Analytical results for groundwater samples collected at MW-02 indicate the presence benzene at a concentration estimated to be 1.0 ug/l.

Analytical results for groundwater samples collected from MW-03 do not indicate the presence of any HSL VOCs. The chemical analyses of groundwater samples collected from MW-04 and the duplicate sample MW-041 indicate the presence of two VOC compounds. The concentrations of trichloroethene detected in samples MW-04 and MW-041 were 4 ug/l (estimated

value) and 17 ug/l respectively. Tetrachloroethene was detected in sample MW-04 at 1 ug/l (estimated value) and MW-041 at 4 ug/l (estimated value).

Three QA/QC samples were collected during groundwater sampling for HSL VOCs. Chloroform was detected in all QA/QC samples and MW-01 at concentrations estimated to be from 1 ug/l to 4 ug/l. Chloroform is a common laboratory contaminant and the presence of this compound is not believed to be related to site conditions. Bromodichloromethane was only detected in the 12/1/88 trip blank and attributed to laboratory contamination. Ethylbenzene was detected in the 12/1/88 trip blank and MW-01. This compound is believed to be related to site conditions, due to the level of ethylbenzene in MW-01 (53 ug/l) and the trace amount in 12/1/88 trip blank (5 ug/l) Styrene was detected in a laboratory method blank at 1 ug/l estimated value. The level of styrene present in MW-01 was 83 ug/l and is believed to be site related.

4.8.4 HSL Base Neutral-Acid Extractables

Ground Water samples collected for HSL BNA analysis indicate the presence of nine compounds. Table 4-18 is a summary of HSL BNA analytical results for the groundwater program conducted by WESTON on 1 and 2 December 1988.

No HSL BNA target compounds were detected in samples MW-02, MW-03, or MW-041. The HSL BNA results indicated the presence of eight of nine compounds detected at the site are present in the background well, MW-01. The HSL BNA compounds detected in MW-01 are naphthalene (5,200 ug/l), 2-methyl-naphthalene (470 ug/l), phenanthrene (59 ug/l estimated value) fluorene (52 ug/l estimated value), acenaphthylene (49 ug/l estimated value), 4-methylphenol (46 ug/l estimated value), dibenzo furan (41 ug/l estimated value), and 2,4-dimethylphenol (37 ug/l estimated value). One BNA compound, n-nitrosodiphenylamine was detected in MW-04 at 3ug/l (estimated value). This compound was not detected in any other well or the duplicate sample, MW-041.

4.8.5 HSL Pesticide/PCBs

No HSL Pesticide/PCB target compounds were detected in samples MW-02, MW-03, MW-04 or MW-041. One target compound of HSL Pesticide/PCB was detected in MW-01. The concentration of 4,4-DDT detected in MW-01 ranged form 2.8 ug/l to 3.4 ug/l. The MW-01 sample was diluted and analyzed again due to interference from non-target compounds. Table 4-19 summarizes Pesticide/PCB results.

Table 4-18

Summary of Base Neutral and Acid Extractables
Detected in Groundwater
Allied Chemical
Tonawanda, New York
(ug/l)

Standard		1	1	10	None	None	None	50	50	50	50

Parameters

Sample No.	Date	4-Methyl-phenol	2,4-Dime-thylphenol	Naphthalene	2-Methyl-naphthalene	Acenaph-thylene	Dibenzo-furan	Fluorene	N-nitrosodi-phenylamine	Phenanthrene	bis(2-Ethylhexyl) Phthalate
MW-01	12-1-88	46.0J	37.0J	5200	470	49.0J	41.0J	52.0J	ND	59.0J	ND
MW-02	1-17-89	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-03	12-2-88	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-04	12-1-88	ND	ND	ND	ND	ND	ND	ND	3.0J	ND	ND
MW-04l*	12-1-88	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
FB											7.0 J

Field Blank
ND - Not Detected
* - Duplicate sample.
J - Estimated value. Compound detected below quantification limit.

Table 4-19

Summary of HSL Pesticide/PCBs
Detected in Groundwater

Allied Chemical
Tonawanda, New York

Well	Dilution Factor	4,4,DDT
MW-01	5	2.8
MW-01DL	50	3.8DL

DL - Sample diluted due to interference with non-target compounds

4.8.6 Cyanide

Cyanide was detected in all groundwater samples. Concentrations of this compound ranged from 585 ug/l to 2,580 ug/l. Based on current information it is WESTON's understanding that cyanide was not used at the Tonawanda Facility. The NYDEC standard for cyanide in drinking water in 200 ug/l. Table 4-20 summarize the results of the cyanide analysis.

4.8.7 Metals

The following is a discussion of chemical results for the metals of concern which relate to NYDEC drinking water standards. These metals appear most frequently in MW-01.

Groundwater samples MW-01, MW-02, MW-03, MW-04 and duplicate MW-041 were analyzed for HSL metals. Chemical results indicated the presence of 19 target metals in the groundwater. Table 4-21 is a summary of metals detected in the groundwater at the Tonawanda facility.

4.8.7.1 Arsenic

Arsenic was not detected in samples MW-02, MW-03, MW-04 or duplicate MW-041. Arsenic was detected in sample MW-01 filtered and unfiltered at 11.6 ug/l and 16.6 ug/l respectively. Both samples exceed the NYDEC drinking water level guideline of 2.5 ug/l.

4.8.7.2 Total Chromium and Hexavalent Chromium

No hexavalent chromium was detected in any groundwater samples. No trivalent chromium was detected in samples MW-02, MW-03, MW-04 or duplicate MW-041. Trivalent chromium was detected in sample MW-01 (filtered and unfiltered) at 117 ug/l and 128 ug/l respectively. Both samples exceed the SDWA MCL of 50 ug/l.

4.8.7.3 Lead

Lead was detected in the unfiltered sample from MW-03 at 27.8 ug/l but lead was not detected in the filtered sample of MW-03 due to the removal of non-soluble lead in the filtering process. The NYDEC standard for lead in groundwater is 25 ug/l.

Table 4-20

Summary of Cyanide
Detected in Groundwater

Allied Chemical
Tonawanda, New York

Well	Concentration (ug/l)
MW-01	585
MW-02	2580
MW-03	730
MW-04	1120
MW-041	1170
FB	ND

all wells exceeded standard of 100 ug/l

ND - not detected

Table 4-21

SUMMARY OF HSL METALS
DETECTED IN GROUNDWATER ALLIED CHEMICAL
TONAWANDA, NEW YORK
(ug/l)

Standard	50	NA	25	1000	3	NA	50
Parameter							
Sample No.	Silver	Aluminum	Arsenic	Barium	Berrylium	Calcium	Chromium
MW-01 (F)	22.0	4060.0	16.6	ND	7.0	327000.0	28.0
MW-01	29.0	3740.0	11.6	ND	6.0	359000.0	117.0
MW-02 (F)	ND	223.0	ND	ND	ND	298000.0	ND
MW-02	13.0	173.0 J	ND	20.0 J	ND	271000.0	ND
MW-03 (F)	ND	ND	ND	ND	ND	237000.0	ND
MW-03	ND	1870.0	ND	ND	ND	190000.0	ND
MW-04 (F)	24.0	ND	ND	17.0 J	ND	323000.0	ND
MW-04	11.0	179.0 J	ND	26.0 J	ND	294000.0	ND
MW-041* (F)	26.0	ND	ND	17.0 J	2.0 J	321000.0	ND
MW-041*	ND	169.0 J	ND	27.0 J	ND	265000.0	ND
Field Blank (F)	ND	ND	ND	ND	ND	ND	ND
Field Blank	ND	ND	ND	ND	ND	ND	ND

Standard	200	300	NA	35000	300	20000	NA	25
Parameter								
Sample No.	Copper	Iron	Potassium	Magnesium	Manganese	Sodium	Nickel	Lead
MW-01 (F)	ND	480000.0	10500.0	71300.0	8470.0	55700.0	ND	ND
MW-01	ND	463000.0	10300.0	78500.0	9440.0	56400.0	18.0	1.6 J
MW-02 (F)	32.3	1200.0	ND	142000.0	3840.0	72200.0	ND	ND
MW-02	17.0 J	5080.0	7300.0	148000.0	7500.0	19000.0	ND	ND
MW-03 (F)	ND	421.0	ND	36500.0	348.0	54000.0	ND	ND
MW-03	ND	2280.0	ND	42300.0	1350.0	64300.0	ND	27.8
MW-04 (F)	ND	450.0	2600.0	95000.0	3350.0	77000.0	ND	ND
MW-04	17.0 J	750.0	1300.0 J	155000.0	5170.0	23000.0	ND	ND
MW-041* (F)	12.0 J	470.0	2800.0 J	82300.0	2850.0	68000.0	ND	ND
MW-041*	9.0 J	930.0	1200.0 J	203000.0	5270.0	59000.0	ND	ND
Field Blank (F)	ND	ND	ND	ND	ND	ND	ND	ND
Field Blank	ND	133.0	ND	ND	ND	ND	ND	ND

Standard	3	NA	300
Parameter			
Sample No.	Antimony	Vanadium	Zinc
MW-01 (F)	ND	65.0	165.0
MW-01	ND	66.0	167.0
MW-02 (F)	ND	ND	60.1
MW-02	ND	ND	20.0
MW-03 (F)	ND	ND	60.3
MW-03	ND	ND	175.0
MW-04 (F)	ND	ND	15.0 J
MW-04	ND	11.0 J	31.0 J
MW-041* (F)	72.0	11.0 J	9.0 J
MW-041*	ND	ND	31.0 J
Field Blank (F)	ND	ND	56.5
Field Blank	ND	ND	35.2

LEGEND
F - Filtered Sample
ND- Not Detected
J - Estimated value. Detected below quantification limit.
* - Duplicate Sample

SECTION 5

CONCLUSIONS

The purpose of the Remedial Investigation of the former Allied Specialty Chemical disposal pit (New York Department of Environmental Conservation site # 9-15-003-B) was to define the horizontal and vertical extent of contamination in the surrounding unconsolidated materials and groundwater, and to assess the potential for contaminant migration from the former disposal pit area. In order to achieve the objectives of the Remedial Investigation, a field investigation was initiated which included:

- A geophysical survey
- Monitor well installation
- Slug testing of selected monitor wells
- The collection of samples for chemical analysis from soil borings, groundwater, surface soil, surface water, and sediment.

A geophysical survey was conducted to define the horizontal and vertical extent of the former disposal pit and to determine the exact location of a storm sewer line. The former disposal pit was located, mapped, and estimated to contain 400 cubic yards of material within the confines of the defined pit boundary. The location of the storm sewer line was determined and confirmed to be ~~the~~ west of the disposal pit. A manhole originally thought to be part of the main storm sewer line was determined to be part of a smaller pipe line which may connect into the larger storm sewer.

Four monitor wells were installed into a water bearing zone perched on a glaciolacustrine clay unit which underlies the unconsolidated clayey sandy gravel fill material of the site. The monitor wells all yield less than 0.5 gallons per minute. It should be noted that the water bearing zone is not recognized, or locally used as an aquifer nor can the zone produce quantities of water sufficient for drinking water purposes.

Tested chemical parameters for groundwater were highest (except for cyanide) from the upgradient well (MW-01). Analyte levels for MW-01 exceeded NYDEC drinking water

standards for some regulated Hazardous Substance List volatile organic compounds, pesticides, cyanide and some metals. In general the downgradient wells met drinking water standards with the exceptions of TCE in the duplicate sample from MW-04, lead in MW-03, and cyanide, iron and manganese in all the wells. These results indicate a possible upgradient source such as a past fuel spill at the tank farm upgradient of the site or other off-site sources.

The soil boring program was designed to confirm the former disposal pit boundaries defined by the geophysical survey. The vertical extent of contamination was investigated by collection of thirty-four soil samples and one test pit sample which were subsequently submitted to WESTON's laboratory for chemical analyses. The results of an EP Toxicity Analysis, performed on two soil samples, from within the pit, indicated one of the samples failed the test due to a selenium concentration slightly in excess of the regulatory limit (1.15 mg/l versus 1.0 mg/l). It should be noted that sample SB03-04 had a selenium concentration of 0.0776 mg/l, which is significantly lower than sample TP-1-8.

The leachate from sample TP-1-8, which failed the EP Tox analysis for selenium, was reanalyzed. The initial analysis was done by ICP (inductively coupled plasma) which is sensitive to interference. The reanalysis showed a very strong iron line approximately 0.10 nanometer from the usual position for selenium, which the analyst felt caused sufficient interference to give a false selenium detection. The leachate was also analyzed using graphite furnace atomic absorption techniques. No selenium was detected during this analysis. Iron interference with the selenium analysis is probable since sample SB-03-05, collected from approximately the same depth as TP-1-8, had an iron concentration of 613 mg/kg. The elevated iron concentrations in the soils, and the lack of selenium in the other soil samples tested, support the idea that the selenium detected was a false positive result.

The analysis of the subsurface soils collected from within the former disposal pit indicate the presence of benzene, toluene, ethylbenzene, total xylenes, BNA compounds, cyanide, total chromium, lead, mercury and silver. Samples SB-04-4, 5 and 6 from the disposal pit contained lead and total chromium concentrations one to two orders of magnitude higher than the samples from SB-03-04, which were used for the EP Toxicity Analysis.

Of the seventeen subsurface samples collected from outside of the formal disposal pit, fifteen exceeded concentrations of total chromium found in undisturbed (background) soils from the Tonawanda area, but were within the range for chromium found in other parts of the country. No hexavalent chromium was found in any of the samples.

Six surface soil samples were collected in the vicinity of the former disposal pit for chemical analyses. The results of these analyses indicate concentrations of chromium which exceed background levels of undisturbed soils in the Tonawanda, New York area. Lead concentrations at one location also exceeded background levels.

The purpose of the surface water and sediment sampling along the storm sewer line was to determine the quality of effluent water entering and discharging from the site. The downgradient surface water sample did not exceed NYDEC regulatory levels for effluent discharging into a body of drinking quality water for the metals of concern. Naphthalene was detected in the surface water sample, however, no regulatory level exists for this compound.

Sediment samples collected at a manhole entrance, which may be connected to the storm sewer line, contained ~~the~~ levels of cadmium, total chromium, copper, and zinc which were outside the range of concentrations for these metals in natural soils. Full HSL parameters were tested on the sediment and surface water samples at the discharge point of the storm sewer line. The only organic compounds detected in the sediment sample above the quantification limits were benzene (71 ug/kg) and acetone (310 ug/kg).

REFERENCES

Allaway, W.H. 1968. Agronmic Controls over the Environmental Cycling of Trace Elements in A.G. Norman (ed.). Advances in Agronomy, 20:235-274.

Bouwer and Rice, June 1976; A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells.

Driscoll, F.G., 1986; Groundwater and Wells, 2nd Edition St. Paul Minnesota.

EPA, April, 1983, Hazardous Waste Land Treatment SW-874, Municipal Environmental Research Laboratory p. 237.

EPA, June, 1986, 40 CFR Parts 261, 271 and 302 Hazardous Waste Management System; Identification and Listing of Hazardous Waste; Notification Requirement; Reportable Quantity Adjustments; Proposed Rule; Vol. 51, No. 114, p. 1652 and 1672.

EPA, March 1985, Preliminary Evaluation of Chemical Migration to Groundwater and the Niagra River from selected Waste-Disposal Sites, p. 45.

LaSala, A.M, 1969; Groundwater Resources of the Erie-Niagara Basin, New York.

Lisk, D.J., 1972; Trace Metals in Soils, Plants, and Animals, Adv. Agronomy, 24:267-311.

NYDEC, Title 6, Chapter X, Parts 700-705 Water Quality Regulations and Standards.

Pressant, E.W. 1971. Geochemistry of Iron, Manganes, Lead, Copper, Zinc, Arsenic, Antimony, Silver, Tin and Cadmium in the Soils of the Bathurst Area, New Brunswick Geol. Survey, Can. Bul. No. 174.

RECRA Research, Inc. 1980; Hydrogeologic Investigation Durez Division, Hooker Chemicals and Plastics Corporation, Walck Road, North Tonawanda Niagara County, New York.

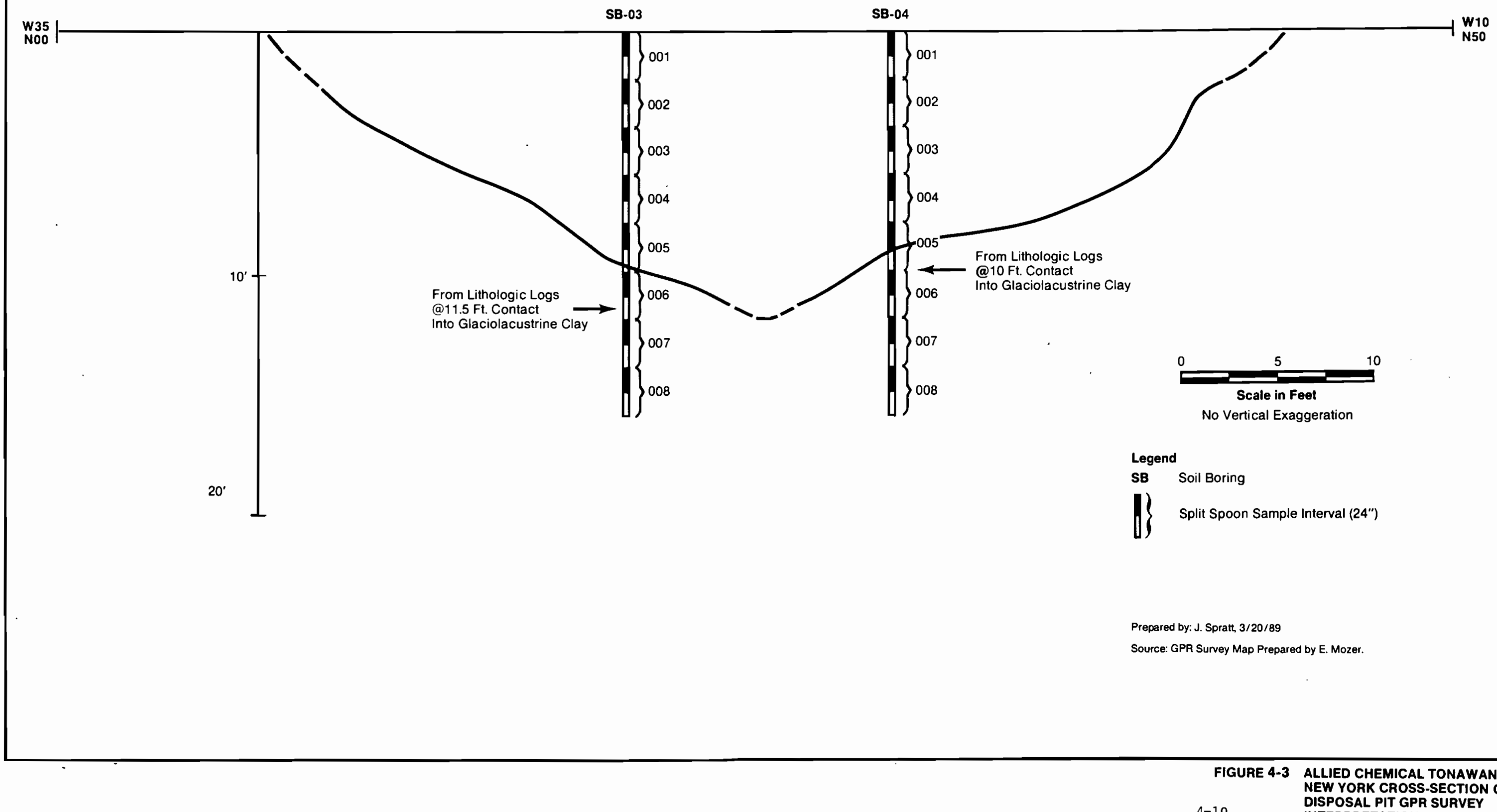
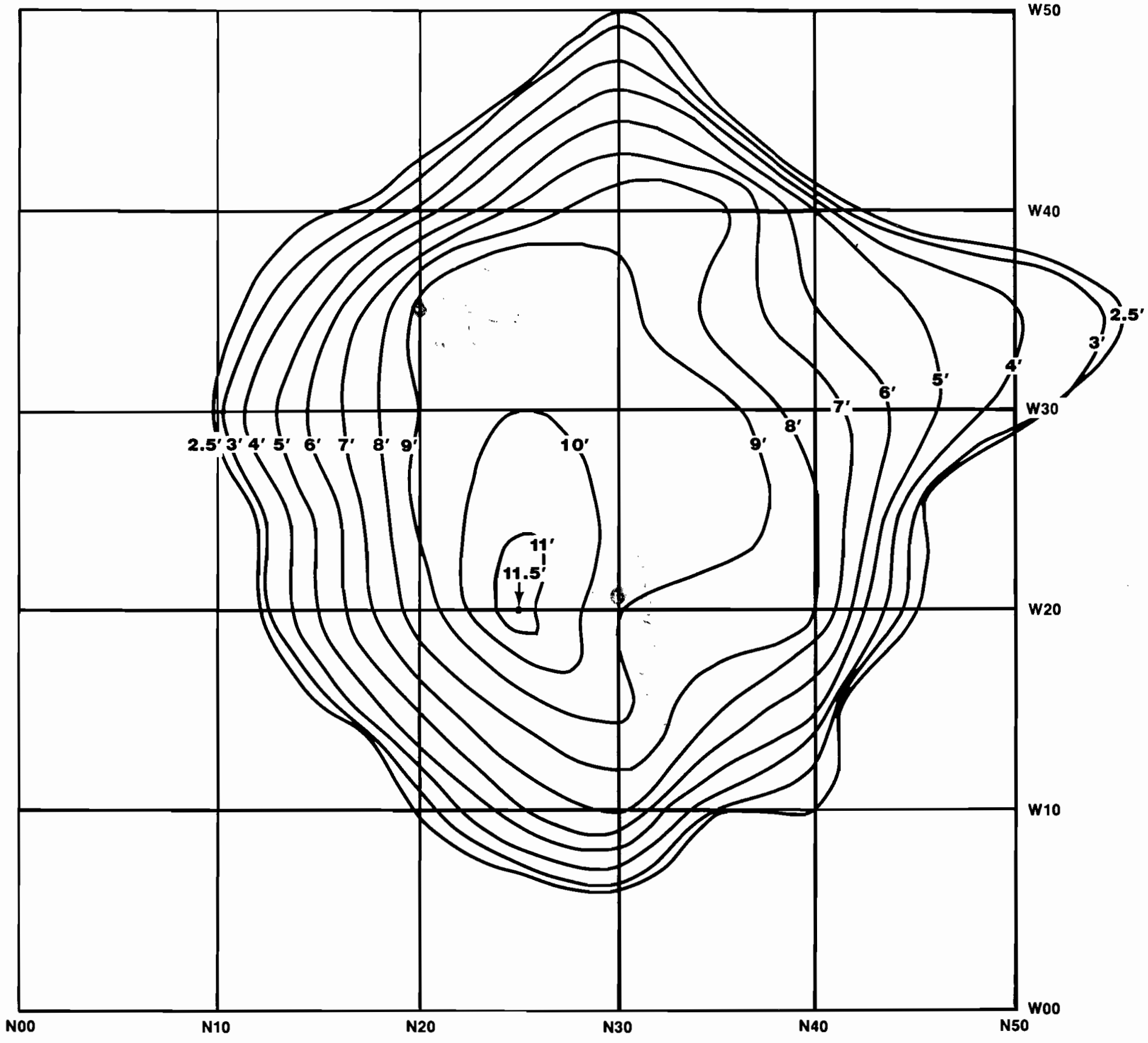


FIGURE 4-3 ALLIED CHEMICAL TONAWANDA, NEW YORK CROSS-SECTION OF DISPOSAL PIT GPR SURVEY INTERPRETATION



NOTE: Depth Contours are Approximate Based on GPR Data Interpretation. Accuracy is Probably +/-2 Feet

Estimated Volume 400 yd³

0 5 10

Scale in Feet

Prepared by: E. Mozer, 1989

FIGURE 4-2 ALLIED CHEMICAL GPR SURVEY PIT BOTTOM CONTOURS

ROAD

FENCE

INV. 573.60

GAS METER

36" CMP

M.H. (CHAMBER) 7' DIAMETER COVER

SW/SD-03

48" R.C.P. (UNDER 4' OF WATER)

HYDRANT

CLEANOUT

WATER VALVE

METAL BUILDING (WAREHOUSE) FIRST FLOOR ELEV. 582.00

METAL BUILDING (WAREHOUSE)

FOUND REBAR

GEOPHYSICAL GRID

HYDRANT

WASTE M.H.

SW/SD-02

MW-04

MW-03

SS-05

SS-06

SS-04

MW-02/SB-02

SB-04

SB 03

SS 03

SS 02

SB-01

SS 01

GEOPHYSICAL GRID

FOUND REBAR

FOUND REBAR

BLACKTOP

N100

N50

CONC

CONCRETE

CONC. BLOCK BUILDING

FIRST FLOOR ELEV. 584.70

BLACKTOP

FENCE

MW-01

N 100

PAVEMENT

OF

FENCE

ROAD

INV. 573.60

GAS METER

36" C.M.P.

M.H. (CHAMBER) 7' DIAMETER COVER

SW/SD-03

48" R.C.P. (UNDER 4' OF WATER)

HYDRANT

CLEANOUT

WATER VALVE

METAL BUILDING (WAREHOUSE) FIRST FLOOR ELEV. 582.00

METAL BUILDING (WAREHOUSE)

FOUND REBAR

GEOPHYSICAL GRID

HYDRANT

WASTE M.H.

SW/SD-02

MW-04

MW-03

SS-06

SS-05

SS-04

MW-02/SB-02

SB-04

SB-03

SS-03

SS-01

SB-01

FOUND REBAR

FOUND REBAR

MW-01

BENCHMARK ELEV. 585.98 SET ON LETTER 'D' ON DARLING, TOP OF HYDRANT

BLACKTOP

CONCRETE

CONC. BLOCK BUILDING

FIRST FLOOR ELEV. 584.70

CONC.

FENCE

PAVEMENT EDGE OF

FENCE

48" R.C.P.

FENCE

BLACKTOP DRIVE

SOUTH LINE OF LOT 97 OF THE MILE RESERVE

INV. 574.30

N 100

N 50

W 100

W 50

W 00

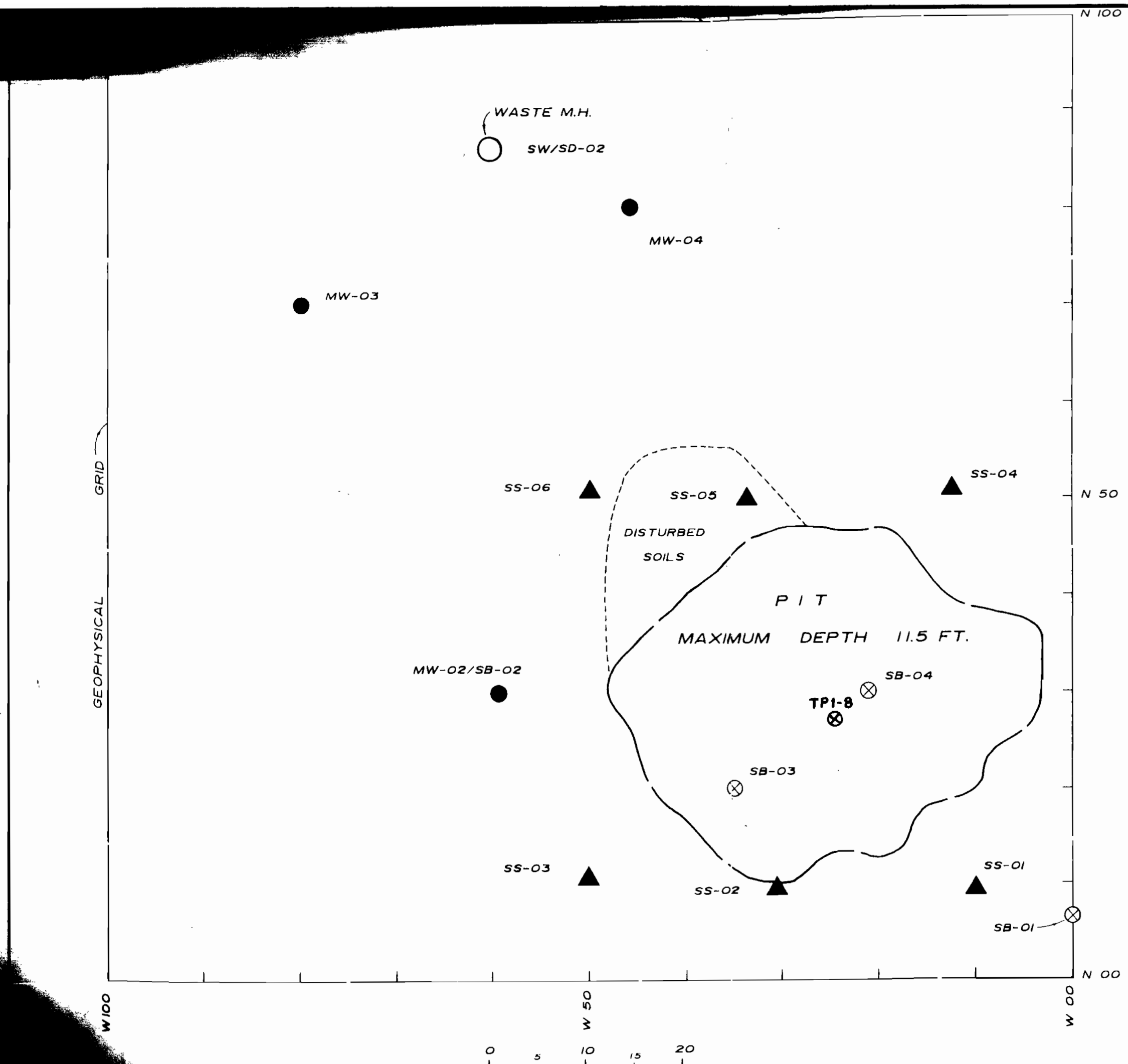
N 00

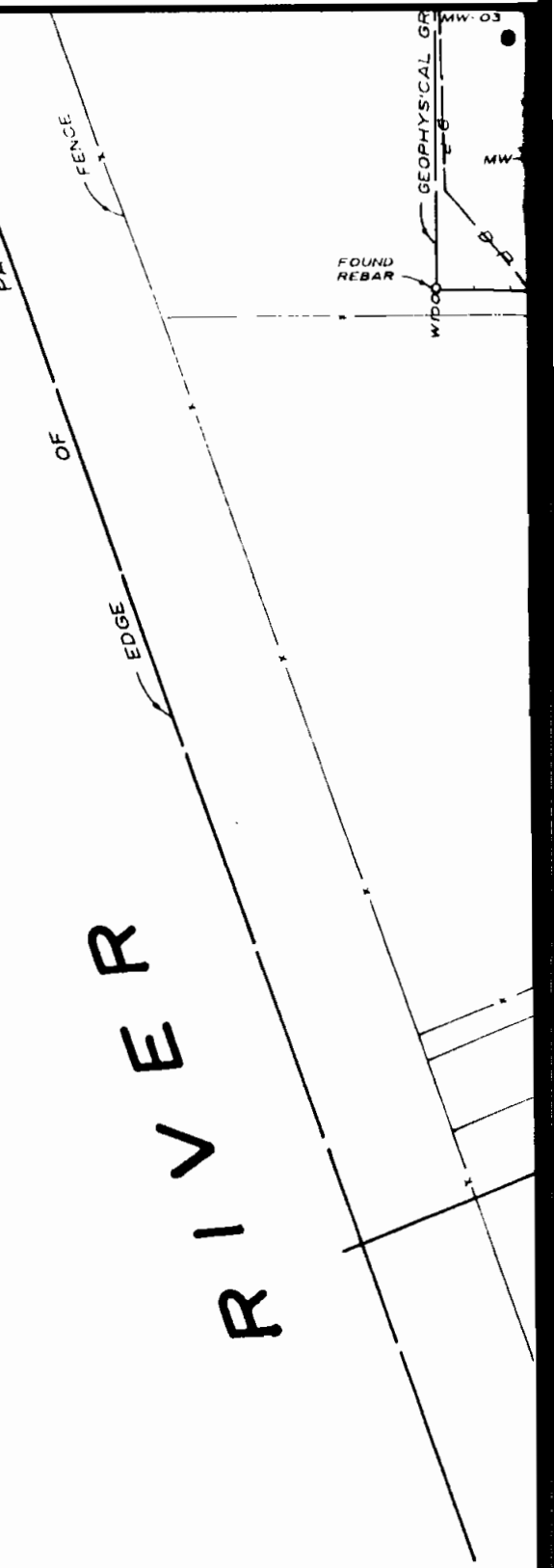
N 50

N 100

SS-04

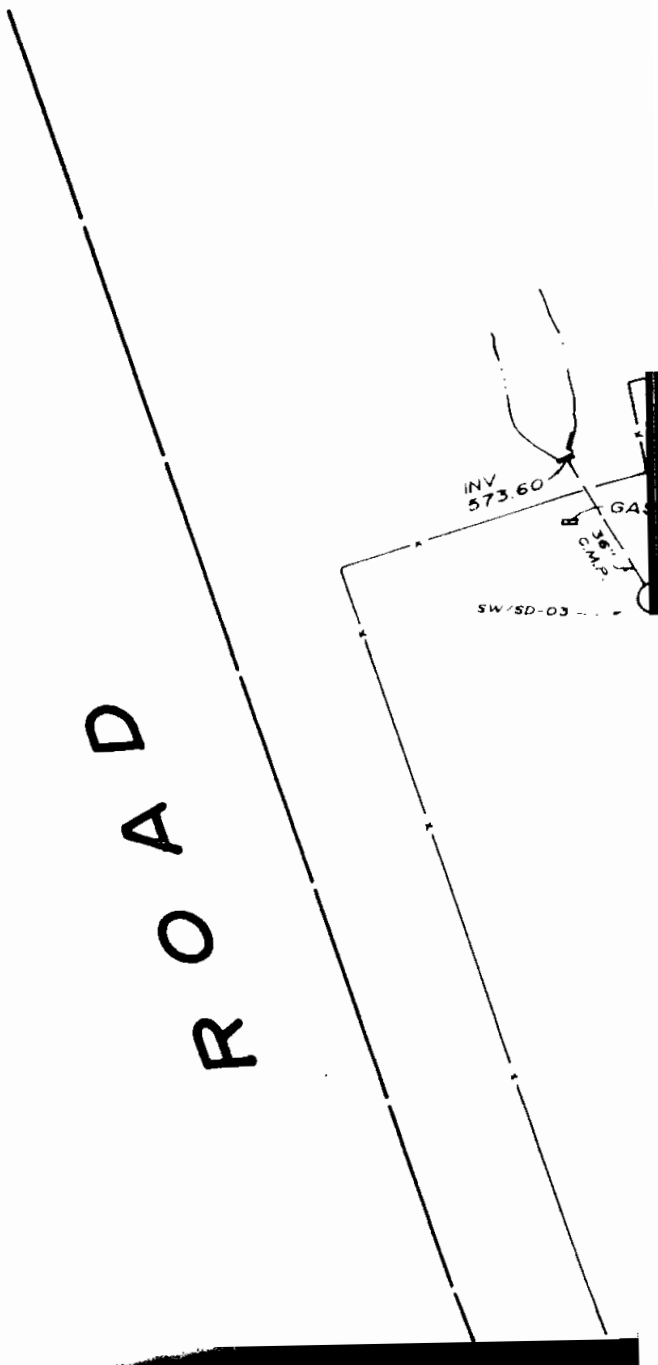
0 10 30 40 50 60 70 80 90 100


WASTE M.H.
SW/SD-02
MW-04
MW-03
GRID
GEOPHYSICAL
SS-06
SS-05
SS-04
DISTURBED
SOILS
PIT
MAXIMUM DEPTH 11.5 FT.
MW-02/SB-02
SB-04
TP1-8
SB-03
SS-03
SS-02
SS-01
SB-01
N 100
N 50
N 00
W 100
W 50
W 00
0
5
10
15
20


PAVEMENT
OF
EDGE
FENCE
RIVER
GEOPHYSICAL GRID
MW-03
MW-
FOUND REBAR
W100

ELEVATION	TABLE
MW-01	585.41
MW/SB-02	583.83
MW-03	582.55
MW-04	583.88
SW/SD-01	INV. 574.30
SW/SD-02 (WASTE M.H.)	RIM 582.40 INV. 577.30 (10" PIPE) INV. 574.85 (SUMP)
SW/SD-03 (M.H. CHAMBER)	RIM 578.26 INV. 573.16 (36" C.M.P.) INV. 571.06 (48" R.C.P.)
SB-01	583.62
SB-03	582.37
SB-04	582.97

NOTE:
MONITOR WELL ELEVATIONS MEASURED ON MARK ON INNERCASING.



ENLARGEMENT OF GEOPHYSICAL GRID