A MEMBER OF THE ENVIRONMENTAL RESOURCES MANAGEMENT GROUP

DRAFT
DESIGN INVESTIGATION REPORT

Former Red Devil Facility
Mount Vernon, New York

14 July 1997

Prepared for:

Insilco Corporation
Dublin, Ohio

Prepared by:

ERM-Northeast
475 Park Avenue South, 29th Floor
New York, New York 10016

and

ERM-Northeast
175 Froehlich Farm Boulevard
Woodbury, New York 11797

ERM

SAVE!

ERM-Northeast

475 Park Avenue South
29th Floor
New York, NY 10016
(212) 447-1900
(212) 447-1904 (Fax)

ERM

14 July 1997

Mr. Robert Smith
New York State Department of Environmental Conservation
21 South Putt Corners Road
New Paltz, New York 12561-1696

RE: Design Investigation Report
Former Red Devil Facility
Mount Vernon, New York

Dear Rob:

Enclosed please find four copies of the Design Investigation Report prepared by ERM-Northeast, on behalf of Insilco Corporation (Insilco), for the former Red Devil Facility in Mt. Vernon, NY. This report is being submitted pursuant to the Administrative Order on Consent between the New York State Department of Environmental Conservation and Insilco that was executed on 26 March 1997. The report includes the results of the pilot tests that were conducted in Area D as well as the results of the investigation and pilot tests conducted on the bank of the Bronx River.

If you have any questions regarding the report, please do not hesitate to contact me or Carla Weinpahl at (212) 447-1900.

Sincerely,

ERM-Northeast

Laura Truettner

Laura E. Truettner
Project Director

Carla Weinpahl/ler

Carla Weinpahl
Prpoject Manager

cc: G. Anders Carlson (2 copies)
Michael J. O'Toole (1 copy)
Rosalie Rusinko (1 copy)
John Genuise (1 copy)
Kenneth Koch (1 copy)
Jeff Zimmerman (1 copy)
Sam DeLuca (1 copy)

C:\LETWORK\INSILCO2\061.DOC

DRAFT DESIGN INVESTIGATION REPORT

Former Red Devil Facility
Mount Vernon, New York

14 July 1997

Prepared for:

Insilco Corporation
Dublin, Ohio

Prepared by:

ERM-Northeast
475 Park Avenue South, 29th Floor
New York, New York 10016

and

ERM-Northeast
175 Froehlich Farm Boulevard
Woodbury, New York 11797

List of Tables

List of Figures

Appendix

1.0 INTRODUCTION

1.1 SITE DESCRIPTION

The former Red Devil Facility is located at 30 North West Street in the Town of Mount Vernon, Westchester County, New York and is hereafter referred to as "the Site". The location of the Site is shown on Figure 1-1 and a map of the site features is shown in Figure 1-2. The property is approximately 50,000 square feet (sf) in area, 73 percent (37,035 sf) of which is occupied by the original multi-floored plant building. As a result of the size of the Site, the property was divided into four areas, designated as A, B, C and D. It should be noted when reviewing the maps of the Site that Area A is at ground level, while Areas B, C and D are actually below the ground surface in the basement of the former facility building.

Commercial/industrial buildings border the Site on its north, west and east sides. As shown in Figure 1-1, the Bronx River is located to the west of the Site and a railroad embankment, on which Metro-North railroad operates the Harlem line, is located between the Site and the Bronx River. A generalized cross-section of the site and the area between the site and the Bronx River is presented as Figure 1-3. As shown in this figure, the railroad embankment steeply slopes down to a narrow, relatively flat portion along the river bank. From this flat portion, the embankment steeply slopes down to the Bronx River.

1.2 REGULATORY BACKGROUND

At some point in the late forties or early fifties, Red Devil Paints and Chemicals, Inc. began operations at the Site. Insilco Corporation acquired Red Devil Paint in 1971 and purchased the property in 1985. In 1989, Insilco sold the Red Devil Paint division to Thompson and Formby and operations at the facility ceased in 1990.

As part of the closure of the paint manufacturing business, Insilco undertook the necessary steps to locate and properly close a number of above ground and underground storage tanks at the former Red Devil Facility. During this work, it was found that soils and ground water at the Site had been impacted by releases from tanks, associated tank piping and possibly by other discharges of raw material used to manufacture paint and finished paint products. A layer of light non-aqueous phase liquid (LNAPL) was also identified on the water table. These impacts were discovered during plant closure activities in 1991 and the New York State Department of Environmental Conservation (NYSDEC) was notified. The Site was listed in the Registry of Inactive Hazardous Waste Disposal Sites in New York State as "Red Devil", Site Number 3-60-031 in 1992. The NYSDEC has classified the Site as a "2" pursuant to New York State Environmental Conservation Law Section 27-1305 (4)(b).

In response to the listing of the former Red Devil Facility, Insilco Corporation undertook a Remedial Investigation/Feasibility Study (RI/FS) program at the Site. In December 1992, a RI/FS Work Plan was prepared by ERM-Northeast. The investigative activities were conducted at the Site from November 1992 through December 1993 and the Remedial Investigation report was finalized in May 1994. The results of the RI indicated that there has been some impact to the soils and ground water at the Site from operations at the facility. The soils and the ground water contained volatile organic compounds (VOCs), such as toluene and xylenes and LNAPL was also observed floating on the ground water table in Areas C and D. It was also noted during the RI that the floor drain and sump system required cleanout to eliminate these locations as potential chemical sources and exposure pathways. Furthermore, it was also concluded in the RI that additional ground water sampling was necessary to further characterize potential upgradient sources of volatiles. In the meantime, an on-site LNAPL recovery system was constructed in Areas C and D of the Site and operated as Interim Remedial Measure 1 (IRM#1); LNAPL recovery was not required in Areas A and B since LNAPL was not observed in these two remaining areas of the Site. In addition, an off-site passive recovery system was set up in the Bronx River to collect LNAPL discharged to the river. The passive off-site system was referred to as IRM#2.

After NYSDEC approved the Remedial Investigation Report, a Feasibility Study (FS) was prepared in June 1995. It was concluded in the FS that the most effective way to address the Site was in two operable units (OUs): the first OU was to focus on LNAPL and the second OU was to focus on soil and ground water. The OU I FS, prepared in June 1995, addressed the on-site Area C LNAPL, on-site Area D LNAPL, off-site LNAPL in the Bronx River and the indoor floor drain and trench. The OU II FS, which will be completed after on-site LNAPL has been addressed, will address any residual constituents in the on-site soil and ground water.

The remedial action objectives identified for LNAPL in the OU I FS were as follows: (1) to identify a remedial alternative for the on-site LNAPL that would mitigate the potential impact to ground water posed by LNAPL, to the extent practicable; and (2) to prevent the potential for exposure to LNAPL in the surface water of the Bronx River. With regard to the first remedial action objective, the OU I FS concluded that the remedial activities being conducted under IRM#1 were adequate for Area C LNAPL, but that additional investigation was needed to improve Area D LNAPL recovery. It was also concluded in the OU I FS that the boom system in the Bronx River adequately prevents the potential for exposure to LNAPL in the surface water of the Bronx River. However, at the recommendation of the NYSDEC, a decision was made to conduct additional investigation to evaluate more active recovery of off-site LNAPL.

In summary, it was concluded in the OU I FS that the following activities be conducted at the Site:

- continued on-site recovery of Area C LNAPL;
- additional investigation to determine alternate technologies for recovery of the more viscous Area D LNAPL;
- maintenance of the boom system in the Bronx River to prevent direct human or animal contact with floating LNAPL;
- completion of a Design Investigation to evaluate the feasibility of active off-site LNAPL recovery from the banks of the Bronx River;
- cleanout of the indoor floor trench and drain system; and
- performance of a quarterly ground water monitoring program.

This report documents the results of ongoing IRM#1 and IRM#2 as well as the results of the Design Investigation activities.

1.3 *STATUS OF OU I ACTIVITIES*

As previously discussed, the OU I media of interest are: on-site Area C LNAPL; on-site Area D LNAPL; off-site LNAPL in the Bronx River; and the indoor floor trench and drain system.

In July of 1994, operation of the IRM#1 system commenced. A plan view of the IRM system layout is shown in Figure 1-4. The purpose of IRM#1 was to recover on-site LNAPL from beneath the former Production Area (Area C) and the former garage/storage room (Area D). Because LNAPL was not consistently observed in the other two areas of the site, Area A and Area B, LNAPL recovery was not proposed for these areas.

The IRM on-site LNAPL recovery system is comprised of eleven LNAPL recovery wells (three in Area C and eight in Area D), four NAPL-only SpillBuster® pumps, one 500 gallon aboveground LNAPL storage tank for Area C LNAPL, one 300 gallon aboveground LNAPL storage tank for Area D LNAPL, piping, tubing and controls. Pumps are rotated between the recovery wells located in each area to allow for a period of static conditions when LNAPL can migrate in to the recovery wells. The LNAPL, collected into the two on-site storage tanks, is pumped out when the tanks are full for off-site disposal.

During the 1995 RI, the maximum apparent thickness of LNAPL in Area D wells was four feet (DW-10D and DW-13D). In contrast, the maximum apparent LNAPL thickness in Area C was two feet (DW-6C). Based on the information collected during the RI, the total volume of LNAPL in Areas C and D was conservatively estimated to be approximately 12,000 gallons (ERM, 1995).

In addition to the difference in thickness, the physical characteristics of the LNAPL in each of these areas also differs. The specific gravity of Area C LNAPL is notably lower than the specific gravity of the Area D LNAPL; and correspondingly, the viscosity of the Area C LNAPL is considerably lower than the Area D LNAPL. Due to the different viscosities of the LNAPL observed in Areas C and D during investigative activities, slightly different pumps were installed in these areas.

1.3.1 *Area C LNAPL Recovery Efforts*

appx 142 gal per month

The history of LNAPL recovery in Area C is summarized in Figure 1-5. This figure shows that the IRM system has recovered approximately 5,000 gallons of LNAPL from this area over the past 35 months. An additional 2,041 gallons of LNAPL were recovered during the pre-IRM pilot testing. Therefore, the total recovery in Area C is estimated to be 7,041 gallons. Area C LNAPL recovery rates have decreased in recent months (i.e. since December 1996). This decrease is predominantly due to pump failures and associated down time. The recovery pumps are scheduled for replacement. Monthly recovery rates are expected to increase to pre-December 1996 rates after the new pumps are installed.

1.3.2 *Area D LNAPL Recovery Efforts*

The on-site automated LNAPL recovery IRM system has been less successful in Area D. Approximately 120 gallons of LNAPL was recovered with the IRM system during the first five months of operation and an additional 157 gallons has been recovered using manual bailing and passive recovery techniques. Poor LNAPL recovery in this area of the Site is predominantly due to the high viscosity of the Area D LNAPL and the propensity of this material to solidify upon exposure to air. All Area D LNAPL has a consistently higher viscosity than Area C LNAPL and the viscosity of the LNAPL varies from well to well in Area D. In general, very high viscosity LNAPL has been observed in DW-8D and DW-13D; high viscosity LNAPL has been observed in DW-10D, DW-4D and DW-1D; and lower viscosity LNAPL has been observed in DW-11D and DW-2D. DW-6D is monitored periodically; the only material observed in this well is a paste-like plug of floating material that cannot be removed. A description of the physical characteristics of the Area D LNAPL that have been observed since the start of the IRM is presented in Table 1-1.

The poor performance of IRM#1 in Area D can be attributed to the following operational problems:

- Area D LNAPL, which has a higher viscosity than Area C LNAPL, has poor flow characteristics and thus does not readily recharge into the recovery wells;

- The transient occurrence of very high viscosity LNAPL in recovery wells DW-8D and DW-13D has caused numerous pump failures due to premature pump burn-out; and

- As a result of the small amount of material recovered and the intermittent operation of the automated NAPL-only pump recovery system, LNAPL recovered in Area D hardened in the NAPL conveyance piping that connects the pumps to the storage tank.

After repeated attempts to modify the existing IRM system, it became apparent that the SpillBuster® equipment was not effective in Area D. Automated on-site NAPL recovery in Area D was discontinued in November 1994. Passive recovery equipment, i.e., sorbents, have been installed in all the Area D recovery wells. The sorbents are removed from the wells, every one to two weeks, after they have become saturated. Manual bailing of Area D wells is also conducted when an appreciable amount of LNAPL has accumulated in the wells. The LNAPL recovered from Area D is currently stored in the Area C tank and the Area D tank is no longer used. Since only a small volume of LNAPL was recovered in Area D, the LNAPL tended to harden inside of the tank.

In a meeting held in the Tarrytown offices of NYSDEC on 7 December 1994, which was attended by representatives from ERM, Insilco and NYSDEC, it was agreed that the existing SpillBuster® system in Area D would be replaced by passive recovery devices and an alternative method of automated recovery would be evaluated. The procedures and results of this effort are presented in this report.

1.3.3 *Off-Site LNAPL Recovery Efforts*

Operation of the containment boom in the Bronx River (i.e., IRM#2) has successfully prevented direct human and animal contact with LNAPL discharged to the Bronx River. Approximately 535 gallons of this material had been recovered as of mid-May 1997. At the request of NYSDEC, active recovery of off-site LNAPL has also been investigated. To address this issue, a Design Investigation Workplan (ERM, 1996) was prepared and implemented to determine whether LNAPL could be recovered from beneath the bank of the Bronx River. The procedures and results of this effort are presented in this report.

1.3.4 *Indoor Floor Drain and Sump System*

During the RI, an indoor floor drain and sump system was identified in the basement of Areas C and D. Visual inspection indicated that sediment had accumulated in this system. In accordance with the OU I FS, the floor drain and sump system was mapped and materials that had accumulated within the indoor floor drains and sumps were removed to eliminate this potential source of chemicals and exposure pathway. This activity was conducted between January and March of 1996 as part of the Design

Investigation. The procedures and results of this effort are presented in this report.

1.3.5 *Ground Water Monitoring Program*

Although the OU I FS did not address remediation of ground water, a quarterly ground water monitoring program was conducted as part of the Design Investigation. Only two rounds of ground water samples were collected during the RI and the data from the two rounds were so different that they were difficult to interpret. The data suggested that there was an upgradient off-site source of volatile organics that was impacting the ground water in Area A. In order to verify this interpretation, a quarterly ground water monitoring program was incorporated into the Design Investigation. ERM collected eight rounds of samples from the Site as part of the Design Investigation and the data collected during these sampling events is included in this report.

1.3.6 *Summary*

In summary, the status of the OU I activities is as follows:

- the Area C IRM LNAPL recovery system continues to operate satisfactorily;
- active recovery of Area D LNAPL using the IRM system has been discontinued and an evaluation of alternative recovery technologies systems for Area D LNAPL has been conducted;
- operation of IRM#2 (i.e., collection of off-site LNAPL in the Bronx River using a containment boom) has continued to prevent direct human and animal contact with LNAPL migration at the Bronx River;

- an investigation to evaluate the feasibility of actively recovering off-site LNAPL from beneath the bank of the Bronx River has been conducted;
- accumulated materials have been removed from the indoor floor trench and drain system and the system has been mapped; and
- a quarterly monitoring program has been implemented to evaluate potential off-site upgradient sources.

1.4 *PURPOSE OF DESIGN INVESTIGATION*

The purpose of the Design Investigation was to collect the information needed to design the OU I remedial action and to evaluate the potential for an off-site upgradient source of volatile organics. The work to be conducted as part of the Design Investigation was outlined in the Design Investigation Work Plan which was approved by NYSDEC on 04 September 1996. The tasks completed were:

- investigation of subsurface conditions on the banks of the Bronx River to determine whether LNAPL recovery from beneath the banks of the Bronx River would be feasible;
- evaluation of alternative LNAPL recovery technologies for Area D NAPL;
- installation of a ground water monitoring well downgradient of Area A along the bank of the Bronx River and performance of a quarterly ground water monitoring program; and
- cleanout and mapping of the indoor floor drain and trench system.

1.5 MEDIA AT SITE REQUIRING DESIGN INVESTIGATIVE ACTIVITIES

As discussed above, three media required design investigative activities: the indoor floor drain and sump system, on-site Area D LNAPL, and off-site LNAPL located beneath the banks of the Bronx River (i.e., Bronx River Bank LNAPL). Conclusions regarding the viability of remedial actions for the Area D LNAPL and the Bronx River LNAPL were then to be incorporated into the OU I remedial action for the Site. In addition, ground water monitoring was also included in the Design Investigation activities. Although not required for the OU I remedial design, the ground water monitoring results are included and discussed in this document.

1.5.1 *Indoor Floor Drain and Sump System*

It was concluded in the July 1994 Remedial Investigation Report (RI) that the floor drain and sump system in Area C and D at the facility may have been impacted by facility operations. During the RI, ERM identified six sumps and four floor drains. However, as a result of the presence of material in the pipes, the configuration of the underground piping that connected these floor penetrations could not be identified with a dye test. Therefore it was agreed that the floor drains, sumps, and interconnecting pipes would be inspected, cleaned and mapped as part of the Design Investigation.

1.5.2 *Ground Water*

As part of the Design Investigation, a ground water monitoring well was installed downgradient of Area A, along the Bronx River bank and a quarterly ground water monitoring program was conducted. This work was done to determine the source of volatile organics in Area A ground water and to determine why the concentrations of volatiles in Area A wells have fluctuated over time.

1.5.3 *Area D LNAPL*

As discussed in Section 1.2, limited recovery of LNAPL from Area D has been achieved using the IRM recovery system. A technology evaluation was therefore conducted to review alternate recovery technologies for the highly viscous Area D LNAPL. Although not included as an activity under the Design Investigation Workplan, the procedures and results of this evaluation are discussed in this document. The results of this evaluation will be used to determine the recovery strategy for Area D LNAPL.

1.5.4 *Bronx River Bank LNAPL*

As part of the Design Investigation, subsurface conditions of the Bronx River bank downgradient of the Site were investigated to determine whether recovery of LNAPL from beneath this area is feasible. If feasible, recovery of LNAPL from beneath the Bronx River bank would be included in the OU I remedial action for the Site.

1.6 *REPORT ORGANIZATION*

The remaining sections of this document describe the procedures and results of the Design Investigation. These sections are briefly described below.

Section 2.0 presents the field activities conducted for the four media investigated under the Design Investigation (i.e., indoor floor drain and sump system, ground water, on-site Area D LNAPL and Bronx River Bank LNAPL). The field activities for each media are discussed separately. These discussions address: objectives; technology screening procedures; sampling activities; and field testing procedures.

Section 3.0 presents the results of the Design Investigation effort for the four media investigated. Again, the results for each media are discussed separately. Included in this section are: results of the indoor floor drain and trench cleanout; a discussion of the historical ground water trends; the effectiveness of the alternate LNAPL recovery technologies for Area D LNAPL; LNAPL characterization and baildown testing results for Bronx River bank LNAPL; and technology testing results for recovery of Bronx River bank LNAPL.

Section 4.0 presents an evaluation of the results for the Area D LNAPL recovery technology review and an evaluation of remedial action alternatives for the LNAPL located beneath the Bronx River bank. The results of the Area D technology review are evaluated based upon the three technology screening criteria (i.e., effectiveness, implementability and cost). The remedial action alternatives for recovery of LNAPL located beneath the Bronx River bank are evaluated based on the seven remedial action evaluation criteria (i.e., protection of human health and the environment, compliance with New York State standards, criteria and guidance (i.e., SCGs), long-term effectiveness, implementability, reduction of toxicity, mobility and volume, short-term effectiveness and cost).

Section 5.0 presents the conclusions and recommendations of the Design Investigation and the final components OU I. Also included in this section is a framework for the implementation of OU II.

2.0 *FIELD ACTIVITIES*

This section presents the field activities conducted for the: indoor floor drain and sump cleanout (Section 2.1); ground water sampling (Section 2.2); Area D LNAPL recovery technology evaluation (Section 2.3); and the Bronx River bank investigation (Section 2.4). Provided in this section are the objectives of each of these field activities along with the procedures employed.

2.1 *FLOOR DRAIN AND SUMP CLEANOUT*

2.1.1 *Objectives*

The objective of the floor drain and sump system cleanout was to remove any potentially impacted material that had accumulated in the system; and eliminate a potential source of chemicals. By removing this material, potential impacts to soil and ground water from this media and potential direct contact risks to maintenance personnel at the facility would be eliminated. In addition, during the cleaning of these systems, a complete map of the floor drains, sumps and underground piping was developed. (need to see)

2.1.2 *Procedures*

The cleaning and mapping of the floor drain and sump system was conducted by National Water Main Cleaning Corporation (NWMC) and the field activities were coordinated by an on-site ERM field engineer. The on-site activities began on 22 January 1996 and were completed on 25 March 1996. The on-site activities consisted of the following tasks:

1. initial inspection and pipe tracing;

2. cleaning and mapping; and
3. wastewater and sediment collection and disposal.

These tasks are discussed below and a detailed discussion regarding the results of this effort is presented in Section 3.1.

Initial Inspection and Pipe Tracing

During the RI, an inspection of the basement areas indicated that there were six sumps, four floor drains and two connecting pipes located in Areas C and D. During a second inspection conducted while preparing the OU I FS, a number of fixtures, which may have been openings or cleanouts to the subsurface floor drain system, were also identified. During the Design Investigation, field personnel investigated each of these fixtures to determine their relationship to the floor drain and sump system.

At each of these locations, loose sediment within the fixtures was removed with a shop vacuum and the connecting piping was traced using a pipe locating device. If necessary, the pipe was scoured to remove hardened sediment and the loosened sediment was removed with a shop vacuum. Following the initial cleaning, the locating device probe was pushed through the underground pipe and traced at the floor surface with the locator. After the pipe was traced and the end of the pipe was located, the pipe was cleaned with a water jet.

Cleaning and Mapping

Following the initial inspection, the remainder of the floor drain and sump system was cleaned to determine the system routing. Again, loose sediment was first removed from the system using a shop vacuum. An internal pipe scouring device was then used to remove any caked-on material and the interconnecting piping was finally cleaned using the water jet. In addition to the floor drains and sumps, the storm drain system at the north and south ends of the alleyway were also cleaned and mapped.

Water used to clean the floor drain and sump system was supplied by a dedicated tanker truck. Water for the tanker truck was obtained from a nearby Mount Vernon Water Authority (MVWA) fire hydrant; approval to use this hydrant for water supply had previously been obtained from MVWA. Management of the spent wastewater and collected solids is discussed below.

The information collected during the initial pipe tracing and subsequent pipe cleaning (i.e., the locations of the sumps, floor drains and interconnected piping) was then used to construct a map of the floor drain and sump system. This map is presented in Section 3.1.

Wastewater Collection and Disposal

Wastewater and sediment generated during the floor drain, sump and storm drain cleanout were collected in a vacuum truck. Upon completion of the system cleanout, the turbid wastewater was pumped from the vacuum truck through disposable fabric cartridge filters and two drums, connected in series, containing 200 pounds of granular activated carbon (GAC) into a temporary, upright 4,000 gallon aboveground storage tank. This tank was located in the alleyway in the northwest corner of the Site. The heavier sediments, which had settled to the bottom of the vacuum truck tank, were removed from the tank and placed into steel drums for disposal. The spent cartridges that were used to remove particulates from the wastewater were also placed in steel drums. Waste characterization sampling was conducted to determine the appropriate handling and disposal requirements for these materials.

In addition to the wastewater generated during the pipe cleanout, approximately 700 gallons of purge water generated during the quarterly ground water sampling program was placed into the 4,000 gallon storage tank. This water was also passed through the disposable cartridge filters and carbon vessels prior to introduction into the 4,000 gallon storage tank.

Prior to implementation of the floor drain and sumps system investigation, the City of Mount Vernon and the Westchester County Sewage Authority (WCSA) were contacted to arrange discharge of the treated floor drain cleanout and purged ground water to the sanitary sewer system. The City of Mount Vernon controls the sanitary sewer system piping adjacent to the Site and this piping discharges to the WCSA wastewater treatment facility. Permission for the discharge of the wastewater to the sanitary sewer system was granted by the plumbing inspector of the City of Mount Vernon. The WCSA issued a temporary discharge permit with the condition that the wastewater would be sampled to confirm that it met the discharge permit limits. A comparison of the sampling results and discharge limits is presented in Table 2-1. As documented in this table, the treated wastewater met all of the WCSA permit requirements. Prior to discharging the wastewater, the laboratory results were sent to the WCSA for review. The wastewater was discharged to the sanitary sewer system on 22 March 1996; the City of Mount Vernon plumbing inspector was on-site to observe the discharge of the wastewater.

2.2 *QUARTERLY GROUND WATER MONITORING PROGRAM*

2.2.1 *Objectives*

The purpose of the Design Investigation ground water monitoring program was to continue to monitor ground water flow direction and quality at the facility and determine the source of toluene in MW-2A. As part of this investigation, a ground water monitoring well, MW-9, was installed downgradient of Area A on the Bronx River bank. The procedures followed for installation of this well are presented in Section 2.4.2.

2.2.2 *Water Level Measurements*

Water level measurements have been collected at the Site since the start of field activities in 1993. A round of water level measurements is always collected prior to the collection of a round of ground water samples in order to determine the volume of water that must be purged from the well. The procedures used to collect depth to water level measurements are the same as those used during the RI. During the surveying, a permanent mark was placed on the north side of the inner well casing and all measurements are taken from that mark. The water level measurements were obtained with an electronic interface probe accurate to 0.01 feet. The probe is decontaminated between each well with an Alconox and water solution and a tap water rinse. The probe is lowered into the well and the depth to water measurement is recorded in the field notebook along with the date and time of the measurement. The depth to water and water table elevation measurements are contained in Section 3.2.

2.2.3 *Sampling Activities*

Quarterly ground water sampling was initiated in February 1996 in anticipation of the Design Investigation program. Quarterly samples were originally collected from monitoring wells MW-1A, MW-2A, MW-4D, MW-5D, MW-6C, MW-7A and MW-8C. After a comparison of the first quarterly round of data from February 1996 to the historic data collected during the RI, it was decided that additional information was needed on the distribution of toluene in Area A. Consequently, the delineation wells DW-1A, DW-2A and DW-3A were included in the second quarterly sampling round performed in June 1996. ERM has continued to include these wells in the quarterly sampling program. Other additions to the quarterly sampling program were two of the wells installed on the Bronx River Bank, MW-9 and DW-16D, that did not contain LNAPL. (Additional discussion regarding wells DW-16D, DW-17D, DW-18D and DW-19D are presented in Section 2.4.) MW-9 has been included in the quarterly sampling since September 1996, but DW-16D was dropped from the program after the September sampling round because it was found to contain LNAPL.

ERM followed the same procedures that were used during the RI for ground water sampling. Prior to bailing or removing water from the wells, a round of water level measurements was collected so that the aqueous volume of each well could be calculated. A total volume equivalent to between three and five well casings was removed from each well prior to the acquisition of ground water samples.

The purge water was evaluated in the field using a Photo Ionization Detector (PID). If the PID did not detect total VOC concentrations in excess of the background readings then the purge water was applied to the ground surface. If, on the other hand, the PID measured total VOC concentrations that exceeded background readings then the purge water was drummed and characterized for disposal. Purge water was typically drummed for the following wells: MW-2A, DW-2A, MW-6C and MW-4D. Purge water was drummed at MW-2A because of high VOC concentrations and at the remaining wells because they are located within the building and there is no place to discharge the purge water. The drummed purge water has been treated on-site and discharged to the sanitary sewer. The treatment includes pumping the purge water through a disposable cartridge filter and then through a 200 lb. granular activated carbon vessel for removal of organic compounds prior to discharge. After treatment , the water is discharged to the sanitary sewer system. This process has been approved by the Westchester County Department of Environmental Facilities.

After the wells were purged, the ground water samples were collected using dedicated disposable high-density polyethylene bottom-loading bailers suspended by polyethylene cord. The samples were poured from the bailer into laboratory-prepared sample vials and the vials were stored in a cooler on ice. After all of the wells had been sampled, the coolers were picked up by NYTEST Environmental, Inc. (NEI) and analyzed for Target Compound List (TCL) volatile organic parameters by NYSDEC 1991 Analytical Services Protocols (ASP) analytical methods. NEI analyzed all of the soil and ground water samples collected at the Site during the RI.

One duplicate sample, one field blank and one trip blank were also collected during each round of ground water sampling. The duplicate sample was assigned a sample identification number other than that of the monitoring well from which it was collected. The field blank was prepared with distilled, deionized water provided by NEI. The water was poured into a decontaminated bailer and transferred to laboratory-prepared bottles. Both the duplicate sample and the field blank were analyzed for TCL volatile organics. One laboratory prepared trip blank accompanied the glassware and was also analyzed for TCL volatile organics.

Samples collected for laboratory analysis were placed in the appropriate glassware prepared and supplied by NEI. All samples were properly identified, packed in coolers on ice, logged and shipped under full chain of custody procedures.

2.3 *PILOT TEST IN AREA D*

2.3.1 *Objectives*

A technology evaluation was conducted for the former Red Devil facility to identify alternate recovery technologies for Area D LNAPL. As discussed in Section 1.2, recovery of Area D LNAPL using NAPL-only recovery pumps has not been successful due to the high viscosity of this material and its propensity to solidify upon exposure to air. Therefore, modifications to the existing LNAPL recovery system and alternate recovery LNAPL technologies were evaluated.

The following five-step procedure was used to identify and evaluate potential alternate recovery technologies for Area D LNAPL:

Step 1: **Screen LNAPL Recovery Technologies** - review LNAPL recovery technologies, identify potential recovery technologies for Area D LNAPL, and select representative recovery technologies for field testing;

Step 2: **Establish Performance Criteria -** develop testing parameters to evaluated the effectiveness, implementability and relative cost of the LNAPL recovery technologies selected for testing in Step 1;

Step 3: **Conduct Field Testing;**

Step 4: **Evaluate the Field Testing Results -** evaluate the performance of the selected recovery technologies for Area D LNAPL using the performance criteria developed in Step 2; and

Step 5: **Select a Recovery Technology for Area D LNAPL -** identify the most appropriate recovery technology for Area D LNAPL based on effectiveness, implementability and relative cost (if needed, additional testing would also be identified during this final step).

A description of these steps and the results of this evaluation are presented in the following sections: technology screening (Section 2.3.2); field testing procedures (Section 2.3.3); field testing results (Section 3.3); evaluation of field testing results (Section 4.2); and conclusions and recommendations (Section 5.1.3).

2.3.2 *Technology Screening*

LNAPL recovery technologies were first screened: (1) to identify potentially appropriate technologies for Area D LNAPL; and (2) to select representative LNAPL recovery technologies for field testing. Both manual and automated LNAPL recovery technologies were investigated. Although automated recovery systems are generally capable of recovering larger quantities of LNAPL over shorter periods of time, manual recovery systems were evaluated due to the physical characteristics of Area D LNAPL (i.e., high viscosity) and the decreased recharge in Area D recovery wells.

Potential manual LNAPL recovery technologies include: hydrophobic sorbents and hydrophobic collection canisters. Potential automated LNAPL recovery technologies include: NAPL-only recovery pumps; hydrophobic collection canisters with transfer systems; total fluids recovery systems; and hydrophobic belt skimmers.

2.3.2.1 *Manual LNAPL Recovery Technologies*

Manual collection of LNAPL may be accomplished with hydrophobic sorbents or hydrophobic collection canisters. Hydrophobic sorbent systems are comprised of absorbent materials housed in refillable canisters. These canisters are manufactured from a variety of materials. Once the absorbent material has been saturated, the canister is manually removed from the well and the absorbent material is removed from the canister. The absorbent material is then replaced and the canister is placed back into the well. The spent adsorbent is then wrung out to remove the collected LNAPL and the spent absorbent and recovered LNAPL is stored for subsequent disposal.

Hydrophobic collection canisters are essentially bailers constructed with hydrophobic filter buoy systems. This buoy system enables the hydrophobic collection canister to float on the LNAPL/water interface within the well so that the LNAPL can flow through the hydrophobic filter into the canister's collection chamber. The recovered LNAPL is then stored in the sump located at the bottom of the canister until the canister is manually removed from the well. Once removed, the canister can then be drained through a valve located at the bottom of the unit. Canisters capable of storing from 0.25 to 1.75 gallons of LNAPL are readily available depending upon the well diameter.

Manual Technologies Selected for Testing

Both hydrophobic sorbents and hydrophobic collection canisters were selected as potential recovery technologies for Area D LNAPL. Viscosity problems, which are a major concern for automated recovery systems are less of a concern for these manual collection systems.

Field testing was conducted for manual hydrophobic sorbent and manual hydrophobic collection canister LNAPL recovery systems. The 2" SoakEase, manufactured by Enviro LNAPLs, Inc., was selected for hydrophobic sorbent field testing and the PRC-91 Keck Canister, manufactured by Keck Instruments, Inc., was selected for hydrophobic collection canister field testing.

The procedures for the hydrophobic sorbent and hydrophobic collection canister field tests are presented in Sections 2.3.3.1 and 2.3.3.2, respectively. The results of the hydrophobic sorbent and hydrophobic collection canister field tests are presented in Sections 3.3.1 and 3.3.2, respectively.

2.3.2.2 *Potential Automated LNAPL Recovery Technologies*

Automated LNAPL recovery may be accomplished via:

- NAPL-only recovery pumps;

- hydrophobic collection canisters with transfer systems;
- total fluids recovery systems; or
- hydrophobic belt skimmers.

Hydrophobic collection of LNAPL via NAPL-only recovery pumps entails installation of submersible pumps with automatic level sensors (ALS). The ALS enables the pump to automatically move up and down in the well as the floating LNAPL layer moves up and down. Pumps can be electrically or pneumatically powered. Electrically powered NAPL recovery pumps were installed in Areas C and D of the Site. This technology is successfully recovering Area C LNAPL; however, as discussed in Section 1.2, considerable difficulty has been encountered recovering the more viscous Area D LNAPL. Two modifications to the existing NAPL-only recovery pump system were initially identified for investigation: (1) replacement of electric pumps with pneumatic pumps; and (2) in-well addition of solvent to reduce the viscosity of the LNAPL.

Hydrophobic collection canisters with transfer pumps can be used for LNAPL recovery. These canisters, like manual hydrophobic collection canisters, float on the water/LNAPL interface and use an oleophilic/hydrophobic mesh screen to collect only LNAPL. Material collected in these canisters is then transferred to an aboveground storage vessel via a transfer pump or a water displacement transfer system.

Total fluids recovery entails collection of both LNAPL and water from recovery wells using a single pump. Using this technology, LNAPL along with a small amount of water is pumped from the wells. Consequently, this technology also requires fluid separation equipment, and possibly water treatment equipment. Automated total fluids recovery is generally used in areas with thick LNAPL layers where water treatment equipment and discharge locations are available.

In addition to canister collection systems and pump recovery systems, hydrophobic belt skimmers can also be used to collect LNAPL from wells. This technology uses a well head mounted, or mobile cart mounted, continuous hydrophobic belt to recover LNAPL. The hydrophobic belt continuously passes through the LNAPL layer. The LNAPL adheres to the belt and is scraped off of the belt at the well head or at the mobile cart. The recovered LNAPL is then stored in a reservoir and transferred to a larger storage tank or an accompanying drum with a transfer pump.

Automated Technologies Selected for Testing

NAPL-only recovery pumps were not selected for field testing since the ineffectiveness of this technology for recovery of Area D LNAPL had been previously demonstrated. In addition, a decision was made not to pursue the process modifications originally identified for the recovery system (i.e., solvent addition and pneumatic pumps). Bench-scale testing indicated that both linseed oil and canola oil could be used to reduce the viscosity of Area D LNAPL. However, recovery with in-well solvents was eliminated from consideration because of the concerns associated with addition of solvent to a relatively immobile subsurface LNAPL plume. NAPL-only pumping with pneumatic pumps was eliminated from consideration since it was suspected that air discharged into the well by the pneumatic pump would accelerate solidification of the LNAPL within the well.

Hydrophobic collection canisters with transfer pumps were not selected for field testing since the manual version of this recovery technology was being evaluated in the manual system field tests. Total fluids recovery was not selected for field testing since this recovery technology would not induce a change in the flow characteristics of Area D LNAPL and thus would not increase the volume or rate of LNAPL recovery. Furthermore, use of this technology would generate a large volume of recovered material that would require difficult treatment.

Hydrophobic belt skimming was selected for testing since this mechanical NAPL removal technology might be well suited for the high viscosity LNAPL encountered at this site. Prior to conducting the field test, a bench-scale test was conducted to determine whether this technology might be used to recover Area D LNAPL. A 40 ml sample of LNAPL collected from DW-8D, a very high viscosity amber colored LNAPL, was added to a jar containing tap water. A piece of the hydrophobic belt was then dipped into the jar. The floating LNAPL layer was removed and the adhering LNAPL was scraped off of the belt into another container. After repeated dipping and scraping of the belt, the LNAPL layer was reduced to a sheen; and there was no water found in the recovered LNAPL container. Hydrophobic belt skimming was therefore field tested. The field testing procedures for this technology are presented in Section 2.3.3.3 and the field test results for this technology are presented in Section 3.3.3.

2.3.3 *Field Testing Procedures*

This section presents the testing procedures for the:

- manual hydrophobic sorbent LNAPL recovery tests;
- manual LNAPL hydrophobic collection canister tests; and
- hydrophobic belt skimmer tests.

Performance criteria were established to determine the effectiveness, implementability and cost of technologies selected for field testing. The effectiveness, implementability and cost of each of these technologies was then used to evaluate and select the most technically and economically feasible Area D LNAPL recovery technology(ies). Effectiveness, implementability and cost are routinely used to screen technologies in the Superfund and New York State Feasibility Study process. These performance criteria are presented in Table 2-2.

During the field testing, each technology was tested in several wells in order to evaluate performance in a range of viscosity conditions. In general, very high viscosity LNAPL has been observed in DW-8D and DW-13D; high viscosity LNAPL has been observed in DW-10D, DW-4D and DW-1D; and lower viscosity LNAPL has been observed in DW-11D and DW-2D.

It must be noted that the viscosity of LNAPL observed in wells has changed with time. Consequently, since the effectiveness of a technology is dependent upon the viscosity of the LNAPL, the technology will be selected for that viscosity and not necessary for that well. (A change in the viscosity of LNAPL in a well could make recovery via that technology ineffective.)

All field tests were conducted in a manner that addressed the evaluation criteria presented in Table 2-2. The recovery wells were tested using uniform procedures and all data and observations were recorded in a dedicated field notebook.

2.3.3.1 *Manual LNAPL Recovery Using Hydrophobic Sorbents*

A hydrophobic sorbent unit, the 2" SoakEase, manufactured by Enviro LNAPLs, Inc., was field tested in Area D from December 1994 through June 1995 and from October 1995 through March 1996. In total, testing was conducted for 13 months. During this field test, SoakEase socks were deployed in the following seven recovery wells: DW-1D, DW-2D, DW-4D, DW-8D, DW-10D, DW-11D and DW-13D.

The following procedures were implemented during the field test:

1. Before deployment, depth to LNAPL (DTP) and depth to water (DTW) level readings were obtained;

2. a new absorbent sock was placed in the SoakEase cage and deployed at the appropriate depth in order to allow the sock to absorb the LNAPL via a wicking action;

3. during each weekly scheduled IRM O&M field visit, the cage and spent sock were manually removed from the well and the spent sock was placed into a manual ringer to remove the absorbed LNAPL;

4. the LNAPL removed from the absorbent sock was collected in a small pail and transferred to the storage tank;

5. the spent sock was placed in an accumulation drum for off-site disposal;

6. the amount of LNAPL recovered from each well was recorded along with any other observations; and

7. after the well was allowed to equilibrate for a brief period, DTP and DTW readings were recorded, a new sock was inserted into the cage and the cage was re-deployed into the well.

2.3.3.2 *Manual LNAPL Recovery Using Hydrophobic Collection Canisters*

A manual hydrophobic collection canister, the PRC-91 Keck Canister, manufactured by Keck Instruments, Inc., was field tested from December 1994 through June 1995 and from October 1995 through December 1995. In total, this technology was field tested for ten months. During this field test, the Keck Canister was deployed in the following recovery wells: DW-2, DW-8D and DW-11D.

The following procedures were implemented during the field test for this technology:

1. Before deployment, the depth to LNAPL (DTP) and the depth to water (DTW) readings were obtained;

2. the canister was then deployed at an appropriate depth to allow the floating filter buoy to track the changing LNAPL/water interface as LNAPL was recovered;

3. the canister was manually removed from the well during each weekly scheduled IRM O&M field visit and the recovered LNAPL, which collected in the sump at the bottom of the unit, was drained from the bottom of the canister through a valve;

4. the recovered LNAPL was drained into a small pail which was transferred to the storage tank;

5. the amount of LNAPL recovered in each well was recorded along with any other observations; and

6. after the well was allowed to equilibrate for a brief period, DTP and DTW readings were recorded and the canister was re-deployed into the well.

2.3.3.3 *Automated LNAPL Recovery Using Hydrophobic Belt Skimmer*

This section presents the procedures that were implemented during the hydrophobic belt skimmer field test. Field testing was conducted using a cart-mounted Petro-Belt Hydrocarbon Skimmer ("Petro-Belt"). During the four month field test, the Petro-Belt system was tested in the following seven recovery wells: DW-1D, DW-2D, DW-4D, DW-8D, DW-10D, DW-11D and DW-13D.

The following procedures were used during the field test of the belt skimmer:

1. The DTP and DTW in each recovery well was measured using an oil/water interface probe;

2. the cart-mounted Petro-Belt was positioned over the well vault and the position of the motor/pulley housing on the cart was adjusted to ensure that the belt did not make contact with the well casing;

3. the appropriate Petro-Belt length was selected for the recovery well being tested based on the following conditions: the belt must extend into the water table through the entire LNAPL column; and the in-well pulley/weight, which anchors the belt, cannot rest on the bottom of the well;

4. the selected belt with the in-well pulley/weight was installed on the motor-driven pulley and the belt was placed in the well;

5. the tension of the belt scraper was adjusted such that the scrapers would remove LNAPL from the belt, but would not become stuck on the belt due to excessive tension;

6. the Petro-Belt motor was started and the time, LNAPL appearance and initial LNAPL recovery rate were recorded;

7. the amount of LNAPL recovered was recorded at various time intervals, as well as changes in LNAPL appearance, mechanical problems, and other appropriate observations;

8. LNAPL recovery was discontinued by turning off the Petro-Belt motor (Test run times ranged from 30 and 310 minutes);

9. the total amount of LNAPL recovered was recorded and the cart was moved away from the recovery well so that the DTP and DTW could be measured again;

10. the well was closed and the Petro-Belt system parts were decontaminated and cleaned as necessary; and

11. the condition of the belt as well as the condition of the other Petro-Belt system components was recorded.

2.4 *BRONX RIVER BANK INVESTIGATION*

2.4.1 *Objectives*

The overall objective of the Bronx River bank investigation was to determine whether or not a discrete layer of LNAPL is present under the banks of the Bronx River and if so, to determine the characteristics and the feasibility of recovering LNAPL from wells located on the Bronx River bank.

This investigation entailed: (1) installation of four LNAPL delineation wells on the bank of the Bronx River downgradient of the Site; (2) installation of one monitoring well downgradient of Area A; (3) characterization of LNAPL that may be present in the delineation wells; (4) LNAPL baildown tests in these wells to evaluate LNAPL recharge characteristics; and (5) pilot testing to evaluate technologies for LNAPL recovery. The following sections contain a description of these activities.

2.4.2 *Well Installation*

As part of the Design Investigation, five wells (i.e., four LNAPL delineation wells and one ground water monitoring well) were installed between 5 September and 13 September 1996 along the Bronx River bank on property owned by Westchester County. The four LNAPL delineation wells were installed downgradient of Areas C and D. The objective of installation of these wells was to determine whether or not a discrete layer of LNAPL is present under the banks of the Bronx River and if so, to determine the characteristics and the feasibility of recovering LNAPL from these wells.

The fifth well was installed downgradient of Area A as a ground water quality monitoring well. This well was installed to determine whether toluene detected in Area A monitoring wells had migrated off-site towards the Bronx River.

The wells were installed on the river bank between Oak Street and Mount Vernon Avenue. Prior to the mobilization of the drilling equipment to the work area, a roadway was cleared and graded by EnviroClean Northeast in accordance with the Tree Plan approved by Westchester County. No road cover, i.e. asphalt, was applied to the road. The roadway was partially located on Metro-North Railroad Company (Metro-North) property. Access agreements were executed with both Metro-North and Westchester County prior to the initiation of the well installation activities. Now that the well installation activities have been completed, the road will be allowed to return to its natural condition.

The Bronx River bank area was inaccessible to the drill rig and equipment, therefore, a crane was used during the mobilization stage to lift the rig, equipment and materials over the Mount Vernon Avenue bridge and onto the cleared path on the river bank. Prior to mobilizing the crane and drilling equipment to the work area, the Mount Vernon Department of Public Works (DPW) and Police Department were notified. The crane operator provided a flag person to direct traffic while the crane was on Mt. Vernon Avenue. The transfer of the rig and equipment by the crane took approximately three hours. The crane was remobilized on 13

September 1997 to remove the rig and equipment. The demobilization took approximately four hours to complete.

The wells were installed by Aquifer Drilling and Testing, Inc. (ADT) using a down hole air hammer to drive six-inch surface casing. All of the wells installed on the river bank are four inches in diameter. The screens in the four LNAPL delineation (i.e., DW-16, DW-17, DW-18 and DW-19) are 10 feet long and straddle the water table with approximately five feet of screen below the water table and five feet above the water table. The ground water monitoring well, MW-9, has five feet of screen which is set approximately two feet below the water table to ensure that LNAPL will not enter the screen zone area. All of the monitoring/delineation wells were constructed of schedule 40 PVC casing and 20-slot PVC screen. All joints were threaded; no screwed or glued couplings were used. After the screen and riser pipe were set in the borehole, a clean filter pack was placed in the annulus and extended to approximately two feet above the top of the screen. A two-foot bentonite pellet layer was placed above the sand pack and the remaining annular space was tremie grouted with a Portland cement/high grade bentonite mixture. All grouting material and drilling fluids were mixed with potable water. All of the wells were finished with flush mount protective casing with a locking surface manhole cover. The boring logs for these five wells are included as Appendix A.

The subsurface conditions were similar at all five of the monitoring/delineation well locations. The top four to five feet was brown unconsolidated fine and medium sand with some gravel. From five feet to approximately twelve feet below grade heavy cobbles and boulders were encountered. At the water table, at approximately twelve feet below grade, the formation changed to fine sands and silt with occasional gravel, river bed material.

Since air rotary was used as the drilling method to install the wells, an insignificant amount of drill cuttings were generated during the drilling activities. Therefore, the drill cuttings that were generated during installation of the wells were applied to the ground surface.

Since MW-9 and DW-16 did not contain LNAPL, they were developed after installation; the remainder of the wells were not developed. The development water was evaluated in the field using a PID. The total volatile organic concentrations did not exceed background and the development water was applied to the ground surface in close proximity to each well.

All drilling equipment was properly decontaminated prior to and after each use. Prior to drilling, all drilling equipment used for surface sampling and the construction of wells was cleaned of all foreign matter and sanitized with a high pressure steam cleaner.

Once in the work area on the Bronx River bank, all drill rods and tools were steamed cleaned between soil borings, and well casing and screen materials were steam cleaned prior to their installation. After steam cleaning, all decontaminated equipment was stored on lined two inch by six inch boards so that the equipment was above ground. After decontamination, well screens were handled with clean gloves.

Prior to leaving the Bronx River bank, the drilling rig and all sampling equipment utilized during the field activities were decontaminated. All decontamination rinseate generated during steam cleaning was allowed to percolate back into the River bank.

2.4.3 *LNAPL Characterization*

The objective of LNAPL characterization was to determine the physical and chemical characteristics of LNAPL present on the water table beneath the Bronx River bank. Chemical analysis provides information regarding the presence or absence of particular constituents and therefore can be used to evaluate the relative risks and hazards posed by the LNAPL. The physical analysis, which includes determination of the density and viscosity of the LNAPL, can be used to identify the source of the LNAPL, its flow properties both within the formation and after extraction from the formation and the mobility of this floating material.

Individual grab samples were collected from delineation wells DW-17D, DW-18D and DW-19D. In addition, a composite sample was also prepared using LNAPL from each of these three wells. A sample was not collected from DW-16D since no appreciable amount of LNAPL was observed in this delineation well during the pilot test. The composite sample was collected to: (1) evaluate the physical and chemical properties of the combined LNAPL stream that would be recovered from the delineation wells; and (2) determine the waste classification for this recovered LNAPL.

The grab samples and aliquots for the composite sample were collected using dedicated disposable bailers and sent to two laboratories under a continuous chain of custody. The physical and total chemical analysis was conducted by Leberco-Celcius Testing Inc. located in Hawthorne, New Jersey. The Toxicity Characteristic Leaching Procedure (TCLP) chemical analysis was conducted by EcoTest Laboratories Inc. located in North Babylon, New York.

In accordance with the workplan, the samples were analyzed for: GC profile, GC/MS composition, TCLP volatiles, specific gravity, viscosity, percent ash, pH and solubility in water. Samples were also analyzed for percent water and percent solids. These results of these analysis are presented and discussed in Section 3.4.1. Visual observations made during collection of the LNAPL samples suggested that the riverbank LNAPL resembled the less viscous Area C LNAPL.

2.4.4 *LNAPL Thickness Measurements*

LNAPL thickness measurements were collected to determine the distribution of LNAPL located beneath the Bronx River bank and to estimate the extent of LNAPL in this area.

Immediately after installation, a round of LNAPL thickness measurements was collected in the river bank delineation wells. LNAPL thickness measurements were collected on a monthly basis thereafter. The LNAPL measurement schedule became somewhat less regular when access to the wells was limited due to construction on the Mount Vernon Avenue bridge. LNAPL thickness measurements were collected using an optical interface probe. The interface probe was wiped clean between each well.

An evaluation of the LNAPL thickness measurements and the distribution of LNAPL at the Site are discussed in Section 3.4.2.

2.4.5 *Baildown Tests*

The objective of the baildown testing was to evaluate the LNAPL recharge characteristics of the newly installed NAPL recovery wells. On 16 October 1996, LNAPL baildown tests were conducted on river bank wells DW-17, DW-18 and DW-19. At the time of the baildown testing, these were the only wells that contained LNAPL, it was not until 31 October 1996 that LNAPL was identified in DW-16.

The tests were performed by manually bailing out the LNAPL until no additional LNAPL could be recovered. After the LNAPL was removed, LNAPL thickness measurements were collected at appropriate time intervals using an optical interface probe until 95% of the original LNAPL thickness was recovered or until the LNAPL thickness stabilized.

The raw data from the baildown test was tabulated and graphed and is discussed in Section 3.4.3. Copies of the raw data are included as Appendix B.

2.4.6 *Pilot Study Activities*

The goal of this evaluation was to enhance the overall recovery of off-site LNAPL by identifying a technically appropriate and implementable: (1) in-well LNAPL recovery method; and (2) LNAPL pumping system that could be used to transfer recovered LNAPL from the well head to a storage tank.

The following five-step procedure was used to identify and evaluate potential recovery technologies for riverbank LNAPL:

Step 1: **Screen LNAPL Recovery Technologies** - review LNAPL recovery technologies, identify potential recovery technologies for riverbank LNAPL, and select representative recovery technologies for field testing;

Step 2: **Establish Performance Criteria** - develop testing parameters to evaluate the effectiveness, implementability and relative cost of the LNAPL recovery technologies selected for testing in Step 1;

Step 3: **Conduct Field Testing;**

Step 4: **Evaluate the Field Testing Results** - evaluate the performance of the selected recovery technologies for riverbank LNAPL using the performance criteria developed in Step 2; and

Step 5: **Select a Recovery Technology for Riverbank LNAPL** - identify the most appropriate recovery technology for riverbank LNAPL.

Following identification of the selected technology, remedial action alternatives for the recovery of LNAPL located beneath the Bronx River bank were then developed.

A description of the above technology evaluation steps and the results of this evaluation are presented in the following sections: technology screening (Section 2.4.6.1); field testing procedures (Section 2.4.6.2); field testing results (Section 3.4.3); and evaluation of recovery alternatives for LNAPL beneath the bank of the Bronx River (Section 4.2).

2.4.6.1 *Technology Screening*

LNAPL recovery technologies were first screened: (1) to identify potentially appropriate technologies for riverbank LNAPL; and (2) to select representative LNAPL recovery technologies for field testing. As discussed in Section 2.3.2, several manual and automated recovery technologies are available for LNAPL. The manual technologies include: hydrophobic sorbents and hydrophobic collection. The automated NAPL technologies include: NAPL-only recovery pumps, hydrophobic/ oleophilic collection canisters with transfer systems, total fluids recovery systems and hydrophobic belt skimmers. Several of these technologies (i.e., NAPL-only pumps, hydrophobic/oleophilic canisters, belt skimmers and hydrophobic sorbents) have been tested and used in the on-site Area C and Area D recovery wells with various degrees of success. A review of the on-site performance of these systems was therefore taken into consideration during this screening process.

As previously discussed, visual observation of the samples of LNAPL from beneath the banks of the Bronx River suggests that this material is similar to the less viscous Area C LNAPL. Consequently, it was assumed that the technology being used to recover Area C LNAPL, NAPL-only recovery, would most likely be effective for the LNAPL located beneath the banks of the Bronx River.

When implementable, automated NAPL-only recovery is generally the most cost effective technology for LNAPL recovery. The Spillbuster Product Terminator™ system, an upgrade of the Spillbuster® system currently being used in Area C, was therefore selected for pilot testing in the riverbank wells. Because there was a high probability that NAPL-only recovery would be effective for LNAPL located beneath the Bronx River

OK

bank, manual NAPL recovery technologies (i.e., hydrophobic sorbents and hydrophobic collection canisters) and the remaining automated NAPL recovery technologies (i.e., hydrophobic/oleophilic collection canisters with transfer systems, total fluids recovery systems and hydrophobic belt skimmers) were not selected for pilot testing.

The Product Terminator™ system contains a probe which houses a pump and a non-contact sensor to detect the LNAPL/water interface. This non-contact sensor is very resistant to fouling, compared to other types of sensors, such as conductive and float sensors. The Product Terminator™ system also includes an automatic level seeker (ALS), which rests at the top of the wellhead. The ALS consists of a motorized reel which raises and lowers the pump probe to follow the LNAPL layer. In order to avoid tangling, the power line to the pump and the discharge tubing are in the same conduit on the ALS reel.

2.4.6.2 *Field Testing Procedures*

Performance criteria were established to determine the effectiveness, implementability and cost of the technology selected for field testing at the bank of the Bronx River. Effectiveness, implementability and cost are routinely used to screen technologies in the Superfund and New York State Feasibility Study process. These performance criteria, which have also been identified for evaluation of the Area D LNAPL recovery technologies, are presented in Table 2-3.

The performance criteria were used to develop a set of field testing procedures that would adequately answer all of the above questions.. At the Bronx River bank, the Product Terminator™ system was field tested on November 7, 8 and 22, 1996. As previously discussed, NAPL has been observed in riverbank wells DW-16D, DW-17D, DW-18D and DW-19D. The Product Terminator™ system was tested in three of these wells (i.e., DW-17D, DW-18D and DW-19D). Because the LNAPL layer observed in DW-16D at the time of the field testing was significantly thinner than the other three wells, the effectiveness of the recovery technology in DW-16D was not evaluated during these field activities.

The procedures that were followed for each day for testing are described below:

Every Day:

1. before deployment of the Product Terminator™ system, depth to LNAPL (DTP) and depth to water (DTW) level readings were obtained from all of the wells;
2. at routine intervals during system deployment, the following parameters were recorded:
   - cumulative volume of LNAPL recovered;
   - pump cycle times;
   - duration of test period;
   - pumping rate;
   - DTP; and
   - DTW;
3. during the pilot testing, the concentration of volatile organic compounds (VOCs) was routinely measured using a photoionization detector (PID) - readings were typically obtained in the vicinity of the recovered LNAPL and in the open well casings; and
4. at the end of the day, the final DTP and DTW readings were measured in each of the wells.

Day 1:

1. the Product Terminator™ system was deployed in wells DW-17D, DW-18D and DW-19D for short-term testing.

Day 2:

1. the Product Terminator™ system was deployed in DW-17D for a two hour pump test;
2. a ball valve was installed on the pump discharge at monitoring well DW-17D so that a back pressure on the pump could be simulated; and
3. the head against which the pump at DW-17D could effectively operate was determined by applying back pressure to the pump.

Day 3:

1. the Product Terminator™ system was deployed in DW-17D for a five hour pump test.

The results of the pilot test are presented in Section 3.4.3.

3.0 RESULTS

3.1 FLOOR DRAIN AND SUMP CLEANOUT

As discussed in Section 2.1, the floor drain and sump systems were inspected, cleaned and mapped during the Design Investigation. This section provides a detailed discussion of the conditions encountered at each floor drain, sump and storm drain that were cleaned and details the wastewater disposal. As was discussed in the RI report, the floor drain and sump systems are located in the facility basement Areas C and D. The floor drain and sump system in each of these areas is discussed individually since no connection between the systems in these two areas was encountered. The layout of the floor drain and sump system is presented as Figure 3-1.

3.1.1 Area C

The first area that was investigated was the southern section of Area C. There are three floor drains (i.e., FD-C1, FD-C2 and FD-C3) and one sump (i.e., S-C1) located in this area. Each of these structures had earthen bottoms. The three floor drains are connected to a main pipe which flows through the sump as shown in Figure 3-1. The pipe is exposed within the sump and a hole was noted in the top of the pipe. This pipe exits the sump and connects to the sanitary sewer line just before sanitary riser #3.

During the investigation, it was observed that the pipes in this area were covered with layers of hardened sediment. The exterior layer of sediment within the pipe was removed with a pipe scouring device and the pipe was then cleaned with a water jet. In addition to piping which connected the floor drains and the sump, a pipe that flowed into FD-C1 from the south was also observed. As shown in Figure 3-1, this pipe terminated in Area B and no other floor drains, sumps or piping were discovered along this pipe or at its terminus.

A pipe cleanout (CO-C1) located near the sanitary trap was inspected and found to end several feet beyond the wall which separates Areas C and B. This pipe was cleaned and no further action was warranted.

A pipe cleanout (CO-C2) was also discovered in the center hallway in Area C. This cleanout was partially embedded in the concrete floor. The concrete was chipped away and the cleanout plug was removed. The cleanout had been connected to a 2-inch diameter pipe with a tee connection to two, 1-inch diameter pipes approximately three feet away. The two, 1-inch diameter pipes then terminated approximately six inches from the tee connection. This tee appeared to be a connection for a pumping network or distribution system. The 2-inch diameter pipe and the two, 1-inch diameter pipes were removed. The floor was then restored to grade with concrete. No other piping was encountered in this area.

Two floor drains, identified as FD-C4 and FD-C5, were encountered in Area C just inside the alleyway garage door as shown in Figure 3-1. These two floor drains, which had concrete bottoms, were connected to one another as shown. The pipe which exited from FD-C5 (identified as Pipe F) was connected to the storm drain catch basin just outside the alleyway garage door. Both of these drains and their associated piping were cleaned with the water jet. As discussed below in the storm water subsection, this storm water catch basin was also cleaned.

After the floor drain and sump system in Area C was cleaned and mapped, the four earthen-bottom structures (i.e., FD-C1, FD-C2, FD-C3 and S-C1) located in Area C were lined with concrete. Concrete was installed in these structures to cover any earthen portions and to prevent any future infiltration of liquids from these structures into subsurface soil. However, it is unlikely that any liquids would be generated in this area since it is used as a public self storage area.

3.1.2 *Area D*

In total, three sumps and one floor drain were observed in Area D. One sump (S-D1) was located in the southeast corner of Area D and two sumps (S-D2 and S-D3) and one floor drain (FD-D1) were located in the former garage/storage area of Area D.

S-D1 contained several inches of loose sediment and contained one pipe that exited the east sump wall. Upon removal of the loose sediment, it was determined that the sump had an earthen bottom. Due to storm water drainage problems, there is occasional accumulation of storm water in this area. The storm water leaks in from the ceiling along the wall that is located beneath the North West Street sidewalk. The sump bottom needs to remain permeable to allow storm water infiltration during severe rain events. Since this portion of Area D is currently used as a public self storage area, it is unlikely that any liquids, other than storm water, will enter into this sump. Therefore, the bottom of this sump was not sealed.

The pipe exiting this sump led to a tee connection. At the tee, one branch pipe traveled north approximately 5 feet and ended at a surface cleanout access port (CO-D1). The other branch pipe of the tee traveled south and terminated approximately 60 feet south of the sump as shown in Figure 3-

1 in Area C. No other floor penetrations were encountered near the end of this pipe. All of these pipes were traced and cleaned.

Two large sumps (S-D2 and S-D3) and a floor drain (FD-D1) were investigated in the former garage/storage area of Area D as shown in Figure 3-1. The northern-most sump (S-D2) had an earthen bottom and no pipes were observed to enter or exit the sump. The loose soil was removed from the sump. This structure receives storm water runoff from under the warehouse garage door during severe rain events. Therefore, to prevent flooding inside the warehouse, the sump bottom was not sealed with concrete. Furthermore, the Area D warehouse is currently used to store construction materials, such as drywall, steel studs and insulation materials. Therefore, discharge of hazardous materials through the sump to the soil beneath this area is not anticipated. No further action was taken in this sump.

The southeast sump (S-D3) appeared to be an inactive dry well. This presumption was based on the contruction of the entry to this structure (i.e., a ring system) and since large rocks and loose gravel were observed within the structure. A 4-inch diameter pipe exited the sump in a north easterly direction. This pipe was traced and cleaned with the water jet. Large amounts of small rocks, gravel and sediment were removed from this pipe and it is suspected that the pipe may connect to another inactive drywell approximately 10 feet away. It was not possible to the access the connecting structure. Therefore, this structure is not shown in Figure 3-1. No further action was taken at this structure.

The floor drain, FD-D1, located in the northeast section of the former garage/storage area contained several inches of loose sediment. During the cleanout, a pipe was observed in the sump and its path was subsequently traced as shown in Figure 3-1. The pipe exits the sump, runs parallel to Oak Street and then turns south and runs parallel to North West Street. This pipe was severely clogged with sediment. The pipe was cleaned and found to terminate approximately 20 feet from the floor drain in the general vicinity of the suspected inactive dry well. Upon cleaning, it was determined that the floor drain had an earthen bottom. After the floor drain and its associated piping were cleaned, the floor drain was lined with concrete. Concrete was used to line the bottom of this structure to cover any earthen portions and to prevent infiltration of liquids from these structures into subsurface soil. However, because this area is not used for liquid storage, it is unlikely that liquids will enter into this floor drain.

3.1.3 *Storm Drains*

The storm drain catch basin located just south of the sidewalk along Oak Street (SD-CB1) contained approximately two to three feet of sediment. This sediment was dug out with shovels by the NWMC field personnel. Once the sediments were removed, the side walls of the catch basin were cleaned with the water jet and the loose sediments and water were captured with a vacuum truck. The pipe entering the catch basin from the south was also cleaned with the water jet. As shown in Figure 3-1, this pipe (Pipe E) connects catch basin SD-CB1 with the catch basin located at the south end of the alleyway (SD-CB2) immediately outside the garage door. All wastewater generated during the pipe and catch basin cleaning was collected by the vacuum truck at the Oak Street catch basin (SD-CB1) to prevent discharge, via the pipe leaving the catch basin, to the Bronx River.

SD-CB2 also contained sediments which were subsequently removed by NWMC. A total of six pipes enter/exit SD-CB2, as illustrated in Figure 3-1. Two pipes (Pipes A and B) penetrate the west end of the basin. Pipe A conveys water from the existing roof drain storm water system to the storm water header from the roof drains just inside the building in Area C as shown in Figure 3-1. Pipe B is an old storm water roof drain which terminates approximately six feet to the west of SD-CB2 on the adjacent railroad embankment. No connecting structure was located at the pipe terminus for Pipe B.

The third pipe (Pipe C) exits from the east end of SD-CB2 and connects to an underground storm water tank. Pipe D appears to exit from this tank and connects to the north wall of the catch basin. It is suspected that this storm water tank provided storm water overflow capacity to prevent the alleyway from flooding. Pipe D is located just below Pipe E, which connects to the Oak Street catch basin as discussed above.

Pipe F enters the south side of the SD-CB2 connecting the two floor drains, FD-C4 and FD-C5, from within the building in Area C. All five of these pipes were traced and then cleaned with the water jet.

3.2 *GROUND WATER MONITORING PROGRAM*

3.2.1 *Ground Water Flow Direction*

A summary of the water level measurements collected at the Site since 1993 is shown in Table 3-1. As of the date of this report, eight rounds of measurements have been collected from wells at the Site. Data from the 26 September 1996 and 15 March 1997 monitoring events were used to prepare water elevation contour maps which are shown in Figures 3-2 and 3-3. These two dates were chosen because the ground water quality data from September 1996 and March 1997 were significantly different. The highest levels of volatiles found in Area A to-date were detected in September 1996 and the samples collected during the March 1997 sampling event contained significantly lower concentrations of volatiles.

As shown in Figures 3-2 and 3-3, the general direction of ground water flow at the Site is to the northwest toward the Bronx River. This direction is similar to that mapped during the RI. A comparison of the ground water flow direction in Figures 3-2 and 3-3 does show a minor shift in the direction of ground water flow. In September 1996 (Figure 3-3), ground water appears to be flowing northwest from the Site towards the Bronx River. In March 1997 (Figure 3-2), ground water flow shows a little more variability, particularly in the vicinity of DW-3A, and is flowing in a more westerly direction. In March of 1997, the water level elevation in DW-3A was 0.2 to 0.4 ft higher than in the adjacent wells. In contrast, in September of 1996, the water level elevation in DW-3A was virtually the same as in the adjacent wells. There does appear to be some change in the water table elevation in DW-3A, which is thought to be close to the source of the toluene, between the March 1996 and September 1997 measurements. However, it is difficult to use this data to explain the difference in the volatile organic concentrations between these two rounds of sampling.

Please note that in Figure 3-2, the 15 March 1997 water level elevation for MW-6C was not used because of the anomalous nature of the measurement.

3.2.2 *Ground Water Quality Data*

Two rounds of ground water samples were collected from the monitoring wells at the facility during the RI in 1993. One additional round of samples was collected in June 1995 prior to start up of the quarterly monitoring program in February 1996. A summary of the data is presented in Table 3-2 and a map showing the distribution of volatile compounds is shown in Figure 3-4.

The data collected during these rounds of sampling indicate that dissolved constituents have been found in the ground water at the Site. The major compounds of concern are benzene, toluene, ethylbenzene and xylene (BTEX). The highest concentrations of BTEX, and in particular toluene, have been found in Area A. Comparatively low levels of chlorinated organic compounds have also been identified at the Site. The highest concentrations of chlorinated compounds are generally found in Area D.

In general, the ground water quality data in Areas C and D have been consistent over time. A different trend has been observed in Area A, where toluene concentrations have fluctuated in the same well by two or more orders of magnitude over a three month period. At one time it was suspected that the source of toluene was upgradient of the Site. However, the additional monitoring data suggests that the source of toluene is on-site and is most likely a pocket of residual toluene in the soil in the vicinity of delineation wells DW-1A and DW-3A. However, the cause of the significant fluctuations in toluene concentrations has not been identified. The following sections contain a description of the results of each round of ground water sampling.

3.2.2.1 *March 1997 Round of Sampling*

The most recent round of ground water data was collected on 15 and 20 March 1997. This is the eighth data set collected from wells MW-1A, MW-2A, MW-4D, MW-5D, MW-6C, MW-7A and MW-8D. The samples collected from the wells in Areas C and D show a similar set of compounds and the concentrations are generally consistent, and in several cases show a declining trend, with the historical data. In Area C, low concentrations of chloroform and tetrachloroethene (PCE) are the predominant volatiles. In Area D, ethylbenzene; xylenes; 1,1-Dichloroethane (1,1-DCA); and chloroethane are the primary compounds of concern.

However, the data collected in Area A during this sampling round is significantly different from the previous rounds (Table 3-2). The concentrations of BTEX compounds in Area A have dropped by at least two orders of magnitude over the previous two sampling rounds. The highest concentration in the March sampling round was found in MW-2A where the BTEX concentration totaled 582 μg/l. In contrast, the BTEX concentration in December 1996 was 61,124 μg/l. The concentrations of BTEX in well DW-1A and DW-3A in the court yard were 168 μg/l and 72 μg/l, respectively, in the March sampling round. In prior rounds, the BTEX concentrations in these wells ranged from a high of 20,046 ug/l in DW-1A to 100,098 ug/l in DW-3A. The validation report and copies of the validated Form Is are included as Appendix C.

A review of the data in Table 3-2 shows that the majority of the fluctuations in the BTEX concentrations in Area A are related to the toluene concentrations. It is believed that the soil in the courtyard area contains some residual levels of toluene somewhere in the vicinity of DW-

1A and DW-3A. During the RI it was noted that a hydropunch soil sample collected from boring HP-6 (shown in Figure 3-4) contained 2,200 mg/kg of toluene at a depth of 16 to 18 feet below ground surface. HP-6 was located downgradient of DW-1A, and adjacent to a former underground storage tank that was known to contain toluene.

Figures 3-5 through 3-7 depict BTEX concentration versus water level elevation in MW-2A, DW-1A and DW-3A. During periods of high BTEX concentrations in DW-1A and DW-3A the water table is low, conversely during periods of low BTEX concentrations the water table is high. There appears to be a more straight forward correlation in MW-2A between BTEX concentration and the water level elevation, BTEX concentrations are high when the water table is high. The control on the trends in DW-1A and DW-3A is not well understood. However, it seems likely that there is a connection between the depth of the source area and its proximity to the water table. The fact that the toluene concentrations in DW-1A and DW-3A respond differently to water table fluctuations than toluene concentrations in MW-2A may be related to the fact that DW-1A and DW-3A are closer to the source area. Or, it may be related to the fact that the delineation wells are constructed differently than the monitoring wells. MW-2A tends to show high BTEX concentrations one sampling round after the courtyard wells, which seems to confirm that the residual source must be in the courtyard and closer to DW-1A and DW-3A.

Based on the data collected in MW-9 to date, the BTEX dissipates prior to reaching the banks of the Bronx River. The VOC concentrations in MW-9, have been essentially non-detect during three rounds of sampling.

The data from MW-6C, the downgradient well in Area C, continued to show trace levels of chlorinated compounds and no BTEX. A review of the data collected in this well since 1993 shows that the concentrations of BTEX have decreased from 249 µg/l to non-detect. The concentrations of chlorinated compounds have fluctuated between 5 and 24 µg/l and, because they are relatively low to begin with, do not show as clear a decrease over time.

In contrast to Area C, both BTEX constituents and chlorinated compounds have been found in the downgradient well in Area D. The concentrations of BTEX in Area D wells are typically lower than those found in Area A. In addition, the BTEX constituents in Area D are primarily ethylbenzene and xylenes whereas the primary BTEX constituent in Area A is toluene. The concentrations of chlorinated compounds is higher in Area D than in Area A. The types and concentrations of the chlorinated compounds found in the March samples in the two downgradient wells in Area are consistent with the historical data

The distribution of BTEX compounds in the ground water in March 1997 is shown in Figure 3-8. The BTEX iso-concentration map shows that there are two distinct areas of dissolved BTEX, one in Area A and one in Area D. The concentrations of BTEX in the two plumes are fairly similar.

3.2.2.2 *Historical Trends*

Round 1: 2 June 1993

The first round of ground water samples was collected on 2 June 1993 as part of the RI field activities. BTEX concentrations were highest in Area D monitoring wells and ranged from non-detect in MW-8C to 1,380 µg/l in MW-5D. BTEX concentrations in Areas A and C were comparable: 249 µg/l of BTEX was present in MW-6C and 205 µg/l was detected in MW-

2A. The BTEX concentrations in MW-1A and MW-7A were non-detect. Chlorinated compounds were also detected in Areas A, C and D. The total concentration of chlorinated compounds was 367 µg/l in MW-2A, 24 µg/l in MW-6C, 200 µg/l in MW-5D and 4 µg/l in MW-4D.

In order to completely characterize ground water quality during the RI, the samples were also analyzed for semi-volatile organics and phenols during the first round of sampling. Minor concentrations of polynuclear aromatic hydrocarbons (PAHs) were detected in the wells located in Areas C and D. Specifically, MW-6C contained 7 µg/l, MW-4D contained 4 µg/l and MW-5D contained 28 µg/l. Phenols were also detected in several wells, ranging in concentration from non-detect in MW-6C to 218 µg/l in MW-5D.

Round 2: 21 September 1993

The second round of ground water samples was also collected as part of the RI field activities, on 21 September 1993. Although the concentrations of chlorinated compounds, PAHs, and phenols were essentially the same as in the first rounds, the BTEX concentrations were significantly different from the first round. The concentrations of toluene were several orders of magnitude higher in the Area A wells than they had been in the first round of sampling. The concentrations in upgradient well MW-7A increased from non-detect in the first round to 16,013 µg/l in the second round. In MW-1A the BTEX concentrations increased from non-detect in the first round to 96,000 µg/l in the second round. In downgradient well MW-2A, 10,147 µg/l of BTEX compounds were found in the second round while only 205 µg/l was found in the first round. The BTEX concentrations in the Areas C and D wells were consistent with those found in the first round.

The evaluation of the first two rounds of analytical data indicated that the compounds of concern at the Site were BTEX and chlorinated compounds. Therefore, a decision was made to eliminate phenols and semi-volatiles from future rounds of sampling.

Round 3: 21 June 1995

The third sampling round was performed on 21 June 1995. BTEX concentrations ranged from non-detect in wells MW-1A, MW-6C, MW-7A and MW-8C to 18,050 µg/l in MW-2A. The highest BTEX concentrations were again found in Area A. The BTEX concentration in MW-2A was consistent with the previous round of sampling, while the BTEX concentrations in wells MW-1A and MW-7A decreased significantly. The BTEX concentrations in the remaining wells are consistent with the first and second sampling rounds.

Round 4: 06 February 1996

The fourth round of ground water samples represents the start of the quarterly monitoring program. Ground water samples were collected on 6 February 1996. BTEX concentrations ranged from non-detect in wells MW-1A and MW-8C to 38,109 µg/l in MW-2A. No BTEX constituents were detected in the ground water samples collected from MW-1A and MW-8C, which is consistent with the results from the third sampling round. BTEX concentrations in MW-2A were slightly higher than in the third sampling round. Trace concentrations of BTEX were also detected in wells MW-6C and MW-7A, both wells contained a concentration of 2µg/l. BTEX concentrations increased slightly between the third and fourth sampling rounds in wells MW-4D and MW-5D in Area D. MW-4D contained 80 µg/l of BTEX in Round 4 and only 6 µg/l BTEX in the third sampling round. MW-5D contained 1,084 µg/l of BTEX in Round 4 and 1,033 µg/l BTEX in the third sampling round. Low concentrations of chlorinated compounds were also detected in downgradient wells MW-6C and MW-5D.

Round 5: 16 June 1996

The fifth ground water sampling event was on 16 June 1996 and samples were collected from the same monitoring wells sampled in the previous rounds: MW-1A, MW-2A, MW-4D, MW-5D, MW-6C, MW-7A and MW-8C. In addition, as a result of data collected during prior rounds of sampling that indicated the continuing presence of toluene in downgradient well MW-2A, samples were also collected from three delineation wells in Areas A and B (DW-1A, DW-2A and DW-3A). With the exception of the data from MW-2A, the data from this round of ground water sampling are consistent with previous data collected at the site. In general, low levels of chlorinated compounds and several aromatic compounds were detected in the wells on and downgradient of the Site. The highest concentrations of BTEX are found in Area A and the highest concentrations of chlorinated compounds are found in Area D.

One well in which a significant change in concentrations was noted was MW-2A. The BTEX concentrations in this well showed a significant decrease. In the previous several rounds of sampling, between 10,000 and 38,000 µg/l of BTEX had been found in this well. In the fifth round of sampling, only 240 µg/l of BTEX was found. Interestingly, this concentration is similar to that collected during the first round of sampling in June 1993.

A total of 19,328 μg/l of BTEX was also detected in DW-1A. A significantly lower concentration of BTEX, 1,338 μg/l, was detected in DW-3A, which is located on the west side of DW-1A. The concentration of BTEX in DW-2A, on the east side of DW-1A was non-detectable.

Round 6: 26 September 1996

The sixth round of ground water samples was collected on 26 September 1996 from the same monitoring wells sampled in the previous rounds. In addition, two of the five newly installed Bronx River Bank wells (MW-9 and DW-16) were also sampled. DW-16 was sampled because it did not contain any NAPL at the time of the sampling activities. The remaining three Bronx River Bank wells contained NAPL, and consequently were not sampled.

The data from Area A are generally consistent with the data collected in the past. The BTEX concentrations are non-detect on the upgradient side of the Area A, highest in DW-1A and DW-3A in the court yard and somewhat lower in MW-2A. There were two notable features in this round of sampling data: the concentration of BTEX in DW-3A was the highest noted to date and the concentration of BTEX in MW-9 on the Bronx River bank was 2 μg/l. These data strongly suggest that the source of the BTEX is in the vicinity of DW-3A. More importantly, they also show that only trace concentrations of BTEX are entering the Bronx River. ?

The data from MW-6 C shows the presence of low concentrations of chlorinated compounds and no BTEX. The concentrations of volatiles in Area D wells are significantly lower than those found in Area A. The data from all three wells in Area D: MW-8C, MW-4D and MW-5D were consistent with the historical data and show low levels of volatiles in MW-8C and MW-4D and somewhat higher concentrations in MW-5D.

Figure 3-9 shows the distribution of BTEX compounds in ground water collected during this sixth sampling round. The BTEX iso-concentration map shows two distinct areas of dissolved BTEX, in Areas A and D. The BTEX concentrations in the vicinity of Area A are much higher than those in Area D. This distribution is quite different from that shown in Figure 3-8, which showed that the BTEX concentrations in Areas A and D were of similar.

Round 7: 09 and 10 December 1996

The seventh round of samples was collected on 09 and 10 December 1996. Samples were collected from the same monitoring wells sampled in the previous round, with the exception of DW-16. LNAPL was identified on DW-16 in late October 1996, and the well was dropped from the sampling program.

With the exception of the data from MW-2A and DW-3A, these data are consistent with the last several rounds of data collected at the Site. The data from Area A shows that the BTEX constituents have migrated downgradient since the last round of sampling. In the prior round, the highest concentrations of BTEX were in DW-1A and DW-3A in the courtyard and lower concentrations of BTEX were found downgradient in MW-2A. During the December round of sampling, the BTEX concentrations in MW-2A were four times higher than those at DW-1A and DW-3A. The BTEX concentrations in MW-9 were non-detect during the December round of sampling.

The data from MW-6C continued to show trace levels of chlorinated compounds and no BTEX. The data from all three wells in Area D: MW-8C, MW-4D and MW-5D were consistent with the historical data and showed trace levels of BTEX in MW-4D and somewhat higher concentrations in MW-5D.

3.3 PILOT TESTS IN AREA D

This section presents the results of the LNAPL pilot testing conducted in Area D from December 1994 through April 1996. The results are discussed in terms of effectiveness and implementability. As discussed below, both manual and automated NAPL recovery technologies were evaluated for removal of Area D LNAPL. A comparative evaluation of the NAPL recovery technologies tested is presented in Section 4.1.

3.3.1 Manual LNAPL Recovery using Hydrophobic Sorbents

A hydrophobic sorbent unit (or sock), the 2" SoakEase, manufactured by Enviro LNAPLs, Inc., was field tested in Area D from December 1994 through June 1995 and from October 1995 through March 1996. During this field test, SoakEase socks were deployed in the following seven recovery wells: DW-1D, DW-2D, DW-4D, DW-8D, DW-10D, DW-11D and DW-13D. This subsection presents the results of this field test.

In total, approximately 22 gallons of LNAPL was collected from the seven recovery wells during the field test. Table 3-3 presents the total volume of Area D LNAPL recovered over the course of the 13 month field test and the overall average monthly recovery per well during the test period. The overall average LNAPL recovery rate per well was 0.46 gallons per month for the entire test period. The field test measurements for this manual LNAPL recovery technology are presented in Appendix D.

The SoakEase system was capable of recovering very high, high and lower viscosity LNAPL from all seven recovery wells tested. Average weekly LNAPL recovery rates for each of the seven wells tested and average weekly recovery rates for each type of Area D LNAPL are presented in Table 3-4.

3.3.2 *Manual LNAPL Recovery using Hydrophobic Collection Canisters*

A manual hydrophobic collection canister, the PRC-91 Keck Canister, manufactured by Keck Instruments, Inc., was field tested from December 1994 through June 1995 and from October 1995 through December 1995. During this field test, the Keck Canister was deployed in the following recovery wells: DW-2, DW-8D and DW-11D. This subsection presents the results of this field test.

In total, approximately 9 gallons of LNAPL was collected from the three recovery wells during the field test. Table 3-3 presents the total volume of Area D LNAPL recovered over the course of the ten month field test and the overall average monthly LNAPL recovery rate per well during the test period. The overall average LNAPL recovery rate was 0.88 gallons per well per month.

Average weekly LNAPL recovery rates for each of the three wells tested and average weekly recovery rates according to Area D LNAPL viscosity are presented in Table 3-4. As demonstrated in this table, the Keck Canister was able to remove Area D LNAPL from all three wells tested (DW-2, DW-8D and DW-11D). However, the recovery rates for DW-2 and

DW-11D (i.e., 0.72 and 1.22 gallons per week, respectively) were considerably higher than the recovery rate for DW-8D (0.18 gallons per week). During the field test, DW-2 and DW-11D contained lower viscosity LNAPL and DW-8D contained very high viscosity LNAPL. The low recovery rate for DW-8D was due to the very high viscosity of this material; the very high viscosity of this LNAPL prevents it from passing through the hydrophobic screen.

Although the Keck Canister was not tested in any wells containing high viscosity LNAPL, it is suspected that this material would also have difficulty passing through the screen installed on the Keck Canister. Alternate hydrophobic screens may however be available for collection of the high and very high viscosity LNAPL.

3.3.3 *Automated LNAPL Recovery using Hydrophobic Belt Skimmer*

The Petro-Belt system, an automated hydrophobic belt skimmer, was field tested from July 1995 through October 1995. During this field test, the Petro-Belt system was tested in the following seven recovery wells: DW-1D, DW-2D, DW-4D, DW-8D, DW-10D, DW-11D and DW-13D.

In total, approximately 15 gallons of LNAPL was collected from the seven recovery wells during the field test. Table 3-3 presents the total volume of Area D LNAPL recovered over the course of the four month field test and the overall average monthly LNAPL recovery per well during the test period. The overall average monthly LNAPL recovery rate for this technology was 0.71 gallons per well.

Short-term LNAPL recovery rates for this technology are presented in Table 3-5. These recovery rates are all non-continuous, short-duration recovery rates and cannot be extrapolated to determine continuous long-term LNAPL recovery in these wells. This short-term data indicates that the Petro-Belt system is capable of recovering very high, high and lower viscosity LNAPL.

During the field test, the adsorption of the LNAPL appeared to be directly proportional to the viscosity of the material; on a per square inch of belt basis, more very high viscosity LNAPL was absorbed than high viscosity LNAPL. However, due to the increased downtime of the system when it was used to recover very high viscosity LNAPL, the average weekly recovery rates for the wells containing very high viscosity material were considerably lower than the recovery rates for wells with high viscosity LNAPL. (As shown in Table 3-5, average weekly recovery rates for wells containing very high, high and lower viscosity LNAPL were 0.30, 0.87 and 0.33 gallons per week, respectively.) Additional O&M problems associated with this technology are discussed below.

3.4 *BRONX RIVER BANK INVESTIGATION*

This section presents the results of the investigative activities conducted as part of the Design Investigation for the LNAPL located beneath the bank of the Bronx River. As discussed in Section 2.4, this investigation entailed: (1) LNAPL characterization; (2) LNAPL delineation; (3) LNAPL recharge; and (4) pilot study activities to determine the effectiveness of automated NAPL-only recovery. This section presents the results of this investigation. Using these results, remedial alternatives for LNAPL located beneath the bank of the Bronx River are developed and evaluated in Section 4.2.

3.4.1 *LNAPL Characterization*

The analytical results from the chemical and physical laboratory testing are presented in Table 3-6 and copies of the laboratory data reports can be found in Appendix E. The chemical fingerprint analysis, GC chromatograms and FTIR spectra indicate that the LNAPL resembles a alkyd resin with petroleum distillates. The LNAPL contains no appreciable amounts of inorganics, as indicated by the very low percent ash analysis. The pH, specific gravity, viscosity, percent water and percent solid results for the three grab LNAPL samples are consistent with one another and with the composite sample. This indicates that the LNAPL collected from each of the riverbank LNAPL delineation wells is consistent with one another.

The physical analysis conducted on these samples was also used to verify the source of riverbank LNAPL. The chemical fingerprint analysis, GC chromatograms and FTIR spectra results (i.e., identification of the LNAPL as resembling an alkyd resin with petroleum distillates similar to gasoline) are consistent with materials previously stored on-site (i.e., polyurethane, paints, etc.).

As shown in Table 3-6, the viscosity of the LNAPL located beneath the Bronx River bank ranged from 7 to 8 cps. This value is slightly higher than the viscosity of the Area C LNAPL (i.e., 1 cps) and considerably less than the viscosity of the Area D LNAPL (i.e., 95 cps). As the LNAPL travels from Area C toward the river, it is exposed to air within the formation. This exposure to air would explain the slight increase in viscosity between the Area C LNAPL and the river bank LNAPL. Thus the viscosity data supports the assumption that Area C LNAPL is the source of the riverbank LNAPL.

3.4.2 *Distribution of LNAPL*

LNAPL thickness measurements were collected from the newly installed delineation wells on a biweekly basis between September 1996 and March 1997. LNAPL was identified in three of the four Bronx River bank delineation wells (DW-17, DW-18 and DW-19) immediately after their installation. LNAPL was identified in DW-16 at the end of October 1996, about one and one-half months after its installation. A summary of the data from the Bronx River bank wells is shown in Table 3-7.

In order to evaluate the change in LNAPL elevation and thickness over time, depth to water and depth to LNAPL measurements were plotted against time for each of the wells on the Bronx River bank. These graphs are shown in Figures 3-10 through 3-13. A review of the data in Figure 3-10, from DW-16, shows that only a thin layer of NAPL has been found on an intermittent basis in this well. A review of the data from DW-17, which is just downstream from DW-16, shows that a thicker layer of LNAPL has been detected on a more consistent basis in this well (Figure 3-11). The LNAPL layer was thickest on 21 October and 10 December but the water level elevation only shows a minor increase. The data from DW-18 is shown in Figure 3-12. Similar to the trend in DW-16 and DW-17, the LNAPL elevation was highest on 21 October 1996 and 10 December 1996 in DW-18. However, the thickness of LNAPL in this well showed more variability over the period of measurement than the LNAPL in either DW-16 or DW-17. The LNAPL elevation does not track changes in water level in DW-18, the lowest water level was observed on one of the days of the highest elevation. The data from the most downstream well, DW-19, is shown in Figure 3-13. The LNAPL elevation seems to follow the water level elevation more closely in this well than in other wells. However, unlike DW-17 and DW-18, no LNAPL was observed in this well on 21 October 1996.

Given the fact that the elevation of the LNAPL in the majority of the wells was highest around 21 October and 10 December, it seems that the LNAPL in the wells must have responded to the same influence on those dates. A review of the LNAPL elevation data from the on-site delineation wells also shows a similar trend: the LNAPL elevation in the on-site delineation wells tended to be higher on 21 October and 10 December. A review of the water level elevation data also shows that the water level elevation was higher on those dates. Therefore, it appears that the layer of LNAPL generally moves up and down in the aquifer as the water table rises and falls.

The LNAPL thickness data collected from the delineation wells on the Bronx River bank were combined with the data collected from the on-site delineation wells to construct maps showing the distribution of LNAPL. The data from 12 February 1997 and 19 September 1996 were selected to prepare the maps. These dates were chosen to include the largest group of LNAPL thickness measurements and to correspond to the dates selected for the water level elevation contour maps and the BTEX iso-concentration maps. The data is shown in Table 3-8 and the contour maps are shown in Figures 3-14 and 3-15.

A review of the distribution of LNAPL in February 1997 in Figure 3-14 suggests that there are two LNAPL plumes at the Site. The source of one plume is Area D and the source of the second, larger plume, is Area C. The plume in Area D appears to be confined to that area. The plume in Area C extends to the Bronx River bank delineation wells. The northern-most extent of the plume is inferred to be in the vicinity of DW-16, while the western-most extent of the LNAPL plume is inferred to be between DW-19 and MW-9. The plume has a westerly component to the direction of migration that indicates that ground water, which flows in a westerly direction, has an impact on the distribution of the LNAPL.

The February 1997 data indicates that the thickest accumulations of LNAPL were found in Area D at wells DW-10D and DW-13D. In Area C, the LNAPL layer ranged from 0 to 0.42 feet in thickness. No LNAPL was reported in delineation well DW-6C, located on the southwestern side of the Production Area. DW-6C historically contained the thickest accumulation of LNAPL in Area C. This change is probably related to LNAPL removal efforts, fluctuations in the elevation of the water table, seasonal changes and possibly the fact that there is some preferential movement of LNAPL along subsurface pathways.

The LNAPL distribution map constructed with the September 1996 data is similar in configuration to the plume map constructed from the February 1997 data (Figure 3-15). However, the thickness of the LNAPL layer is essentially the same in both areas in September 1996. The thickest accumulation of LNAPL in Area D was 0.82 feet in DW-13D and in Area C, the thickest accumulation of LNAPL was also 0.82 feet in DW-1C.

A comparison of the LNAPL thickness between the two rounds of measurements indicates that the Area D LNAPL was thicker in February 1997 than in September 1996. The Area C LNAPL was thicker in September 1996 than in February 1997.

3.4.3 *Pilot Test Activities*

Pilot testing was conducted on the banks of the Bronx River in the fall of 1996. This program entailed:

1. baildown testing to estimate LNAPL recharge rates, the actual thickness of the LNAPL in the formation and to qualitatively evaluate whether the rate of LNAPL recharge in this area would be suitable for automated NAPL-only recovery; and
2. pilot testing of the Product Terminator™ system in three LNAPL delineation wells to evaluate the effectiveness of this recovery technology for LNAPL located beneath the bank of the Bronx River.

Both short and extended duration pump tests were conducted using the Product Terminator™ system in the LNAPL delineation wells. The pilot testing was conducted in accordance with the field testing procedures provided in Section 2.4.5.2 for these tasks.

Baildown tests were conducted in all three delineation wells under investigation on October 16, 1996. The results of baildown tests conducted in wells DW-17D, DW-18D and DW-19D are provided in Table 3-9. As described in Section 2.4.4, the baildown tests entailed manually bailing the LNAPL in these wells until approximately one inch of LNAPL remained. The recharge rate of LNAPL back into the well was then measured. The baildown test results indicate that recharge rates in each of the three wells would be favorable for automated NAPL recovery. Based on this determination, pilot testing of the automated NAPL-only recovery technology selected in Section 2.3.2 was pursued.

The baildown test data was also reduced to estimate the actual thickness of LNAPL in the formation. This analysis entailed a graphical evaluation of DTP, DTW and apparent LNAPL thickness over time measured during the recovery of liquid in the monitoring well following Gruszczenski's (1987) method.

The premise of Gruszczenski's method is that during recovery, the LNAPL level strives to approach the original static level. However, the LNAPL/water interface initially rises then falls at some point during recovery. This fall represents the displacement of water by the accumulation of LNAPL in the well. According to Gruszczenski, the distance from this point where the depth to water changes from a positive to negative slope (inflection point) and the measured stabilized top of LNAPL is considered to be the mobile NAPL thickness in the formation.

Analysis of the data collected during the October baildown tests indicate that the actual LNAPL thickness in DW-17 was 0.32 feet, in DW-18 it was 0.15 feet and in DW-19 it was 0.12 feet. Copies of the data plots are included with the raw baildown test data in Appendix B.

The baildown test results were used to estimate an apparent thickness correction factor for the formation. Using the estimated apparent thickness correction factor, the porosity of the formation and the LNAPL distribution provided in Figure 3-10 from 12 February 1997, the total volume of LNAPL located between the Site and the Bronx River was estimated to be approximately 17,500 gallons. The backup calculations for this estimation are provided in Appendix F.

As discussed in Section 2.4.5.2, the Product Terminator™ system was deployed in all three delineation wells under investigation (i.e., DW-17D, DW-18D and DW-19D) on the first day of the pilot test. Prior to system deployment, the LNAPL thickness was measured in each of the wells and was found to be 0.90 feet in DW-17D, 0.91 feet in DW-18D and 0.40 feet in and DW-19D. In all three wells, the Product Terminator™ system reduced the LNAPL thickness to less than one inch in approximately two to three minutes. The results from all three days indicate that the Product Terminator™ system can maintain a LNAPL thickness of less than one inch in the wells.

On the second day of testing, a longer duration (i.e., 2-hour) pump test was conducted on DW-17D. The initial LNAPL thickness in DW-17D was 0.76 feet. After a few minutes, the LNAPL thickness was reduced to less than one inch. This thickness was maintained during the duration of the test. In addition, on the second day of testing, the head against which the pump at DW-17D could effectively operate was determined by applying a back pressure to the pump via a ball valve. A pressure of 24 psi was induced and did not cause a significant decrease in the flow rate. This indicates that the Product Terminator™ system would be able to recover LNAPL at an acceptable flow rate and pump it against a head of at least 55 ft (i.e., 24 psi). This is the head that might be produced in the event recovered LNAPL had to be pumped to a holding tank. Head losses in the LNAPL recovery systems would be produced by any elevation differences between the NAPL recovery wells and associated LNAPL transfer and storage equipment and by losses that occur in small diameter tubing. The allowable system head loss will therefore be used to design the LNAPL recovery systems in this area.

On the third day, an extended duration (i.e., 5-hour) pump test was conducted on DW-17D. Table 3-10 and Figure 3-16 present the volume of LNAPL recovered at regular time intervals during this extended duration test. Again, the Product Terminator™ system was able to maintain a LNAPL thickness of one-inch within the well.

The primary goal of the pilot tests was to determine the daily volume of LNAPL that could be realistically recovered from each of the three wells (i.e., DW-17D, DW-18D and DW-19D) in the riverbank area. Using the Product Terminator™ system pilot test data in conjunction with the baildown test results, the LNAPL recovery rate that could be obtained with a Product Terminator™ system in each well was estimated.

Figure 3-16 presents the baildown test results for the three delineation wells tested, as well as the data obtained from the extended duration test in DW-17D. This figure presents the volume of LNAPL that was recovered from each well, or recharged to the well, versus time. As such, the slope of each of these plots can be used to determine the LNAPL recovery rate, in gallons per hour (gph), at any given time for each of these three wells.

By definition, the recharge rate observed during a baildown test should become constant (i.e., achieve steady state) within 110 minutes. Figure 3-16 demonstrates that each of the three wells achieved steady state conditions within 110 minutes. The steady state recharge rates observed in DW-17D, DW-18D and DW-19D during baildown testing at 110 minutes were 0.229 gph, 0.185 gph and 0.071 gph, respectively.

As discussed above, in addition to baildown testing, an extended duration pump test was also conducted in DW-17D. The results of this test are also presented in Figure 3-16. As shown on this figure, the actual steady state recharge rate, that would be achieved using the Product Terminator™ system in DW-17D, would be approximately 0.336 gph. This value is higher than the steady state recharge rate observed during the baildown test (i.e., 0.229 gph). Based on this information, the anticipated steady state recharge rate using automated NAPL-only recovery would be approximately 1.47 times higher than the steady state recharge rate estimated using the baildown test results. Consequently, the anticipated steady state recharge rates for DW-18D and DW-19D were also estimated to be 1.47 times higher than their baildown test estimates.

If a Product Terminator™ system is installed in wells DW-17D, DW-18D and DW-19D, the LNAPL recovery rate from each of these wells is expected to be 0.336, 0.272 and 0.104 gph, respectively. This recovery rate would result in a total flow rate of approximately 0.712 gph or 17.1 gallons per day (gpd) from all three wells. Although LNAPL recharge testing was not conducted for delineation well DW-16D, the observed LNAPL thickness in this well has been consistently less than the other three delineation wells. Therefore, it has been assumed that DW-16D will not yield as much LNAPL as the other wells and the total LNAPL recovery rate for a four well system would be approximately 17.5 gpd.

During the field test, the concentration of VOCs in air above the well casing, where the Product Terminator™ system was deployed, and above the 5-gallon storage bucket used to store the recovered LNAPL was measured. VOC concentrations above the well casing ranged from 0 to 25 ppmv and VOC concentrations above the LNAPL storage bucket ranged from 100 to 400 ppmv. This information will be used to design the LNAPL recovery systems in this area.

4.0 EVALUATION OF REMEDIAL TECHNOLOGIES FOR LNAPL IN AREA D AND LNAPL OBSERVED ALONG THE BRONX RIVER BANK

This section presents an evaluation of remedial technologies for LNAPL located in Area D and LNAPL located beneath the bank of the Bronx River. In Section 4.1, the field testing results presented in Sections 3.3 for alternate Area D LNAPL recovery technologies are evaluated based on effectiveness, implementability and cost using the performance criteria provided in Table 2-3. The effectiveness, implementability and cost of each of these technologies are then compared to one another to determine the most appropriate course of action for Area D LNAPL.

In Section 4.2, the field testing results provided in Section 3.4 are used to formulate two LNAPL recovery, transfer and storage alternatives for LNAPL located beneath the banks of the Bronx River. These alternatives are then compared to one another based on protection of human health and the environment, compliance with New York State standards, criteria and guidance (i.e., SCGs), long-term effectiveness, implementability, reduction of toxicity, mobility and volume, short-term effectiveness and cost. The results of this evaluation are then used to determine the recommended course of action for off-site LNAPL located beneath the banks of the Bronx River.

4.1 EVALUATION OF REMEDIAL TECHNOLOGIES TESTED FOR LNAPL IN AREA D

This section presents the evaluation of results for the hydrophobic sorbent, hydrophobic collection canister and belt skimmer field tests. As discussed above, field testing results are evaluated according to effectiveness, implementability and cost using the performance criteria provided in Table 2-3.

4.1.1 *Manual LNAPL Recovery using Hydrophobic Sorbents*

A hydrophobic sorbent unit (or sock), the 2" SoakEase, manufactured by Enviro LNAPLs, Inc., was field tested in Area D from December 1994 through June 1995 and from October 1995 through March 1996. During this field test, SoakEase socks were deployed in the following seven recovery wells: DW-1D, DW-2D, DW-4D, DW-8D, DW-10D, DW-11D and DW-13D.

4.1.1.1 *Effectiveness*

As discussed in Section 3.3.1, the SoakEase system was able to recover LNAPL from all seven recovery wells tested (DW-1D, DW-2D, DW-4D, DW-8D, DW-10D, DW-11D and DW-13D) and was able to recover lower, high and very high viscosity Area D LNAPL. Furthermore, based on the average weekly recovery rates presented in Table 3-4, the amount of LNAPL recovered did not vary considerably with viscosity.

Cold weather causes the Area D LNAPL to become more viscous and the Area D LNAPL exposed to air to solidify more readily. As a result, lower NAPL recharge along with lower LNAPL recovery and higher O&M is expected in the colder months. The average amount of LNAPL recovered per well via this technology during the warm weather months (April through September) ranged from 0.54 to 0.78 gallons per month and the average amount of LNAPL recovered per well during the cold weather months (October through March) ranged from 0.19 to 0.71 gallons per month. Temperature appears to have a moderate impact on the ability of Soakease to recover LNAPL.

To determine the long-term effectiveness of this technology, the time required to remove all recoverable Area D LNAPL via this technology was estimated. The following assumptions were made for this calculation: (1) that 7,000 gallons of LNAPL is located in Area D; (2) that one-half of this material is recoverable; (3) that a consistent average monthly recovery rate of 0.46 gallons per well is maintained; and (4) that SoakEase units are installed in seven wells. Under these assumptions, it would take over 90 years to remove the recoverable portion of Area D LNAPL (i.e., 3,500 gallons) via this technology. Consequently this technology would not recover Area D LNAPL in a reasonable time period.

Based on these results, the hydrophobic absorbent recovery technology would be effective for short-term recovery of Area D LNAPL; however due to the extended time required to recover Area D LNAPL, this technology would not be effective for long-term recovery of Area D LNAPL.

4.1.1.2 *Implementability*

SoakEase units are readily available and can be easily installed in all Area D recovery wells any month of the year. The SoakEase unit is compatible with lower, high and very high viscosity Area D LNAPL. Deterioration of neither the absorption material nor the cage was observed. In general, the SoakEase units were replaced weekly.

Because this technology is a manual NAPL recovery system, the existing NAPL transfer piping cannot be used. Instead, the recovered LNAPL is manually transported to and placed into the existing Area C LNAPL recovery tank. All Area D LNAPL regardless of its recovery method is compatible with the existing LNAPL recovery tank.

The Health and Safety (H&S) concerns associated with operation of this recovery system were also evaluated. During installation, removal and wringing of the SoakEase units, system operators must manually handle Area D LNAPL. The H&S concerns associated with installation and removal of the units are relatively minor. In contrast, the H&S concerns associated with wringing out the SoakEase units to remove accumulated LNAPL are high. Area D LNAPL is a volatile and flammable material which presents inhalation and fire hazards. H&S concerns during this process can be mitigated by protective equipment (i.e., gloves, respirator, etc.) and adequate safety measures (e.g., non-sparking equipment, etc.).

Operational labor requirements for this manual recovery system are high. The SoakEase units must be manually removed from the wells and wrung out to remove recovered LNAPL. Maintenance labor requirements for this straight forward recovery technology are low.

In summary, the SoakEase system:

- is readily available and easy to install;
- is compatible with all Area D LNAPL;
- does not have any installation restrictions in Area D;
- has high H&S concerns since the absorbent socks must be manually wrung to remove the LNAPL; and
- has high operation labor requirements and low maintenance labor requirements.

4.1.1.3 *Cost*

The capital and O&M costs for this technology are presented in Table 4-1. The capital cost to implement this technology in Area D would be approximately $770. This cost, which covers the cost of the cages and the initial absorbent socks, assumes installation of SoakEase units in all seven recovery wells tested. The approximate O&M cost for this technology is $556 per gallon of LNAPL recovered. This O&M cost includes costs for replacement SoakEase absorbent socks, O&M labor and expenses, LNAPL disposal, and health and safety.

4.1.2 ***Manual LNAPL Recovery using Hydrophobic Collection Canisters***

A manual hydrophobic collection canister, the PRC-91 Keck Canister, manufactured by Keck Instruments, Inc., was field tested from December 1994 through June 1995 and from October 1995 through December 1995. During this field test, the Keck Canister was deployed in the following recovery wells: DW-2, DW-8D and DW-11D. This subsection presents the results of this field test.

4.1.2.1 *Effectiveness*

As discussed in Section 3.3.2, the Keck Canister was able to recover low viscosity LNAPL, but was unable to recover very high viscosity LNAPL. Recovery of high viscosity LNAPL was not evaluated.

Although lower NAPL recharge and consequently lower LNAPL recovery is expected in the colder months, definitive conclusions regarding the effect of temperature on this technology could not be made. The average monthly LNAPL recovery rate per well during the cold weather months

(October through March) were variable from year to year and sufficient test data was not available to accurately evaluate LNAPL recovery during warm weather months. Based on field observations, a moderate temperature effect was assumed.

To determine the long-term effectiveness of this technology, the time required to remove all recoverable Area D LNAPL with the Keck canister was estimated. The same assumptions used to estimate a timeframe for the Soakease were also used for this calculation. In addition, it was assumed that alternate screens capable of recovering high and very high viscosity LNAPL are available and that a recovery rate of 0.88 gallons per well for all types of LNAPL can be maintained (a very optimistic assumption). Based on these assumptions, it would take over 47 years to remove the recoverable portion of Area D LNAPL (i.e., 3,500 gallons) via this technology. Consequently this technology would not recover Area D LNAPL in a reasonable time.

Based on these results, the hydrophobic collection canister LNAPL recovery technology would be effective for short-term recovery of lower viscosity Area D LNAPL; however due to the extended time required to recover Area D LNAPL, this technology would not be effective for long-term recovery of Area D LNAPL.

4.1.2.2 *Implementability*

Keck Canisters are readily available and can be easily installed in all Area D recovery wells. The same canister was used throughout the entire test period. Degradation of the canister and hydrophobic screen was not observed. However, the screen did become clogged with LNAPL after approximately five months of use in various wells. Cleaning of the screen did not return the system to optimum operating conditions and the screen was subsequently replaced. The hydrophobic screen supplied with the Keck Canister is not appropriate for the very high and possibly the high viscosity Area D LNAPL.

The existing LNAPL transfer piping is not needed for this manual NAPL recovery system. Instead, the recovered LNAPL would be manually transported to the existing Area C LNAPL recovery tank. All Area D LNAPL regardless of its recovery method is compatible with the existing LNAPL recovery tank.

The H&S concerns associated with operation of this recovery system are low. The limited H&S concerns associated with installation and removal of the Keck Canisters can be mitigated by protective equipment (i.e., gloves, respirator, etc.) and adequate safety measures (e.g., non-sparking equipment, etc.).

Operational labor requirements for this manual recovery system are moderate. The canisters must be removed from the wells weekly, the LNAPL decanted to buckets and transferred to the storage tank. In addition, maintenance requirements for this recovery technology are low.

In summary, the Keck Canister:

- is readily available and easy to install;
- is compatible with all Area D LNAPL;
- is not appropriate for recovery of high and very high viscosity Area D LNAPL, using the hydrophobic screen provided;
- can be installed in any well year-round; and
- has both low H&S concerns and low O&M requirements.

4.1.2.3 *Cost*

The capital and O&M costs for this technology are presented in Table 4-1. The capital cost to implement this technology is Area D of the site would be approximately $1,600. This cost assumes installation of Keck Canisters in the following two recovery wells: DW-2D and DW-11D. The approximate O&M cost for this technology is $282 per gallon of LNAPL recovered. As documented in Table 4-1, the O&M component of the costs include: labor and expenses, materials (e.g., screen and transfer hose replacement) and disposal costs.

4.1.3 ***Automated LNAPL Recovery using Hydrophobic Belt Skimmer***

The Petro-Belt system, an automated hydrophobic belt skimmer, was field tested from July 1995 through October 1995. During this field test, the Petro-Belt system was tested in the following seven recovery wells: DW-1D, DW-2D, DW-4D, DW-8D, DW-10D, DW-11D and DW-13D.

4.1.3.1 *Effectiveness*

As discussed in Section 3.3.3, the Petro-Belt was able to recover some LNAPL from all seven recovery wells tested and was able to recover lower, high and very high viscosity Area D LNAPL. Furthermore, it was also found that the LNAPL recovery rates for this technology were a function of the viscosity of the material and the amount of downtime encountered.

Although lower NAPL recharge and consequently lower LNAPL recovery is expected in the colder months, definitive conclusions regarding the effect of temperature on this technology could not be made. The average monthly LNAPL recovery rate per well during the warm weather months (April through September) were variable and sufficient test data was not available to accurately evaluate LNAPL recovery during cold weather months. The average monthly recovery rate during the warm 1995 months ranged from 0.23 to 1.32 gallons per well and the average monthly LNAPL recovery rate for the one month of cold weather (i.e., October 1995) was 0.57 gallons per well. The effect of temperature on LNAPL recovery via the SoakEase system appears to be moderate.

Cold weather in the middle to latter portion of the testing period also resulted in implementability concerns (i.e., LNAPL hardening and an increase in equipment malfunctions).

The time to remove all recoverable Area D LNAPL via this technology was estimated using the same assumptions described for the other technologies. In addition, it was assumed that a consistent average monthly recovery rate of 0.71 gallons per well can be maintained. These calculations indicate that it would take over 58 years to remove the recoverable portion of Area D LNAPL (i.e., 3,500 gallons) via this technology. Consequently this technology would not recover Area D LNAPL in a reasonable time period and therefore does not provide adequate Area D LNAPL recovery.

Based on these results, the belt skimmer LNAPL recovery technology would be effective for short-term recovery of lower, high and very high viscosity Area D LNAPL; however due to the extended time required to recover Area D LNAPL, this technology would not be effective for long-term recovery of Area D LNAPL.

4.1.3.2 *Implementability*

Unlike manual technologies that collect LNAPL on an as-recharged basis, the implementability of automated recovery technologies is highly dependent upon the rate of recharge of LNAPL into the well in which the system is installed. Consequently, the LNAPL recharge rates of Area D recovery wells were evaluated during this field test.

For unattended operation, recovery wells must have adequate recharge to allow automated NAPL recovery. If the NAPL recharge rate of a well is not adequate and a sufficient amount of LNAPL does not recharge into the well casing, unattended automated systems will continue to attempt LNAPL removal from the well even though LNAPL is no longer present.

Using pre-test and post-test LNAPL thickness (generated from DTP and DTW measurements), the pre-test standing volume of LNAPL and the volume of LNAPL removed during the field test from each recovery well were determined. Post-test LNAPL thickness measurements were collected toward the end of the pilot testing program in October 1995. A summary of the DTP and DTW measurements, along with the LNAPL thickness for Area D recovery wells is presented in Table 3-5.

The pre-test standing volume of LNAPL and the volume of LNAPL removed was then used: (1) to determine the LNAPL recharge for each well tested; and (2) to compare the recharge of the various Area D recovery wells. If four to five times the standing volume was recovered during the recharge test and if the post-test LNAPL thickness at the well was greater than 0.1 feet, the LNAPL yield for that recovery well was considered adequate for automated LNAPL recovery.

Based on this criteria, one recovery well (DW-10D) exhibited adequate recharge for installation of unattended automated recovery systems. Three recovery wells (DW-4D, DW-8D and DW-13D) exhibited inadequate recharge for unattended automated recovery and the remaining three recovery wells (DW-1D, DW-2D and DW-11D) were not tested long enough to permit evaluation of recharge (short-term data is biased high by the initial presence of standing LNAPL in the well). Long-duration tests had been planned for wells DW-1D, DW-2D and DW-11D. However, the cold weather and subsequent LNAPL hardening prohibited performance of long-duration tests in these three wells.

Although the recharge of DW-2D and DW-11D could not be determined, it is suspected that the recharge of these wells, which generally contain lower viscosity LNAPL, would be adequate for unattended automated technologies. Consequently, unattended operation of the Petro-Belt system was considered to be potentially feasible in three of the seven Area D wells tested (DW-2D, DW-10D and DW-11D). Unfortunately, as discussed below, field testing demonstrated that the physical properties of the Area D LNAPL and the configuration of the Petro-Belt prohibited unattended operation of this system.

The compatibility of the Petro-Belt system with Area D LNAPL was evaluated during the field test to identify potential equipment failures, deterioration concerns and operational oversight requirements. The following system components that came into contact with LNAPL were evaluated: belts, in-well pulley/weight, pulley cage, scraper blades, transfer pump, LNAPL collection trough and LNAPL discharge piping.

Three belts were used at the site throughout the four-month pilot test, each of a different length. This system component has the most contact with the LNAPL and therefore would have the highest potential for degradation. Significant degradation of the belts was not observed. The belt seams appeared to be slightly thinner at the end of the pilot test; however, all seams appeared intact and in adequate condition for continued use.

Although the other system components (e.g., in-well pulley/weight assembly, recovery trough, and scraper blades), which had less contact with the LNAPL, did not degrade, they were prone to accumulate hardened LNAPL. Problems associated with hardened LNAPL were exacerbated by cold weather and in some cases, LNAPL hardening caused system shut-down. In addition, hardening of the very high viscosity LNAPL in the trough reduced the effective capacity of the trough. This resulted in overflow of the trough between site inspections. In addition, the need to remove the hardened LNAPL also resulted in increased cleaning and increased system maintenance.

The Petro-Belt system is equipped with a three gallon LNAPL collection reservoir with a transfer pump and float switch for automatic activation. In order to connect the Petro-Belt system to the existing LNAPL recovery system, the transfer pump was connected to the existing pipe manifold with tubing. Although the Petro-Belt system pump successfully transferred recovered LNAPL from the recovery wells to the Area D storage tank without mechanical failure, it was necessary to clean the tubing and transfer piping monthly to remove any accumulated hardened LNAPL. In general, the Petro-Belt transfer pump and existing LNAPL transfer system performed well together.

Although the Petro-Belt system was able to remove the very high viscosity LNAPL, this material hardened quickly upon removal, regardless of ambient temperature, and caused equipment malfunctions. Consequently, recovery of very high viscosity Area D LNAPL required higher maintenance than recovery of the other Area D LNAPL.

The H&S concerns associated with operation of this recovery system are moderate. Since the system is open, the operator is exposed to the LNAPL recovered from the well during system operation. This material, which is volatile and flammable, has associated inhalation and safety concerns. However, H&S concerns during this process can be mitigated by protective equipment (i.e., gloves, respirator, etc.) and adequate safety measures (e.g., non-sparking equipment, etc.).

In summary, the Petro-Belt system:

- is readily available;
- could be operated unattended in DW-10D and possibly DW-2D and DW-11D if O&M problems associated with unattended operation can be resolved;
- cannot be operated unattended in DW-4D, DW-8D or DW-13D;
- is difficult to install in DW-4D, DW-10D and DW-8D year-round and can only be operated in DW-1D, DW-2D and DW-11D during the non-winter months;
- is compatible with the existing LNAPL recovery and transfer system;
- cannot recover Area D LNAPL in cold weather months since the recovered LNAPL hardens too quickly in cold temperatures; and
- has moderate H&S concerns associated with operations; and
- has high O&M requirements since hardened LNAPL must be periodically removed from the components of the system and consequently, the system must be attended during operation.

4.1.3.3 *Cost*

The capital and O&M costs for this technology are presented in Table 4-1. The capital cost to implement this technology is Area D would be approximately $13,500. This cost assumes installation of a Petro-Belt system in the following three recovery wells: DW-2D, DW-11D and DW-10D. The approximate O&M cost for this technology is $766 per gallon of LNAPL recovered. The O&M component of the cost includes: labor and expenses, materials and disposal and is also provided in Table 4-1.

4.1.4 ***Comparison of Field Testing Results***

This section presents a comparison of the performance and evaluation criteria for the three LNAPL recovery technologies field tested for Area D LNAPL. In addition to these technologies, the performance of the IRM NAPL-only pumping system will also be included in this evaluation to provide an overview of Area D LNAPL recovery feasibility.

A comparison of the three technologies evaluated for recovery of Area D LNAPL is presented in Table 4-2. This table presents a summary of the information collected during the field tests and discussed in Section 6.0 regarding the effectiveness, implementability and cost of these three technologies.

4.1.4.1 *Effectiveness*

As shown in Table 4-2, the total volume of Area D LNAPL recovered by the SoakEase unit, Keck Canister and Petro-Belt was approximately 22, 9 and 15 gallons, respectively. In comparison, approximately 120 gallons of Area D LNAPL was recovered via the IRM NAPL-only pumping system over a period of five months from the eight Area D LNAPL recovery wells and approximately 52 gallons of Area D LNAPL was recovered via manual bailing.

In Section 3.0, average monthly recovery rates were estimated to provide the average recovery exhibited during the pilot test for each of the three technologies tested. The average monthly recovery rates for the SoakEase unit, Keck Canister and Petro-Belt were 0.46, 0.88 and 0.71 gallons per well per month, respectively. In contrast, the average long-term recovery rate for NAPL-only pumping was approximately 3 gallons per month per well. Although NAPL-only pumping recovery rates were clearly higher than the recovery rates for the alternate technologies tested, these recovery rates could not be maintained for the remainder of the project due to a decrease in the LNAPL recharge rate, LNAPL hardening and equipment failure. Additional discussion regarding the implementability problems associated with the IRM system are presented in Section 4.1.4.2.

Although the average monthly recovery rates are useful for general evaluation purposes, these rates will not be used to compare the three technologies testing since they do not take the various properties of the Area D LNAPL (i.e., viscosities) into account. Although the Keck Canister demonstrated the highest long-term recovery rate, this system was only tested on three wells and was unable to recover very high and possibly high viscosity LNAPL. Both the hydrophobic sorbent and the belt skimmer technology were able to recover all types of Area D LNAPL; however, the recovery rates for LNAPL via these technologies varied with viscosity.

To more accurately evaluate technology performance for the various LNAPL viscosities encountered, average weekly recovery rates were determined for each well. Since the viscosity of LNAPL in each well did not change during the field test (i.e., certain wells contained only low viscosity LNAPL throughout the testing, other wells contained only high viscosity LNAPL throughout the testing and the remaining wells contained only very high viscosity LNAPL throughout the testing), recovery rates by viscosity could be evaluated. It is suspected that stratified layers of LNAPL with varying viscosities may be present in Area D. Consequently, it was important to evaluate these technologies based on viscosity since the viscosity of LNAPL found within a well may change over time.

Table 4-2 presents average weekly LNAPL recovery rates for each well and average weekly recovery rates for very high, high and lower viscosity Area D LNAPL. As documented in this table, the average weekly recovery rates for the SoakEase unit, Keck Canister and Petro-Belt system were: 0.66, 0.97 and 0.33 gallons per week for low viscosity Area D LNAPL; 0.81, (Keck Canister not tested) and 0.87 gallons per week for high viscosity Area D LNAPL; and 0.69, 0.18 and 0.30 gallons per week for very high viscosity Area D LNAPL. Based on this comparison, of the three technologies evaluated, the Keck Canister would be the most effective recovery technology for low viscosity Area D LNAPL, the SoakEase and the Petro-Belt systems would be equally effective for recovery of high viscosity Area D LNAPL and the SoakEase unit would be the most effective recovery technology for the very high viscosity Area D LNAPL.

To evaluate the long-term effectiveness of these alternate recovery technologies, the time required to remove the recoverable Area D LNAPL (one-half the total estimated Area D volume of 7,000 gallons) for each of these technologies was estimated. Based on the average monthly recovery rates demonstrated by these alternate LNAPL recovery technologies, removal of the recoverable portion of Area D LNAPL would take over 90 years for the hydrophobic absorbent technology; over 47 years for the hydrophobic collection canister technology; and over 56 years for the hydrophobic belt skimming technology.

These time estimates are highly conservative since they assume that the average monthly recovery rates demonstrated during the field test are consistent throughout the 47 plus years of LNAPL recovery and assume 50% of the material is recoverable. Furthermore, the time estimate for the hydrophobic collection canister technology is even more conservative since it also assumes that this technology can be used to recover all Area D LNAPL and that the recovery rates for other LNAPL would be the same as those demonstrated during the field test. Based on these recovery estimates and the probability that recovery could take longer, none of the alternate LNAPL recovery technologies evaluated are capable of removing Area D LNAPL in a reasonable time period.

In conclusion, out of the three technologies evaluated, the hydrophobic collection canister technology provided the most effective recovery for low viscosity LNAPL, the hydrophobic adsorbent and belt skimming technologies provided the most effective recovery for high viscosity LNAPL and the hydrophobic adsorbent technology provided the most effective recovery for very high viscosity LNAPL. However, because none of these technologies were able to remove Area D LNAPL in a reasonable time period (i.e., less than 20 years), these technologies cannot be considered effective for recovery of Area D LNAPL.

4.1.4.2 *Implementability*

The SoakEase unit, Keck Canister and Petro-Belt system are all readily available. Both the SoakEase unit and the Keck Canister can be installed in any Area D well any time of the year. In contrast, it is difficult to install the mobile Petro-Belt system in DW-4D, DW-8D and DW-10D any month of the year and the mobile Petro-Belt system can only be operated in DW-1D, DW-2D and DW-11D during the non-winter months. Since three of these six recovery wells are anticipated to have adequate recharge to use the Petro-Belt system, either permanent Petro-Belt systems would have to be installed at these locations to mitigate this access issue and/or LNAPL recovery could only be conducted at these wells in the non-winter months. Permanent installation would require well vault modifications and electrical wiring modifications and result in additional capital costs.

Both the SoakEase unit and the Keck Canister were able to maintain recovery with little oversight. Because these systems are manual recovery systems, they can be operated at any recharge rate. Consequently, these systems can be left in wells and allowed to recover LNAPL at the rate of recharge. In contrast, field testing demonstrated that the physical properties of the Area D LNAPL, high maintenance requirements and the configuration of the Petro-Belt prohibited unattended operation of this system in any of the Area D wells.

All SoakEase, Keck Canister and Petro-Belt system components were found to be compatible with Area D LNAPL; no degradation was experienced. However, clogging of the hydrophobic screen installed on the Keck canister was experienced after five months of operation. In addition, due to the propensity of the Area D LNAPL to solidify upon exposure to air and the mechanical nature of the Petro-Belt system, the

Petro-Belt system requires considerably more O&M than the other two technologies to maintain system operation.

Similar implementability concerns were also experienced with the IRM NAPL recovery system in Area D. Due to decreased LNAPL recharge, LNAPL hardening and equipment failure, recovery rates could not be maintained in Area D with the IRM system. As previously discussed in Section 4.1.3.2, the implementability of automated recovery systems is highly dependent upon the recharge rate of the recovery wells. Recharge testing during the field test demonstrated that the majority of Area D wells now have insufficient recharge rates to sustain unattended automated recovery of Area D LNAPL. As operation of the Area D IRM system progressed, operator labor efforts and equipment malfunctions increased. Operation of the Area C IRM system required only weekly site visits; whereas, the Area D IRM system required 3 to 4 site visits per week in order to clean and replace clogged and burnt-out recovery pumps and to replace recovery piping clogged with hardened LNAPL.

Compatibility of the recovery system materials with the existing Area C NAPL transfer piping and NAPL storage tank was also evaluated. Manual recovery technologies do not require NAPL transfer piping since LNAPL collected via these methods is manually transported and transferred to the storage tank. With regard to the automated technology, belt skimming, transfer of recovered LNAPL through the existing piping is feasible. Due to the low recovery rates for Area D LNAPL exhibited for all three technologies and the propensity of this material to harden, use of the Area D LNAPL storage tank would not be feasible. Unless a sufficient volume of LNAPL is present in the storage tank, the contents of the tank will harden. Consequently, the recovered Area D LNAPL would have to be stored in the Area C LNAPL storage tank which contains accumulated Area C LNAPL.

The Keck Canister system has the relatively low O&M requirements. This system requires labor for installation and removal of canisters and periodic replacement of canister screens. The SoakEase system has relatively high O&M requirements. This system requires labor for installation and removal of absorbent socks and for wringing out of the used socks to remove the recovered LNAPL. The Petro-Belt system has the highest O&M requirements of the three technologies. This system requires labor for installation of the system, attended operation of the system and extensive cleaning of the system components during and after use.

The SoakEase system has high H&S concerns; while the Petro-Belt system has moderate H&S concerns. High operator exposure to LNAPL occurs during the wringing process for the SoakEase system. Since the Petro-Belt system must be attended during operation and the system is not enclosed, moderate operator exposure to LNAPL occurs during operation of this system. Any unacceptable H&S exposures can be mitigated by protective equipment (i.e., gloves, respirator, etc.) and adequate safety measures (e.g., non-sparking equipment, etc.).

In summary:

- The SoakEase unit, Keck Canister and Petro-Belt system are all readily available;
- Neither the SoakEase unit nor the Keck Canister have any installation problems or restrictions;

- Use of mobile Petro-Belt systems would either have to be limited to non-winter months or permanent systems would have to be installed in the three potential recovery wells;
- The SoakEase and Keck Canister systems can be operated unattended, while the Petro-Belt system must be attended during operation;
- All SoakEase, Keck Canister and Petro-Belt system components are compatible with Area D LNAPL;
- Due to the mechanical nature of the Petro-Belt technology, cold temperatures had the greatest effect on the implementability of this technology;
- All technologies, as needed, are compatible with the existing IRM NAPL recovery system components;
- The SoakEase technology has the highest H&S concerns; and
- The SoakEase and Petro-Belt technologies have the highest O&M requirements.

4.1.4.3 Cost

A summary of the estimated capital and operating costs for the three alternate LNAPL recovery technologies were presented in Table 4-1. Operating costs are presented in dollars per gallon of LNAPL removed. In addition, capital and O&M costs for the existing IRM Area D LNAPL recovery system are also provided for comparative purposes.

As documented in this Table 4-1, the capital costs for the existing IRM recovery system are considerably higher than the capital costs for the alternate technologies and the O&M costs for the IRM system are considerably lower than those for the alternate technologies. Operation of the existing LNAPL recovery system would be preferable since: (1) the system has already been installed; (2) the capital costs have been expended; and (3) the O&M cost for this system is considerably lower than the cost for the alternate LNAPL recovery technologies. However, as discussed in Sections 1.4.3 and 4.1.4.1, continued automated recovery via the IRM recovery system is no longer feasible due to the decreased recharge, LNAPL hardening and equipment failure.

Comparatively, the capital costs for the SoakEase and Keck Canister technologies are low and the capital costs for the Petro-Belt system are high. Capital costs for the SoakEase unit assume installation of absorbent socks in seven Area D recovery wells; capital costs for the Keck Canister assume installation of canisters in two Area D recovery wells; and capital costs for the Petro-Belt assume the use of mobile cart mounted systems in three Area D recovery wells.

O&M costs for all alternate Area D recovery technologies range from high ($282/gallon for the Keck Canister) to extremely high ($766/gallon for the Petro-Belt). The bulk of these costs is attributable to the high labor costs associated with operation of manual technologies (i.e., SoakEase and Keck Canister systems) and operation of an automated system requiring attended operation and high maintenance (i.e., Petro-Belt system).

These O&M costs demonstrate that none of the three alternate LNAPL removal systems are capable of recovering Area D LNAPL in a cost-effective manner.

4.2 *EVALUATION OF RECOVERY ALTERNATIVES FOR LNAPL BENEATH THE BANK OF THE BRONX RIVER*

As discussed in Section 3.4.3, the pilot testing results indicate that LNAPL located beneath the bank of the Bronx River can be recovered from the three recovery wells evaluated (i.e., DW-17D, DW-18D and DW-19D) using NAPL-only recovery pumps. Remedial alternatives were therefore developed for recovery, transfer and storage of LNAPL located beneath the banks of the Bronx River. All remedial alternatives will include NAPL-only pumping from the four LNAPL delineation wells installed along the Bronx River bank. Consequently, the alternatives will differ with respect to transfer and storage of the recovered LNAPL.

4.2.1 *Description of Remedial Alternatives for LNAPL Located Beneath the Banks of the Bronx River*

Two LNAPL recovery alternatives were developed for recovery, transfer and storage of LNAPL located beneath the banks of the Bronx River. They are:

Alternative I: NAPL-only recovery with transfer of recovered LNAPL to the Former Red Devil facility for storage in an existing aboveground storage tank; and
Alternative II: NAPL-only recovery with transfer of recovered LNAPL to an aboveground storage tank located adjacent to the recovery wells on the Bronx River bank.

The following section presents a description of these alternatives.

4.2.1.1 *Alternative I: NAPL-Only Recovery with Transfer of Recovered LNAPL to the Former Red Devil Facility for Storage*

Under this alternative, LNAPL would be recovered from the four LNAPL delineation wells located along the bank of the Bronx River (i.e., DW-16D, DW-17D, DW-18D and DW-19D) using NAPL-only recovery systems. Vaults would be installed at each of the delineation wells and the NAPL-only recovery pumps and their associated equipment would be installed within these vaults. An additional vault would be installed to house the controls for the four recovery wells and another vault would be installed to house the electrical panel for the pumps. Therefore, in total, six vaults would be installed for the LNAPL recovery system. Electricity would be provided to the area from the former Red Devil facility.

LNAPL recovered from beneath the bank of the Bronx River would be conveyed through small inner diameter tubing (i.e., less than 0.5") encased in a conduit to the Former Red Devil facility for storage. A schematic of the conduit layout is provided in Figure 4-1. As shown in this figure, the transfer conduit for the recovered NAPL would travel from the recovery wells toward Mount Vernon Avenue. If possible, the conduit would be located two feet below grade. If soil conditions are such that no excavation is possible, the piping connecting the recovery vaults would be installed above ground and encased in concrete. In addition, an electrical conduit would be installed in the same trench as the LNAPL transfer conduit.

Once at Mount Vernon Avenue, the pipe would travel underground along the side of the retaining wall and then exit above ground near the top of the retaining wall. Once the conduit is above ground, two separate galvanized steel conduits would be used to contain: (1) the recovered LNAPL tubing; and (2) the power cables. The conduits would then be attached to the concrete side wall underneath the Mount Vernon Avenue railroad bridge with pipe hangars (refer to Figure 4-2 for a typical pipe support). The conduits would travel along the concrete retaining wall underneath the bridge and exit on the east side of the bridge. Once on the other side of the bridge, the conduits would run along the side of the retaining wall in a northerly direction and then in an easterly direction. From the retaining wall, the conduits would cross over to the Former Red Devil facility property as shown in Figure 4-1. The recovered LNAPL would then be transferred to the existing Area C above ground LNAPL storage tank located within the Former Red Devil Facility. This tank is currently being used to store LNAPL removed by the Area C IRM recovery system.

Because the LNAPL to be removed from this area is viscous and has the propensity to solidify and clog system piping, options to reduce the viscosity of the LNAPL and promote easier pumping were investigated. As discussed in Section 2.3.2.2, during Area D pilot testing, canola oil was shown to successfully reduce the viscosity of on-site LNAPL. As a contingency, a dosing system would be installed in each of the recovery well vaults to add canola oil, or an equivalent low viscosity oil, to the recovered LNAPL prior to pumping to the site. The addition of low viscosity oil would be conducted, if necessary after the system start-up, to reduce clogging of the LNAPL recovery transfer tubing and reduce system downtime and operations and maintenance.

NAPL accumulated in the storage tank would be removed once the tank is full or every 90 days, whichever is less, and disposed of off-site. Based on the estimated cumulative LNAPL recovery rates for the three wells (i.e., 17.5 gallons/day), an estimated dosing of 0.5 parts low viscosity oil to 1 part recovered LNAPL and the current Area C IRM LNAPL recovery rate (i.e., approximately 50 gallons per month), the 500 gallon tank in Area C would need to be emptied every two weeks.

Prior to off-site disposal, the recovered LNAPL would be tested for disposal characteristics. Although the TCLP analysis provided in Table 3-6 did not indicate that any chemicals were present above the TCLP limits, for cost estimate purposes, it has been assumed that the recovered LNAPL would be a RCRA characteristic waste for toxicity (i.e., D018 - benzene), an ignitable hazardous waste and disposed of at a RCRA-permitted disposal facility. This conservative assumption was made since the detection limits for a number of TCLP parameters were greater than their TCLP limits and previous characterization of the Area C LNAPL, the suspected source of LNAPL located beneath the Bronx River bank, indicated that Area C LNAPL is a RCRA toxic characteristic waste for benzene and an ignitable waste.

As shown in Figure 4-1, the LNAPL recovery equipment (i.e., vaults, pumps) and a large portion of the LNAPL transfer conduits would be installed on Metro-North property. Metro-North has been contacted regarding installation of equipment on their property and has provided access and usage costs for use of this area. These costs are included in the estimated cost for this alternative.

The total estimated cost for installation and operation and maintenance (O&M) of the LNAPL recovery system described above for Alternative I would be approximately $644,000. A detailed breakdown of this costs is provided in Table 4-3. The estimated capital cost for this alternative is $253,400. This cost includes: LNAPL recovery system installation, dosing system for low viscosity oil, engineering design, construction oversight, security during construction activities and Metro-North access and usage costs. The estimated annual O&M costs for this alternative would range from $103,500 (Year 1) to $79,400 (Years 3-5). This cost includes: operating labor and materials, maintenance labor and materials, supply of low viscosity oil, LNAPL disposal as a RCRA hazardous waste and electricity. Assuming 5 years of operation, a 7% interest rate and a 10% contingency, the present worth of the annual O&M costs would be approximately $390,600.

4.2.1.2 *Alternative II: NAPL-Only Recovery with Transfer of Recovered LNAPL to an Aboveground Storage Tank Located Adjacent to the Recovery Wells on the Bronx River Bank*

Under this alternative, LNAPL would be recovered from the four recovery wells located on the bank of the Bronx River (i.e., DW-16D, DW-17D, DW-18D and DW-19D) using NAPL-only recovery wells. Vaults would be installed for each well and the NAPL-only recovery pumps and associated equipment would be installed in each vault. An additional vault would house the controls for the four recovery wells and another vault would house the electrical panel for the pumps. In total, six vaults would be installed for the recovery system.

NAPL recovered from beneath the bank of the Bronx River would be conveyed through small inner diameter tubing (i.e., less than 0.5") encased in a conduit to an aboveground 250-gallon storage tank located on the bank of the Bronx River. A schematic of the piping layout and the location of the tank is provided in Figure 4-3. If possible, the LNAPL transfer conduits would be located two feet below grade. If soil conditions are such that no excavation is possible, the piping that connects the recovery vaults could be installed above ground and encased in concrete.

The NAPL storage tank would be installed on a reinforced concrete foundation with secondary containment and would be located within a permanent concrete structure that is surrounded by fencing. The storage tank building would be approximately 15 feet by 15 feet in size and would be vented with a ceiling fan. Electricity would be supplied to the building and the well vaults from an electrical pole on Mount Vernon Avenue.

At a minimum, the tank and its building would:

- comply with all applicable NFPA Fire Codes, applicable New York State Building Codes and applicable requirements of the City of Mount Vernon Building Department and the Fire Marshall;
- be registered with the NYSDEC for Hazardous Substance Bulk Storage, and
- be UL - 142 listed.

NAPL accumulated in the storage tank would be removed once the tank is full or every 90 days, whichever is less, and disposed of off-site. Based on the estimated cumulative LNAPL recovery rates for the three wells (i.e., 17 gallons/day), the 250 gallon tank would need to be emptied every two weeks.

Prior to off-site disposal, the recovered LNAPL would be tested for disposal characteristics. As discussed in Section 4.2.1.1, for cost estimation purposes, it has been assumed that the recovered LNAPL would be classified as a RCRA hazardous waste for toxicity (i.e., D018 - benzene) and ignitability and disposed of at a RCRA-permitted disposal facility.

As shown in Figure 4-3, the LNAPL recovery equipment (i.e., vaults, pumps), the LNAPL transfer conduits and the LNAPL storage tank building would be installed on Metro-North property. Metro-North has been contacted regarding installation of equipment on their property and has provided access and usage costs for use of this area. These costs are included in the estimated cost for this alternative.

The total estimated cost for installation and operation and maintenance (O&M) of the LNAPL recovery system described above for Alternative II would be approximately $606,700. A detailed breakdown of this costs is provided in Table 4-3. The estimated capital cost for this alternative is $290,700. This cost includes: LNAPL recovery system installation, engineering design, construction oversight, security during construction activities, access costs for the alleyway located adjacent to the eastern retaining wall for O&M work on the LNAPL transfer tubing located in this area and Metro-North access and usage costs. The estimated annual O&M cost for this alternative would range from $81,700 (Year 1) to $65,100 (Years 3-5). This cost includes: operating labor and materials, maintenance labor and materials, LNAPL disposal as a RCRA hazardous waste, electricity and maintenance of the fire suppression system for the LNAPL storage tank building. Assuming five years of operation, a 7% interest rate and a 10% contingency, the present worth of the annual O&M costs would be approximately $316,000.

4.2.2 *Evaluation of Remedial Alternatives for LNAPL Located Beneath the Banks of the Bronx River*

In accordance with the *Revised TAGM - Selection of Remedial Actions at Inactive Hazardous Waste Sites* (NYSDEC, 1990), *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA, 1988) and the National Contingency Plan (USEPA, 1990), the two proposed remedial alternatives for recovery of LNAPL located beneath the Bronx River bank were evaluated based upon the following criteria:

- protection of human health and the environment;
- compliance with SCGs;
- long-term effectiveness and permanence;
- implementability;
- reduction of toxicity, mobility and volume;
- short-term effectiveness; and
- cost.

Under both Alternative I and Alternative II, LNAPL will be recovered from beneath the Bronx River bank in the same manner (i.e., from LNAPL recovery wells located on the riverbank). Consequently, the two alternatives differ only with respect to their method of LNAPL transfer and storage. As a result, the two alternatives will achieve the same level of protectiveness for a number of the above criteria. Following is an evaluation of each of these criteria for the two above-referenced remedial action alternatives.

4.2.2.1 *Protection of Human Health and the Environment*

Both Alternative I and Alternative II would achieve adequate protection of human health and the environment through recovery and off-site disposal of LNAPL. As discussed in the OU I FS and Section 1.2 of this document, the passive LNAPL recovery system in the Bronx River is currently achieving adequate protection of human health and the environment. Consequently, an active LNAPL recovery system along the bank of the Bronx River would also provide adequate protection of human health and the environment. To ensure that LNAPL seeps do not migrate into the Bronx River, the boom system would be maintained during operation of the active LNAPL recovery system.

4.2.2.2 *Compliance with SCGs*

Both Alternative I and Alternative II would comply with their applicable SCGs. LNAPL, determined to be a hazardous waste, would be transported and disposed in accordance with the hazardous waste regulations.

4.2.2.3 *Long-Term Effectiveness*

The pilot testing conducted in the riverbank area indicated that a Product Terminator™ system is capable of recovering LNAPL at an estimated total LNAPL recovery rate of approximately 17.5 gpd. Although the Product Terminator™ system was capable of recovering LNAPL at a reasonable rate, the LNAPL recovery wells are situated in an area that is subject to changing hydrogeological conditions. Due to the proximity of the Bronx River, the system must be able to respond to the rapid changes in water table elevation and LNAPL thickness. The system was not tested for a long enough period of time to observe how the system performed relative to changes in the river. However, the LNAPL intake is attached to a motorized reel that will actively seek LNAPL down to a depth of only six inches of water in the well. It appears that the Product Terminator™ system will be able to respond to the expected water level changes.

The Product Terminator™ system is an upgrade of the Spillbuster system installed in Area C of the Site. The system appears to be reliable and would adequately recover LNAPL for an extended period provided proper maintenance is conducted. Because both alternatives would utilize the Product Terminator™ systems, both alternatives would address this criteria adequately and equally.

Based on the estimated quantity of LNAPL located between the Site and the Bronx River (i.e., approximately 17,500 gallons) and assuming: (1) 75% of the LNAPL is recoverable; (2) 17.5 gpd is recovered during the first year of operation; (3) one-half of the initial recovery (i.e., 8.8 gpd) is maintained during the second year of operation; and (4) one-quarter of the initial recovery (i.e., 4.4 gpd) is maintained during the subsequent years of operation, it would take approximately 4.2 years to remove the recoverable portion of LNAPL located between the Site and the Bronx River.

4.2.2.4 *Implementability*

Both LNAPL recovery, transfer and storage system are readily available. However, there are a number of implementability concerns associated with the two LNAPL recovery alternatives. Under both alternatives, permission would have to be obtained from Metro-North to install LNAPL recovery equipment (e.g., pipes, tanks, vaults, etc.) on their property. As discussed above, Metro-North has been contacted regarding this issue and has provided access and usage costs. They appear to be amenable to installation of LNAPL recovery equipment provided certain insurance and design provisions are met. Metro-North's provisions appear to be reasonable and attainable.

The major implementability concern for Alternative I is transfer of recovered LNAPL. Based on past experience with recovery of LNAPL in Area C, it is not known whether recovered LNAPL can be transferred a distance of approximately 900 feet through small diameter tubing to the former Red Devil facility. Even with the addition of low viscosity oil, transfer of LNAPL through small diameter tubing is expected to be a great concern. Furthermore, during the cold months, LNAPL located in the aboveground LNAPL transfer conduits will be exposed to cold temperatures, the viscosity of this material will increase and the material will be more difficult to pump. Due to the flammable nature of this material, it would not be prudent to heat trace the aboveground conduit.

In contrast, under Alternative II, the recovered LNAPL would travel a relatively short distance to the LNAPL storage tank through underground or concrete encased conduits. As a result, Alternative II has considerably less implementability concerns related to LNAPL transfer than Alternative I.

4.2.2.5 *Reduction of Toxicity, Mobility and Volume*

Through LNAPL recovery, the mobility of LNAPL located beneath the Bronx River bank would be reduced to the same extent under both alternatives. In addition, the toxicity of the recovered LNAPL would be reduced to the same extent under the two alternatives. Under either alternative, the toxicity of LNAPL will be reduced through off-site incineration at a hazardous waste disposal facility. Under Alternative I, the volume of LNAPL requiring disposal would be increased as a result of the addition of low viscosity oil. As previously discussed, low viscosity oil would be added to the recovered LNAPL to facilitate transfer of this material to the former Red Devil facility for storage. Because Alternative II would not require the addition of low viscosity oil, Alternative II would not increase the volume of LNAPL requiring off-site disposal.

4.2.2.6 *Short-Term Effectiveness*

Short-term effects may occur during construction of the LNAPL recovery systems proposed for each alternative, during operation and maintenance of the LNAPL recovery systems and during transport of recovered LNAPL off-site for disposal. Alternative II construction activities for the LNAPL storage building (e.g., regrading) could generate dust. This short-term effect could be controlled by the use of dust control measures such as water or foam sprays, if needed.

As discussed above, Alternative I is expected to require more maintenance than Alternative II. During O&M activities for Alternative I, workers may be required to access the elevated LNAPL transfer conduits installed along the railroad retaining wall. Consequently, Alternative I is expected to pose more short-term chemical exposure and physical risks to maintenance workers than Alternative II.

Under both scenarios, recovered LNAPL would be collected for disposal every two weeks. The potential short-term effects related to transfer of recovered LNAPL would therefore be equal for the two alternatives.

4.2.2.7 *Cost*

As discussed above the total estimated total costs for Alternative I and II are provided in Table 4-3. As shown in this table, the total estimated cost for Alternative I would be approximately $644,000 and the total estimated cost for Alternative II would be approximately $606,700. Alternative II would therefore cost approximately $37,000 less than Alternative I.

4.2.2.8 *Summary*

Alternatives I and II would both provide adequate and equal protection of human health and the environment, compliance with the SCGs and long-term effectiveness and permanence.

Both Alternative I and II would pose potential short-term effects. Although some of these potential effects could be mitigated with engineering controls, other may not be mitigatable (i.e., increased physical risks). Due to difficulties associated with LNAPL pumping, Alternative I is expected to have considerably more implementability concerns than Alternative I. Consequently, Alternative II would be more implementable than Alternative I.

With regard to reduction of toxicity, mobility and volume, Alternatives I and II would both reduce mobility of LNAPL through recovery and reduce the toxicity of LNAPL through off-site treatment. However, the addition of low viscosity oil to enable transfer of recovered LNAPL under Alternative I would increase to volume of LNAPL requiring disposal.

Finally Alternative I would cost approximately $37,000 more than Alternative II.

In summary, Alternative II: (1) would provide the same level of protection as Alternative I for human health and the environment, compliance with the SCGs and long-term effectiveness and permanence; (2) would pose fewer non-mitigatable short-term effects than Alternative II; (3) would have considerably fewer implementability concerns than Alternative I; (4) would reduce mobility and toxicity to the same extent as Alternative I; (5) would not result in an increase in the volume of LNAPL, as Alternative I would; and (6) would cost approximately $37,000 less than Alternative I. Based on this evaluation, Alternative II has been selected as the preferred alternative for recovery, transfer and disposal of LNAPL located beneath the Bronx River bank.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 OU I MEDIA OF INTEREST

The OU I media of interest at the former Red Devil site are:

- the indoor floor drain and sump system;
- on-site Area C LNAPL;
- on-site Area D LNAPL; and
- off-site LNAPL located beneath the bank of the Bronx River.

The conclusions and recommendations for these media of interest are provided below and a summary of the findings and recommendations for these media is provided in Table 5-1.

5.1.1 Floor Drains and Sumps

As part of the Design Investigation, the indoor floor drain and sump system was cleaned to remove accumulated materials (i.e., sediment and dried paint material) and the configuration of the system was mapped. A schematic of the indoor floor drain and sump system is presented as Figure 3-1. As shown in this figure, in addition to floor drains and sumps, piping emanating from these structures were also mapped. While some of these pipes eventually connected to either the sanitary sewer or the storm sewer system, a number of these pipes terminated a short distance from their structure of origin. It could not be determined during the investigation whether these pipes were sealed or open ended.

To the extent practicable, soil penetrations (e.g., earthen bottoms) within floor drains and sumps were sealed with concrete to reduce the potential for infiltration of liquids through the drainage system to the subsurface soil. A summary of the floor drain and sump system investigation findings and response actions taken is presented in Table 5-2. Potentially open ended or broken pipes were not sealed. However, since accumulated materials in the floor drain and sump system have been removed and the Site is currently used as a public self storage facility, it is highly unlikely that chemicals would be discharged to the existing floor drain and sump system. Consequently, unsealed floor penetrations, broken pipes and open ended pipes are not considered to present an unacceptable Site risk. The indoor floor trench and drain system has therefore been eliminated as a potential area of concern. Consequently, no further action is recommended for this system. It should be noted that any impacts to the soil and ground water beneath Areas C and D that may have resulted from historical discharges to the former floor drain and sump system will be addressed during OU-II activities. OK

5.1.2 *Area C LNAPL*

The history of LNAPL recovery in Area C was summarized in Figure 1-5. This figure shows that the IRM system has removed approximately 5,000 gallons of LNAPL from this area over 35 months. Including the additional LNAPL recovered during the pre-IRM pilot testing, total recovery in Area C is estimated to be 7,041 gallons. IRM#1 therefore continues to be operated in Area C. Although, LNAPL recovery rates have decreased over time, the LNAPL recovery system continues to successfully recover LNAPL from Area C. It is therefore recommended that the IRM#1 recovery system in Area C continue to operate until LNAPL is recovered to the extent practical. OK

5.1.3 *Area D LNAPL*

Field testing of three alternate LNAPL recovery technologies was conducted at this site from December 1994 through March 1996. During this period, manual hydrophobic sorbents, hydrophobic collection canisters and belt skimming systems were field tested for recovery of Area D LNAPL. Each technology was evaluated to determine its effectiveness, implementability and cost with regard to recovery of Area D LNAPL. A comparison of the field test results for these three technologies was presented in Table 4-2.

As discussed in Section 4.1, the performance of each technology was evaluated for the various LNAPL viscosities observed in Area D during the field testing period. In general, very high viscosity LNAPL was observed in DW-8D and DW-13D; high viscosity LNAPL was observed in DW-10D, DW-4D and DW-1D; and lower viscosity LNAPL was observed in DW-11D and DW-2D. It must be stressed that the viscosity of LNAPL observed in Area D wells has changed with time. Consequently, since the effectiveness of a technology is dependent upon the viscosity of the LNAPL, the technology will be selected for that viscosity and not necessarily for that well. (A change in the viscosity of LNAPL in a well could make recovery via that technology ineffective.)

On a short-term basis, field testing indicated that of the three technologies evaluated, hydrophobic collection canisters would be the most appropriate recovery technology for wells with low viscosity LNAPL; hydrophobic belt skimming or hydrophobic sorbents would be the most appropriate recovery technology for high viscosity LNAPL and hydrophobic sorbents would be the most appropriate recovery technology for wells with very high viscosity LNAPL. However, the relatively low recovery rates demonstrated by all of the alternate LNAPL recovery technologies resulted in inadequate long-term LNAPL recovery. Based on the average monthly LNAPL recovery rates for these technologies, estimated removal times for Area D LNAPL via hydrophobic absorbent, hydrophobic collection canister and hydrophobic belt skimming technologies were over 90, 47 and 56 years, respectively. In addition, high O&M costs demonstrate that none of these technologies recover Area D LNAPL in a cost-effective manner.

In conclusion, although all types of Area D LNAPL could be recovered by at least one of these technologies, the recovery rates observed during the field test demonstrate that manual NAPL recovery technologies (i.e., sorbents and hydrophobic collection canisters) and hydrophobic belt skimmers do not provide adequate recovery rates and do not provide time or cost-effective recovery of Area D LNAPL.

As discussed in Section 2.3.2.2, in addition to hydrophobic belt skimmers, three automated LNAPL recovery technologies exist. They are: NAPL-only recovery pumps; hydrophobic collection canisters with transfer systems; and total fluids recovery systems. The first two of these technologies are NAPL only recovery technologies; the latter is not a NAPL only recovery technology since water is recovered along with NAPL.

Based on the poor performance of NAPL-only recovery pumps used for IRM#1, this technology is not appropriate for Area D LNAPL. The cost-effectiveness of the hydrophobic canister technology for recovery of low viscosity LNAPL could be improved by automating LNAPL transfer. However, due to the size constraints of the recovery wells, NAPL transfer pumps cannot be installed in the wells containing low viscosity LNAPL. Recovery systems that employ hydrophobic collection canisters with hydraulic displacement transfer systems have recently been developed. However, recent experience with hydraulic displacement systems suggests that this type of transfer system may not be appropriate for Area D LNAPL. These applications, which entailed recovery of LNAPL having a considerably lower viscosity than Area D LNAPL, suggest that LNAPL has a propensity to harden on the system probes and that the system vacuum seal tends to break unless the water supply system is located immediately above the recovery well. Based on these difficulties, hydrophobic collection canisters with transfer systems would not be an appropriate technology for Area D LNAPL.

In conclusion, operation of IRM#1 in Area D and the field testing have confirmed that the Area D LNAPL cannot be cost-effectively recovered using manual or automated NAPL-only recovery techniques. Since these technologies do not work, the remaining more expensive automated NAPL recovery technology, total fluids recovery, will be evaluated. However, in the event that this recovery technology is likewise found to be ineffective, Insilco Corporation will submit a letter to NYSDEC indicating that to the extent practical, all Area D LNAPL has been recovered. Since LNAPL from Area D is quite viscous, it has not migrated a significant distance from the Site. Therefore, cessation of recovery efforts in this area will not adversely impact the Bronx River. In the meantime, Area C LNAPL which has migrated to the Bronx River will be recovered to eliminate, the extent practical, the impact of Area C LNAPL on the Bronx River.

As discussed in Section 2.3.2.2, total fluids recovery entails collection of both LNAPL and water from recovery wells using a single pump. Using this technology, LNAPL along with a small amount of water is pumped from the wells. Consequently, this technology also requires fluid separation equipment, and possibly water treatment equipment. Because more powerful, aboveground pumps can be used for total fluids recovery, this technology may be effective in recovering the more viscous Area D LNAPL. Pilot testing should be conducted to determine whether this technology could be used to recover Area D LNAPL and to evaluate the design parameters for such a system.

5.1.4 *Bronx River Bank LNAPL*

In November 1996, design investigation activities were conducted along the banks of the Bronx River downgradient of the Former Red Devil Facility to determine the feasibility of recovering LNAPL located beneath the bank of the Bronx River. This investigation entailed: installation of four LNAPL delineation wells (DW-16D, DW-17D, DW-18D and DW-19D); LNAPL delineation; LNAPL characterization; and pilot testing to determine LNAPL recharge to these delineation wells and the effectiveness of a NAPL-only recovery system, the Product Terminator™ system. Following installation of the four LNAPL delineation wells:

- NAPL thickness measurements were collected from the four wells to delineate the extent of LNAPL located beneath the bank of the Bronx River;
- LNAPL samples were collected and analyzed to provide a physical and chemical characterization of the LNAPL located beneath the bank of the Bronx River;
- baildown testing was conducted in each of the four delineation wells to estimate their individual recharge rates; and
- pilot testing of the Product Terminator™ system was conducted in the three delineation wells containing the greatest LNAPL thickness (DW-17D, DW-18D and DW-19D) to determine the effectiveness of NAPL-only recovery from these wells.

As shown in Figure 3-8 and discussed in Section 3.4.2, the thickness of LNAPL beneath the bank of the Bronx River ranged from 0.14 to 0.65 feet in March 1997 and the LNAPL extends from Area C at the Site to the Bronx River. Based on the LNAPL thickness measurements collected during this measurement round, approximately 17,500 gallons of LNAPL is located beneath the railroad embankment between the Site and the Bronx River.

As discussed in Section 3.4.1, characterization of the LNAPL located beneath the banks of the Bronx River indicates that this material appears very similar to the Area C LNAPL. Based on this similarity, it was assumed that the NAPL-only recovery technology currently being used to recover Area C LNAPL would most likely be effective for the LNAPL located beneath the banks of the Bronx River. This technology was tested and found to be effective in the three LNAPL delineation wells tested. Based on the pilot test results, it has been estimated that the four delineation wells, in total, would be capable of recovering up to 17.5 gpd of LNAPL from beneath the bank of the Bronx River.

Two LNAPL recovery alternatives were therefore formulated in Section 4.2 for removal of LNAPL located beneath the bank of the Bronx River. They were identified as:

Alternative I: NAPL-only recovery with transfer of recovered LNAPL to the Former Red Devil facility for storage in an existing aboveground storage tank;

and

Alternative II: NAPL-only recovery with transfer of recovered LNAPL to an aboveground storage tank located adjacent to the recovery wells on the Bronx River bank.

A detailed description of these alternatives was provided in Section 4.2.1.

The remedial action alternatives were then evaluated in Section 4.2.2 based on protection of human health and the environment, compliance with New York State standards, criteria and guidance (i.e., SCGs), long-term effectiveness, implementability, reduction of toxicity, mobility and volume, short-term effectiveness and cost. This evaluation concluded that **Alternative II:** NAPL-only recovery with transfer of recovered LNAPL to an aboveground storage tank located adjacent to the recovery wells on the Bronx River bank would:

- provide the same level of protection as Alternative I for human health and the environment, compliance with the SCGs and long-term effectiveness and permanence;
- pose fewer non-mitigatable short-term effects than Alternative II;
- have considerably fewer implementability concerns than Alternative I;
- reduce mobility and toxicity to the same extent as Alternative I;
- not result in an increase in the volume of LNAPL; and
- cost approximately $37,000 less than Alternative I.

Based on this evaluation Alternative II was selected as the preferred alternative for recovery, transfer and disposal of LNAPL located beneath the Bronx River bank.

5.1.5 *Ground Water*

In Areas C and D at the Site, the concentrations of BTEX and chlorinated compounds in the ground water have remained fairly consistent, and shown some small decline, through four years of sampling. A different trend has been observed in Area A, particularly in wells MW-2A, DW-1A and DW-3A. As suggested in Section 3.2.1, it appears that a source of toluene remains in the soils in the vicinity of DW-1A and DW-3A.

The difference in the conditions in Areas C and D and Area A and the impact that the soils in Area A are having on the ground water suggest that it might be reasonable to manage future activities in the two areas differently. It was decided in the OU I FS that an assessment of the need for soil and/or ground water remediation would be left until after the completion of LNAPL recovery in Areas C and D conducted as part of OU I. In Areas C and D, where LNAPL recovery is occurring, the concentrations of BTEX and chlorinated compounds have shown some decline over time. Consequently, in these areas it is logical to wait until the LNAPL is recovered because LNAPL recovery is having a positive effect on the ground water concentrations. However, since there was no LNAPL in Area A, there are no recovery efforts in this area. Furthermore, ground water quality has shown some significant fluctuations over time and it is thought that the source of the toluene is in the soils. It may be prudent to more definitively determine the characteristics of the source area in Area A and, if possible, evaluate the possibility of a cost-effective remedial solution. Since this work was not included in OU I, it could be conducted as IRM#3 at the Site. In that way, the work could be started prior to the completion of OU I at the Site. A preliminary scope of work for the investigative program is outlined below.

In an effort to obtain a clearer understanding of the subsurface conditions in the courtyard area, a soil sampling program will be implemented in Area A as IRM#3. This program will entail the collection of approximately five hydropunch samples in the vicinity of the former boring HP-6 to further delineate the horizontal and vertical extent of soils that contain toluene. Since most of the soils to a depth of ten feet in this area are backfill, the first sampling interval will be at 13 feet. Continuous split samples will be collected from a depth of 13 feet below ground surface to the top of the water table. Total volatile organic readings will be taken with a PID and the two sample intervals that exhibit the highest volatile readings (worst case samples) will be sent to NEI-Nytest for volatile organic analysis. During the field activities, the PID readings will be evaluated to ensure that the toluene concentrations have been delineated in a vertical and horizontal direction. The sampling results will be transmitted to the NYSDEC with the quarterly progress report.

Once received, the sampling results will be evaluated to determine whether source reduction (e.g., passive soil vapor extraction) is feasible and appropriate for this area of the Site. Installation and operation of any soil treatment systems in this area would also be conducted as IRM#3.

ERM also reviewed the ground water monitoring data to evaluate whether modifications to the quarterly monitoring program might be possible. Since the ground water concentrations in the wells in Areas C and D have not changed significantly over time, ERM recommends that these wells be placed on a biannual sampling schedule. The following wells would be sampled on this basis: MW-8C, MW-4D, MW-5D and MW-6C. ERM also reviewed the data from the wells in Area A. DW-2A was originally added to the monitoring program to provide further data on the spatial distribution of toluene in the ground water. The concentrations of toluene in this well have been non-detectable for four rounds of sampling and ERM recommends that this well be dropped from the monitoring program. On the other hand, the remainder of the wells in Area A have showed significant fluctuations and ERM recommends that these wells continue on a quarterly sampling schedule until at least the soil sampling program in Area A has been completed. The following wells will continue to be sampled quarterly: MW-7A, MW-1A, DW-1A, DW-3A, MW-2A, and MW-9.

5.2 *DESCRIPTION OF FINAL COMPONENTS OF OPERABLE UNIT I AND IRM#3*

As discussed in Section 1.0, the Design Investigation was conducted to provide the additional information needed to design the OU I remedial action. In summary, the final components of the OU I remedy will be:

- continued active LNAPL recovery in Area C;
- additional investigation of active recovery technologies for Area D LNAPL; and
- installation and operation of Alternative II for LNAPL located beneath the bank of the Bronx River.

No further action is required for the floor drain and sump system.

In addition to OU I, an IRM has been formulated for Area A soil and ground water. As recommended above, soil and ground water in Area A that contain toluene may be addressed as interim remedial measure, IRM#3. As discussed in Section 5.1.2, this work will involve collection of soil samples from Area A to identify the source of toluene in ground water and, if appropriate, identify source removal technologies.

Red Revil:

4.0 gpm

1.4 gpm - gw

AND

D. S.

5.3 *FRAMEWORK FOR OPERABLE UNIT II*

As discussed in the OU I FS, OU II will be focused on soil and ground water at the Site after on-site LNAPL has been removed to the extent practical. Because only Area C and Area D contain LNAPL, only soil and ground water in these two areas of the Site will be addressed under OU II.

Once the recovery of LNAPL has been completed to the extent practical, the risks posed by the constituents in the Area C and Area D soil and ground water will be evaluated. This assessment will entail: identifying chemicals of concern for soil and ground water in Area C and Area D; identifying potential exposure pathways and receptors for the chemicals of concern; and determining the relative risks posed by each complete pathway. Remedial actions will then be developed for any media that exhibits an unacceptable risks.

Tables

Table 1-1
Physical Characteristics of Area D LNAPL
Former Red Devil Facility, Mount Vernon, New York

Well No.	Date	Product Appearance & Odor	Estimated Product Viscosity
DW-1D	6/23/94	Light Brown	Low
	7/26/94	Light Brown	Low
	9/1/94	Light Brown	Low
	9/7/94	Light Brown	Low
layer 1	9/23/94	Black/Grey Suspended Matter - Septic	Low
layer 2	9/23/94	Amber - Light Turpentine Odor	Med
	10/26/94	Black/Grey Suspended Matter - Septic	Low
	11/1/94	Black/Grey Suspended Matter - Septic	Low
layer 1	11/29/94	Amber - Light Turpentine Odor	Low
layer 2	11/29/94	Amber - Light Turpentine Odor	Med
DW-2D	6/23/94	Brown Gel	Med
	7/26/94	Brown Gel	Med
	9/1/94	Brown Gel	Med
	9/7/94	Grey Gel	Hi
	9/23/94	Grey Gel	Hi
	10/26/94	Grey Gel	Hi
	11/1/94	Grey Gel	Hi
	11/29/94	Amber - Light Turpentine Odor	Med
DW-4D	6/23/94	Light Brown	Med
	7/26/94	Light Brown	Med
	9/1/94	Light Brown	Med
	9/7/94	Light Brown	Med
	9/19/94	Light Brown	Med
	9/23/94	Light Brown	Med
	10/26/94	Light Brown	Med
	11/1/94	Amber - Light Turpentine Odor	Low
	11/29/94	Amber - Light Turpentine Odor	Low
DW-6D	6/23/94	Brown Gel	High
	7/26/94	Brown Gel	High
	9/1/94	Brown Gel	High
	9/7/94	Brown Gel	High
	9/19/94	Brown Gel	High
	9/23/94	Brown Gel	High
	10/26/94	Brown Gel	High
	11/1/94	Green/Tan Paste Strong Turpentine Odor	Paste
	11/29/94	Green/Tan Paste Strong Turpentine Odor	Paste

Table 1-1
Physical Characteristics of Area D LNAPL
Former Red Devil Facility, Mount Vernon, New York

Well No.	Date	Product Appearance & Odor	Estimated Product Viscosity
DW-8D	6/23/94	Brown Gel	High
	7/26/94	Brown Gel	High
	9/1/94	Brown Gel	High
	9/7/94	Brown Gel	High
	9/19/94	Brown Gel	High
	9/23/94	Brown Gel	High
	10/26/94	Brown Gel	High
	11/1/94	Amber - Chemical Odor	High
	11/29/94	Amber - Chemical Odor	High
	12/6/94	Amber - Chemical Odor	High
DW-10D	6/23/94	Brown Gel	High
	7/26/94	Brown Gel	High
	9/1/94	Brown Gel	High
	9/7/94	Brown Gel	High
	9/19/94	Brown Gel	High
	9/23/94	Brown Gel	High
	10/26/94	Brown Gel	High
	11/1/94	Brown Gel	High
	11/29/94	Brown Gel	High
DW-11D	6/23/94	Light Brown	Low
	7/26/94	Light Brown	Low
	9/1/94	Light Brown	Low
Layer 1	9/7/94	Light Brown	Low
Layer 2		Dissolved Black Metal - Chemical Odor	Low
	9/19/94	Milky WHighte	High
	9/23/94	Light Brown	Low
	10/26/94	Light Brown	Low
	11/1/94	Light Brown	Low
Layer 1	11/29/94	Light Brown	Low
Layer 2		Dissolved Black Metal - Chemical Odor	
DW-13D	6/23/94	Brown Liquid	Med
	7/26/94	Brown Liquid	Med
	9/1/94	Brown Liquid	Med
	9/7/94	Brown Liquid	Med
	9/19/94	Brown Liquid	Med
	9/23/94	Brown Gel	High
	10/26/94	Amber - Chemical Odor	High
	11/1/94	Amber - Chemical Odor	High
	11/29/94	Amber - Chemical Odor	High

Table 2-1
Comparison of Analytical Results for Treated Wastewater Disharged to the Sanitary Sewer with Permit Limits for Temporary Discharge to WCSA Former Red Devil Facility, Mount Vernon, New York

	Treated Wastewater Concentration, mg/l	WCSA Discharge Permit Limits, mg/l
Toxic Organics		
Methylene Chloride	0.003	NL
1,1-Dichloroethane	0.001	NL
1,1,1-Trichloroethane	0.001	NL
Toluene	0.002	NL
Ethylbenzene	0.002	NL
bis(2-Ethylexyl) phthalate	0.01	NL
Naphthalene	0.008	NL
Total Toxic Organics	0.027	2.1
Inorganics		
Arsenic	0.0051	0.2
Barium	0.163	2
Cadmium	0.0052	0.7
Chromium (Total)	0.0064	3
Copper	0.182	2.8
Lead	0.26	0.4
Mercury	0.0073	0.2
Nickel	0.0163	2.8
Selenium	0.005	0.2
Silver	0.0013	0.8
Zinc	1.03	1.8
Conventional Pollutants		
Cyanide	0.112	0.8
Phenols	0.012	4
Oil & Grease	6	100

Notes:
NL: No limit; WCSA discharge permit limits were not specified for individual toxic organics
Results are only provided for chemicals detected.

Table 2-2
Performance Criteria for LNAPL Recovery Techologies
Former Red Devil Facility, Mount Vernon, New York

<u>Effectiveness</u>

E-1. Can the technology be used to recover LNAPL from this area?

E-2. Does the technology provide adequate LNAPL recovery (i.e., can the technology recover LNAPL in a reasonable time period (e.g., within 20 years))?

E-3. Is the technology adaptable to the various characteristics of LNAPL in this area?

<u>Implementability</u>

I-1. Is the technology readily available?

I-2. Are the system components compatible with LNAPL in this area?

I-3. Are the proposed LNAPL recovery system components compatible with existing product recovery system components (e.g., LNAPL transfer piping), when necessary?

I-4. Can the system be installed and operated in the LNAPL area?

I-5. Does the technology have high operation and maintenance (O&M) requirements?

I-6. Does the technology pose any unacceptable risks to field personnel or the public?

I-7. For automated LNAPL recovery technologies, is the recharge of the recovery well(s) sufficient to allow unattended system operation?

<u>Cost</u>

C-1: What is the cost per gallon of LNAPL recovered via this technology?

C-2: What is the capital cost of this technology?

C-3. Does the technology collect LNAPL in a cost-effective manner?

Table 3-1
Water Level Elevation Measurements
Former Red Devil Facility, Mount Vernon, New York

		6/2/93		9/9/93		6/21/95		2/6/96		6/18/96	
Well	MPE	DTW	WTE	DTW	WTE	DTW	WTE	DTW	WTE	DTW	WTE
MW-1A	87.79	23.89	63.90	24.53	63.26	24.58	63.21	23.3	64.49	23.86	63.93
MW-2A	91.49	27.69	63.80	28.27	63.22	28.26	63.23	27.14	64.35	27.68	63.81
MW-4D	78.77	13.90	64.87	14.12	64.65	13.55	65.22	11.7	67.07	12.22	66.55
MW-5D	80.09	16.00	64.09	16.4	63.69	16.5	63.59	13.3	66.79	12.87	67.22
MW-6C	77.85	14.08	63.77	14.6	63.25	14.63	63.22	13.54	64.31	14.11	63.74
MW-7A	88.26	23.15	65.11	24.18	64.08	24.37	63.89	22.26	66.00	22.94	65.32
MW-8D	86.68	20.08	66.60	21.47	65.21	20.98	65.70	19.13	67.55	19.67	67.01
DW-1A	88.03									24.19	63.84
DW-2A	79.10									15.41	63.69
DW-3A	87.02									23.14	63.88
MW-9											

		9/26/96		12/9/96		3/15/97	
Well	MPE	DTW	WTE	DTW	WTE	DTW	WTE
MW-1A	87.79	24.37	63.42	22.41	65.38	22.98	64.81
MW-2A	91.49	28.25	63.24	26.3	65.19	26.86	64.63
MW-4D	78.77	13.3	65.47	10.45	68.32	NC	
MW-5D	80.09	16.23	63.86	11.23	68.86	11.8	68.29
MW-6C	77.85	14.4	63.45	12.48	65.37	18.08	59.77
MW-7A	88.26	24.1	64.16	21.47	66.79	22.38	65.88
MW-8D	86.68	20.4	66.28	17.62	69.06	19.07	67.61
DW-1A	88.03	24.6	63.43	22.71	65.32	23.35	64.68
DW-2A	79.10	15.6	63.50	13.85	65.25	14.5	64.60
DW-3A	87.02	23.55	63.47	21.91	65.11	22	65.02
MW-9	75.33	12.2	63.13	10.94	52.19	11.06	64.27

Notes:
MPE = Measuring Point Elevation
DTW = Depth to Water
WTE = Water Table Elevation

NC=not collected

Table 3-2
Ground Water Quality Results
Former Red Devil Facility, Mount Vernon, New York

	MW-1A 6/2/93	MW-1A 9/21/93	MW-1A 6/21/95	MW-1A 2/6/96	MW-1A 6/18/96	MW-1A 9/26/96	MW-1A 12/9/96	MW-1A 3/15/97	MW-2A 6/2/93	MW-2A DUP 6/2/93	MW-2A 9/21/93	MW-2A 6/21/95
Volatiles, µg/l												
Acetone	ND	ND	ND	ND	ND	ND J	ND J	ND	6 J	6 J	ND	ND
Methylene chloride	ND	ND	ND	ND J	ND	ND J	ND	ND	ND	ND	ND	ND
Vinyl Chloride	ND	ND	ND	ND	ND	ND	ND	ND	6 J	6 J	ND	ND
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	ND	74	97	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	19	21	ND	ND
1,1-Dichlorethane	ND	ND	ND	ND	ND	ND	ND	ND	10	11	ND	ND
1,2-Dichloroethene (total)	ND	ND	ND	ND	ND	ND	ND	ND	4 J	4 J	ND	ND
Chloroform	11	ND	11	ND	4 J	4 J	22	28	2 J	2 J	ND	ND
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	74	79	ND	ND
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	5 J	5 J	67 J	25 J
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	ND	ND	1 J	3J	2 J	2 J	1 J	3 J	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND J	ND	ND	ND	ND	ND
Toluene	ND	96,000 D	ND	ND	ND	ND	ND	ND	200 D	200 D	10,000 D	18,000 D
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	25 J	8 J
Xylenes (total)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	55 J	17 J
Styrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	3 J	1 J	1 J	1 J	ND	ND	260 D	270 D	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND	ND	ND	1 J	2 J	ND	ND	ND	ND
Total TICs	41 J	ND	R	ND	ND	ND	ND	ND	86 J	41 J	134 J	80 J

NOTES:
TIC: Tentatively Identified Compounds
J: estimated value, value estimated due to data validation requirements, concentration below CRQL or compound is a TIC.
ND: the compound was analyzed for but not detected.
ND J: The laboratory reported these data as non-detect, but during data validation, analysis of the MS/MSD suggested that there was a potential low bias and the presence or absence of these compounds cannot be confirmed.*
NA: the compound was not analyzed for.
B (organics): compound detected in sample at a concentration greater than ten times the amount in associated method blank.
B (inorganics): result is less than contract lab required detection limit, but greater than the instrument detection limit.
D: result is from secondary dilution analysis.
R: results were rejected during data validation.

Table 3-2
Ground Water Quality Results
Former Red Devil Facility, Mount Vernon, New York

	MW-2A 2/6/96	MW-2A 6/18/96	MW-2A DUP 6/18/96	MW-2A 9/26/96	MW-2A 12/9/96	MW-2A 3/15/97	MW-4D 6/3/93	MW-4D 9/21/93	MW-4D 6/21/95	MW-4D 2/6/96	MW-4D 6/18/96	MW-4D DUP1 9/26/96
Volatiles, μg/l												
Acetone	ND	ND	ND	ND J	ND J	ND	ND	ND	18	ND J	ND	ND J
Methylene chloride	ND	ND	ND	ND J	ND J	ND	ND	ND	ND	ND J	ND	ND J
Vinyl Chloride	ND	ND	ND	ND	ND J	ND	ND	ND	ND J	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND	ND J	ND	19	ND	ND	ND	ND	ND
1,1-Dichloroethene	ND	20	17	ND	ND J	ND	ND	ND	ND	ND	ND	ND
1,1-Dichlorethane	2 J	11	8 J	6 J	3 J	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene (total)	ND	2 J	2 J	ND	ND J	ND	ND	ND	ND	ND	ND	ND
Chloroform	ND	2 J	2 J	ND	ND J	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	ND	54	58	3 J	ND J	ND	ND	ND	ND	ND	ND	ND
Benzene	40 J	ND	ND	9 J	36 J	2 J	ND	ND	ND	ND	ND	ND
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND J	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	ND	2 J	2 J	ND	ND J	ND	4 J	3J	3 J	2 J	ND	1 J
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND J	ND	ND	ND	ND	ND	ND	ND
Toluene	38,000 BD	240 D	220 D	16,000 D	61,000 D	580 D	ND	ND	ND	ND	ND	2 J
Chlorobenzene	ND	ND	ND	ND	ND J	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	20 J	ND	ND	5 J	24 J	ND	6 J	1J	1 J	14	ND	ND
Xylenes (total)	49 J	ND	ND	11	64 J	ND	28	1J	5 J	66	ND	ND
Styrene	ND	ND	ND	ND	ND J	ND	ND	ND	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND	ND J	ND	ND	ND	ND	ND	ND	ND J
1,1,1-Trichloroethane	ND	ND	ND	4 J	ND J	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND J	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND	ND J	ND	ND	ND	ND	ND	ND	ND
Total TICs	144 J	ND	ND	28 J	6624 J	28 JD	369 J	39 J	6 J	681 J	6 J	ND

NOTES:
TIC: Tentatively Identified Compounds
J: estimated value, value estimated due to data validation requirements, concentration below CRQL or compound is a TIC.
ND: the compound was analyzed for but not detected.
ND J: The laboratory reported these data as non-detect, but during data validation, analysis of the MS/MSD suggested that there was a potential low bias and the presence or absence of these compounds cannot be confirmed.*
NA: the compound was not analyzed for.
B (organics): compound detected in sample at a concentration greater than ten times the amount in associated method blank.
B (inorganics): result is less than contract lab required detection limit, but greater than the instrument detection limit.
D: result is from secondary dilution analysis.
R: results were rejected during data validation.

Table 3-2
Ground Water Quality Results
Former Red Devil Facility, Mount Vernon, New York

	MW-4D 9/26/96	MW-4D 12/9/96	MW-4D DUP1 12/9/96	MW-4D 3/20/97	MW-5D 6/3/93	MW-5D 9/21/93	MW-5D 6/21/95	MW-5D 2/6/96	MW-5D 6/18/96	MW-5D 9/26/96	MW-5D 12/9/96	MW-5D 3/15/97
Volatiles, µg/l												
Acetone	ND J	ND J	ND J	ND	ND	ND	19	ND	ND	ND J	14 J	ND
Methylene chloride	ND J	ND	ND	ND	ND	ND	ND	11 J	ND	ND J	2 J	ND
Vinyl Chloride	ND	ND	ND	ND	ND	ND	ND	ND J	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND	24 J	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	2 J	ND	1 J	2 J	ND
1,1-Dichlorethane	ND	ND	ND	ND	200	40 J	68	95	27	48	41	24
1,2-Dichloroethene (total)	ND	ND	ND	ND	ND	ND	9 J	19	5 J	12	11	8 J
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	ND	ND	ND	ND	ND	ND	5 J	8 J	3 J	5 J	5 J	4 J
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	10 J	ND	3 J	2 J	ND	ND	ND
Tetrachloroethene	1 J	ND J	ND J	ND	ND	ND	ND	ND	ND	ND	ND J	ND
1,1,2,2-Tetrachloroethane	ND	ND J	ND J	ND	ND	ND	ND	ND	ND	ND	ND J	ND
Toluene	2 J	ND	ND	ND	ND	120	20	16	ND	9 J	12	3 J
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	ND	3 J	3 J	ND	180	100	98	160	9 J	22	82	90
Xylenes (total)	ND	16	16	ND	1200	700	910 D	900 D	400	860 D	410	430 D
Styrene	ND	ND	ND	ND	ND	ND	6 J	ND	ND	ND	ND	4 J
Chloroethane	ND	ND	ND	ND	ND	ND	540 D	830 D	150	440 D	590 D	210 D
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	6 J	ND	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total TICs	ND	211 J	205 J	46 J	2686 J	3140 J	3700 J	795 J	1401 J	1,158 J	755 J	949 J

NOTES:
TIC: Tentatively Identified Compounds
J: estimated value, value estimated due to data validation requirements, concentration below CRQL or compound is a TIC.
ND: the compound was analyzed for but not detected.
ND J: The laboratory reported these data as non-detect, but during data validation, analysis of the MS/MSD suggested that there was a potential low bias and the presence or absence of these compounds cannot be confirmed.*
NA: the compound was not analyzed for.
B (organics): compound detected in sample at a concentration greater than ten times the amount in associated method blank.
B (inorganics): result is less than contract lab required detection limit, but greater than the instrument detection limit.
D: result is from secondary dilution analysis.
R: results were rejected during data validation.

Table 3-2
Ground Water Quality Results
Former Red Devil Facility, Mount Vernon, New York

	MW-6C 6/2/93	MW-6C 9/21/93	MW-6C DUP 9/21/93	MW-6C 6/21/95	MW-6C 2/6/96	MW-6C DUP 2/6/96	MW-6C 6/18/96	MW-6C 9/26/96	MW-6C 12/9/96	MW-6C 3/15/97	MW-6C DUP-1 3/15/97	MW-7A 6/2/93
Volatiles, µg/l												
Acetone	ND	ND	ND	ND	ND J	ND J	ND	ND J	ND J	ND	ND	ND
Methylene chloride	ND	ND	ND	ND	ND J	ND J	ND	ND J	ND	ND	ND	ND
Vinyl Chloride	ND	ND	ND	ND J	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	ND J	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichlorethane	16	5 J	5 J	1 J	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene (total)	2 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	2 J	1 J	2 J	2 J	ND	ND	2 J	2 J	2 J	17	17	2 J
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	4 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	6 J	7 J	6 J	11	12	11	5 J	8 J	6 J	4 J	5 J	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	2 J	ND	ND	ND	ND	ND J	ND	ND	ND
Toluene	150	40	52	ND	2 J	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	18	7 J	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xylenes (total)	77	25	37	ND	ND	ND	ND	ND	ND	ND	ND	ND
Styrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	1 J	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total TICs	503 J	318 J	398 J	247 J	64 J	49 J	57 J	7 J	ND	ND	ND	42 J

NOTES:
TIC: Tentatively Identified Compounds
J: estimated value, value estimated due to data validation requirements, concentration below CRQL or compound is a TIC.
ND: the compound was analyzed for but not detected.
ND J: The laboratory reported these data as non-detect, but during data validation, analysis of the MS/MSD suggested that there was a potential low bias and the presence or absence of these compounds cannot be confirmed.*
NA: the compound was not analyzed for.
B (organics): compound detected in sample at a concentration greater than ten times the amount in associated method blank.
B (inorganics): result is less than contract lab required detection limit, but greater than the instrument detection limit.
D: result is from secondary dilution analysis.
R: results were rejected during data validation.

Table 3-2
Ground Water Quality Results
Former Red Devil Facility, Mount Vernon, New York

	MW-7A 9/21/93	MW-7A 6/21/95	MW-7A 2/6/96	MW-7A 6/18/96	MW-7A 9/26/96	MW-7A 12/9/96	MW-7A 3/15/97	MW-8C 6/2/93	MW-8C 9/21/93	MW-8C 6/21/95	MW-8C DUP 6/21/95	MW-8C 2/6/96
Volatiles, µg/l												
Acetone	ND	ND	ND J	ND	ND J	ND J	ND	ND	ND	ND	ND	ND J
Methylene chloride	ND	ND	ND J	ND	ND J	ND	ND	ND	ND	ND	ND	ND J
Vinyl Chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichlorethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene (total)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	ND	10	ND	1 J	2 J	2 J	2 J	ND	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	13 J	ND J*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND	ND	ND J	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND J	ND	ND	ND	ND	ND	ND
Toluene	16,000 D	ND J*	2 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlorobenzene	ND	ND J*	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Xylenes (total)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Styrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total TICs	ND	R	ND	ND	ND	ND	ND	32 J	ND	ND	ND	ND

NOTES:
TIC: Tentatively Identified Compounds
J: estimated value, value estimated due to data validation requirements, concentration below CRQL or compound is a TIC.
ND: the compound was analyzed for but not detected.
ND J: The laboratory reported these data as non-detect, but during data validation, analysis of the MS/MSD suggested that there was a potential low bias and the presence or absence of these compounds cannot be confirmed.*
NA: the compound was not analyzed for.
B (organics): compound detected in sample at a concentration greater than ten times the amount in associated method blank.
B (inorganics): result is less than contract lab required detection limit, but greater than the instrument detection limit.
D: result is from secondary dilution analysis.
R: results were rejected during data validation.

Table 3-2
Ground Water Quality Results
Former Red Devil Facility, Mount Vernon, New York

	MW-8C 6/18/96	MW-8C 9/26/96	MW-8C 12/9/96	MW-8C 3/15/97	MW-9 9/26/96	MW-9 12/9/96	MW-9 3/15/97	DW-16 9/26/96	DW-1A 6/18/96	DW-1A 9/26/96	DW-1A 12/9/96	DW-1A 3/15/97
Volatiles, µg/l												
Acetone	ND	ND J	ND J	ND	ND J	ND J	ND	ND J	ND	ND J	ND J	ND
Methylene chloride	ND	ND J	ND	ND	ND J	ND	ND	ND J	ND	ND J	ND	ND
Vinyl Chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	ND J	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichlorethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene (total)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	39 J	6 J	5 J	24
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1 J	ND	ND
Benzene	ND	ND	ND	ND	ND	ND	ND	33	ND	4 J	ND	ND
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND J	ND	ND	ND J	ND	ND	24 J	6 J	14 J	5 J
1,1,2,2-Tetrachloroethane	ND	ND	ND J	ND	ND	ND J	ND	ND	ND	ND	ND J	ND
Toluene	ND	ND	ND	ND	2 J	ND	ND	ND	19,000 D	20,000 D	12,000 D	150
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	38 J	9 J	7 J	2 J
Xylenes (total)	ND	ND	ND	ND	ND	ND	ND	2 J	190 J	33	100	16
Styrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroethane	ND	ND	ND	ND	ND	ND	ND	29	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total TICs	ND	ND	ND	ND	ND	ND	ND	428 J	7,499 J	361 J	2360 J	4090 J

NOTES:
TIC: Tentatively Identified Compounds
J: estimated value, value estimated due to data validation requirements, concentration below CRQL or compound is a TIC.
ND: the compound was analyzed for but not detected.
ND J: The laboratory reported these data as non-detect, but during data validation, analysis of the MS/MSD suggested that there was a potential low bias and the presence or absence of these compounds cannot be confirmed.*
NA: the compound was not analyzed for.
B (organics): compound detected in sample at a concentration greater than ten times the amount in associated method blank.
B (inorganics): result is less than contract lab required detection limit, but greater than the instrument detection limit.
D: result is from secondary dilution analysis.
R: results were rejected during data validation.

Table 3-2
Ground Water Quality Results
Former Red Devil Facility, Mount Vernon, New York

	DW-2A 6/18/96	DW-2A 9/26/96	DW-2A 12/9/96	DW-2A 3/15/97	DW-3A 6/18/96	DW-3A 9/26/96	DW-3A 12/9/96	DW-3A 3/15/97
Volatiles, µg/l								
Acetone	ND	ND J	ND J	ND	ND	ND J	ND J	ND
Methylene chloride	ND	ND J	ND	ND	ND	ND J	ND	ND
Vinyl Chloride	ND	ND	ND	ND	ND	ND J	ND	ND
Carbon Disulfide	ND	ND J	ND	ND	ND	ND J	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND J	ND	ND
1,1-Dichlorethane	ND	ND	ND	ND	1 J	3 J	ND	ND
1,2-Dichloroethene (total)	ND	ND	ND	ND	1 J	ND J	ND	ND
Chloroform	7 J	9 J	3 J	27	ND	ND J	ND	ND
Trichloroethene	ND	2 J	4 J	ND	ND	2 J	ND	ND
Benzene	ND	ND	ND	ND	ND	20 J	2 J	ND
4-Methyl-2-Pentanone	ND	ND	ND	ND	ND	ND J	ND	ND
Tetrachloroethene	2 J	ND	ND	ND	ND J	ND J	ND	ND
1,1,2,2-Tetrachloroethane	ND	ND	ND J	ND	ND J	ND J	ND	ND
Toluene	ND	ND	ND	ND	1,300 D	100,000	15,000 D	64
Chlorobenzene	ND	ND	ND	ND	ND J	ND J	ND	ND
Ethylbenzene	ND	ND	ND	ND	ND J	28 J	13	3 J
Xylenes (total)	ND	ND	ND	ND	38 J	50 J	29	5 J
Styrene	ND	ND	ND	ND	ND J	ND J	ND	ND
Chloroethane	ND	ND	ND	ND	ND	ND J	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND J	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND J	ND	ND
Bromodichloromethane	ND	ND	ND	2 J	ND	ND	ND	ND
Total TICs	15 J	ND	ND	ND	1,162 J	645 J	459 J	217 J

NOTES:
TIC: Tentatively Identified Compounds
J: estimated value, value estimated due to data validation requirements, concentration below CRQL or compound is a TIC.
ND: the compound was analyzed for but not detected.
ND J: The laboratory reported these data as non-detect, but during data validation, analysis of the MS/MSD suggested tha there was a potential low bias and the presence or absence of these compounds cannot be confirmed.*
NA: the compound was not analyzed for.
B (organics): compound detected in sample at a concentration greater than ten times the amount in associated method blan
B (inorganics): result is less than contract lab required detection limit, but greater than the instrument detection limit.
D: result is from secondary dilution analysis.
R: results were rejected during data validation.

Table 3-3
Comparison of Long-Term Area D LNAPL Recovery Rates
Former Red Devil Facility, Mount Vernon, New York

Month	Recovery Method									Monthly Total	Cumulative Total
	Soakease			Keck Canister			PetroBelt				
	(gallons)	Wells Deployed	(gal/well)	(gallons)	Wells Deployed	(gal/well)	(gallons)	Wells Deployed	(gal/well)	(gallons)	(gallons)
Dec-94	0.69	1	0.69	1.25	1	1.25	0.00	0	NA	1.94	1.94
Jan-95	1.43	2	0.71	1.88	1	1.88	0.00	0	NA	3.30	5.24
Feb-95	1.78	3	0.59	0.51	2	0.51 (1)	0.00	0	NA	1.78	7.01
Mar-95	1.55	4	0.39	1.30	2	1.30 (1)(2)	0.00	0	NA	1.55	8.56
Apr-95	1.63	3	0.54	0.38	1	0.38 (3)	0.00	0	NA	2.00	10.56
May-95	3.10	4	0.78	0.31	1	0.31 (3)	0.00	0	NA	3.42	13.98
Jun-95	2.45	4	0.61	2.33	1	2.33	0.00	0	NA	4.77	18.75
Jul-95	0.00	0	NA	0.00	0	NA	7.89	6	1.32	7.89	26.64
Aug-95	0.00	0	NA	0.00	0	NA	4.42	6	0.74	4.42	31.06
Sep-95	0.00	0	NA	0.00	0	NA	0.70	3	0.23	0.70	31.76
Oct-95	0.38	2	0.19	0.50	1	0.50	1.70	3	0.57	2.58	34.34
Nov-95	0.39	2	0.19	0.38	1	0.38	0.00	0	NA	0.76	35.10
Dec-95	0.33	2	0.16	0.00	1	0.00	0.00	0	NA	0.33	35.42
Jan-96	2.78	7	0.40	0.00	0	NA	0.00	0	NA	2.78	38.20
Feb-96	2.13	10	0.21	0.00	0	NA	0.00	0	NA	2.13	40.32
Mar-96	3.61	7	0.52	0.00	0	NA	0.00	0	NA	3.61	43.94
Totals	*22.21*	*Average =*	*0.46*	*8.83*	*Average =*	*0.88*	*14.71*	*Average =*	*0.71*		

Notes:
(1) Each well was only tested for one-half the month. Consequently, the recovery rate reflects the cumulative use of one well for that month.
(2) DW-2D and DW-4D were tested this month. Due to the poor recharge of DW-4D, recovery rates for this month were lower than usual.
(3) Hydrophobic filter on Keck Canister was clogged. This resulted in lower recovery rates than usual.
NA: Long-term average monthly recovery rate is not available; recovery method was not deployed during the indicated month.

Table 3-4
Recovery Rates for Area D LNAPL According to Well and LNAPL Viscosity
Former Insilco Facility, Mount Vernon, New York

Manual LNAPL Recovery Technology	Average LNAPL Recovery, gallons/week						
	low viscosity LNAPL		high viscosity LNAPL			very high viscosity LNAPL	
	DW-2D	DW-11D	DW-1D	DW-10D	DW-4D	DW-8D	DW-13D
Soakease	0.63	0.69	0.81	0.82	0.30	0.68	0.70
Keck Canister	0.72	1.22	NC	NC	NC	0.18	NC
Petro-Belt	0.36	0.30	0.30	1.43	0.08	0.35	0.26

Manual LNAPL Recovery Technology	Average LNAPL Recovery By Viscosity, gallons/week		
	low viscosity LNAPL	high viscosity LNAPL (1)	very high viscosity LNAPL
Soakease	0.66	0.81	0.69
Keck Canister	0.97	NC	0.18
Petro-Belt	0.33	0.87	0.30

Notes:
(1) Recovery rates for DW-4D are not included in averages since this well has poor recharge.
NC: LNAPL was not collected via this technology in this well.

Table 3-5
Petro-Belt Field Testing Data
Average Recovery Rates By Well and a Summary of Field Testing Measurements
Former Red Devil Facility, Mount Vernon, New York

Recovery Well	Relative Viscosity	Average Short-Term Recovery Rate (gal/hr)	Average Weekly Recovery (gal/week)(1)
DW-2D	low	0.36	0.36
DW-11D	low	0.31	0.30
DW-1D	high	0.28	0.30
DW-4D	high	0.07	0.08
DW-10D	high	0.59	1.43
DW-8D	very high	0.27	0.35
DW-13D	very high	0.22	0.26

(1) Average weekly recovery rates were estimated using the average total volume of LNAPL recovered, as documented below, and assuming that attended operation of the Petro-Belt system occurs one day per week per well.

				Before Test				Product		Short-Term	After Test			
Recovery Well	Relative Viscosity	Test #	Date	DTP	DTW	Product Thickness (ft)	Product Volume (gal)	Volume Recovered (gal)	Elapsed Time (min)	Recovery Rate (gal/hr)	DTP	DTW	Product Thickness (ft)	Product Volume (gal)
DW-2D	low	1	7/25/95	12.82	13.64	0.82	0.13	0.50	60	0.50	13.15	13.29	0.14	0.0228
		2	8/1/95	12.70	13.63	0.93	0.15	0.45	60	0.45	13.06	13.27	0.21	0.0342
		3	8/22/95	13.03	13.88	0.85	0.14	0.33	60	0.33	13.54	13.55	0.01	0.0016
		4	9/26/95	12.79	13.31	0.52	0.08	0.15	60	0.15	13.10	13.20	0.10	0.0163
DW-11D	low	1	7/6/95	11.51	12.22	0.71	0.12	0.13	30	0.25	11.58	11.91	0.33	0.0538
		2	7/20/95	11.40	11.71	0.31	0.05	0.19	38	0.30	11.33	11.44	0.11	0.0179
		3	7/25/95	11.35	11.95	0.60	0.10	0.38	60	0.38	11.44	11.50	0.06	0.0098
		4	8/1/95	11.19	11.96	0.77	0.13	0.55	95	0.35	11.25	11.44	0.19	0.0310
		5	8/31/95	11.64	12.26	0.62	0.10	0.28	61	0.27	11.88	11.90	0.02	0.0033
DW-1D	high	1	7/11/95	13.01	14.02	1.01	0.16	0.38	67	0.34	13.09	13.12	0.03	0.0049
		2	7/13/95	13.05	14.11	1.06	0.17	0.50	73	0.41	13.20	13.24	0.04	0.0065
		3	7/25/95*	12.98	14.04	1.06	0.17	0.13	40	0.19	13.18	13.39	0.21	0.0342
		4	9/20/95	13.35	14.35	1.00	0.16	0.20	60	0.20	13.47	13.48	0.01	0.0016

Table 3-5
Petro-Belt Field Testing Data
Average Recovery Rates By Well and a Summary of Field Testing Measurements
Former Red Devil Facility, Mount Vernon, New York

Recovery Well	Relative Viscosity	Test #	Date	Before Test				Product Volume Recovered (gal)	Elapsed Time (min)	Short-Term Recovery Rate (gal/hr)	After Test			
				DTP	DTW	Product Thickness (ft)	Product Volume (gal)				DTP	DTW	Product Thickness (ft)	Product Volume (gal)
DW-4D	high	1	8/10/95	15.09	15.70	0.61	0.10	0.08	62	0.07	15.45	15.55	0.10	0.0163
DW-10D	high	1	7/20/95	13.66	16.61	2.95	0.48	1.75	150	0.70	15.02	15.24	0.22	0.0359
		2	7/26/95	14.68	16.09	1.41	0.23	3.50	250	0.84	14.99	15.11	0.12	0.0196
		3	8/22/95	14.96	16.92	1.96	0.32	0.50	60	0.50	15.45	15.60	0.15	0.0245
		4	8/31/95	15.08	16.84	1.76	0.29	0.55	60	0.55	15.62	15.68	0.06	0.0098
		5	10/12/95	14.63	16.60	1.97	0.32	0.85	145	0.35	15.06	15.30	0.24	0.0391
DW-8D	very high	1	7/20/95	11.08	12.76	1.68	0.27	0.17	60	0.17	11.39	11.44	0.05	0.0081
		2	8/1/95	11.40	12.35	0.95	0.15	0.30	60	0.30	11.30	11.43	0.13	0.0212
		3	8/24/95	12.62	13.23	0.61	0.10	0.45	60	0.45	11.67	11.68	0.01	0.0016
		4	8/31/95	11.54	13.02	1.48	0.24	0.35	60	0.35	12.00	12.04	0.04	0.0065
		5	10/18/95	10.94	12.75	1.81	0.30	0.50	310	0.10	11.24	11.30	0.06	0.0098
DW-13D	very high	1	7/6/95	12.64	13.09	0.45	0.07	0.07	30	0.15	12.99	13.00	0.01	0.0016
		2	7/19/95	12.46	13.36	0.90	0.15	0.19	59	0.19	12.63	12.64	0.01	0.0016
		3	8/24/95	12.76	14.01	1.25	0.20	0.35	60	0.35	13.05	13.10	0.05	0.0081
		4	8/31/95	12.90	13.85	0.95	0.15	0.23	63	0.21	13.28	13.29	0.01	0.0016
		5	9/26/95	12.74	14.18	1.44	0.23	0.35	60	0.35	13.03	13.06	0.03	0.0049
		6	10/26/95	11.83	13.63	1.80	0.29	0.35	300	0.07	13.22	13.24	0.02	0.0033

NOTES:

* - Water levels affected by heavy rainstorm at end of test.

Table 3-6
Chemical and Physical Characteristics of LNAPL Located Beneath the Bronx River Bank Former Red Devil Facility, Mount Vernon, New York

Physical Analysis	Sample/Well ID: Composite	DW-17D	DW-18D	DW-19D
% Ash	0.005%	0.01%	0.01%	0.01%
% Water	1.50%	0.26%	0.39%	0.33%
% Solids	12.80%	14.20%	11.70%	11.10%
% NAPL (100 - (% Solids+% Water))	85.80%	85.50%	87.90%	88.60%
Solubility in Water	insoluble	NA	NA	NA
pH	4.7	5.55	5.55	5.38
Specific Gravity	0.806	0.814	0.805	0.804
Viscosity (cps)	7.5	8	7	7

TCLP Volatiles, mg/l	TCLP Regulatory Level, mg/l	Sample/Well ID: Composite:	DW-17D:	DW-18D:	DW-19D:
Benzene	0.5	<50	<50	<50	<50
Carbon tetrachloride	0.5	<50	<50	<50	<50
Chlorobenzene	100	<50	<50	<50	<50
Chloroform	6	<50	<50	<50	<50
1,2-Dichloroethane	0.5	<50	<50	<50	<50
1,1-Dichloroethylene	0.7	<50	<50	<50	<50
Tetrachloroethylene	0.7	<50	<50	<50	<50
Trichloroethylene	0.5	<50	<50	<50	<50
Vinyl chloride	0.2	<50	<50	<50	<50
Toluene	NL	360	1600	<50	3800
Ethyl Benzene	NL	140	480	270	440
Xylenes	NL	2460	3300	1880	3000
1,4-Dichlorobenzene	7.5	<50	<50	<50	<50
Hexachloro-1,3-butadiene	0.5	<50	<50	<50	<50
Isopropylbenzene	NL	150	560	370	430
n-Propylbenzene	NL	300	1100	670	810
1,3,5-Trimethylbenzene	NL	2600	3700	3000	3200
tert-Butylbenzene	NL	<5	65	60	75
p-Isopropyltoluene	NL	380	560	510	600
Naphthalene	NL	250	750	630	700
sec-Butylbenzene	NL	150	550	460	590
1,2,4-Trimethylbenzene	NL	6000	7700	5700	6000

Notes:

NL: No TCLP Limit available for compound.

NA: not analyzed

Table 3-7
LNAPL and Water Level Data Collected from Delineation Wells on the Bronx River Bank
Former Red Devil Facility, Mount Vernon, New York

RIVER MONITORING WELL 16-D

DATE	MPE	DTP	Product Level Elevation	PT	DTW	Water Level Elevation	PRODUCT CHARACTERISTICS
9\19\96	74.85			0.00	11.64	63.21	n/a
9\26\96	74.85			0.00	11.64	63.21	n/a
10\17\96	74.85			0.00	11.60	63.25	n/a
10\21\96	74.85			0.00	10.50	64.35	n/a
10\31\96	74.85	11.08	63.77	0.10	11.18	63.67	very thin light amber
11\22\96	74.85	11.46	63.39	0.08	11.54	63.31	very thin light amber
12\10\96	74.85	9.90	64.95	0.08	9.98	64.87	very thin light amber
12\19\96	74.85	10.46	64.39	0.01	10.47	64.38	very thin light amber
1\2\97	74.85	11.08	63.77	0.04	11.12	63.73	very thin light amber
1\7\97	74.85	11.21	63.64	0.05	11.26	63.59	very thin light amber
2\12\97	74.85			0.00	10.77	64.08	very thin light amber
3\15\97	74.85			0.00	10.25	64.60	

RIVER MONITORING WELL 18-D

DATE	MPE	DTP	Product Level Elevation	PT	DTW	Water Level Elevation	PRODUCT CHARACTERISTICS
9\19\96	74.28	11.01	63.27	0.44	11.45	62.83	very thin light amber
9\26\96	74.28	11.01	63.27	0.44	11.45	62.83	
10\17\96	74.28	10.92	63.36	0.58	11.50	62.78	very thin light amber
10\21\96	74.28	10.28	64.00	2.17	12.45	61.83	very thin light amber
10\31\96	74.28	10.35	63.93	1.14	11.49	62.79	very thin light amber
11\14\96	74.28	10.79	63.49	0.09	10.88	63.40	very thin light amber
11\22\96	74.28	10.91	63.37	0.07	10.98	63.30	very thin light amber
12\10\96	74.28	9.68	64.60	1.00	10.68	63.60	very thin light amber
12\19\96	74.28	10.00	64.28	0.69	10.69	63.59	very thin light amber
1\2\97	74.28	10.45	63.83	0.62	11.07	63.21	very thin light amber
1\7\96	74.28	10.59	63.69	0.44	11.03	63.25	very thin light amber
2\12\97	74.28	10.50	63.78	0.14	10.64	63.64	very thin light amber
3\15\97	74.28	0.00	0.00	0.00	9.88	64.40	

RIVER MONITORING WELL 17-D

DATE	MPE	DTP	Product Level Elevation	PT	DTW	Water Level Elevation	PRODUCT CHARACTERISTICS
9\19\96	74.77	11.44	63.33	0.68	12.12	62.65	very thin light amber
9\26\96	74.77	11.44	63.33	0.68	12.12	62.65	
10\17\96	74.77	11.35	63.42	0.75	12.10	62.67	very thin light amber
10\21\96	74.77	10.02	64.75	1.51	11.53	63.24	very thin light amber
10\31\96	74.77	10.81	63.96	0.94	11.75	63.02	very thin light amber
11\14\96	74.77	11.13	63.64	0.83	11.96	62.81	very thin light amber
11\22\96	74.77	11.22	63.55	0.78	12.00	62.77	very thin light amber
12\10\96	74.77	9.90	64.87	1.88	11.78	62.99	very thin light amber
12\19\96	74.77	10.08	64.69	1.72	11.80	62.97	very thin light amber
1\2\97	74.77	10.98	63.79	1.04	12.02	62.75	very thin light amber
1\7\97	74.77	11.02	63.75	0.98	12.00	62.77	very thin light amber
2\12\97	74.77	10.78	63.99	0.95	11.73	63.04	very thin light amber
3\15\97	74.77	10.16	64.61	0.78	10.94	63.83	very thin light amber

RIVER MONITORING WELL 19-D

DATE	MPE	DTP	Product Level Elevation	PT	DTW	Water Level Elevation	PRODUCT CHARACTERISTICS
9\19\96	74.23	10.97	63.26	0.47	11.44	62.79	very thin light amber
9\26\96	74.23	10.97	63.26	0.47	11.44	62.79	
10\17\96	74.23	10.91	63.32	0.43	11.34	62.89	very thin light amber
10\21\96	74.23	n/d		n/a	10.50	63.73	very thin light amber
10\31\96	74.23	10.40	63.83	0.48	10.88	63.35	very thin light amber
11\14\96	74.23	10.67	63.56	0.46	11.13	63.10	very thin light amber
11\22\96	74.23	10.80	63.43	0.43	11.23	63.00	very thin light amber
12\10\96	74.23	9.53	64.70	0.68	10.21	64.02	very thin light amber
12\19\96	74.23	9.97	64.26	0.53	10.50	63.73	very thin light amber
1\2\97	74.23	10.41	63.82	0.64	11.05	63.18	very thin light amber
1\7\97	74.23	10.51	63.72	0.62	11.13	63.10	very thin light amber
2\12\97	74.23	10.31	63.92	0.62	10.93	63.30	very thin light amber
3\15\97	74.23	9.82	64.41	0.06	9.88	64.35	

Notes:

MPE - Measuring Point Elevation
DTP - Depth to Product
PT - Product Thickness
DTW - Depth to Water

TABLE 3-8
LNAPL and Water Level Data Collected on 12 February 1997 and 19 September 1996
Former Red Devil Facility, Mount Vernon, New York

WELL #	DATE	MPE	DTP	Product Level Elevation	PT	DTW	Water Level Elevation	PRODUCT CHARACTERISTICS
1C	2\12\97	78.18	13.78	64.40	0.42	14.20	63.98	thin amber
3C	2\12\97	78.13	13.22	64.91	0.23	13.45	64.68	amber, thin
6C	2\12\97	78.08	n/d		0.00	13.69	64.39	amber
1D	2\12\97	80.19	11.85	68.34	0.15	12.00	68.19	n/d
4D	2\12\97	79.02	13.90	65.12	0.70	14.60	64.42	amber
8D	2\12\97	79.26	10.40	68.86	0.35	10.75	68.51	thick amber
10D	2\12\97	79.17	13.55	65.62	1.12	14.67	64.50	thick amber
11D	2\12\97	78.51	10.20	68.31	0.67	10.87	67.64	amber
12D	2\12\97	78.45	13.23	65.22	0.51	13.74	64.71	n/a
13D	2\12\97	78.45	10.93	67.52	2.22	13.15	65.30	amber
16D	2\12\97	74.85	n/d		0.00	10.77	64.08	very thin light amber
17D	2\12\97	74.77	10.78	63.99	0.95	11.73	63.04	very thin light amber
18D	2\12\97	74.28	10.50	63.78	0.14	10.64	63.64	very thin light amber
19D	2\12\97	74.23	10.31	63.92	0.62	10.93	63.30	very thin light amber

WELL#	DATE	MPE	DTP	Product Level Elevation	PT	DTW	Water Level Elevation	PRODUCT CHARACTERISTICS
1C	9\19\96	78.18	14.78	63.40	0.82	15.60	62.58	thin amber
4C	9\19\96	78.17	n/d		n/a	16.00	62.17	n/a
5C	9\19\96	78.11	n/d		n/a	14.10	64.01	n/a
6C	9\19\96	78.08	14.91	63.17	0.39	15.30	62.78	amber
7C	9\19\96	78.11	n/d		n/a	16.00	62.11	n/a
1D	9\19\96	80.19	12.41	67.78	0.22	12.63	67.56	thin amber
2D	9\19\96	79.78	12.45	67.33	0.26	12.71	67.07	thick amber
4D	9\19\96	79.02	n/d		n/a	15.00	64.02	amber
5D	9\19\96	78.96	n/a		n/a	15.00	63.96	n/a
6D	9\19\96	78.90	14.30	64.60	*	0.00		no water, moist white goo
8D	9\19\96	79.26	11.16	68.10	0.19	11.35	67.91	thick amber
10D	9\19\96	79.17	15.17	64.00	0.54	15.71	63.46	thick amber
11D	9\19\96	78.51	10.93	67.58	0.02	10.95	67.56	amber
12D	9\19\96	78.45	n/d		n/a	14.38	64.07	n/a
13D	9\19\96	78.45	12.13	66.32	0.82	12.95	65.50	amber
16D	9\19\96	74.85	n/d		n/a	11.64	63.21	n/a
17D	9\19\96	74.77	11.44	63.33	0.68	12.12	62.65	very thin light amber
18D	9\19\96	74.28	11.01	63.27	0.44	11.45	62.83	very thin light amber
19D	9\19\96	74.23	10.97	63.26	0.47	11.44	62.79	very thin light amber

Table 3-9
Riverbank LNAPL: Baildown Test Results for DW-17D, DW-18D, and DW-19D
Former Red Devil Facility, Mount Vernon, New York

Baildown Test Results (10/16/96)
Well 17D

Elapsed Time (min)	Product Thickness (ft)	Volume (gal)	Recovery Rate (gal/hr)
0.00	0.15	0.10	
0.50	0.28	0.18	10.18
1.00	0.31	0.20	2.35
1.50	0.32	0.21	0.78
2.00	0.32	0.21	0.00
2.50	0.38	0.25	4.70
3.00	0.32	0.21	-4.70
3.50	0.33	0.22	0.78
4.00	0.35	0.23	1.57
4.50	0.36	0.24	0.78
5.00	0.36	0.24	0.00
6.00	0.37	0.24	0.39
7.00	0.39	0.25	0.78
8.00	0.43	0.28	1.57
9.00	0.45	0.29	0.78
10.00	0.45	0.29	0.00
12.50	0.48	0.31	0.47
15.00	0.48	0.31	0.00
17.50	0.50	0.33	0.31
20.00	0.52	0.34	0.31
25.00	0.54	0.35	0.16
30.00	0.55	0.36	0.08
40.00	0.58	0.38	0.12
50.00	0.58	0.38	0.00
60.00	0.61	0.40	0.12
80.00	0.64	0.42	0.06
100.00	0.64	0.42	0.00
110.00	0.65	0.42	0.04

Baildown Test Results (10/16/96)
Well 18D

Elapsed Time (min)	Product Thickness (ft)	Volume (gal)	Recovery Rate (gal/hr)
0.00	0.05	0.03	
0.50	0.11	0.07	4.70
1.00	0.16	0.10	3.92
1.50	0.21	0.14	3.92
2.00	0.24	0.16	2.35
2.50	0.26	0.17	1.57
3.00	0.26	0.17	0.00
3.50	0.26	0.17	0.00
4.00	0.27	0.18	0.78
4.50	0.28	0.18	0.78
5.00	0.28	0.18	0.00
6.00	0.31	0.20	1.18
7.00	0.34	0.22	1.18
8.00	0.38	0.25	1.57
9.00	0.39	0.25	0.39
10.00	0.41	0.27	0.78
12.50	0.43	0.28	0.31
15.00	0.45	0.29	0.31
17.50	0.46	0.30	0.16
20.00	0.47	0.31	0.16
25.00	0.47	0.31	0.00
30.00	0.47	0.31	0.00
40.00	0.48	0.31	0.04
50.00	0.49	0.32	0.04
60.00	0.51	0.33	0.08
80.00	0.52	0.34	0.02
100.00	0.52	0.34	0.00
120.00	0.52	0.34	0.00
140.00	0.54	0.35	0.04
160.00	0.52	0.34	-0.04

Baildown Test Results (10/16/96)
Well 19D

Elapsed Time (min)	Product Thickness (ft)	Volume (gal)	Recovery Rate (gal/hr)
0.00	0.05	0.03	
0.50	0.08	0.05	2.35
1.00	0.10	0.07	1.57
1.50	0.11	0.07	0.78
2.00	0.12	0.08	0.78
2.50	0.12	0.08	0.00
3.00	0.13	0.08	0.78
3.50	0.13	0.08	0.00
4.00	0.13	0.08	0.00
4.50	0.13	0.08	0.00
5.00	0.13	0.08	0.00
6.00	0.14	0.09	0.39
7.00	0.14	0.09	0.00
8.00	0.14	0.09	0.00
9.00	0.14	0.09	0.00
10.00	0.14	0.09	0.00
12.50	0.14	0.09	0.00
15.00	0.15	0.10	0.16
17.50	0.15	0.10	0.00
20.00	0.15	0.10	0.00
25.00	0.16	0.10	0.08
30.00	0.18	0.12	0.16
40.00	0.19	0.12	0.04
50.00	0.16	0.10	-0.12
60.00	0.17	0.11	0.04
80.00	0.19	0.12	0.04
100.00	0.20	0.13	0.02
120.00	0.17	0.11	-0.06
140.00	0.21	0.14	0.08
160.00	0.21	0.14	0.00
180.00	0.25	0.16	0.08
200.00	0.25	0.16	0.00

Table 3-10
Riverbank LNAPL: Product Terminator™ System Pilot Test Results for DW-17D
During the Extended Duration Pump Test
Former Red Devil Facility, Mount Vernon, New York

Time	Elapsed Time (hr:min:sec)	Elapsed Time (min)	Time Since Inital Product Removal (min)	DTP (ft)	DTW (ft)	Product Thickness (ft)	Volume of Product Recovered (quarts)	Volume of Product Recovered (gallons)	Product Recovered After Initial Product Removal (gal)	Recovery Rate (gal/hr)
9:05:00	0:00:00	0.00		11.22	12.00	0.78	0	0.00		
9:06:20	0:01:20	1.33					2	0.50		
9:08:53	0:03:53	3.88	0.00			0.15	3.47	0.87	0.00	
9:09:15	0:04:15	4.25	0.37	12.36	12.45	0.09	3.8	0.95	0.08	1.65
9:11:20	0:06:20	6.33	2.45				4	1.00	0.13	3.24
9:15:30	0:10:30	10.50	6.62				5	1.25	0.38	2.88
9:21:00	0:16:00	16	12.12				6	1.50	0.63	3.10
9:30:00	0:25:00	25	21.12	12.35	12.38	0.03	7.25	1.81	0.94	2.33
9:35:00	0:30:00	30	26.12	12.32	12.35	0.03	8	2.00	1.13	2.14
9:41:00	0:36:00	36	32.12	12.32	12.35	0.03	8.5	2.13	1.26	1.70
9:49:00	0:44:00	44	40.12	12.32	12.37	0.05	9.25	2.31	1.44	1.34
9:59:00	0:54:00	54	50.12				10	2.50	1.63	1.25
10:14:00	1:09:00	69	65.12	12.30	12.38	0.08	10.25	2.56	1.69	0.60
10:21:00	1:16:00	76	72.12				11	2.75	1.88	0.68
10:43:00	1:38:00	98	94.12	12.30	12.36	0.06	12	3.00	2.13	0.91
10:54:00	1:49:00	109	105.12				12.75	3.19	2.32	0.80
11:04:00	1:59:00	119	115.12				13	3.25	2.38	0.71
11:10:00	2:05:00	125	121.12	12.32	12.35	0.03	14	3.50	2.63	1.17
11:35:00	2:30:00	150	146.12				14.5	3.63	2.76	0.73
12:03:00	2:58:00	178	174.12	12.31	12.34	0.03	15.5	3.88	3.01	0.42
12:13:00	3:08:00	188	184.12	12.30	12.36	0.06	16	4.00	3.13	0.59
12:27:00	3:22:00	202	198.12	12.27	12.42	0.15	16.1875	4.05	3.18	0.43
12:40:00	3:35:00	215	211.12	12.26	12.46	0.20	16.375	4.09	3.22	0.21
12:50:00	3:45:00	225	221.12				16.5625	4.14	3.27	0.24
12:56:00	3:51:00	231	227.12	12.31	12.33	0.02	16.75	4.19	3.32	0.35
13:14:00	4:09:00	249	245.12				17	4.25	3.38	0.27
13:30:00	4:25:00	265	261.12	12.30	12.32	0.02	17.5	4.38	3.51	0.33
13:47:00	4:42:00	282	278.12	12.31	12.37	0.06	17.75	4.44	3.57	0.34
14:15:00	5:10:00	310	306.12	12.30	12.34	0.04	18.5	4.63	3.76	0.33

Notes:
1) Shaded values are estimated. The first set of shaded values indicates the values at the end of the initial reomval of standing product in the well.
2) The second set of shaded values are estimated due to a temporary shutdown of the pump. Product was allowed to accumulate in the well at this time.

Table 4-1
Estimated Capital and O&M Costs for Area D LNAPL Recovery Technologies
Former Red Devil Facility, Mount Vernon, New York

Device:	Capital Cost: ($)	O&M Costs: Labor and Expenses ($/gal.):	O&M Costs: Materials ($/gal.):	O&M Costs: Disposal ($/gal.):	O&M Costs: Total ($/gal.):
Soakease	$770	$534	$1.50	$20.00	$556
Keck Cannister	$1,600	$279	$0.10	$2.40	$282
Petro-Belt	$13,500	$732	$32.00	$2.40	$766
SpillBuster Pumps	$135,000	$158	$25	$2.40	$185

Notes:

Labor costs based on 4 weekly IRM visits with 2 operators for 4 hours @$45/hour for monthly Area D activities.

Soakease costs are based on deployment in seven (7) Area D recovery wells and monthly average gal/well recovery rates.

Keck Canister costs are based on deployment in two (2) Area D recovery wells (DW-2D & DW-11D) and average per well monthly recovery rates.

Petro Belt costs are based on deployment in three (3) Area D recovery wells (DW-10D, DW-2D & DW-11D) and average per well monthly recovery rates.

LNAPL recovery costs via SpillBuster pumps obtained from ERM and EnviroClean billings; Area D costs assumed to be one-half total capital and O&M costs.

Table 4-2
Comparison of LNAPL Recovery Technology Field Testing Results
Former Insilco Facility, Mount Vernon, New York

Performance Criteria		Alternate LNAPL Recovery Technology		
Type	**Description**	**SoakEase**	**Keck Canister**	**Petro-Belt**
Operating Parameters	Field Test Time Period	Dec '94 - June '95 Oct '95 - March '96	Dec '94 - June '95 Oct '95 - Dec '95	July '95 - Oct '95
	Duration of Field Test	13 months	10	4
	Total Volume of LNAPL Recovered	22 gals	11	15
	Total Number of Recovery Wells Tested	7 wells	3	7
Effectiveness	LNAPL Viscosities Field Systems Were Able to Recover	low, high & very high	low	low, high, very high
	Avg Monthly Recovery Rate, gal/well	0.46	0.88	0.71
	Avg Weekly Recovery Rates by Viscosity, gal/well			
	Lower Viscosity LNAPL	0.66	0.97	0.33
	High Viscosity LNAPL	0.81	NC	0.87
	Very High Viscosity LNAPL	0.69	0.18	0.30
	Can the technology recover Area D LNAPL in a reasonable time period?	no	no	no
Implementability	Is the recovery system readily available?	yes	yes	yes
	Is the recharge of the recovery wells sufficient to allow unattended system operation (for automated technologies only)?	NA	NA	yes:DW-10D (2D&11D?) no:DW-4D,8D&13D(1D?)
	Are the system components compatible with Area D LNAPL?	yes	yes	yes
	Is the system compatible with the existing IRM equipment?	yes	yes	yes
	Are there any access restrictions for installation?	no	no	no winter access:DW-1D,2D&11D difficult access: DW-4D,8D&10D
	What is the effect of temperature on system performance?	moderate	moderate	high
	Degree of O&M Required to Maintain Recovery	high	low	high
	Health and Safety Concerns	high	moderate	high
Cost	O&M Cost, $ per gallon recovered	$555.50	$281.50	$766.40

Table 4-3
Estimated Costs for Recovery of LNAPL Located Beneath the Bronx River Bank
Former Red Devil Facility, Mount Vernon, New York

	Alternative I	Alternative II
Capital Costs		
Labor and Materials	$198,300	$230,000
Canola Oil Contingency	8,900	
Engineering	25,000	32,500
Security	11,200	13,200
Subtotal Capital Costs	$243,400	$275,700
Metro-North Costs	10,000	15,000
Total Capital Costs	$253,400	$290,700
Annual O&M Costs, Year 1		
Labor	$65,000	$52,400
Materials	15,170	4,300
Disposal	22,750	22,050
Fire Suppression		1,700
Electricity	600	1,200
Total Annual O&M Costs, Year 1	$103,520	$81,650
Present Worth Factor	0.935	0.935
Present Worth of Year 1 Annual Costs	$96,748	$76,308
Annual O&M Costs, Year 2		
Labor	$65,000	$52,400
Materials	10,450	4,300
Disposal	11,375	11,025
Fire Suppression		1,700
Electricity	600	1,200
Total Annual O&M Costs, Year 2	$87,425	$70,625
Present Worth Factor	0.873	0.873
Present Worth of Year 2 Annual Costs	$76,360	$61,687

Table 4-3
Estimated Costs for Recovery of LNAPL Located Beneath the Bronx River Bank
Former Red Devil Facility, Mount Vernon, New York

	Alternative I	Alternative II
Annual O&M Costs, Years 3-5		
Labor	$65,000	$52,400
Materials	8,100	4,300
Disposal	5,688	5,513
Fire Suppression		1,700
Electricity	600	1,200
Total Annual O&M Costs, Years 3-5	$79,388	$65,113
Present Worth Factor	2.292	2.292
Present Worth of Year 3-5 Annual Costs	$181,970	$149,250
Total Present Worth of Annual Costs	$355,078	$287,245
Contingency (10%)	35,508	28,724
Total Present Worth of Annual and Capital Costs	$643,986	$606,669

Table 5-1
Summary of Findings and Recommendations for the OU I and IRM3 Media of Interest
Former Red Devil Facility, Mount Vernon, New York

OU I Media of Interest	**Findings**	**Recommendations**
Area C LNAPL	IRM1 continues to successfully recover Area C LNAPL.	• continue operation of IRM1 in Area C until Area C LNAPL has been recovered to the extent practical.
Area D LNAPL	Sorbents, manually operated hydrophobic canisters, and belt skimmers do not provide cost-effective recovery of Area D LNAPL. Hydrophobic canister system cannot be automated due to well size and pump constraints.	• pilot test total fluids recovery for Area D LNAPL; and • if this remaining NAPL removal technology does not work, report to NYSDEC that Area D LNAPL has been removed to the extent practical.
Riverbank LNAPL	Automated NAPL-only recovery would be effective and implementable for recovery of LNAPL located beneath the Bronx River bank.	• implement Alternative II (i.e., NAPL-Only Recovery with Transfer of Recovered LNAPL to an Aboveground Storage Tank Located Adjacent to the Recovery Wells on the Bronx River Bank);and • maintain operation of the boom containment system in the Bronx River.
Indoor Floor Drain and Sump System	see Table 5-2	see Table 5-2

IRM3 Media of Interest	**Findings**	**Recommendations**
Area A Ground Water	Elevated concentrations of toluene observed in Area A ground water monitoring wells over the past few sampling rounds.	• install five hydropunch samples in the vicinity of the former RI boring HP-6 to determine the extent and magnitude of the toluene present in subsurface soil; • evaluate source removal options; and • continue ground water monitoring.

Table 5-2
Summary of the Findings Observed and the Response Actions Taken During the Floor Drain and Sump System Investigation
Former Red Devil Facility, Mount Vernon, New York

Location/Structures	*Inspection Findings*	*Response Actions Taken*	*Remaining Floor Penetrations*
Area C			
FD-C1, FD-C2 and FD-C3 S-C1	• all connected to the sanitary sewer system; • all constructed with earthen bottoms; • broken section on the top of the sump inlet pipe; and • pipe exiting the southermost floor drain may be open-ended.	Earthen bottoms of all four structures lined with concrete.	Broken section on the top of the sump inlet pipe and potentially open-ended pipe from the southermost floor drain. Future Activities: none. (Note 1)
FD-C4 and FD-C5	• both connected to the storm sewer system; and • both constructed with concrete bottoms.	None required.	None.
CO-C1	• pipe from cleanout terminates several feet beyond the wall separating Areas C and D.	Cleanout cleaned.	Potentially open-ended pipe attached to CO#1. Future Activities: none. (Note 1)
CO-C2	• cleanout and associated piping delineated.	Cleanout and associated piping removed.	None.
Area D			
S-D1	• constructed with earthen bottom; • receives rainwater during severe storm events; • prevents basement flooding; • one pipe exiting the structure ends at a cleanout; • the other pipe exiting the structure may be open-ended.	None.	Earthen bottom of sump needed to allow infiltration of rainwater during severe storm events. Potentially open-ended pipe exiting sump. Future Activities: none. (Note 1)

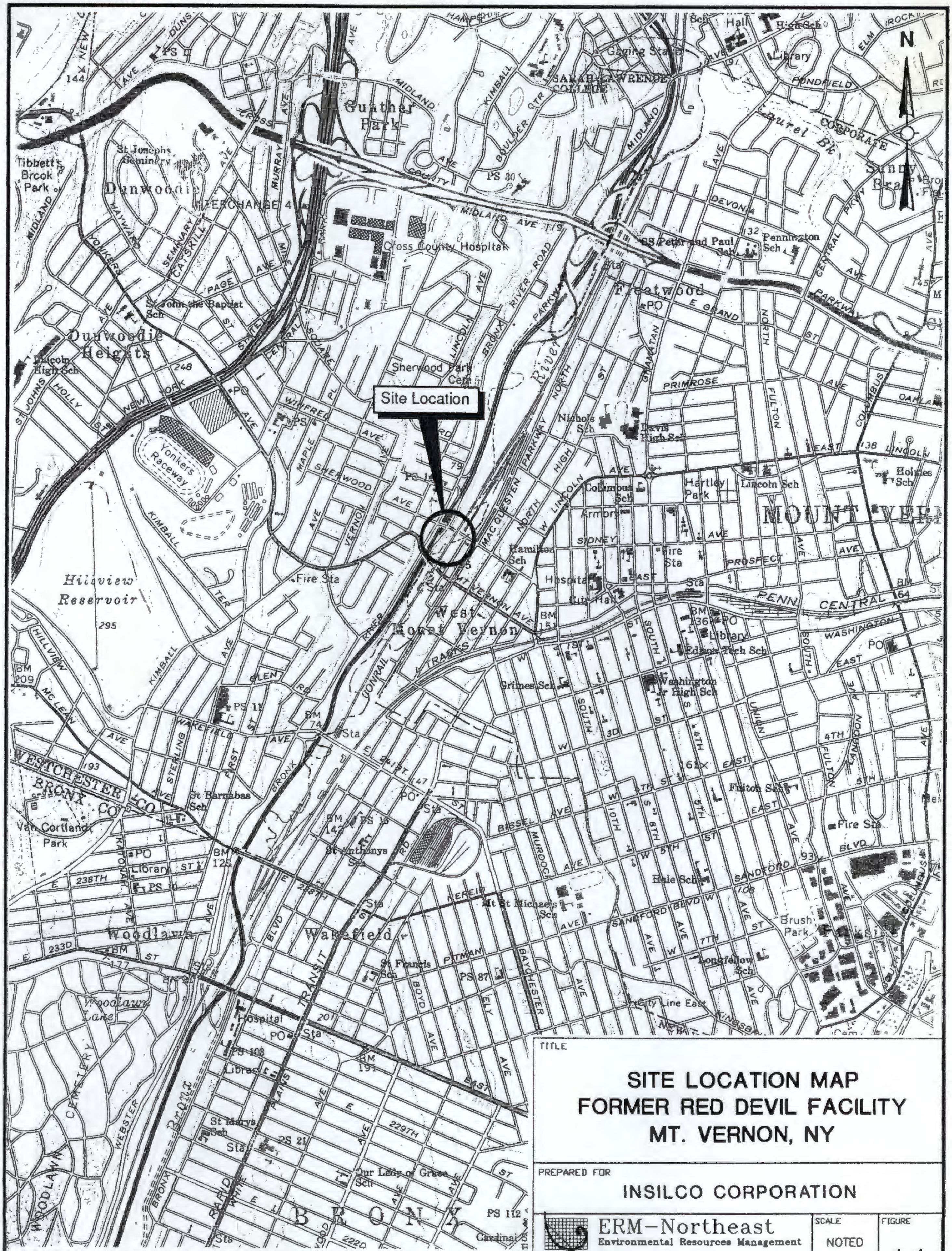
Table 5-2
Summary of the Findings Observed and the Response Actions Taken During the Floor Drain and Sump System Investigation Former Red Devil Facility, Mount Vernon, New York

Location/Structures	*Inspection Findings*	*Response Actions Taken*	*Remaining Floor Penetrations*
Area D, Continued			
S-D2	• constructed with earthen bottom; • receives rainwater during severe storm events; • prevents basement flooding; • no inlet or outlet pipes.	None.	Earthen bottom of sump needed to allow infiltration of rainwater during severe storm events. Future Activities: none.
S-D3	• inactive dry well with suspected connection to a larger dry well.	None.	Inactive dry well. Future Activities: none.
FD-D1	• constructed with earthen bottom; • pipe exiting structure may be open-ended.	Earthen bottom of structure lined with concrete.	Potentially open-ended pipe exiting floor drain. Future Activities: none. (Note 1)

Notes:
(1) A response action is not required for this floor penetration since the potential source of chemicals (i.e., sediment) has been removed, the facility is currently used as a public self storage facility and chemicals are not stored in this area.

FD: floor drain
S: sump
CO: cleanout

Figures



SOURCE: U.S.G.S. Quadrangle Map, Mt. Vernon, NY

SCALE: 1"= 2000'

TITLE

SITE LOCATION MAP
FORMER RED DEVIL FACILITY
MT. VERNON, NY

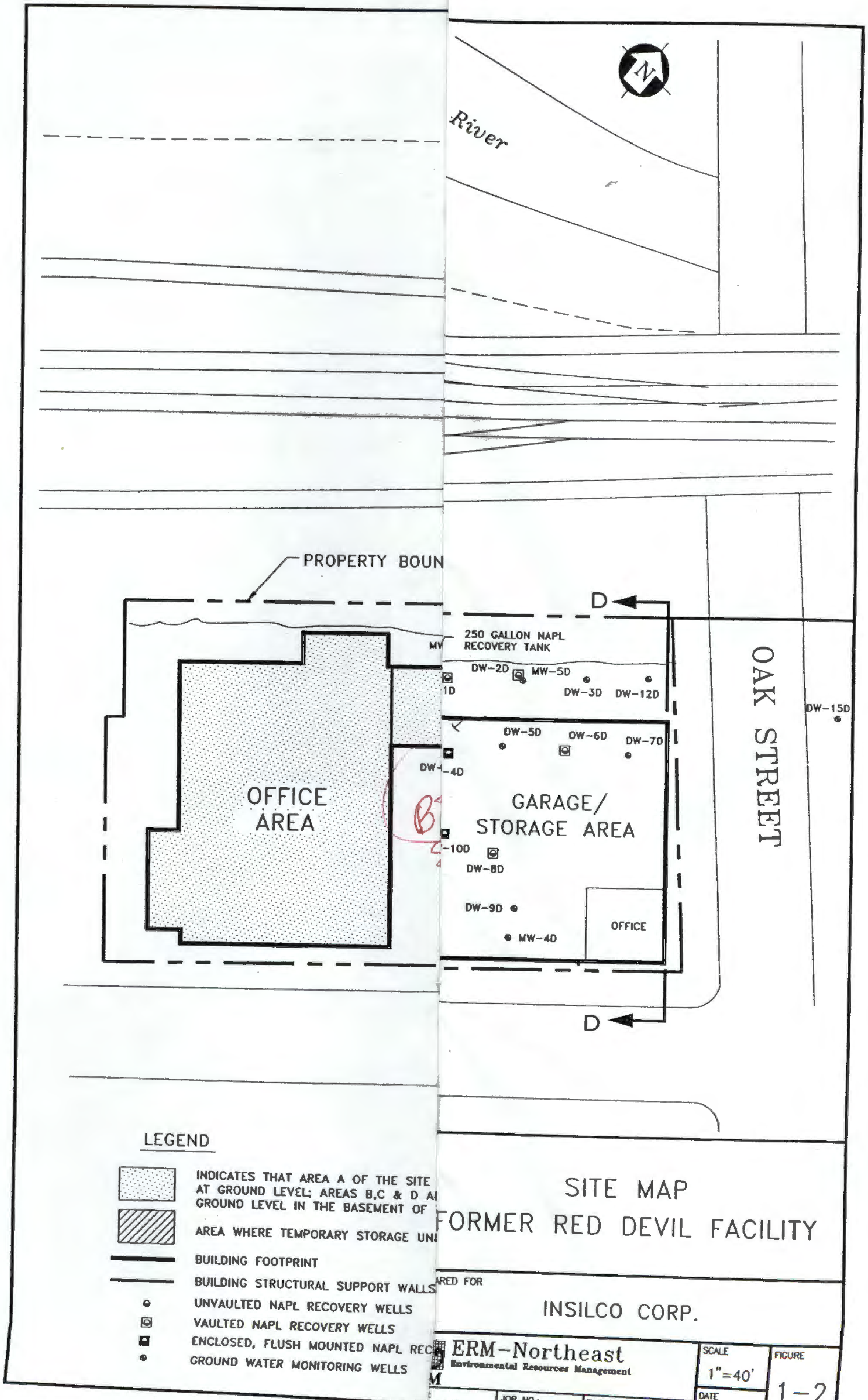
PREPARED FOR

INSILCO CORPORATION

ERM-Northeast
Environmental Resources Management

ERM

DRAWN:	JOB NO.:	FILE NAME:	SCALE	DATE	FIGURE
S.P.	488.004.3	GEN-V	NOTED	11/15/93	1-1

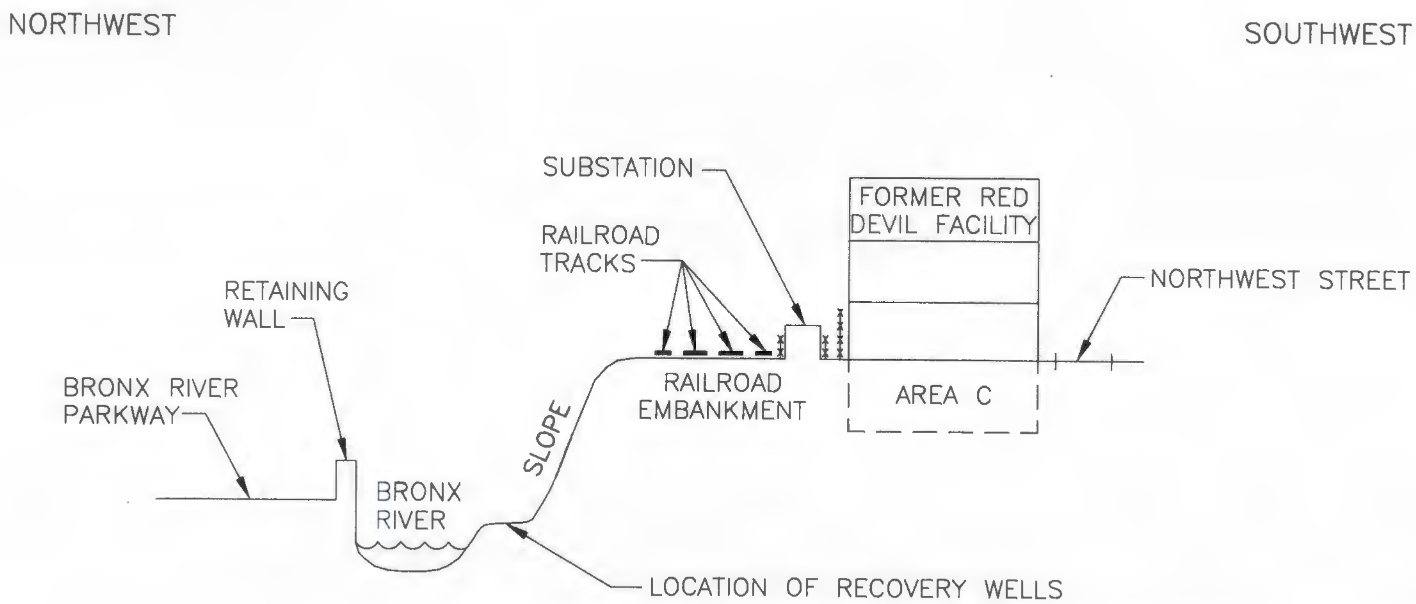


SITE MAP
FORMER RED DEVIL FACILITY

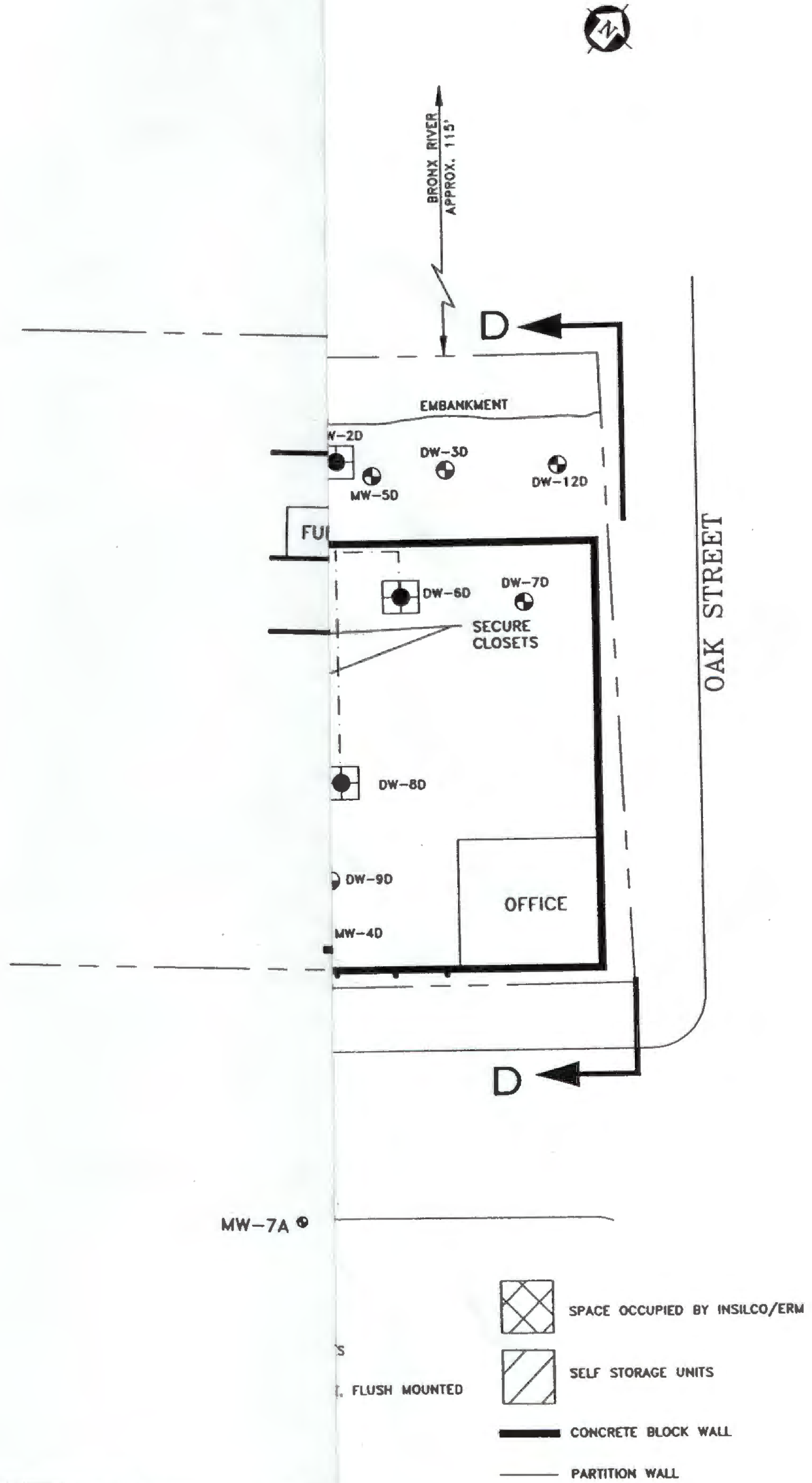
ARED FOR
INSILCO CORP.

ERM–Northeast
Environmental Resources Management

E.M.F.	JOB NO.: 488.006.2	FILE NAME: SITE96	SCALE 1"=40' DATE 5/28/97	FIGURE 1–2



TITLE: GENERALIZED CROSS-SECTION FORMER RED DEVIL FACILITY				
PREPARED FOR: INSILCO CORPORATION				
ERM-Northeast Environmental Resources Management			SCALE: NONE	FIGURE: 1-3
DRAWN: E.M.F./y.z.	JOB NO.: 488.010.5	FILE NAME: 4880105A	DATE: 5/30/97	



NO.	DATE	APPR.	REVISION

SYSTEM LAYOUT

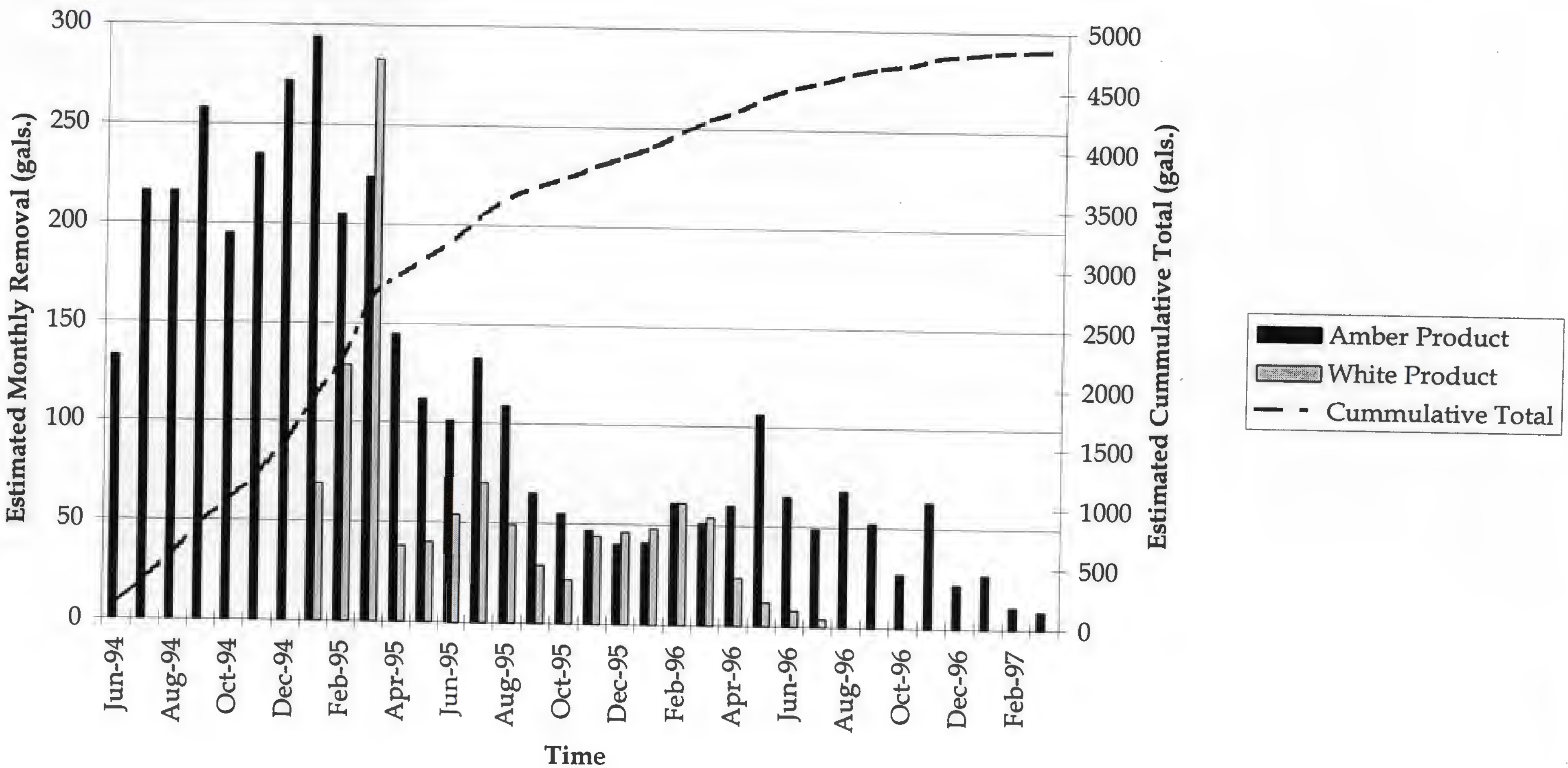
DATE 5/28/97	REVISION DATE
JOB NO. 488.008.1	FILE NAME SYSTRED

DRAWING NO. 1-4

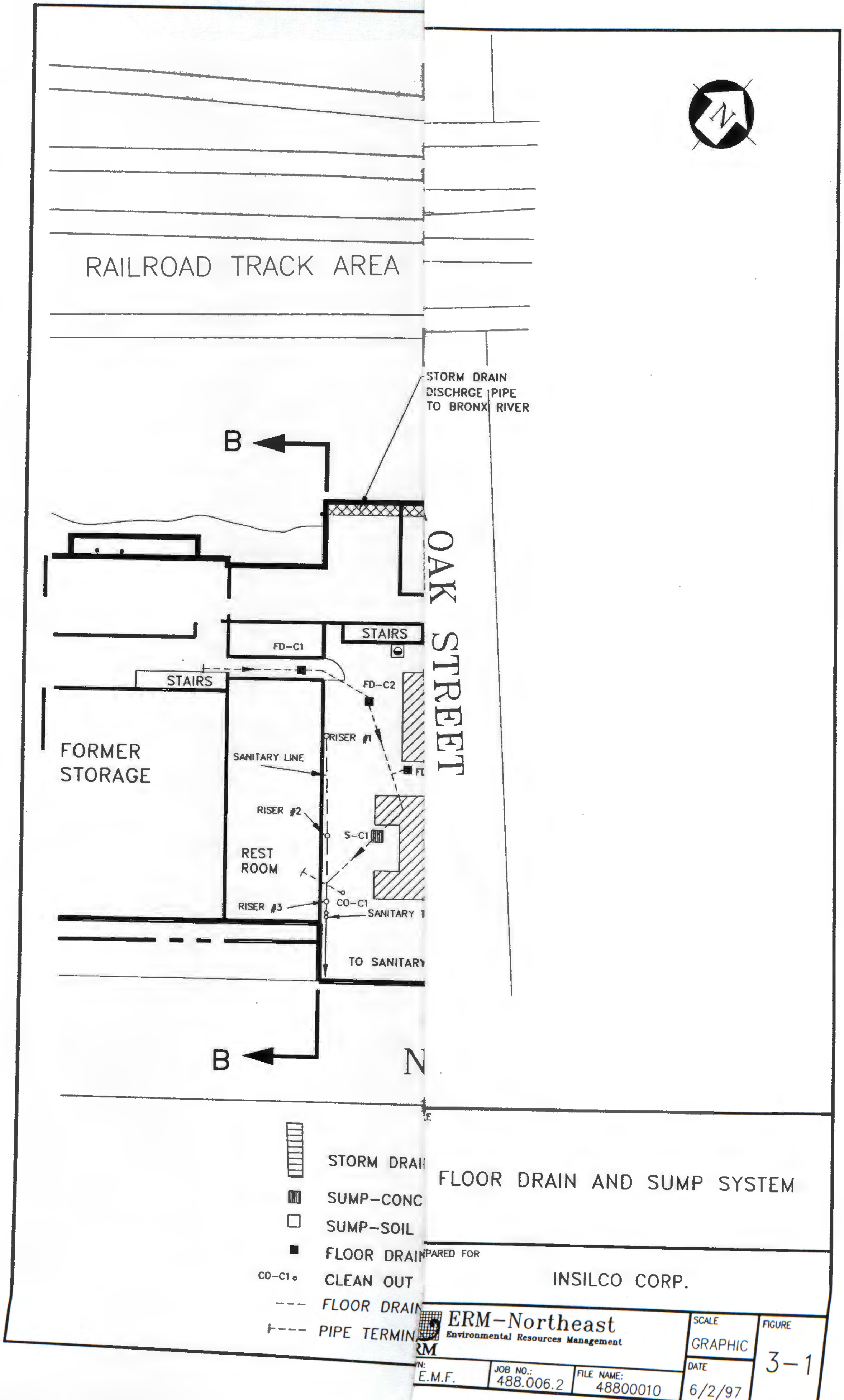
REV. NO.

SHEET OF

Figure 1-5
Estimated Area C Recovery Volumes
Former Red Devil Facility, Mount Vernon, New York



G:\INSILCO\DES_RPT\GRAPH.XLS



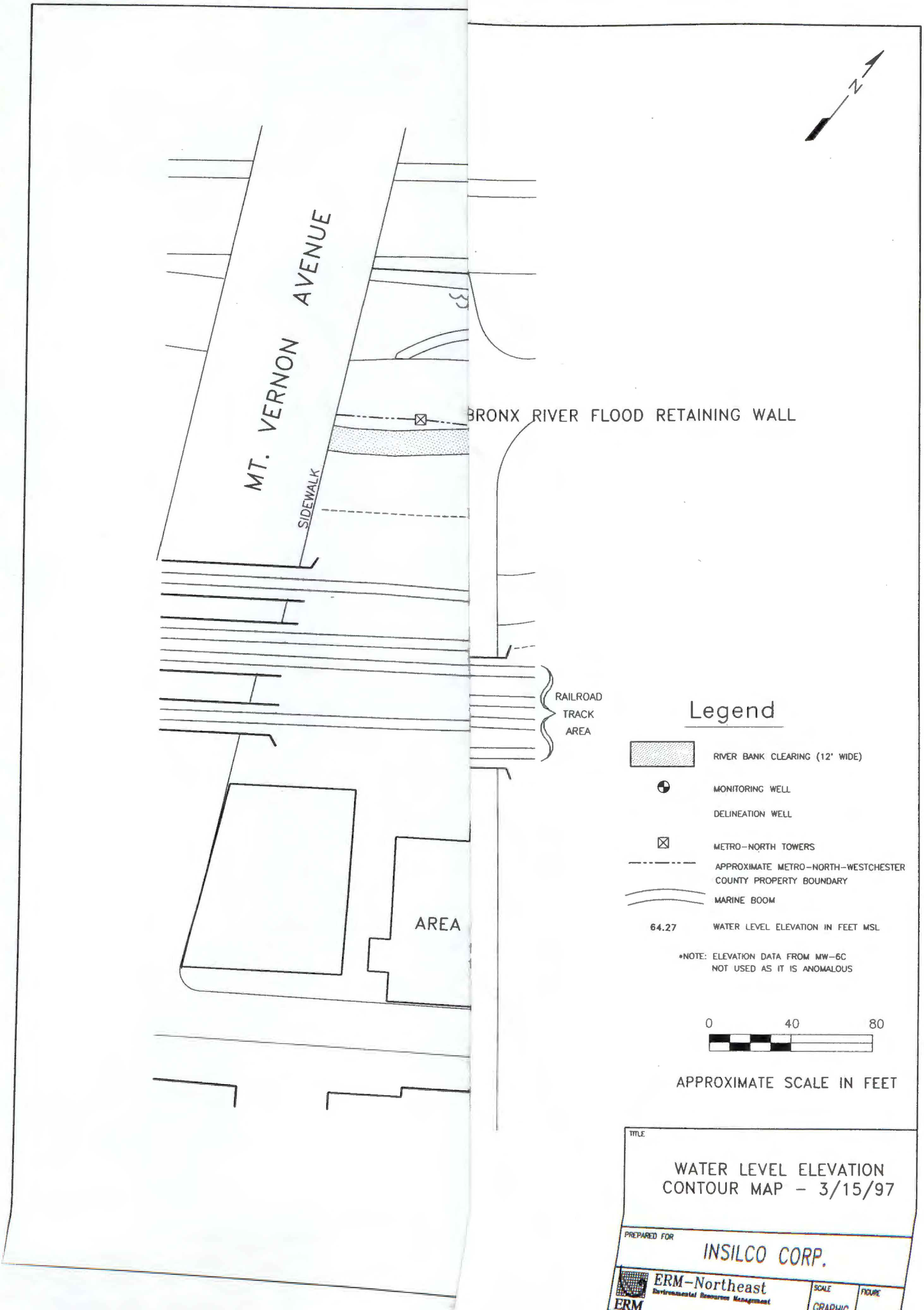
FLOOR DRAIN AND SUMP SYSTEM

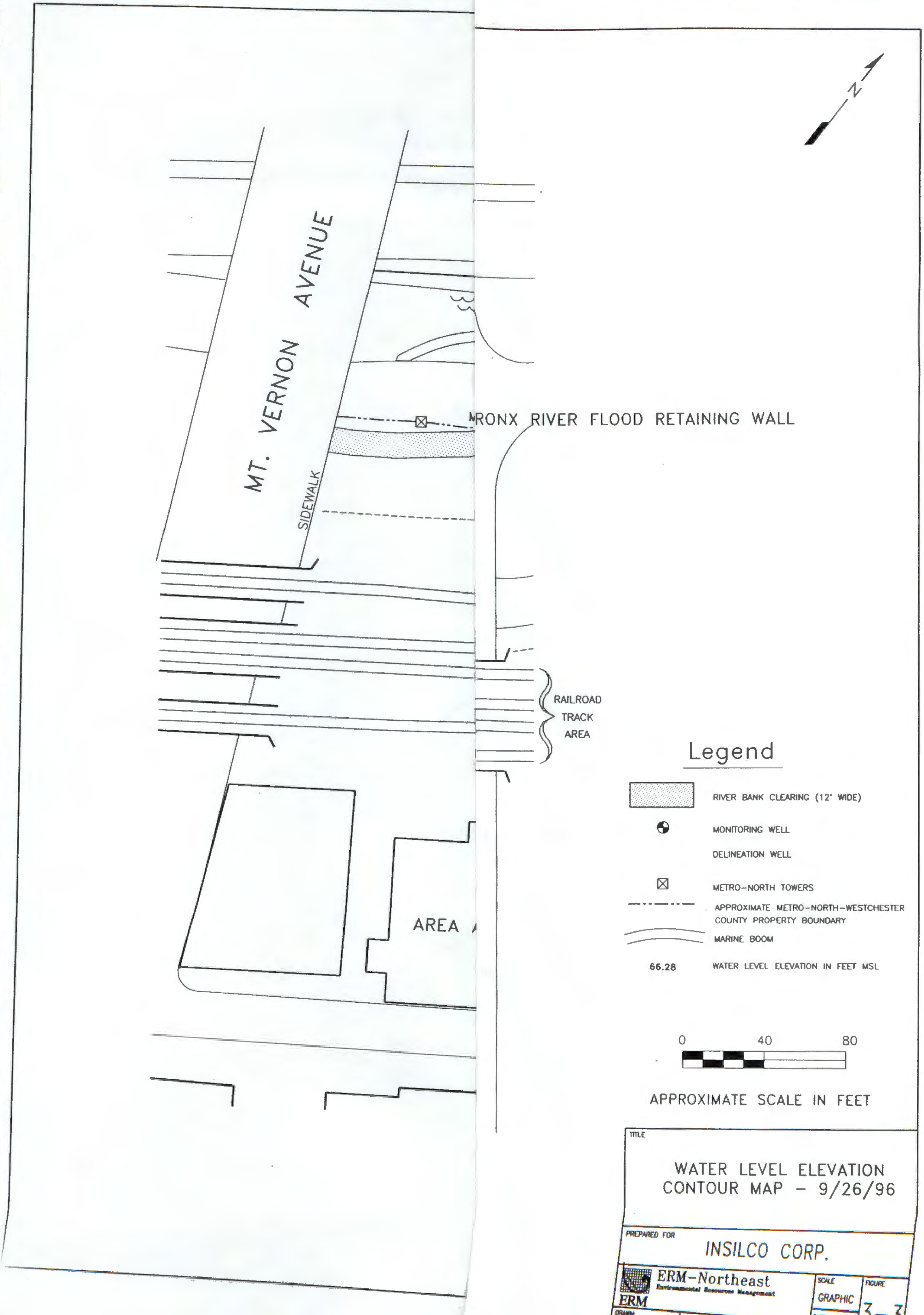
PREPARED FOR

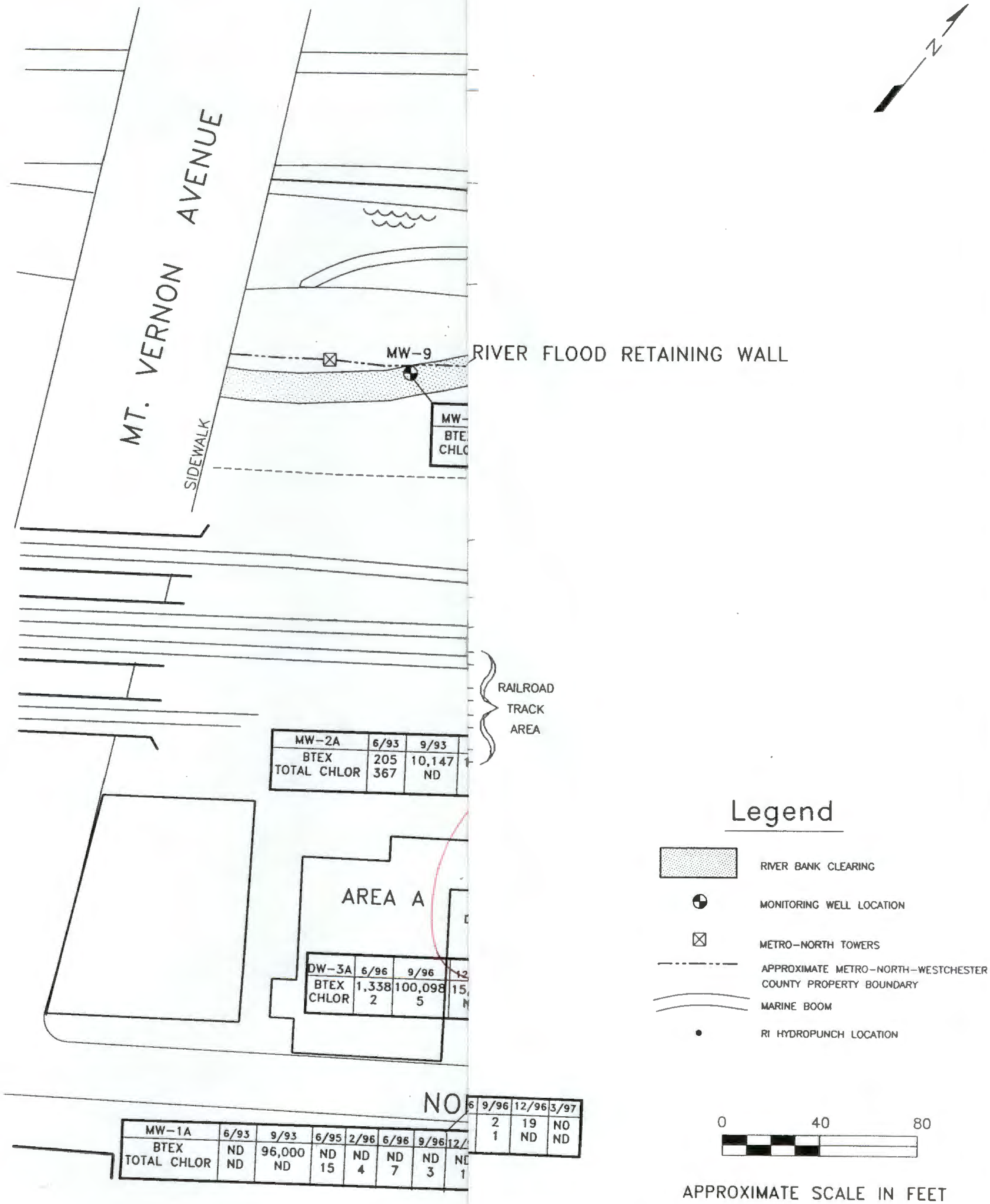
INSILCO CORP.

ERM-Northeast
Environmental Resources Management

DRAWN: E.M.F.	JOB NO.: 488.006.2	FILE NAME: 48800010	SCALE: GRAPHIC / DATE: 6/2/97	FIGURE 3-1


N
MT. VERNON AVENUE
SIDEWALK
BRONX RIVER FLOOD RETAINING WALL
RAILROAD TRACK AREA
AREA
Legend
RIVER BANK CLEARING (12' WIDE)
MONITORING WELL
DELINEATION WELL
METRO-NORTH TOWERS
APPROXIMATE METRO-NORTH-WESTCHESTER COUNTY PROPERTY BOUNDARY
MARINE BOOM
64.27 WATER LEVEL ELEVATION IN FEET MSL
*NOTE: ELEVATION DATA FROM MW-6C NOT USED AS IT IS ANOMALOUS
0
40
80
APPROXIMATE SCALE IN FEET
TITLE
WATER LEVEL ELEVATION CONTOUR MAP - 3/15/97
PREPARED FOR
INSILCO CORP.
ERM-Northeast
Environmental Resources Management
ERM
SCALE
GRAPHIC
FIGURE


MT. VERNON AVENUE
SIDEWALK
BRONX RIVER FLOOD RETAINING WALL
RAILROAD
TRACK
AREA
AREA A
N
Legend
RIVER BANK CLEARING (12' WIDE)
MONITORING WELL
DELINEATION WELL
METRO-NORTH TOWERS
APPROXIMATE METRO-NORTH-WESTCHESTER COUNTY PROPERTY BOUNDARY
MARINE BOOM
66.28
WATER LEVEL ELEVATION IN FEET MSL
0
40
80
APPROXIMATE SCALE IN FEET
TITLE
WATER LEVEL ELEVATION
CONTOUR MAP - 9/26/96
PREPARED FOR
INSILCO CORP.
ERM-Northeast
Environmental Resources Management
ERM
SCALE
GRAPHIC
FIGURE
DRAWN:



NOTES:

1. BTEX= BENZENE, TOLUENE, ETHYLBENZENE AND XYLENE.
2. TOTAL CHLOR= TRICHLOROETHENE, TETRACHLOROETHENE, 1,1,1-TR
1,1-DICHLOROETHENE, 1,1-DICHLOROETHANE, 1,2-DICHLOROETHENE
3. CONCENTRATIONS IN MICROGRAM PER LITER ug/l

TITLE

DISTRIBUTION OF ORGANIC COMPOUNDS IN GROUND WATER FORMER RED DEVIL FACILITY

PREPARED FOR

INSILCO CORP.

ERM-Northeast
Environmental Resources Management

SCALE GRAPHIC

FIGURE

FIGURE 3-5
WATER TABLE ELEVATION vs BTEX CONCENTRATION IN MW-2A

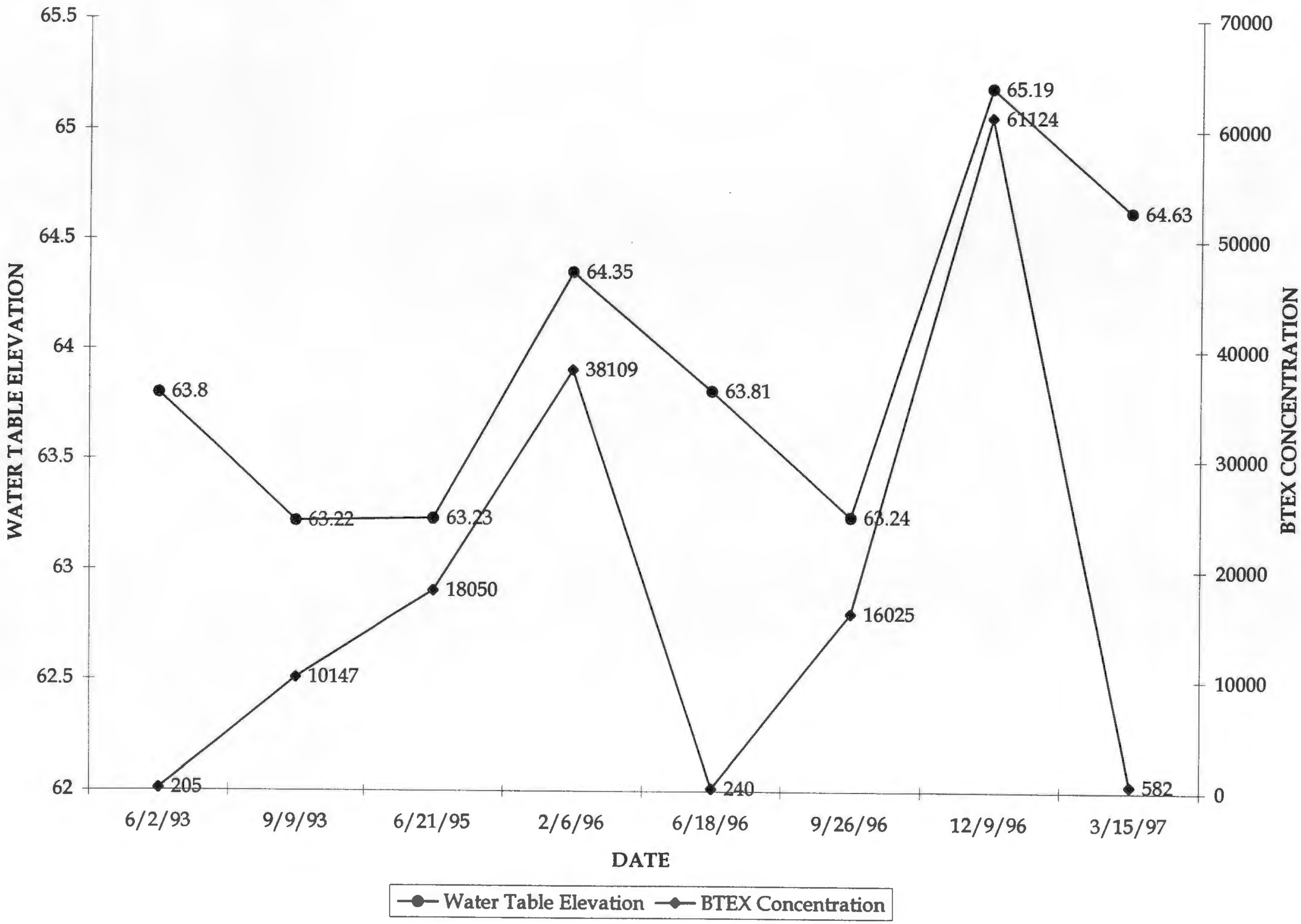


FIGURE 3-6
WATER TABLE ELEVATION vs. BTEX CONCENTRATION IN DW-1A

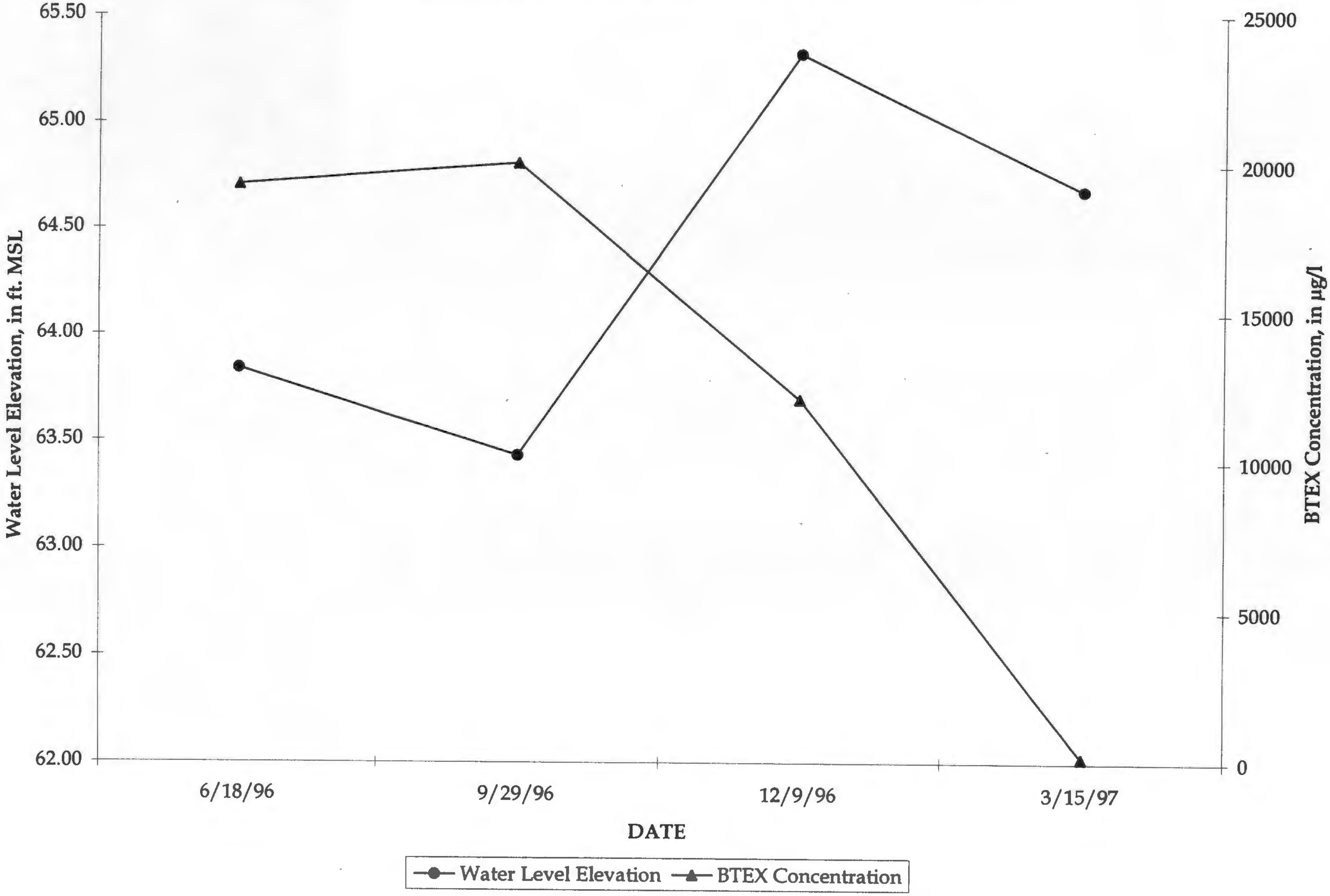
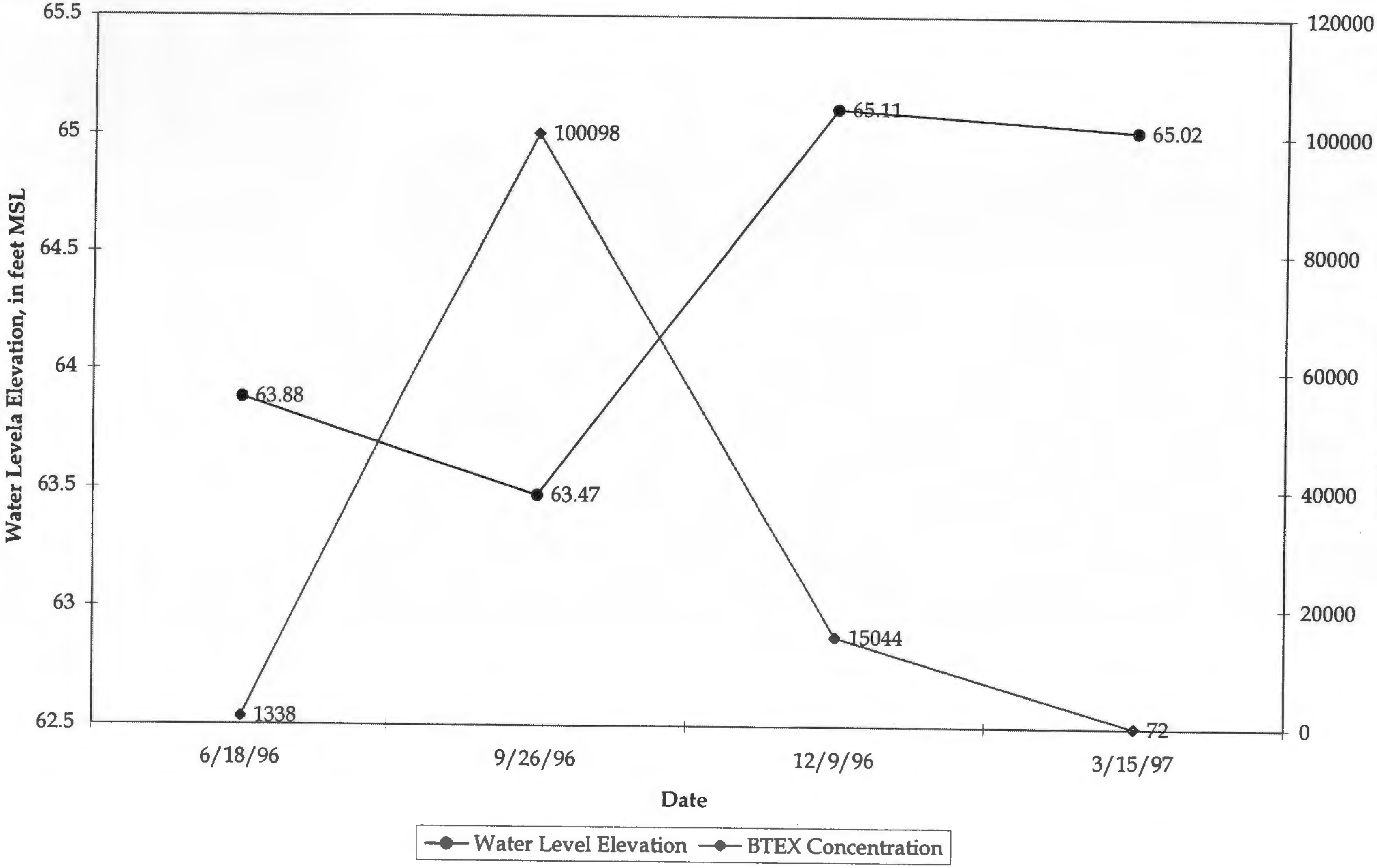
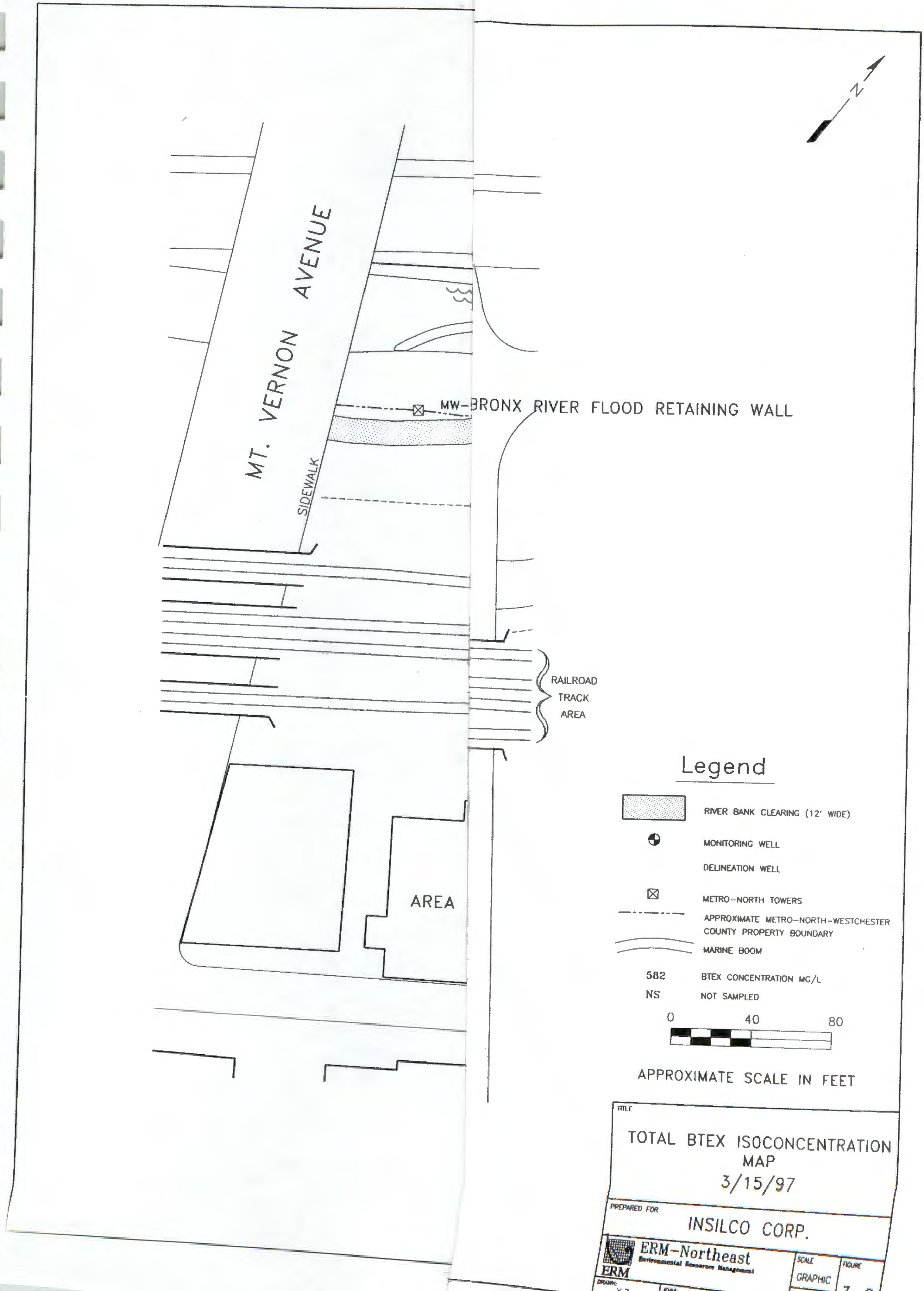
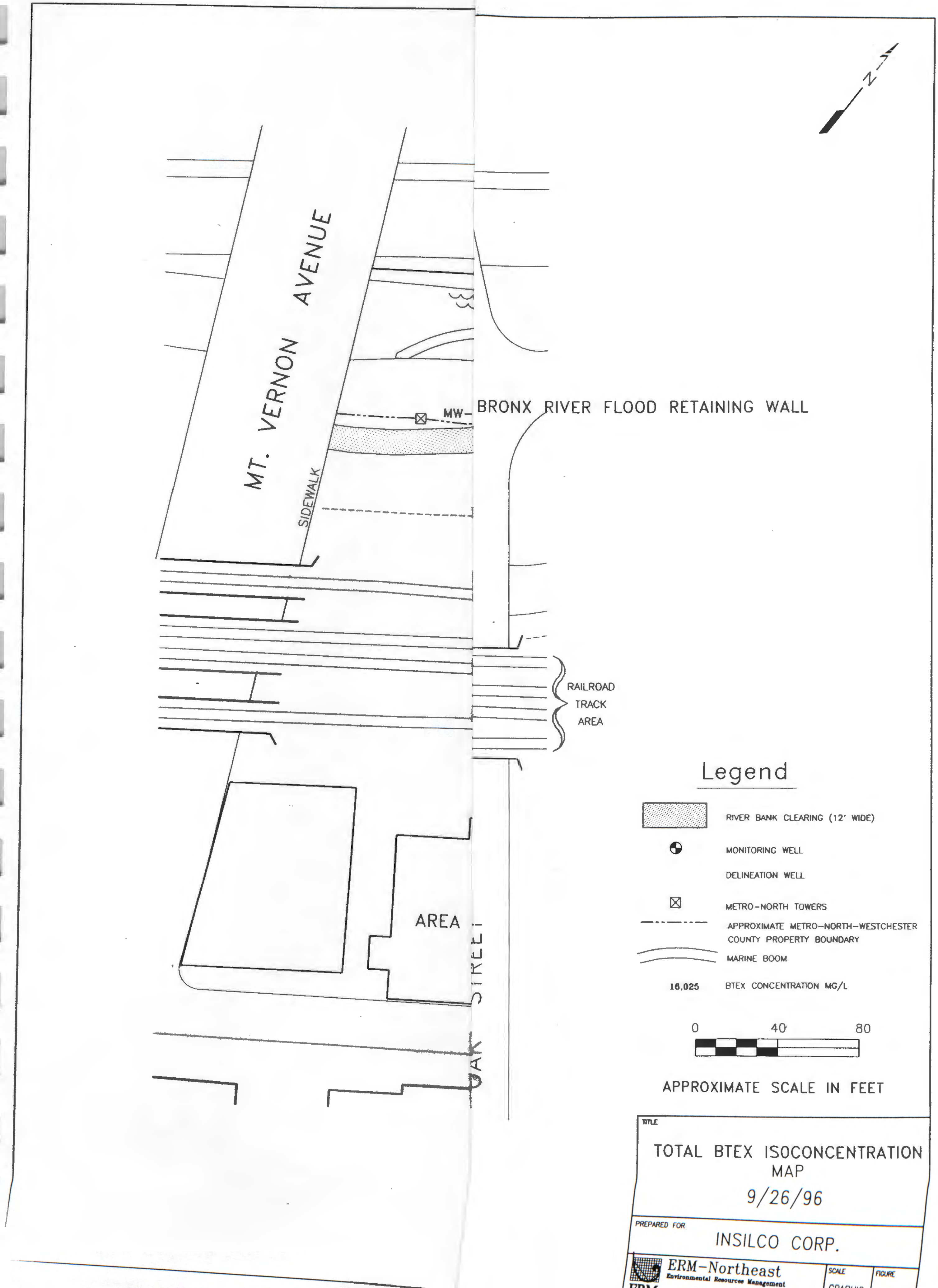


FIGURE 3-7
WATER TABLE ELEVATION vs BTEX CONCENTRATION IN DW-3A





N
MT. VERNON AVENUE
SIDEWALK
MW-BRONX RIVER FLOOD RETAINING WALL
RAILROAD
TRACK
AREA
AREA
Legend
RIVER BANK CLEARING (12' WIDE)
MONITORING WELL
DELINEATION WELL
METRO-NORTH TOWERS
APPROXIMATE METRO-NORTH-WESTCHESTER COUNTY PROPERTY BOUNDARY
MARINE BOOM
582 BTEX CONCENTRATION MG/L
NS NOT SAMPLED
0
40
80
APPROXIMATE SCALE IN FEET
TITLE
TOTAL BTEX ISOCONCENTRATION MAP
3/15/97
PREPARED FOR
INSILCO CORP.
ERM-Northeast
Environmental Resources Management
ERM
SCALE
GRAPHIC
FIGURE



N
MT. VERNON AVENUE
SIDEWALK
MW–
BRONX RIVER FLOOD RETAINING WALL
RAILROAD
TRACK
AREA
AREA
OAK STREET
Legend
RIVER BANK CLEARING (12' WIDE)
MONITORING WELL
DELINEATION WELL
METRO–NORTH TOWERS
APPROXIMATE METRO–NORTH–WESTCHESTER
COUNTY PROPERTY BOUNDARY
MARINE BOOM
16,025
BTEX CONCENTRATION MG/L
0
40
80
APPROXIMATE SCALE IN FEET
TITLE
TOTAL BTEX ISOCONCENTRATION
MAP
9/26/96
PREPARED FOR
INSILCO CORP.
ERM–Northeast
Environmental Resources Management
SCALE
FIGURE

Figure 3-10
LNAPL Elevation vs. Water Level Elevation Over Time in DW-16
Former Red Devil Facility, Mount Vernon, New York

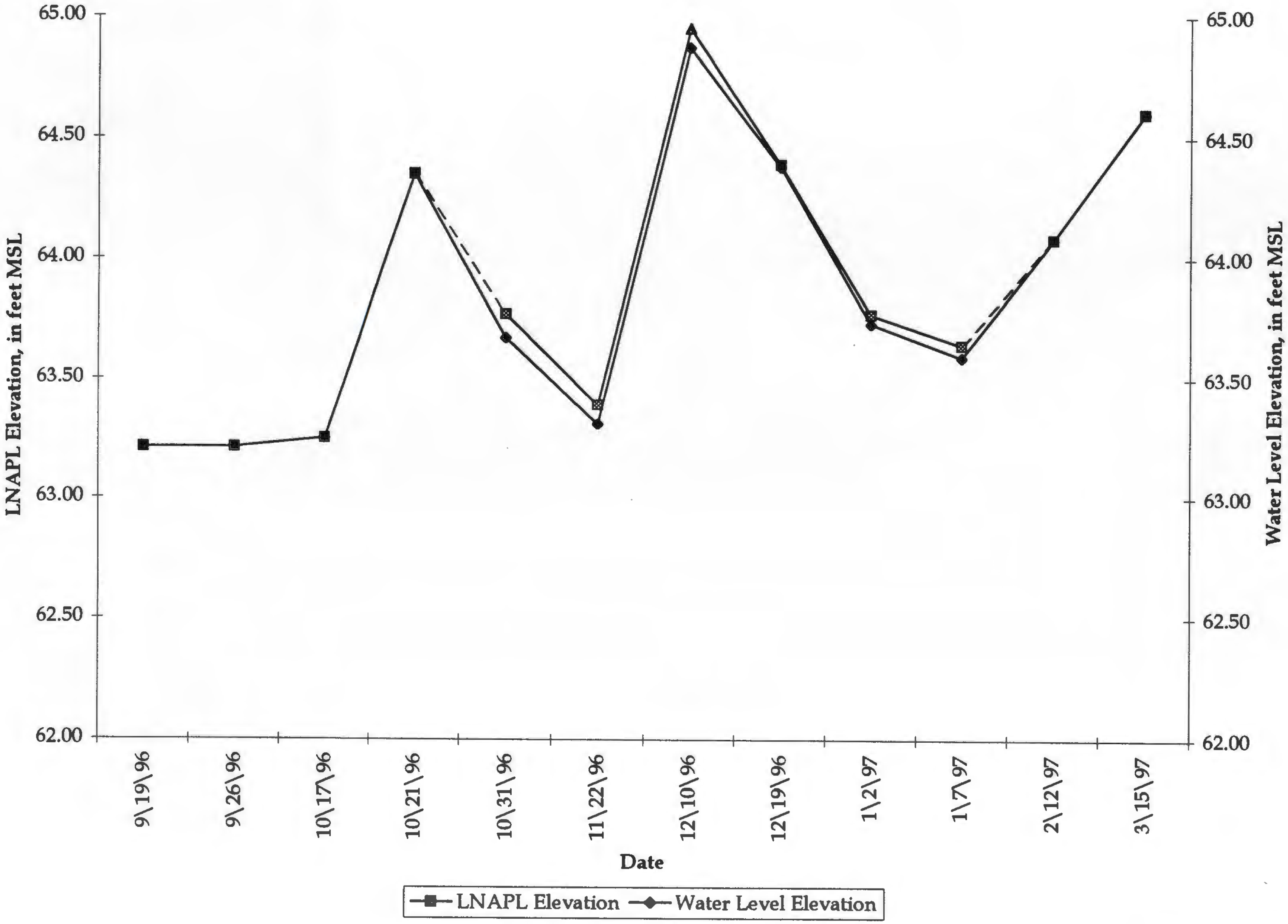
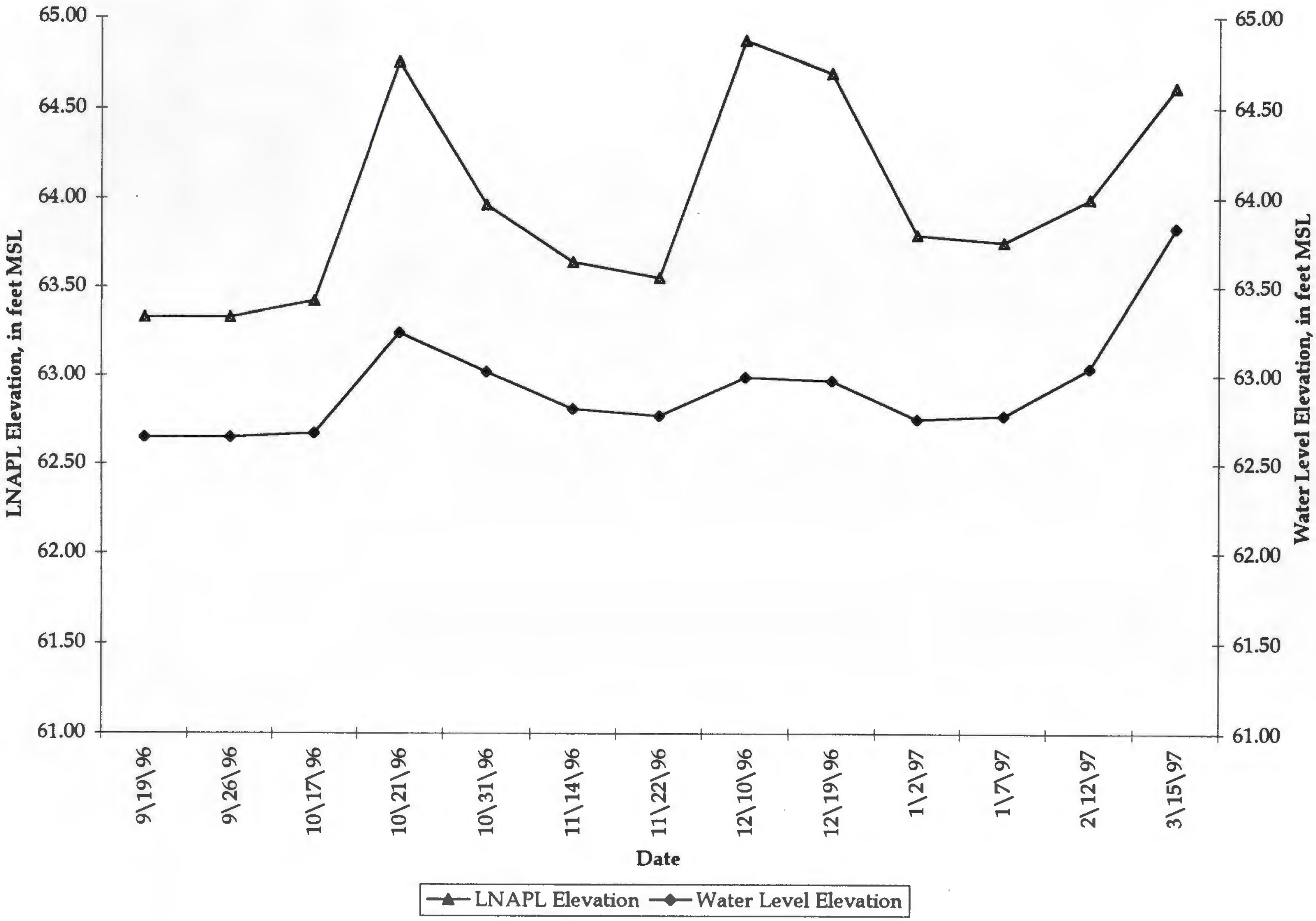
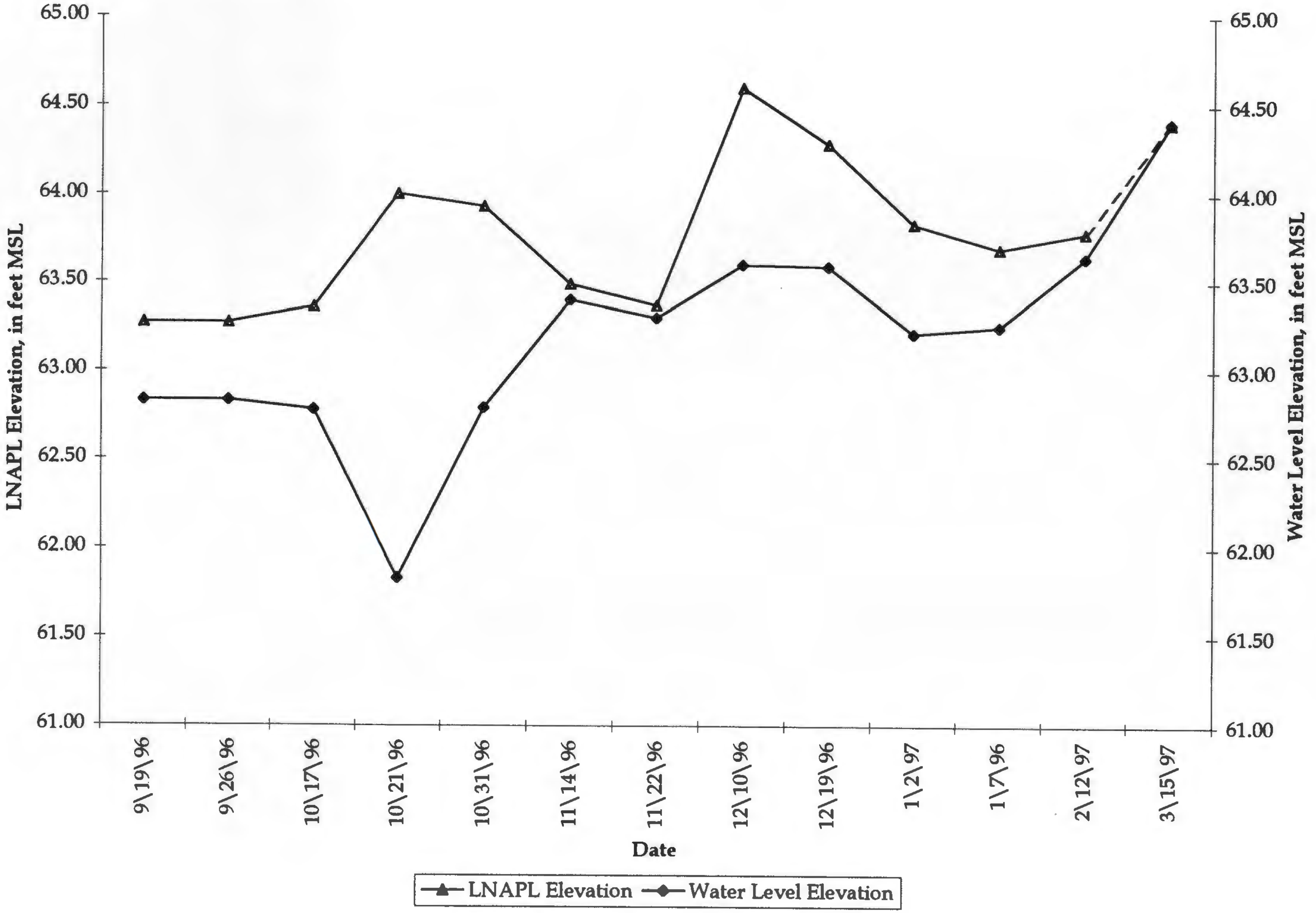


Figure 3-11
LNAPL Elevation vs. Water Level Elevation Over Time in DW-17
Former Red Devil Facility, Mount Vernon, New York



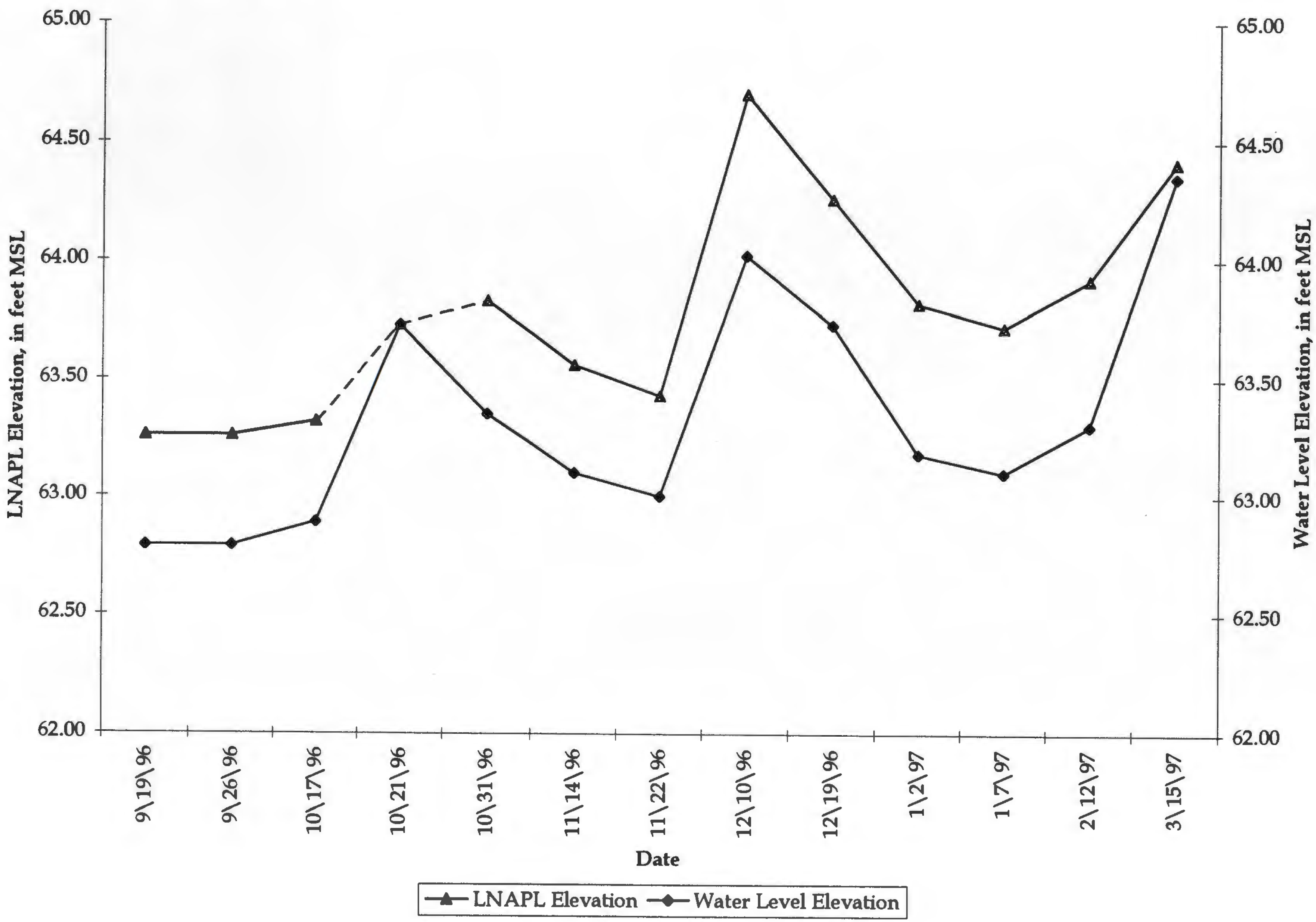
c:\files\instlco\tables\RIVERBAN.XLS\DW-17

Figure 3-12
LNAPL Elevation vs. Water Level Elevation Over Time in DW-18
Former Red Devil Facility, Mount Vernon, New York

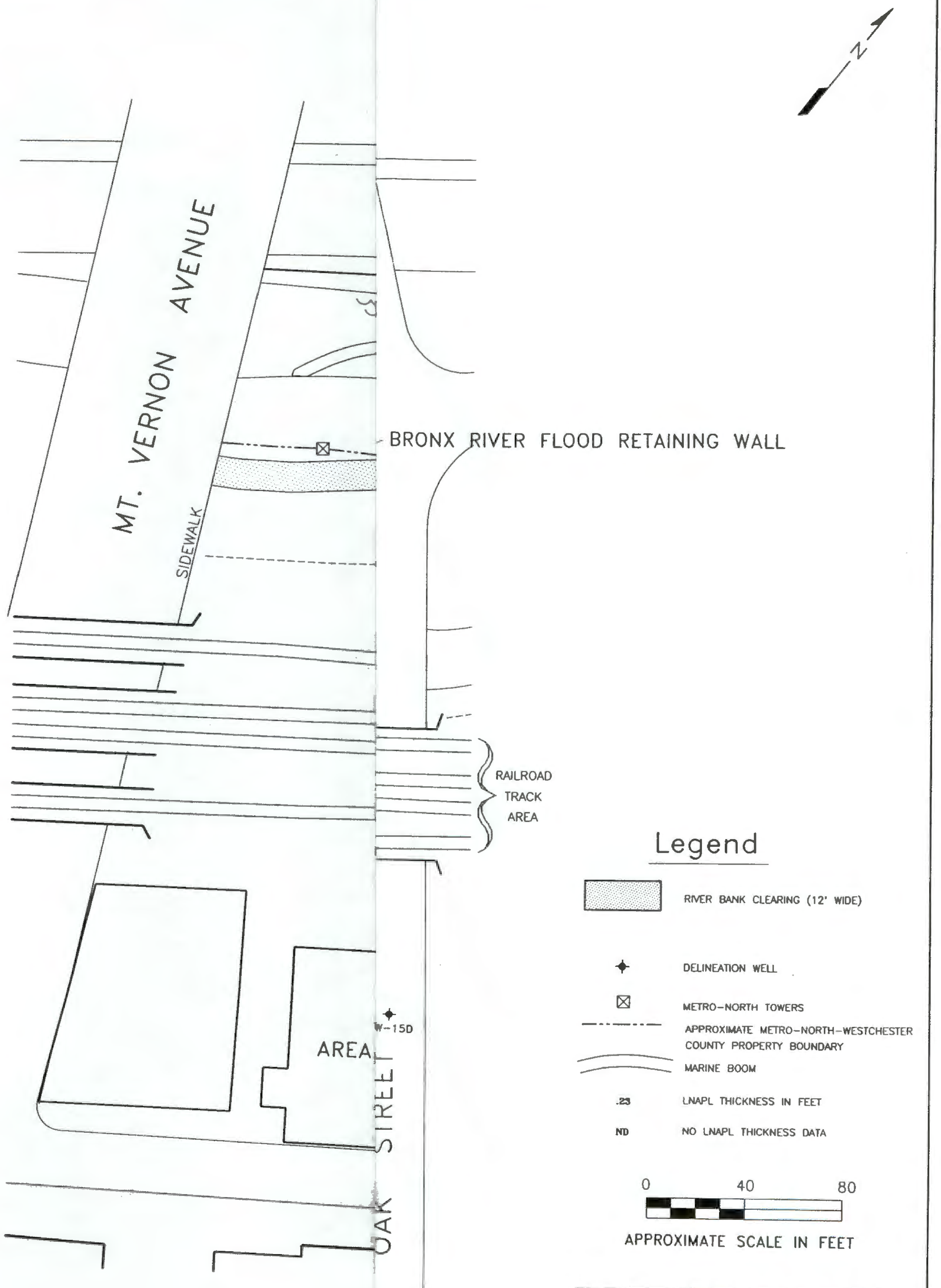


c:\files\insilco\tables\RIVERBAN.XLS\dw-18

Figure 3-13
LNAPL Elevation vs. Water Level Elevation Over Time in DW-19
Former Red Devil Facility, Mount Vernon, New York



c:\files\msilco\tables\RIVERBAN.XLS\dw-19



TITLE

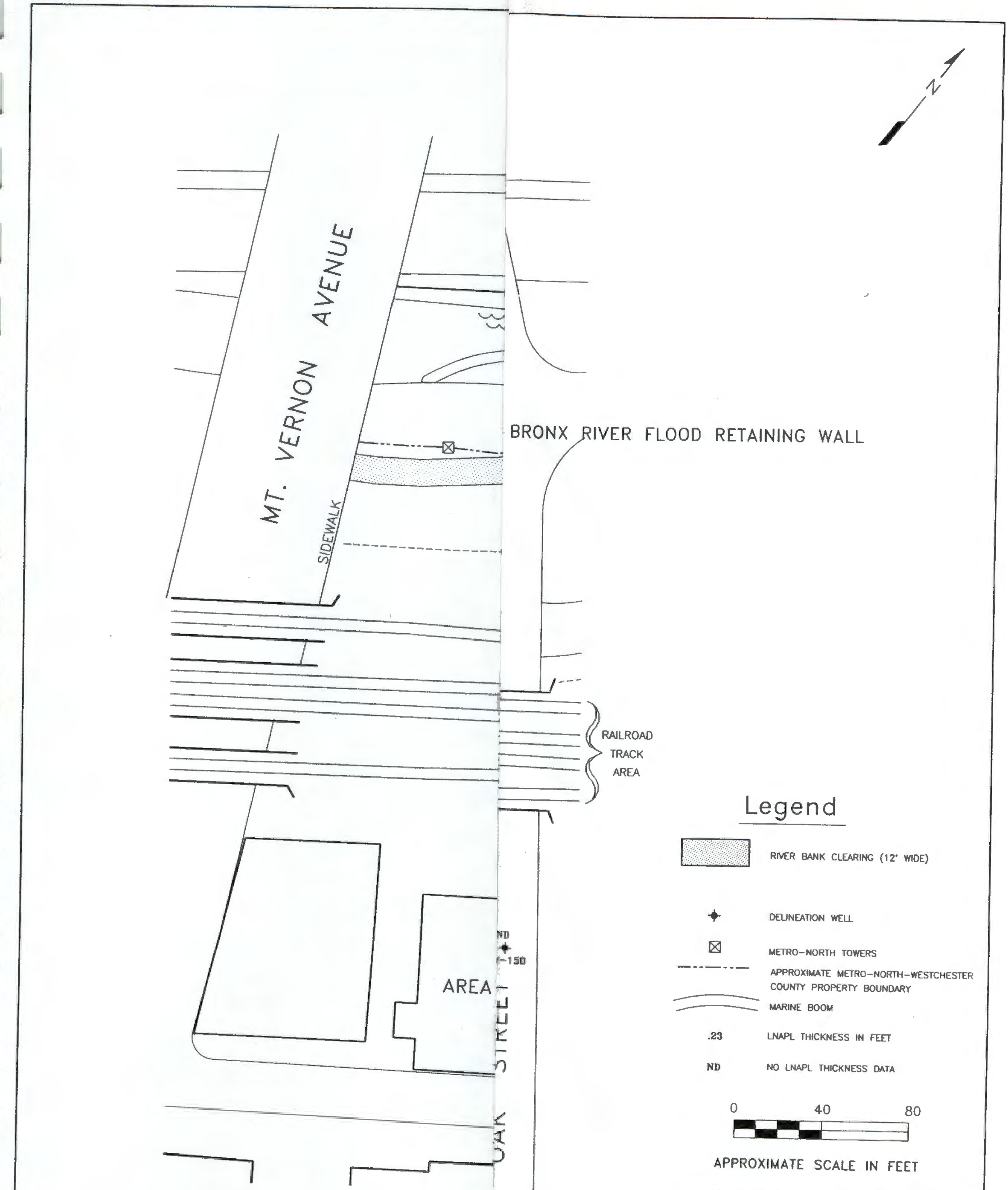
LNAPL DISTRIBUTION
2/12/97

PREPARED FOR

INSILCO CORP.

ERM-Northeast

SCALE | FIGURE



TITLE

LNAPL DISTRIBUTION
9/19/96

PREPARED FOR

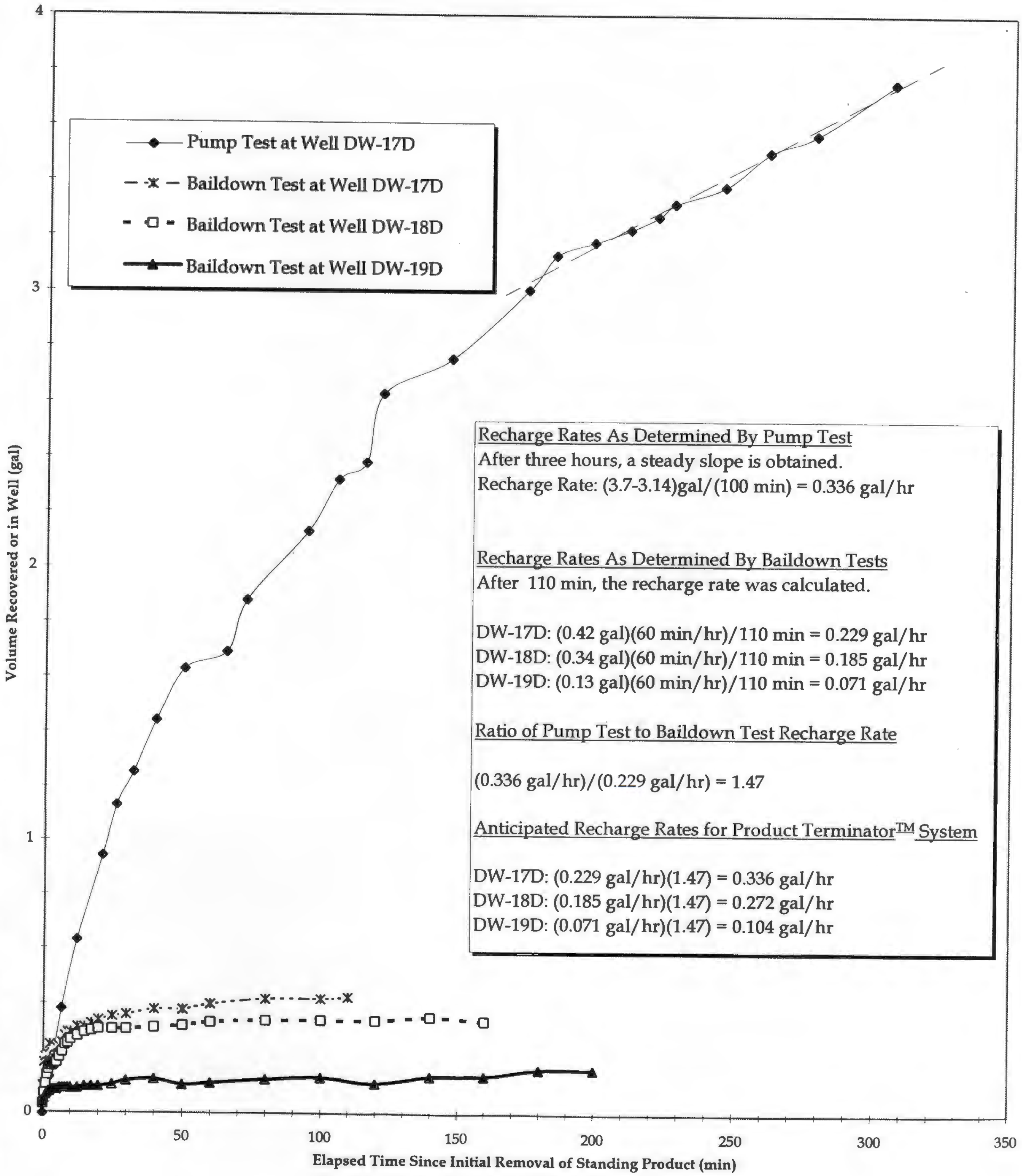
INSILCO CORP.

ERM-Northeast

SCALE

FIGURE

Figure 3-16
LNAPL Recharge Rates for Riverbank Wells
Former Red Devil Facility, Mount Vernon, New York



<u>Recharge Rates As Determined By Pump Test</u>
After three hours, a steady slope is obtained.
Recharge Rate: (3.7-3.14)gal/(100 min) = 0.336 gal/hr

<u>Recharge Rates As Determined By Baildown Tests</u>
After 110 min, the recharge rate was calculated.

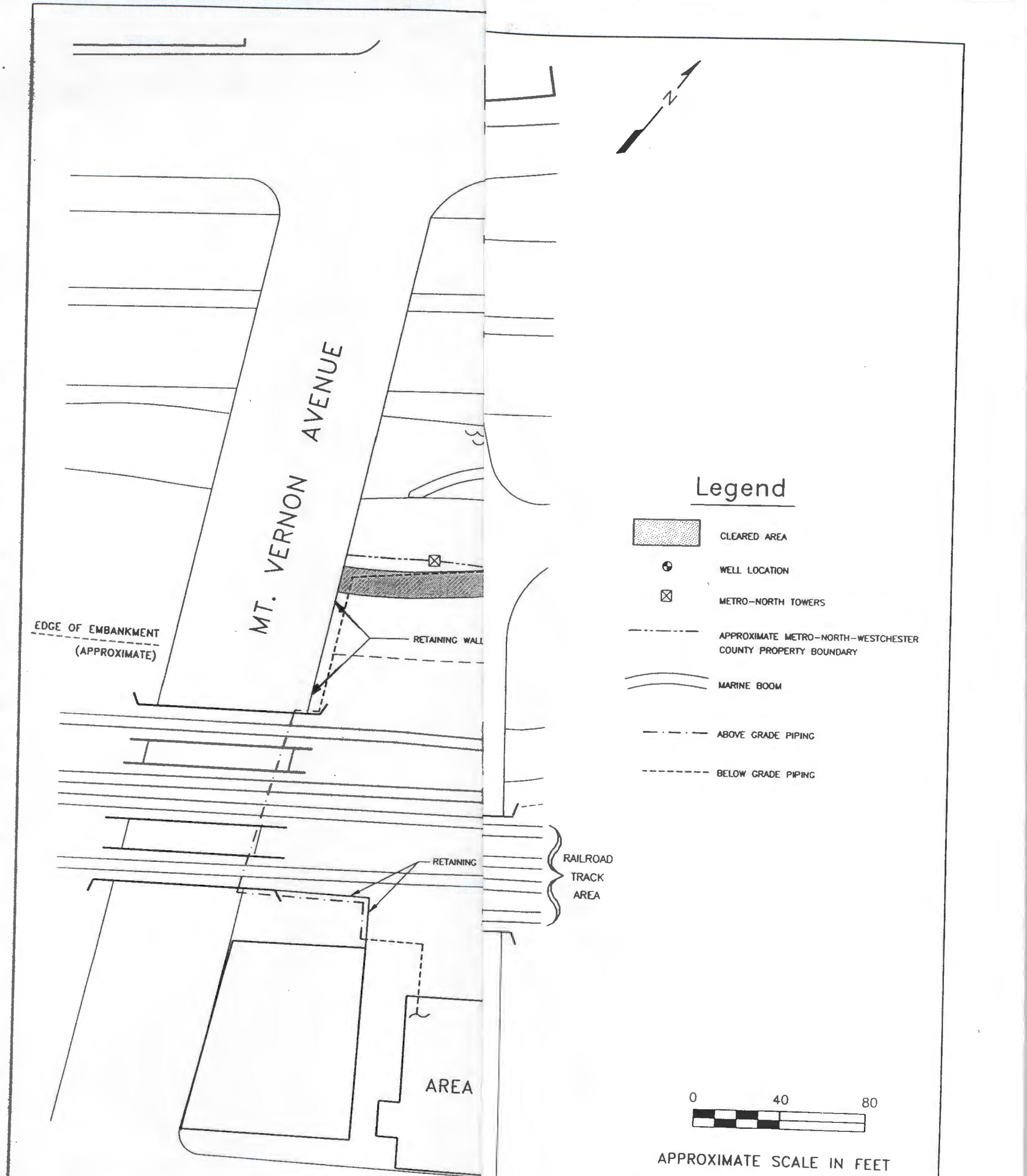
DW-17D: (0.42 gal)(60 min/hr)/110 min = 0.229 gal/hr
DW-18D: (0.34 gal)(60 min/hr)/110 min = 0.185 gal/hr
DW-19D: (0.13 gal)(60 min/hr)/110 min = 0.071 gal/hr

<u>Ratio of Pump Test to Baildown Test Recharge Rate</u>

(0.336 gal/hr)/(0.229 gal/hr) = 1.47

<u>Anticipated Recharge Rates for Product Terminator™ System</u>

DW-17D: (0.229 gal/hr)(1.47) = 0.336 gal/hr
DW-18D: (0.185 gal/hr)(1.47) = 0.272 gal/hr
DW-19D: (0.071 gal/hr)(1.47) = 0.104 gal/hr



TITLE

ALTERNATIVE No. 1
LNAPL RECOVERY WITH TRANSFER TO FORMER RED DEVIL FACILITY FOR STORAGE
SCHEMATIC OF PIPING LAYOUT

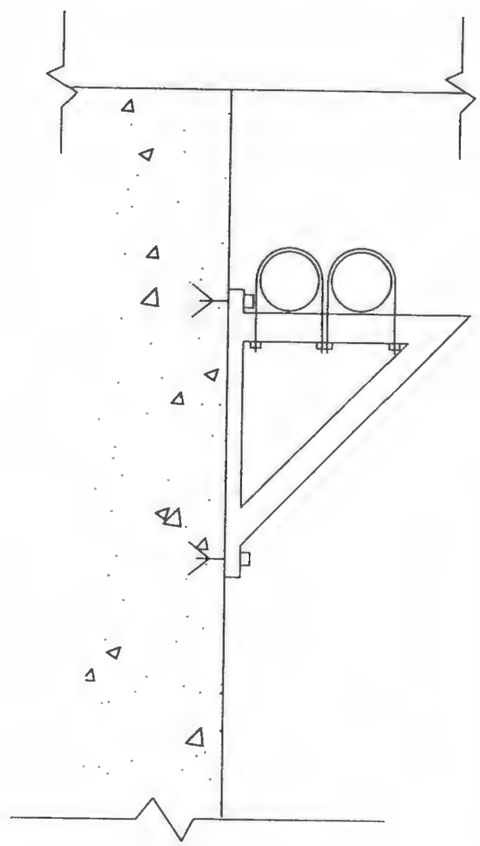
PREPARED FOR

INSILCO CORP.

ERM–Northeast
Environmental Resources Management
ERM

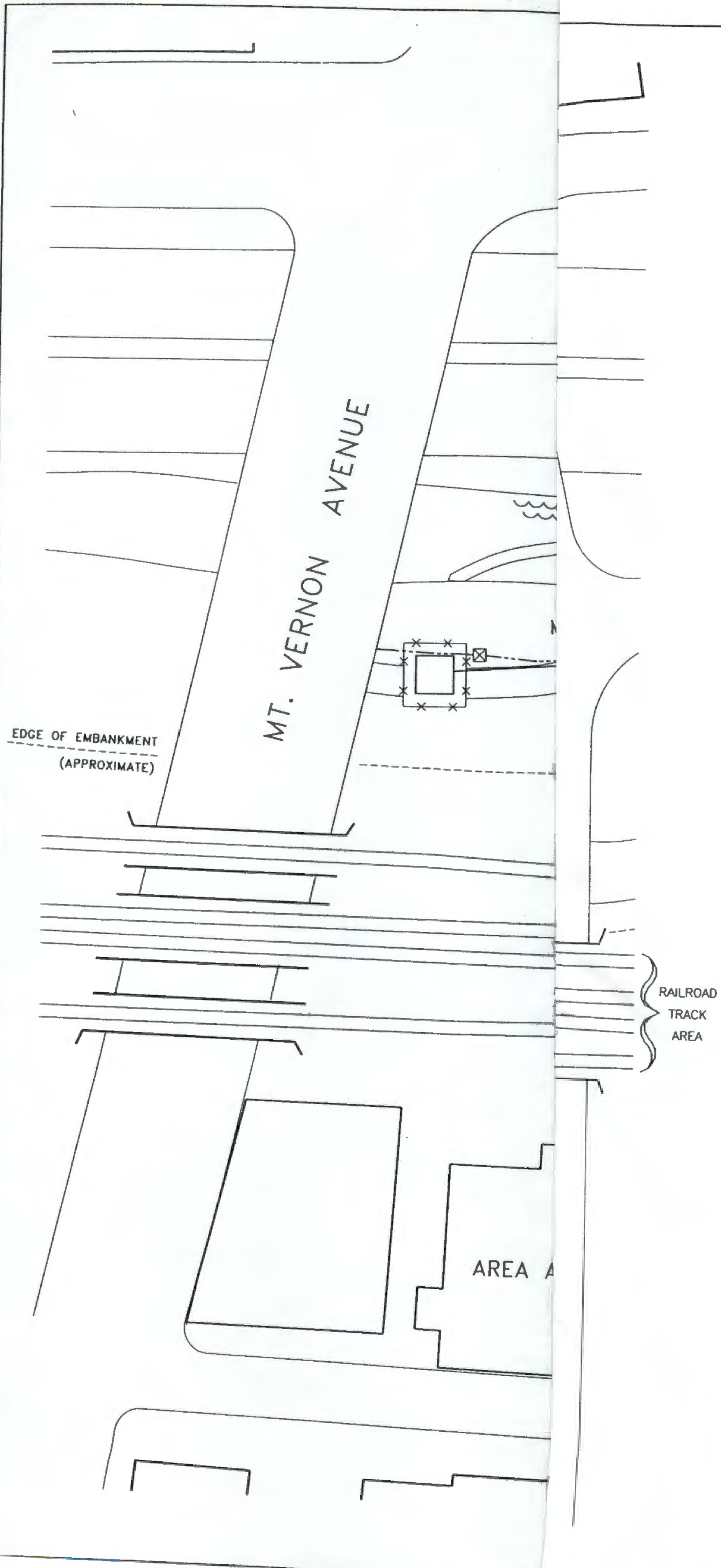
SCALE	FIGURE
GRAPHIC	4-1

DRAWN: JOB#: FILE NAME: DATE



TYPICAL HANGER
NOT TO SCALE

TITLE	PIPE HANGAR DETAIL			
PREPARED FOR	INSILCO CORP.			
ERM–Northeast Environmental Resources Management			SCALE NONE	FIGURE 4–2
DRAWN: E.M.F.	JOB NO.: 488.004.6	FILE NAME: HANGAR	DATE 5/27/97	



Legend

- PROPOSED NAPL RECOVERY WELL VAULT LOCATION
- PROPOSED ABOVE GROUND NAPL STORAGE TANK, BUILDING AND FENCE ENCLOSURE
- PROPOSED BELOW GROUND CONDUIT LOCATION
- CLEARED AREA
- WELL LOCATION
- METRO–NORTH TOWERS
- APPROXIMATE METRO–NORTH–WESTCHESTER COUNTY PROPERTY BOUNDARY
- MARINE BOOM

Notes:

1. NAPL will be pumped from the recovery wells through below ground and above ground conduits to proposed above ground dike storage tank.
2. All conduits to be double wall (i.e., small diameter tubing contained within a PVC or galvanized steel conduit).

0 40 80

APPROXIMATE SCALE IN FEET

TITLE

ALTERNATIVE NO. 2
LNAPL RECOVERY WITH TRANSFER TO ABOVEGROUND STORAGE TANK ON RIVER BANK
SCHEMATIC OF PIPING LAYOUT

PREPARED FOR

INSILCO CORP.

ERM–Northeast

SCALE | FIGURE

Appendix A
Well Boring Logs

ERM-Northeast

175 Froehlich Farm Blvd., Woodbury, NY 11797

WELL: **MW-9**

MONITORING WELL CONSTRUCTION LOG

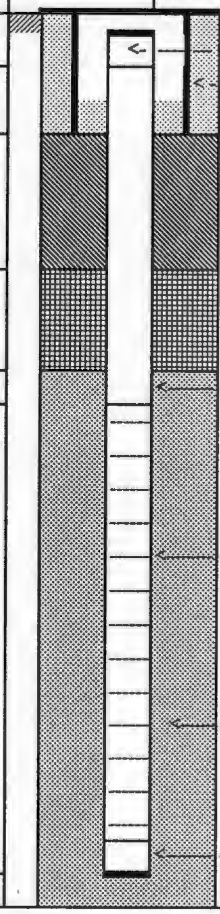
Proje t Name & Lo ation **Insilco corporation**	*Proje t No.* **488.010.4**	*Water Level(s)* *(ft below top of PVC asing)*			*Site Elevation Datum (feet)*
Drilling Company Aquifer Drilling & Testing	*Foreman* T. Gombarra	Date	Time	Level (feet)	*Ground Elevation (feet)*
Surveyor		9/26/96	2:45	12.2	*Top of Prote tive Steel Cap Elevation (feet)*
Date and Time of Completion 9/12/96 1500	*Geologist* J C Sheehan				*Top of Riser Pipe Elevation (feet)*

Generalized Soil Description	*Elevation	**Depth
	0.00	0.0
	0.00	0.0
0-4 FT.: Brown organic material with fine SAND and SILT occational gravel. Very loose material. Dry. No odor.	-3.00	3.0
	-11.00	11.0
	-12.00	12.0
4-14 FT.: Very hard drilling. Heavy gravel and large cobbles/boulders. Trap rock material., blue-gray in color. Wet at approximately 12.0 feet below grade. Some odor at water table.	-13.50	13.5
14-18.5 FT.: Soft material. Brown and dark brown fine SAND and SILT. Some cobbles/gravel. River bed material. Some odor. Wet.		
	-18.50	18.5
	0.00	

CONSTRUCTION DETAILS

PROTECTIVE STEEL CAP FLUSH WITH GROUND

GROUND SURFACE



WATER TIGHT CAP WITH LOCK

PROTECTIVE STEEL CASING CEMENTED IN PLACE

BENTONITE-CEMENT GROUT

BENTONITE SEAL

RISER
- DIAMETER: 4 INCH
- MATERIAL: PVC

WELL SCREEN
- SLOT SIZE: 0.02
- DIAMETER: 4 INCH
- MATERIAL: PVC

SAND PACK
- TYPE: #2 MORIE

BOTTOM CAP

BOTTOM OF BOREHOLE: 18.5 FEET

REMARKS

* Elevation (feet) above mean sea level unless noted

** Depth in feet below ground surface

ERM-Northeast

WELL : **DW-16**

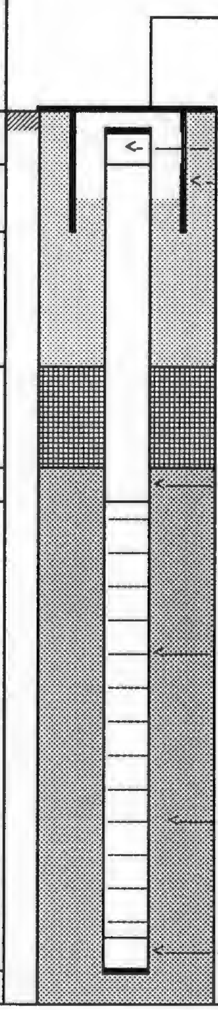
175 Froehlich Farm Blvd., Woodbury, NY 11797

MONITORIN WELL CONSTRUCTION LO

Project Name & Location	Project No.	Water Level(s) (ft below top of PVC casing)			Site Elevation Datum (feet)
Insilco corporation	488.010.4	Date	Time	Level (feet)	Ground Elevation (feet)
Drilling Company	**Foreman**	9/26/96	11:35	11.6	Top of Protective Steel Cap Elevation (feet)
Aquifer Drilling & Testing	T. Gombarra				
Surveyor					Top of Riser Pipe Elevation (feet)
Date and Time of Completion	**Geologist**				
9/10/96 1500	J C Sheehan				

CONSTRUCTION DETAILS

Generalized Soil Description	*Elevation	**Depth
	0.00	0.0
	0.00	0.0
0-3 FT.: Brown fine SAND and SILT with organic material and occational gravel. Loose material. Dry. No odor.	0.00	
	-3.50	3.5
	-4.50	4.5
3-12 FT.: Very hard drilling. Heavy gravel and large cobbles/boulders. Trap rock material., blue-gray in color. Wet at approximately 12.0 feet below grade. Strong odor at water table.	-6.50	6.5
12-16.5 FT.: Soft material. Brown and dark brown fine SAND and SILT. Some cobbles/gravel.River bed material. Strong odor. Wet.	-16.50	16.5
	0.00	



PROTECTIVE STEEL CAP FLUSH WITH GROUND

GROUND SURFACE

— WATER TIGHT CAP WITH LOCK

— PROTECTIVE STEEL CASING CEMENTED IN PLACE

<-- BENTONITE SEAL

— RISER

DIAMETER:	4 INCH
MATERIAL:	PVC

— WELL SCREEN

SLOT SIZE:	0.02
DIAMETER:	4 INCH
MATERIAL:	PVC

— SAND PACK

TYPE:	#2 MORIE

— BOTTOM CAP

BOTTOM OF BOREHOLE: 16.5 FEET

REMARKS

* Elevation (feet) above mean sea level unless noted

** Depth in feet below ground surface

ERM-Northeast

WELL : DW-17

175 Froehlich Farm Blvd., Woodbury, NY 11797

MONITORING WELL CONSTRUCTION LOG

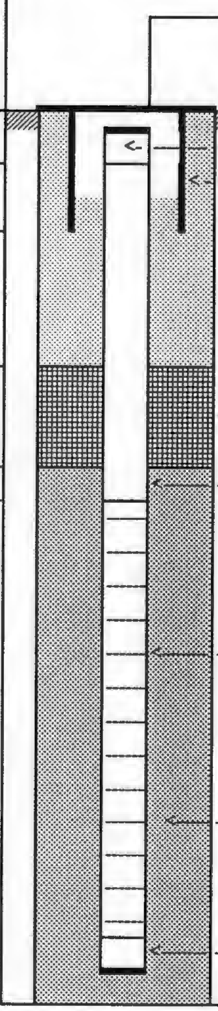
Project Name & Location	Project No.	Water Level(s) (ft below top of PVC casing)			Site Elevation Datum (feet)
Insilco corporation	488.010.4	Date	Time	Level (feet)	
Drilling Company	**Foreman**				**Ground Elevation (feet)**
Aquifer Drilling & Testing	T. Gombarra				
Surveyor		9/9/96	11:55	DTP/ DTW 11.44/ 12.1	**Top of Protective Steel Cap Elevation (feet)**
Date and Time of Completion	**Geologist**				**Top of Riser Pipe Elevation (feet)**
9/9/96 1400	J C Sheehan				

Generalized Soil Description	*Elevation	**Depth
	0.00	0.0
•	0.00	0.0
0-4 FT.: Brown fine SAND and SILT with organic material and occational gravel. Very loose material. Dry. No odor.	0.00	
	-3.00	3.0
	-4.00	4.0
4-12 FT.: Very hard drilling. Heavy gravel and large cobbles/boulders. Trap rock material., blue-gray in color. Wet at approximately 11.0 feet below grade. Strong odor at water table.	-5.50	5.5
12-16FT.: Soft material. Brown and dark brown fine SAND and SILT. Some cobbles/gravel.River bed material. Strong odor. Wet.		
	-15.50	15.5
	0.00	

CONSTRUCTION DETAILS

PROTECTIVE STEEL CAP FLUSH WITH GROUND

GROUND SURFACE



WATER TIGHT CAP WITH LOCK

PROTECTIVE STEEL CASING CEMENTED IN PLACE

BENTONITE SEAL

RISER

DIAMETER:	4 INCH
MATERIAL:	PVC

WELL SCREEN

SLOT SIZE:	0.02
DIAMETER:	4 INCH
MATERIAL:	PVC

SAND PACK

TYPE:	#2 MORIE

BOTTOM CAP

BOTTOM OF BOREHOLE: 16 FEET

REMARKS ______________________________

* Elevation (feet) above mean sea level unless noted

** Depth in feet below ground surface

ERM-Northeast

WELL: **DW-18**

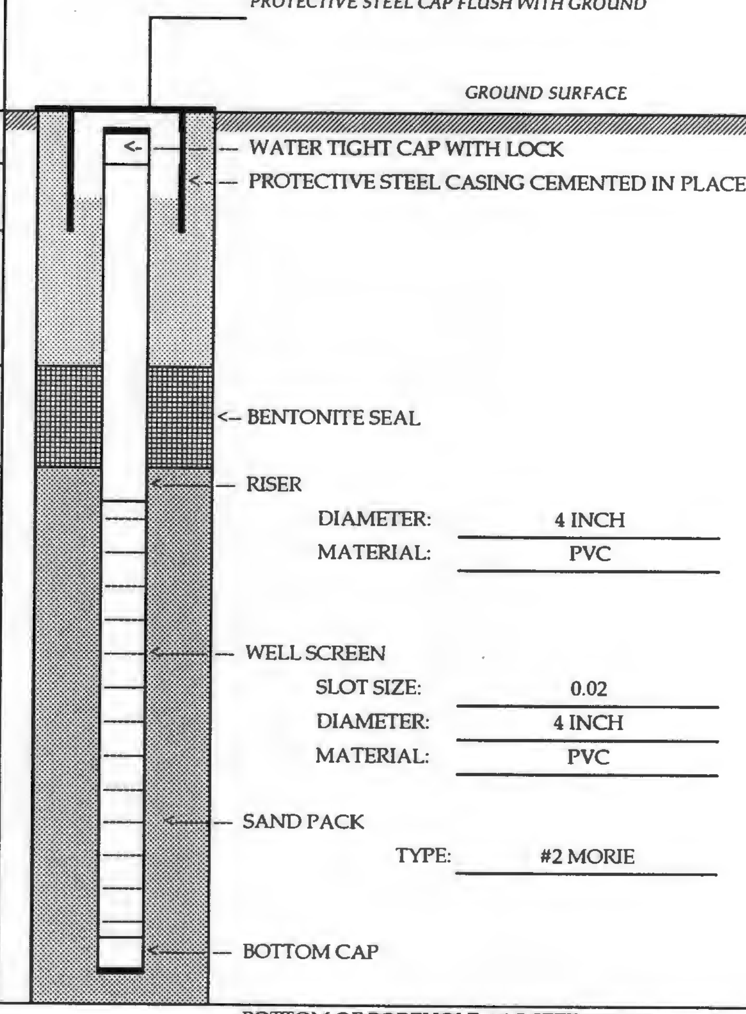
175 Froehlich Farm Blvd., Woodbury, NY 11797

MONITORING WELL CONSTRUCTION LOG

P oject Name & Location	P oject No.	Wate Level(s) (ft below top of PVC casing)			Site Elevation Datum (feet)
Insilco corporation	488.010.4	Date	Time	Level (feet)	
D illing Company: Aquifer Drilling & Testing	Fo eman: T. Gombarra				G ound Elevation (feet)
Su veyo		9/26/96	3:15	DTW/ DTP	Top of P otective Steel Cap Elevation (feet)
Date and Time of Completion: 9/10/96 1600	Geologist: J C Sheehan			11.01/ 11.45	Top of Rise Pipe Elevation (feet)

Generalized Soil Description	*Elevation	**Depth
	0.00	0.0
	0.00	0.0
0-3 FT.: Brown fine SAND and SILT with organic material and occational gravel. Loose material. Dry. No odor.	0.00	
	-3.00	3.0
	-4.00	4.0
3-12 FT.: Very hard drilling. Fill material.Trap rock. Large cobbles/boulders. Blue-gray in color. Wet at approximately 12.0 feet below grade. Strong odor at water table.	-6.50	6.5
12-16.5 FT.: Soft material. Brown and dark brown fine SAND and SILT. Some cobbles/gravel.River bed material. Strong odor. Wet.	-16.50	16.5
	0.00	

CONSTRUCTION DETAILS



RISER
- DIAMETER: 4 INCH
- MATERIAL: PVC

WELL SCREEN
- SLOT SIZE: 0.02
- DIAMETER: 4 INCH
- MATERIAL: PVC

SAND PACK
- TYPE: #2 MORIE

BOTTOM OF BOREHOLE: 16.5 FEET

REMARKS

* Elevation (feet) above mean sea level unless noted

** Depth in feet below ground surface

ERM-Northeast

WELL: **DW-19**

175 Froehlich Farm Blvd., Woodbury, NY 11797

MONITORING WELL CONSTRUCTION LOG

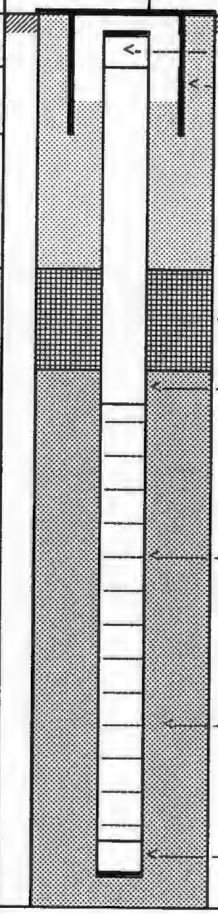
Project Name & Location	Project No.	Water Level(s) (ft below top of PVC casing)			Site Elevation Datum (feet)
Insilco corporation	488.010.4	Date	Time	Level (feet)	
Drilling Company	**Foreman**				**Ground Elevation (feet)**
Aquifer Drilling & Testing	T. Gombarra				
Surveyor				DTW/ DTP	**Top of Protective Steel Cap Elevation (feet)**
		9/26/96	3:35		
Date and Time of Completion	**Geologist**			10.97/ 11.4	**Top of Riser Pipe Elevation (feet)**
9/11/96 1700	J C Sheehan				

Generalized Soil Description	*Elevation	**Depth
	0.00	0.0
	0.00	0.0
0-4 FT.: Brown fine SAND and SILT with organic material and occational gravel. Loose material. Dry. No odor.	0.00	
	-3.00	3.0
	-5.00	5.0
4-12 FT.: Very hard drilling. Fill material.Trap rock. Large cobbles/boulders. Blue-gray in color. Wet at approximately 12.0 feet below grade. Strong odor at water table.	-7.50	7.5
12-17.5 FT.: Soft material. Brown and dark brown fine SAND and SILT. Some cobbles/gravel.River bed material. Strong odor. Wet.		
	-17.50	17.5
	0.00	

CONSTRUCTION DETAILS

PROTECTIVE STEEL CAP FLUSH WITH GROUND

GROUND SURFACE



WATER TIGHT CAP WITH LOCK

PROTECTIVE STEEL CASING CEMENTED IN PLACE

BENTONITE SEAL

RISER
- DIAMETER: 4 INCH
- MATERIAL: PVC

WELL SCREEN
- SLOT SIZE: 0.02
- DIAMETER: 4 INCH
- MATERIAL: PVC

SAND PACK
- TYPE: #2 MORIE

BOTTOM CAP

BOTTOM OF BOREHOLE: 17.5 FEET

REMARKS

* Elevation (feet) above mean sea level unless noted

** Depth in feet below ground surface

Appendix B
Baildown Test Data

Product Baildown Test Results For Bronx River Bank Wells

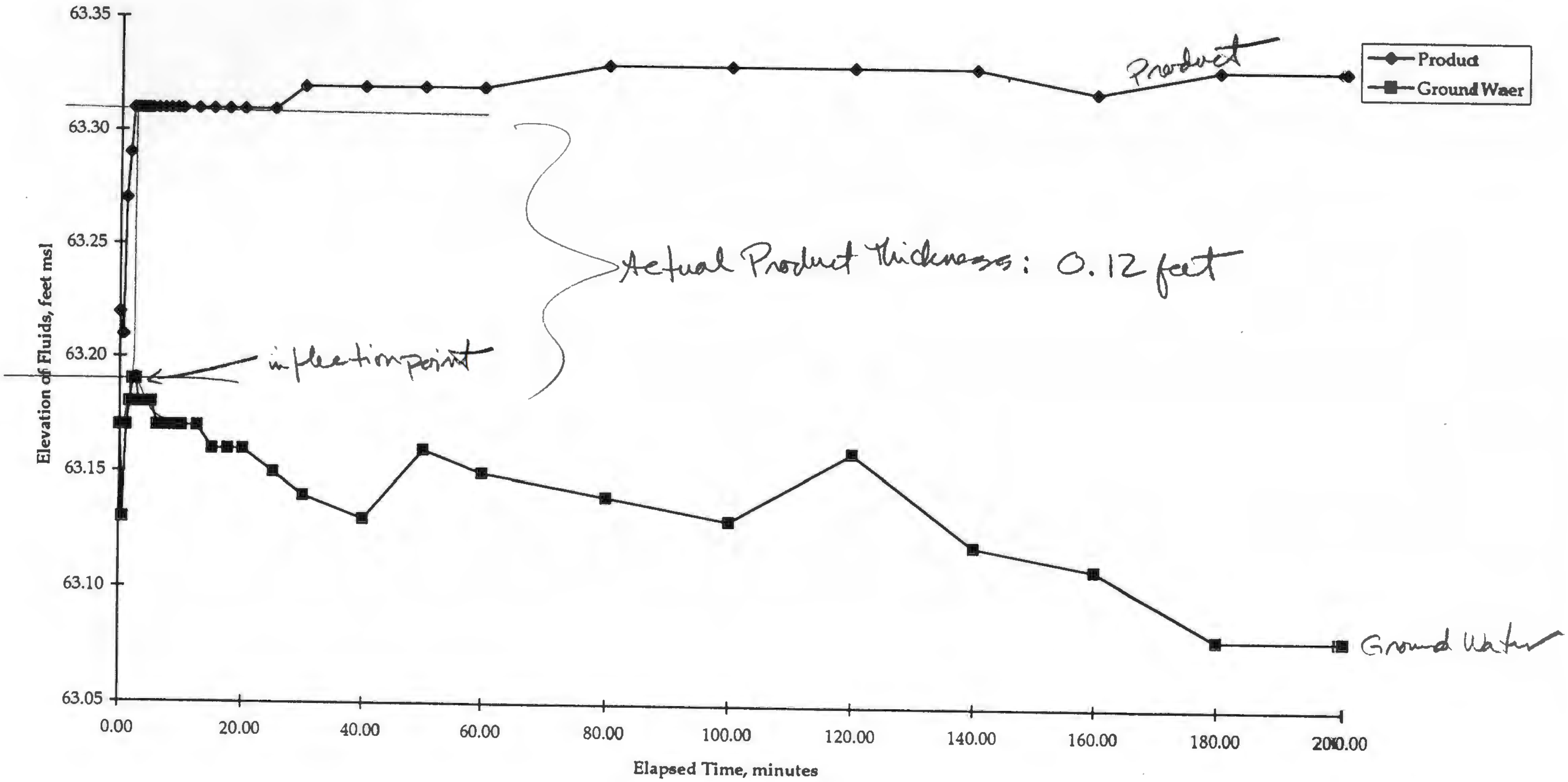
Former Red Devil Site, Mount Vernon, New York

Baildown Test Results (10/16/96)

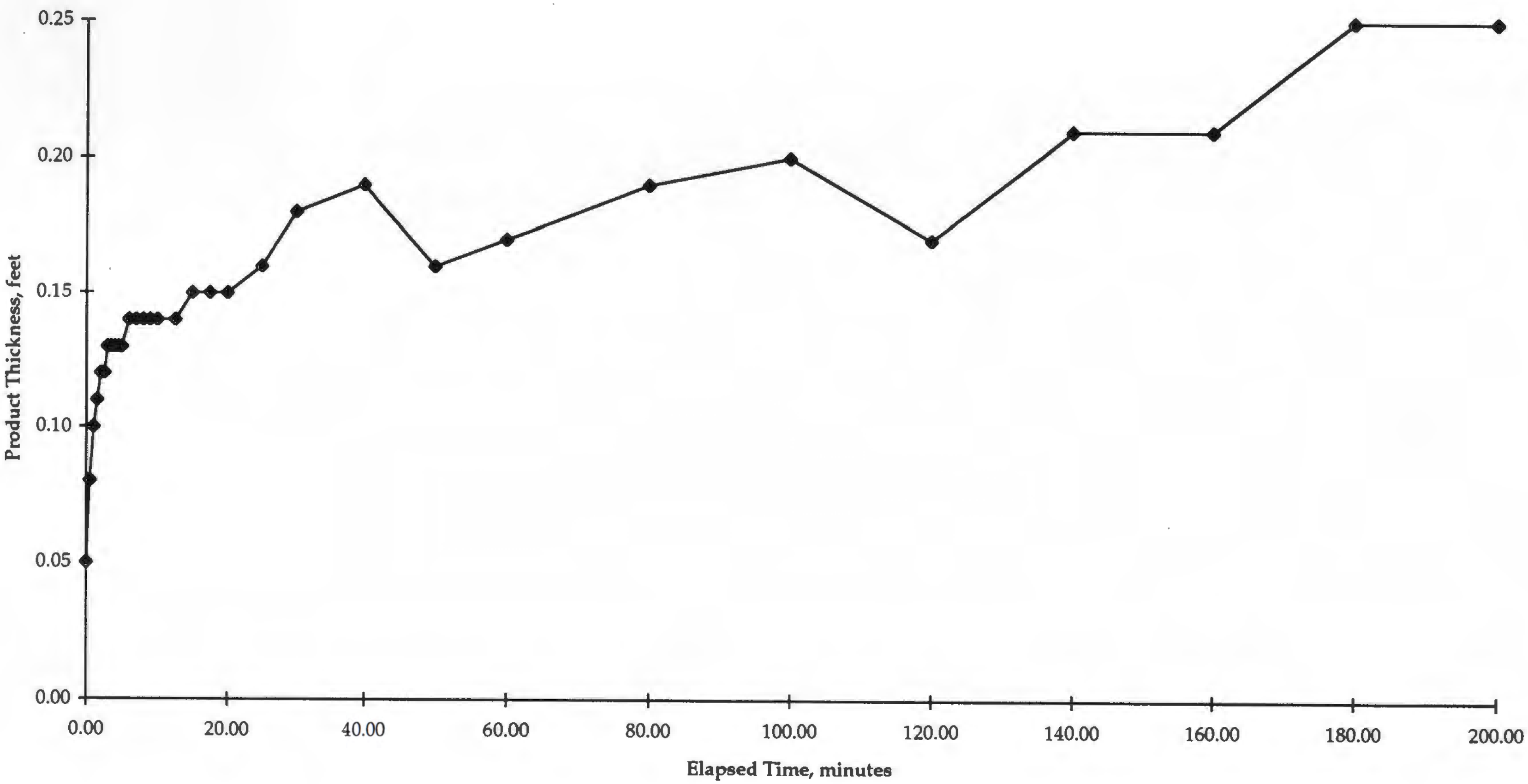
Well 19

Elapsed Time (min)	Product Thickness (ft)	Depth to Product (ft)	Product Level Elevation (ft. MSL)	Depth to Water (ft)	Water Level Elevation (ft. MSL)	Volume (gal)	Recovery Rate (gal/hr)
0.00	0.05	11.01	63.22	11.06	63.17	0.03	
0.50	0.08	11.02	63.21	11.10	63.13	0.05	2.35
1.00	0.10	10.96	63.27	11.06	63.17	0.07	1.57
1.50	0.11	10.94	63.29	11.05	63.18	0.07	0.78
2.00	0.12	10.92	63.31	11.04	63.19	0.08	0.78
2.50	0.12	10.92	63.31	11.04	63.19	0.08	0.00
3.00	0.13	10.92	63.31	11.05	63.18	0.08	0.78
3.50	0.13	10.92	63.31	11.05	63.18	0.08	0.00
4.00	0.13	10.92	63.31	11.05	63.18	0.08	0.00
4.50	0.13	10.92	63.31	11.05	63.18	0.08	0.00
5.00	0.13	10.92	63.31	11.05	63.18	0.08	0.00
6.00	0.14	10.92	63.31	11.06	63.17	0.09	0.39
7.00	0.14	10.92	63.31	11.06	63.17	0.09	0.00
8.00	0.14	10.92	63.31	11.06	63.17	0.09	0.00
9.00	0.14	10.92	63.31	11.06	63.17	0.09	0.00
10.00	0.14	10.92	63.31	11.06	63.17	0.09	0.00
12.50	0.14	10.92	63.31	11.06	63.17	0.09	0.00
15.00	0.15	10.92	63.31	11.07	63.16	0.10	0.16
17.50	0.15	10.92	63.31	11.07	63.16	0.10	0.00
20.00	0.15	10.92	63.31	11.07	63.16	0.10	0.00
25.00	0.16	10.92	63.31	11.08	63.15	0.10	0.08
30.00	0.18	10.91	63.32	11.09	63.14	0.12	0.16
40.00	0.19	10.91	63.32	11.10	63.13	0.12	0.04
50.00	0.16	10.91	63.32	11.07	63.16	0.10	-0.12
60.00	0.17	10.91	63.32	11.08	63.15	0.11	0.04
80.00	0.19	10.90	63.33	11.09	63.14	0.12	0.04
100.00	0.20	10.90	63.33	11.10	63.13	0.13	0.02
120.00	0.17	10.90	63.33	11.07	63.16	0.11	-0.06
140.00	0.21	10.90	63.33	11.11	63.12	0.14	0.08
160.00	0.21	10.91	63.32	11.12	63.11	0.14	0.00
180.00	0.25	10.90	63.33	11.15	63.08	0.16	0.08
200.00	0.25	10.90	63.33	11.15	63.08	0.16	0.00

Well 19 Baildown Test



Well 19 - Product Thickness Versus Elapsed Time



Product Baildown Test Results For Bronx River Bank Wells

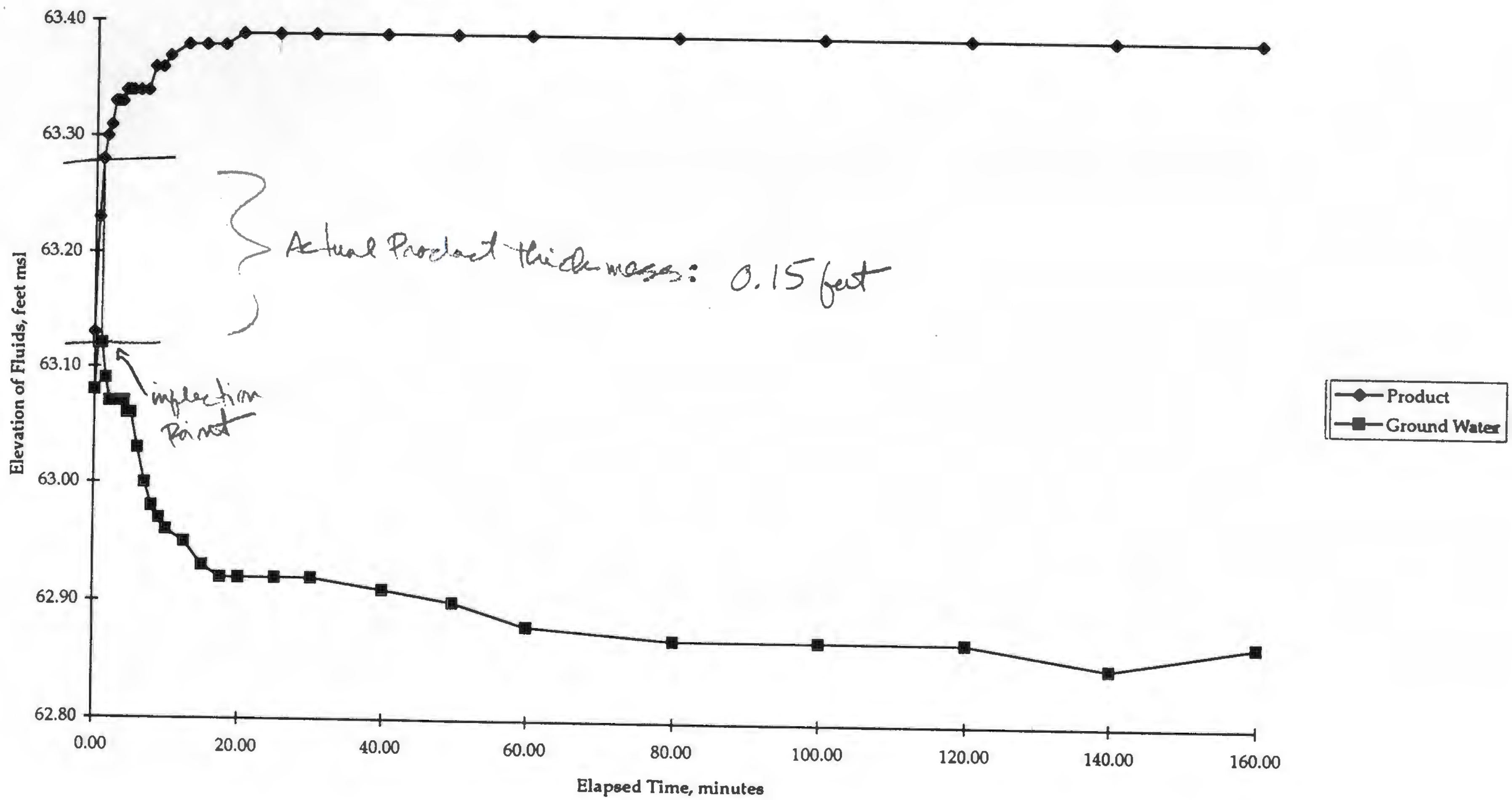
Former Red Devil Site, Mount Vernon, New York

Baildown Test Results (10/16/96)

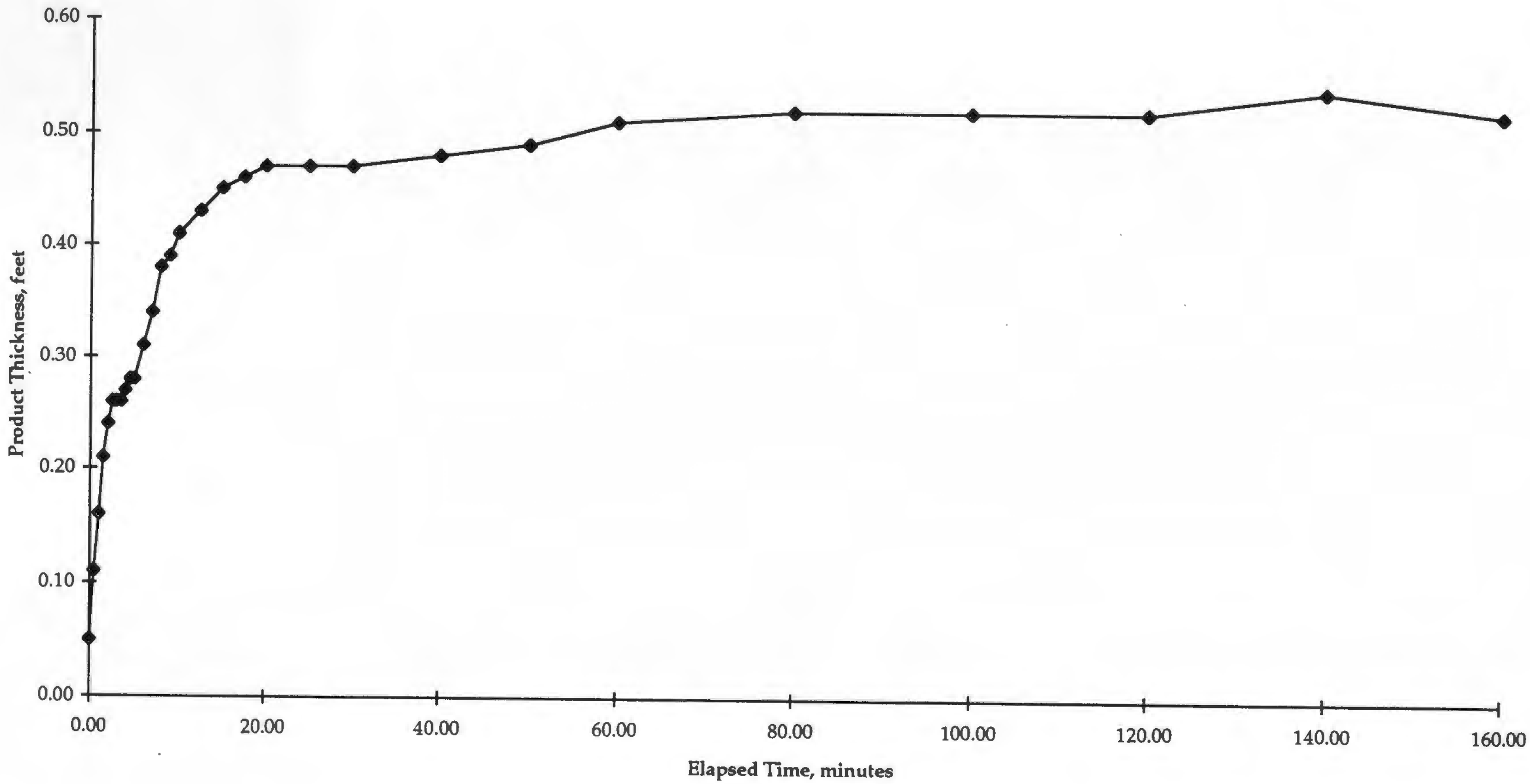
Well 18

Elapsed Time (min)	Product Thickness (ft)	Depth to Product (ft)	Product Level Elevation (ft. MSL)	Depth to Water (ft)	Water Level Elevation (ft. MSL)	Volume (gal)	Recovery Rate (gal/hr)
0.00	0.05	11.15	63.13	11.20	63.08	0.03	
0.50	0.11	11.05	63.23	11.16	63.12	0.07	4.70
1.00	0.16	11.00	63.28	11.16	63.12	0.10	3.92
1.50	0.21	10.98	63.30	11.19	63.09	0.14	3.92
2.00	0.24	10.97	63.31	11.21	63.07	0.16	2.35
2.50	0.26	10.95	63.33	11.21	63.07	0.17	1.57
3.00	0.26	10.95	63.33	11.21	63.07	0.17	0.00
3.50	0.26	10.95	63.33	11.21	63.07	0.17	0.00
4.00	0.27	10.94	63.34	11.21	63.07	0.18	0.78
4.50	0.28	10.94	63.34	11.22	63.06	0.18	0.78
5.00	0.28	10.94	63.34	11.22	63.06	0.18	0.00
6.00	0.31	10.94	63.34	11.25	63.03	0.20	1.18
7.00	0.34	10.94	63.34	11.28	63.00	0.22	1.18
8.00	0.38	10.92	63.36	11.30	62.98	0.25	1.57
9.00	0.39	10.92	63.36	11.31	62.97	0.25	0.39
10.00	0.41	10.91	63.37	11.32	62.96	0.27	0.78
12.50	0.43	10.90	63.38	11.33	62.95	0.28	0.31
15.00	0.45	10.90	63.38	11.35	62.93	0.29	0.31
17.50	0.46	10.90	63.38	11.36	62.92	0.30	0.16
20.00	0.47	10.89	63.39	11.36	62.92	0.31	0.16
25.00	0.47	10.89	63.39	11.36	62.92	0.31	0.00
30.00	0.47	10.89	63.39	11.36	62.92	0.31	0.00
40.00	0.48	10.89	63.39	11.37	62.91	0.31	0.04
50.00	0.49	10.89	63.39	11.38	62.90	0.32	0.04
60.00	0.51	10.89	63.39	11.40	62.88	0.33	0.08
80.00	0.52	10.89	63.39	11.41	62.87	0.34	0.02
100.00	0.52	10.89	63.39	11.41	62.87	0.34	0.00
120.00	0.52	10.89	63.39	11.41	62.87	0.34	0.00
140.00	0.54	10.89	63.39	11.43	62.85	0.35	0.04
160.00	0.52	10.89	63.39	11.41	62.87	0.34	-0.04

Well 18 Baildown Test



Well 18 - Product Thickness Versus Elapsed Time



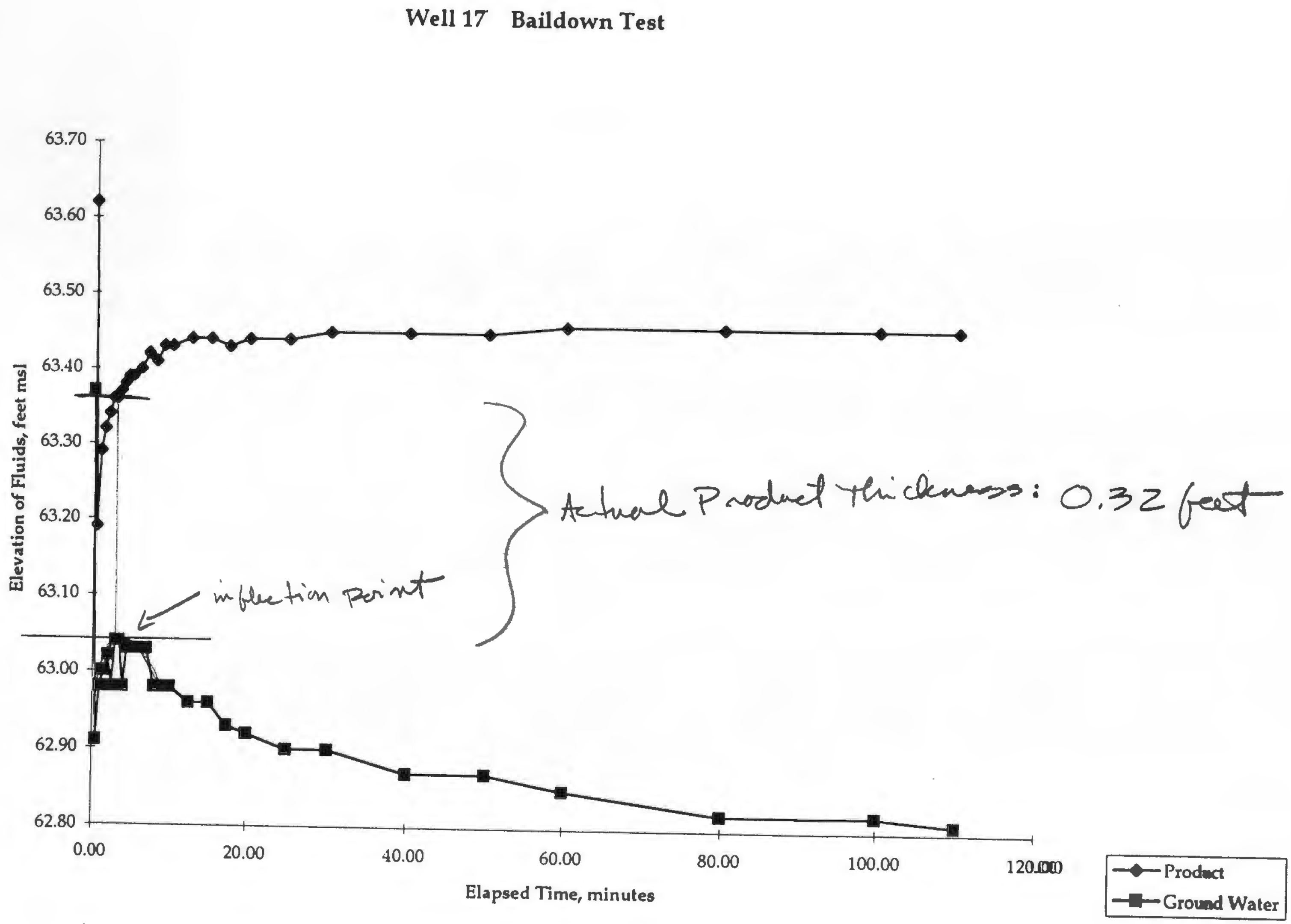
Product Baildown Test Results For Bronx River Bank Wells

Former Red Devil Site, Mount Vernon, New York

Baildown Test Results (10/16/96)

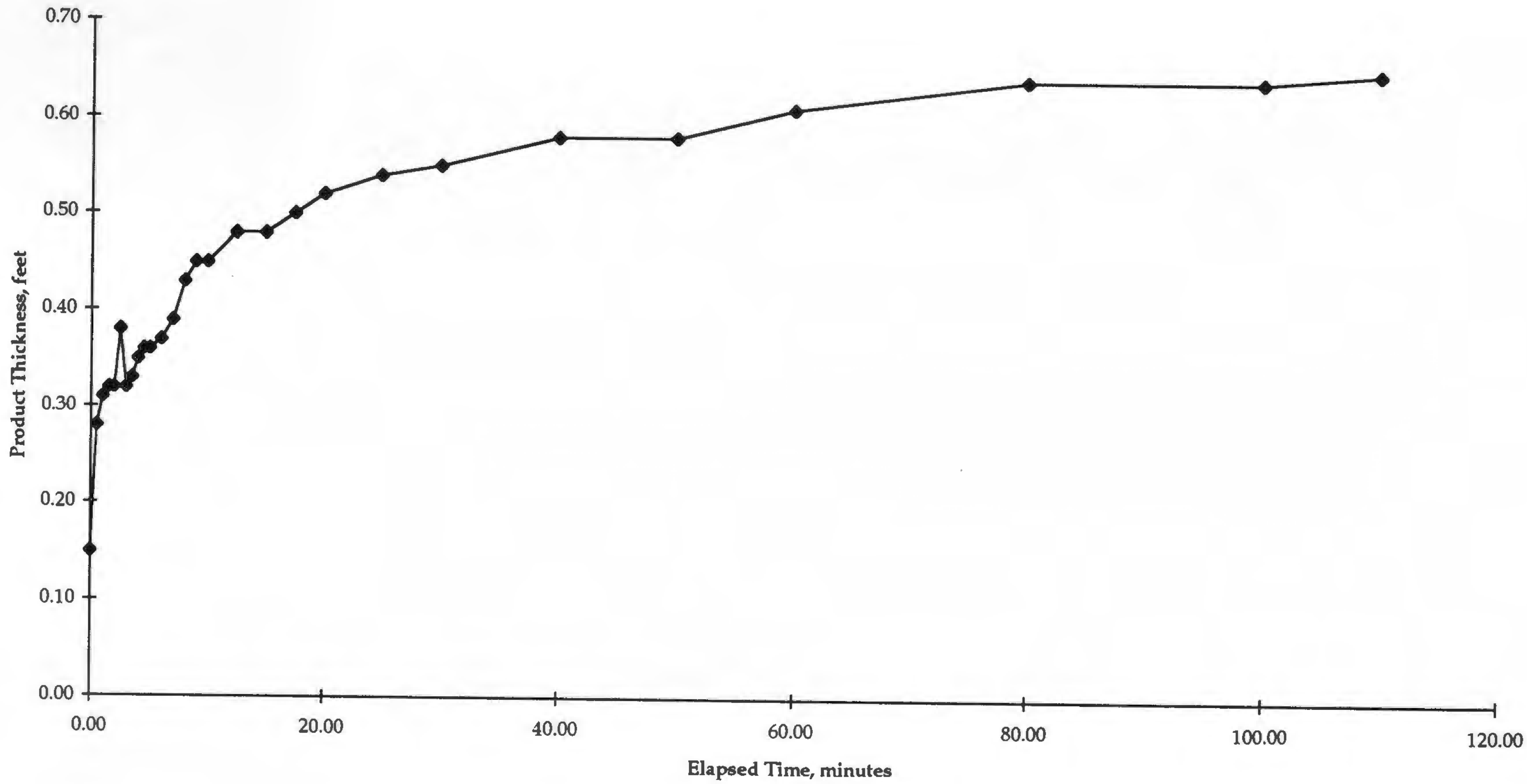
Well 17

Elapsed Time (min)	Product Thickness (ft)	Depth to Product (ft)	Product Level Elevation (ft MSL)	Depth to Water (ft)	Water Level Elevation (ft MSL)	Volume (gal)	Recovery Rate (gal/hr)
0.00	0.25	11.15	63.62	11.40	63.37	0.16	
0.50	0.28	11.58	63.19	11.86	62.91	0.18	2.35
1.00	0.31	11.48	63.29	11.79	62.98	0.20	2.35
1.50	0.32	11.45	63.32	11.77	63.00	0.21	0.78
2.00	0.32	11.43	63.34	11.75	63.02	0.21	0.00
2.50	0.38	11.41	63.36	11.79	62.98	0.25	4.70
3.00	0.32	11.41	63.36	11.73	63.04	0.21	-4.70
3.50	0.33	11.40	63.37	11.73	63.04	0.22	0.78
4.00	0.35	11.39	63.38	11.79	62.98	0.23	1.57
4.50	0.36	11.38	63.39	11.74	63.03	0.24	0.78
5.00	0.36	11.38	63.39	11.74	63.03	0.24	0.00
6.00	0.37	11.37	63.40	11.74	63.03	0.24	0.39
7.00	0.39	11.35	63.42	11.74	63.03	0.25	0.78
8.00	0.43	11.36	63.41	11.79	62.98	0.28	1.57
9.00	0.45	11.34	63.43	11.79	62.98	0.29	0.78
10.00	0.45	11.34	63.43	11.79	62.98	0.29	0.00
12.50	0.48	11.33	63.44	11.81	62.96	0.31	0.47
15.00	0.48	11.33	63.44	11.81	62.96	0.31	0.00
17.50	0.50	11.34	63.43	11.84	62.93	0.33	0.31
20.00	0.52	11.33	63.44	11.85	62.92	0.34	0.31
25.00	0.54	11.33	63.44	11.87	62.90	0.35	0.16
30.00	0.55	11.32	63.45	11.87	62.90	0.36	0.08
40.00	0.58	11.32	63.45	11.90	62.87	0.38	0.12
50.00	0.58	11.32	63.45	11.90	62.87	0.38	0.00
60.00	0.61	11.31	63.46	11.92	62.85	0.40	0.12
80.00	0.64	11.31	63.46	11.95	62.82	0.42	0.06
100.00	0.64	11.31	63.46	11.95	62.82	0.42	0.00
110.00	0.65	11.31	63.46	11.96	62.81	0.42	0.04



Well 17 Baildown Test
63.70
63.60
63.50
63.40
63.30
63.20
63.10
63.00
62.90
62.80
Elevation of Fluids, feet msl
0.00
20.00
40.00
60.00
80.00
100.00
120.00
Elapsed Time, minutes
Product
Ground Water
inflection point
Actual Product thickness: 0.32 feet

Well 17 - Product Thickness Versus Elapsed Time



Appendix C
Validation Report and Validated Form I's from March 1997 Sampling

DATA VALIDATION REVIEW
GROUND WATER SAMPLE ANALYSES
FORMER RED DEVIL FACILITY, MOUNT VERNON, NEW YORK
ERM-NORTHEAST PROJECT NUMBER 488.010
NEI SDG NUMBERS 30793 and 30845

Deliverables

ERM

The above referenced Sample Data Packages for 11 ground water samples, one field duplicate, one field blank and one trip blank contain all required deliverables as stipulated under the 1991 New York State Analytical Services Protocol (ASP) Superfund category for all Target Compound List (TCL) Volatile Organic Compounds (VOC). The data were validated in accordance with the QC requirements of the ASP, the USEPA National Functional Guidelines for Organic Data Review (February, 1994) and the validator's professional judgment.

This validation report pertains to the following samples:

Samples		QC Samples
MW-1A	MW-8C	Dup-1(MW-6C Field Duplicate)
MW-2A	MW-9	TB-1 (trip blank)
MW-4D	DW-1A	FB-1(field blank)
MW-5D	DW-2A	MW-9 MS/MSD
MW-6C	DW-3A	
MW-7A		

The following items/criteria were reviewed:

- Case narrative
- Deliverable requirements
- Holding times
- GC/MS tuning
- Initial and continuing calibration data
- Procedural, field and trip blank data
- Internal standard area summary and data
- Surrogate recoveries and summary
- MS/MSD/MSB recoveries and summary
- Chromatograms and mass spectra
- Qualitative and quantitative compound identification
- Organic analysis data sheets (Form I)

The items listed above were in compliance with both the technical and protocol requirements of the NYSDEC ASP (December, 1991) with the exceptions discussed in the text below. The data have been validated according to the procedures outlined above and qualified accordingly.

ERM

- The continuing instrument calibrations associated with all samples except MW-4D exhibited relative percent difference between the initial calibration average response factor and the continuing calibration response factor greater than the 25% USEPA Functional Guidelines QC limit for chloromethane (26.7% and 31.1% in the continuing calibrations from 3/19/97 and 3/20/97, respectively). Chloromethane non-detect results in these samples are therefore considered estimated at the limit of detection and flagged "UJ".

- The following table shows blanks, blank contaminants and concentrations and associated samples. Levels of methylene chloride in samples associated with these blanks that are less than ten times the amount in the blank will be negated after applying the appropriate dilution factor. Concentrations of TICs in samples less than five times the associated blank concentration will be negated as laboratory contamination.

Blank	Contaminant	Concentration (μg/l)	Associated Samples
VBLKP40	methylene chloride	2J	All except MW-2ADL and MW-5DDL
VBLKP49	methylene chloride	16	MW-4D
FB-1	methylene chloride	2JB	all samples
TB-1	methylene chloride naphthalene @ 26.07	2 JB 17 J	all samples

- MW-4D was the only sample included in SDG 30845. This sample was not specified for MS/MSD analysis, therefore the laboratory provided only batch MS/MSD data to fulfill the protocol obligations. The batch QC has no bearing on the MW-4D data and is not used for sample validation purposes.

- Samples MW-2A and MW-5D were analyzed at an initial 1:1 dilution and a secondary 5:1 dilution due to elevated concentrations of toluene (MW-2A) and chloroethane and total xylenes (MW-5D). The initial analyses of both of these samples should be used for all target compound results except the compounds noted above. The secondary analysis results should be used for the target compounds noted above only. No TICs were noted in the initial analysis of MW-2A, however an unknown hydrocarbon TIC was noted in the dilution analysis. Therefore, as a conservative approach, the dilution analysis TIC results for MW-2A should be reported. The initial analysis TIC results for MW-5D should be reported.

ERM

Package Summary

Sample results are valid with qualifications as noted in this review and presented on the attached form.

Signed: Douglas A. Wolf   Date: 20 May 1997

Douglas A. Wolf, P.G.
Data Quality Assurance Manager

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

NYSDEC SAMPLE NO.

MW-4D

Lab Name: NYTEST ENV INC   Contract: 9723128

Lab Code: NYTEST   Case No.: 30845   SAS No.:   SDG No.: 30845

Matrix: (soil/water) WATER   Lab Sample ID: 3084501

Sample wt/vol: 5.0 (g/mL) ML   Lab File ID: P5880.D

Level: (low/med) LOW   Date Received: 03/21/97

% Moisture: not dec. ________   Date Analyzed: 03/27/97

GC Column:CAP   ID: 0.53 (mm)   Dilution Factor: 1.0

Soil Extract Volume: ______(uL)   Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	~~2~~ 10	~~JB~~ U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (total)	10	U
67-66-3	Chloroform	10	U
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-88-3	Toluene	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Xylene (total)	10	U

5/20/97

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

NYSDEC SAMPLE NO.

MW-4D

Lab Name: NYTEST ENV INC   Contract: 9723128

Lab Code: NYTEST   Case No.: 30845   SAS No.:   SDG No.: 30845

Matrix: (soil/water) WATER   Lab Sample ID: 3084501

Sample wt/vol: 5.0   (g/mL) ML   Lab File ID: P5880.D

Level: (low/med) LOW   Date Received: 03/21/97

% Moisture: not dec. ______   Data Analyzed: 03/27/97

GC Column:CAP   ID: 0.53 (mm)   Dilution Factor: 1.0

Soil Extract Volume: ______(uL)   Soil Aliquot Volume: ______(uL)

Number TICs found: 6

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	UNKNOWN	16.511	5	J
2.	UNKNOWN AROMATIC	18.373	6	J
3.	UNKNOWN AROMATIC	18.966	8	J
4.	UNKNOWN AROMATIC	19.278	9	J
5.	UNKNOWN AROMATIC	20.402	12	J
6.	UNKNOWN AROMATIC	21.016	6	J
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				
26.				
27.				
28.				
29.				
30.				

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

NYSDEC SAMPLE NO.

DUP-1

Lab Name: NYTEST ENV INC Contract: 9723128

Lab Code: NYTEST Case No.: 30793 SAS No.: SDG No.: 30793

Matrix: (soil/water) WATER Lab Sample ID: 3079311

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: P5730.D

Level: (low/med) LOW Date Received: 03/17/97

% Moisture: not dec. ________ Date Analyzed: 03/20/97

GC Column:CAP ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _______(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U J
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	10	U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (total)	10	U
67-66-3	Chloroform	17	
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	5	J
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-88-3	Toluene	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Xylene (total)	10	U

5/20/97

000032

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

NYSDEC SAMPLE NO.

DUP-1

Lab Name: NYTEST ENV INC   Contract: 9723128

Lab Code: NYTEST   Case No.: 30793   SAS No.:   SDG No.: 30793

Matrix: (soil/water) WATER   Lab Sample ID: 3079311

Sample wt/vol: 5.0   (g/mL) ML   Lab File ID: P5730.D

Level: (low/med) LOW   Date Received: 03/17/97

% Moisture: not dec. ________   Data Analyzed: 03/20/97

GC Column:CAP   ID: 0.53 (mm)   Dilution Factor: 1.0

Soil Extract Volume: ______(uL)   Soil Aliquot Volume: _____(uL)

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				
26.				
27.				
28.				
29.				
30.				

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

NYSDEC SAMPLE NO.

DW-1A

Lab Name: NYTEST ENV INC   Contract: 9723128

Lab Code: NYTEST   Case No.: 30793   SAS No.:   SDG No.: 30793

Matrix: (soil/water) WATER   Lab Sample ID: 3079302

Sample wt/vol: 5.0 (g/mL) ML   Lab File ID: P5721.D

Level: (low/med) LOW   Date Received: 03/17/97

% Moisture: not dec. ________   Date Analyzed: 03/20/97

GC Column:CAP   ID: 0.53 (mm)   Dilution Factor: 1.0

Soil Extract Volume: _______(uL)   Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U J
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	10	U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (total)	10	U
67-66-3	Chloroform	24	
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	5	J
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-88-3	Toluene	150	
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	2	J
100-42-5	Styrene	10	U
1330-20-7	Xylene (total)	16	

5/20/97

000037

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

NYSDEC SAMPLE NO.

DW-1A

Lab Name: NYTEST ENV INC   Contract: 9723128

Lab Code: NYTEST   Case No.: 30793   SAS No.:   SDG No.: 30793

Matrix: (soil/water) WATER   Lab Sample ID: 3079302

Sample wt/vol: 5.0 (g/mL) ML   Lab File ID: P5721.D

Level: (low/med) LOW   Date Received: 03/17/97

% Moisture: not dec. ________   Data Analyzed: 03/20/97

GC Column:CAP   ID: 0.53 (mm)   Dilution Factor: 1.0

Soil Extract Volume: _______(uL)   Soil Aliquot Volume: _____(uL)

Number TICs found: 10

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	UNKNOWN HYDROCARBON	16.123	330	J
2.	UNKNOWN HYDROCARBON	16.529	360	J
3.	UNKNOWN HYDROCARBON	16.664	520	J
4.	UNKNOWN HYDROCARBON	16.945	390	J
5.	UNKNOWN HYDROCARBON	17.809	410	J
6.	UNKNOWN HYDROCARBON	18.370	620	J
7.	UNKNOWN HYDROCARBON	19.577	390	J
8.	UNKNOWN HYDROCARBON	19.858	390	J
9.	UNKNOWN HYDROCARBON	20.669	340	J
10.	UNKNOWN AROMATIC	21.023	340	J
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				
26.				
27.				
28.				
29.				
30.				

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

NYSDEC SAMPLE NO.

DW-2A

Lab Name: NYTEST ENV INC Contract: 9723128

Lab Code: NYTEST Case No.: 30793 SAS No.: SDG No.: 30793

Matrix: (soil/water) WATER Lab Sample ID: 3079308

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: P5727.D

Level: (low/med) LOW Date Received: 03/17/97

% Moisture: not dec. ______ Date Analyzed: 03/20/97

GC Column:CAP ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: ______(uL) Soil Aliquot Volume: ______(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U J
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	10	U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (total)	10	U
67-66-3	Chloroform	27	
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	2	J
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-88-3	Toluene	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Xylene (total)	10	U

5/20/97

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

NYSDEC SAMPLE NO.

DW-2A

Lab Name: NYTEST ENV INC Contract: 9723128

Lab Code: NYTEST Case No.: 30793 SAS No.: SDG No.: 30793

Matrix: (soil/water) WATER Lab Sample ID: 3079308

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: P5727.D

Level: (low/med) LOW Date Received: 03/17/97

% Moisture: not dec. ________ Data Analyzed: 03/20/97

GC Column:CAP ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _______(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				
26.				
27.				
28.				
29.				
30.				

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

NYSDEC SAMPLE NO.

DW-3A

Lab Name: NYTEST ENV INC   Contract: 9723128

Lab Code: NYTEST   Case No.: 30793   SAS No.:   SDG No.: 30793

Matrix: (soil/water) WATER   Lab Sample ID: 3079303

Sample wt/vol: 5.0 (g/mL) ML   Lab File ID: P5722.D

Level: (low/med) LOW   Date Received: 03/17/97

% Moisture: not dec. ________   Date Analyzed: 03/20/97

GC Column:CAP   ID: 0.53 (mm)   Dilution Factor: 1.0

Soil Extract Volume: ______(uL)   Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	10	U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (total)	10	U
67-66-3	Chloroform	10	U
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	1[illegible]	U
75-27-4	Bromodichloromethane	1[illegible]	U
78-87-5	1,2-Dichloropropane	1[illegible]	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-88-3	Toluene	64	
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	3	J
100-42-5	Styrene	10	U
1330-20-7	Xylene (total)	5	J

5/20/97

000061

FORM I VOA   NYSDEC ASP 12/91

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

NYSDEC SAMPLE NO.

DW-3A

Lab Name: NYTEST ENV INC Contract: 9723128

Lab Code: NYTEST Case No.: 30793 SAS No.: SDG No.: 30793

Matrix: (soil/water) WATER Lab Sample ID: 3079303

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: P5722.D

Level: (low/med) LOW Date Received: 03/17/97

% Moisture: not dec. ________ Data Analyzed: 03/20/97

GC Column:CAP ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _______(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 10

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

	CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.		UNKNOWN HYDROCARBON	16.497	12	J
2.		UNKNOWN AROMATIC	17.985	11	J
3.		UNKNOWN AROMATIC	18.235	34	J
4.		UNKNOWN AROMATIC	18.963	13	J
5.		UNKNOWN AROMATIC	19.275	54	J
6.		UNKNOWN AROMATIC	20.388	17	J
7.		UNKNOWN AROMATIC	20.814	22	J
8.		UNKNOWN AROMATIC	21.002	26	J
9.		UNKNOWN AROMATIC	21.730	16	J
10.		UNKNOWN AROMATIC	21.959	12	J
11.					
12.					
13.					
14.					
15.					
16.					
17.					
18.					
19.					
20.					
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

NYSDEC SAMPLE NO.

FB-1

Lab Name: NYTEST ENV INC Contract: 9723128

Lab Code: NYTEST Case No.: 30793 SAS No.: SDG No.: 30793

Matrix: (soil/water) WATER Lab Sample ID: 3079312

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: P5715.D

Level: (low/med) LOW Date Received: 03/17/97

% Moisture: not dec. ________ Date Analyzed: 03/19/97

GC Column:CAP ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _______(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	2	JB
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (total)	10	U
67-66-3	Chloroform	10	U
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-88-3	Toluene	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Xylene (total)	10	U

J 3/20/97

000077

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

NYSDEC SAMPLE NO.

FB-1

Lab Name: NYTEST ENV INC Contract: 9723128

Lab Code: NYTEST Case No.: 30793 SAS No.: SDG No.: 30793

Matrix: (soil/water) WATER Lab Sample ID: 3079312

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: P5715.D

Level: (low/med) LOW Date Received: 03/17/97

% Moisture: not dec. ________ Data Analyzed: 03/19/97

GC Column:CAP ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _______(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				
26.				
27.				
28.				
29.				
30.				

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

NYSDEC SAMPLE NO.

MW-1A

Lab Name: NYTEST ENV INC   Contract: 9723128

Lab Code: NYTEST   Case No.: 30793   SAS No.:   SDG No.: 30793

Matrix: (soil/water) WATER   Lab Sample ID: 3079304

Sample wt/vol: 5.0 (g/mL) ML   Lab File ID: P5723.D

Level: (low/med) LOW   Date Received: 03/17/97

% Moisture: not dec. ________   Date Analyzed: 03/20/97

GC Column:CAP   ID: 0.53 (mm)   Dilution Factor: 1.0

Soil Extract Volume: _______(uL)   Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U J
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	10	U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (total)	10	U
67-66-3	Chloroform	28	
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	2	J
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	3	J
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-88-3	Toluene	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Xylene (total)	10	U

5/20/97

000082

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

NYSDEC SAMPLE NO.

MW-1A

Lab Name: NYTEST ENV INC   Contract: 9723128

Lab Code: NYTEST   Case No.: 30793   SAS No.:   SDG No.: 30793

Matrix: (soil/water) WATER   Lab Sample ID: 3079304

Sample wt/vol: 5.0   (g/mL) ML   Lab File ID: P5723.D

Level: (low/med) LOW   Date Received: 03/17/97

% Moisture: not dec. ________   Data Analyzed: 03/20/97

GC Column:CAP   ID: 0.53 (mm)   Dilution Factor: 1.0

Soil Extract Volume: _______(uL)   Soil Aliquot Volume: _____(uL)

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				
26.				
27.				
28.				
29.				
30.				

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

NYSDEC SAMPLE NO.

MW-2A

Lab Name: NYTEST ENV INC   Contract: 9723128

Lab Code: NYTEST   Case No.: 30793   SAS No.:   SDG No.: 30793

Matrix: (soil/water) WATER   Lab Sample ID: 3079310

Sample wt/vol: 5.0 (g/mL) ML   Lab File ID: P5729.D

Level: (low/med) LOW   Date Received: 03/17/97

% Moisture: not dec. ________   Date Analyzed: 03/20/97

GC Column:CAP   ID: 0.53 (mm)   Dilution Factor: 1.0

Soil Extract Volume: ______(uL)   Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U J
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	10	U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (total)	10	U
67-66-3	Chloroform	10	U
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	2	J
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-88-3	Toluene	530	E
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Xylene (total)	10	U

D 5/20/97
USE all except toluene

000088

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

NYSDEC SAMPLE NO.

MW-2A

Lab Name: NYTEST ENV INC Contract: 9723128

Lab Code: NYTEST Case No.: 30793 SAS No.: SDG No.: 30793

Matrix: (soil/water) WATER Lab Sample ID: 3079310

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: P5729.D

Level: (low/med) LOW Date Received: 03/17/97

% Moisture: not dec. ________ Data Analyzed: 03/20/97

GC Column:CAP ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _______(uL) Soil Aliquot Volume: _____(uL)

CONCENTRATION UNITS:
Number TICs found: 0 (ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				
26.				
27.				
28.				
29.				
30.				

Use Dilution Analyses TIC Results
[initials] 5/20/97

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

NYSDEC SAMPLE NO.

MW-2ADL

Lab Name: NYTEST ENV INC Contract: 9723128

Lab Code: NYTEST Case No.: 30793 SAS No.: SDG No.: 30793

Matrix: (soil/water) WATER Lab Sample ID: 3079310

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: P5735.D

Level: (low/med) LOW Date Received: 03/17/97

% Moisture: not dec. ________ Date Analyzed: 03/20/97

GC Column:CAP ID: 0.53 (mm) Dilution Factor: 5.0

Soil Extract Volume: _______(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	50	U J
74-83-9	Bromomethane	50	U
75-01-4	Vinyl Chloride	50	U
75-00-3	Chloroethane	50	U
75-09-2	Methylene Chloride	14	JD
67-64-1	Acetone	50	U
75-15-0	Carbon Disulfide	50	U
75-35-4	1,1-Dichloroethene	50	U
75-34-3	1,1-Dichloroethane	50	U
540-59-0	1,2-Dichloroethene (total)	50	U
67-66-3	Chloroform	50	U
107-06-2	1,2-Dichloroethane	50	U
78-93-3	2-Butanone	50	U
71-55-6	1,1,1-Trichloroethane	50	U
56-23-5	Carbon Tetrachloride	50	U
75-27-4	Bromodichloromethane	50	U
78-87-5	1,2-Dichloropropane	50	U
10061-01-5	cis-1,3-Dichloropropene	50	U
79-01-6	Trichloroethene	50	U
124-48-1	Dibromochloromethane	50	U
79-00-5	1,1,2-Trichloroethane	50	U
71-43-2	Benzene	50	U
10061-02-6	trans-1,3-Dichloropropene	50	U
75-25-2	Bromoform	50	U
108-10-1	4-Methyl-2-Pentanone	50	U
591-78-6	2-Hexanone	50	U
127-18-4	Tetrachloroethene	50	U
79-34-5	1,1,2,2-Tetrachloroethane	50	U
108-88-3	Toluene	580	D
108-90-7	Chlorobenzene	50	U
100-41-4	Ethylbenzene	50	U
100-42-5	Styrene	50	U
1330-20-7	Xylene (total)	50	U

5/20/97

USE Toluene result only

000093

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

NYSDEC SAMPLE NO.

MW-2ADL

Lab Name: NYTEST ENV INC Contract: 9723128

Lab Code: NYTEST Case No.: 30793 SAS No.: SDG No.: 30793

Matrix: (soil/water) WATER Lab Sample ID: 3079310

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: P5735.D

Level: (low/med) LOW Date Received: 03/17/97

% Moisture: not dec. ________ Data Analyzed: 03/20/97

GC Column:CAP ID: 0.53 (mm) Dilution Factor: 5.0

Soil Extract Volume: _______(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 1

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	UNKNOWN HYDROCARBON	16.674	28	JD
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				
26.				
27.				
28.				
29.				
30.				

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

NYSDEC SAMPLE NO.

MW-5D

Lab Name: NYTEST ENV INC Contract: 9723128

Lab Code: NYTEST Case No.: 30793 SAS No.: SDG No.: 30793

Matrix: (soil/water) WATER Lab Sample ID: 3079309

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: P5728.D

Level: (low/med) LOW Date Received: 03/17/97

% Moisture: not dec. ________ Date Analyzed: 03/20/97

GC Column:CAP ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _______(uL) Soil Aliquot Volume: _____(uL)

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	220	E
75-09-2	Methylene Chloride	10	U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	24	
540-59-0	1,2-Dichloroethene (total)	8	J
67-66-3	Chloroform	10	U
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	4	J
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-88-3	Toluene	3	J
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	90	
100-42-5	Styrene	4	J
1330-20-7	Xylene (total)	440	E

J 5/20/97 USE for all except Chloroethane + Xylenes

000100

FORM I VOA NYSDEC ASP 12/91

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

NYSDEC SAMPLE NO.

MW-5D

Lab Name: NYTEST ENV INC Contract: 9723128

Lab Code: NYTEST Case No.: 30793 SAS No.: SDG No.: 30793

Matrix: (soil/water) WATER Lab Sample ID: 3079309

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: P5728.D

Level: (low/med) LOW Date Received: 03/17/97

% Moisture: not dec. ________ Data Analyzed: 03/20/97

GC Column:CAP ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _______(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 10

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	UNKNOWN HYDROCARBON	16.488	34	J
2.	UNKNOWN AROMATIC	17.986	42	J
3.	UNKNOWN AROMATIC	18.236	150	J
4.	UNKNOWN AROMATIC	18.361	74	J
5.	UNKNOWN AROMATIC	18.954	91	J
6.	UNKNOWN AROMATIC	19.276	290	J
7.	UNKNOWN AROMATIC	20.400	140	J
8.	UNKNOWN AROMATIC	20.816	40	J
9.	UNKNOWN AROMATIC	21.003	47	J
10.	UNKNOWN AROMATIC	21.742	41	J
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				
26.				
27.				
28.				
29.				
30.				

000101

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

NYSDEC SAMPLE NO.

MW-5DDL

Lab Name: NYTEST ENV INC Contract: 9723128

Lab Code: NYTEST Case No.: 30793 SAS No.: SDG No.: 30793

Matrix: (soil/water) WATER Lab Sample ID: 3079309

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: P5734.D

Level: (low/med) LOW Date Received: 03/17/97

% Moisture: not dec. ________ Date Analyzed: 03/20/97

GC Column:CAP ID: 0.53 (mm) Dilution Factor: 5.0

Soil Extract Volume: _______(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	50	U
74-83-9	Bromomethane	50	U
75-01-4	Vinyl Chloride	50	U
75-00-3	Chloroethane	210	D
75-09-2	Methylene Chloride	16	JD
67-64-1	Acetone	50	U
75-15-0	Carbon Disulfide	50	U
75-35-4	1,1-Dichloroethene	50	U
75-34-3	1,1-Dichloroethane	23	JD
540-59-0	1,2-Dichloroethene (total)	50	U
67-66-3	Chloroform	50	U
107-06-2	1,2-Dichloroethane	50	U
78-93-3	2-Butanone	50	U
71-55-6	1,1,1-Trichloroethane	50	U
56-23-5	Carbon Tetrachloride	50	U
75-27-4	Bromodichloromethane	50	U
78-87-5	1,2-Dichloropropane	50	U
10061-01-5	cis-1,3-Dichloropropene	50	U
79-01-6	Trichloroethene	50	U
124-48-1	Dibromochloromethane	50	U
79-00-5	1,1,2-Trichloroethane	50	U
71-43-2	Benzene	11	JD
10061-02-6	trans-1,3-Dichloropropene	50	U
75-25-2	Bromoform	50	U
108-10-1	4-Methyl-2-Pentanone	50	U
591-78-6	2-Hexanone	50	U
127-18-4	Tetrachloroethene	50	U
79-34-5	1,1,2,2-Tetrachloroethane	50	U
108-88-3	Toluene	50	U
108-90-7	Chlorobenzene	50	U
100-41-4	Ethylbenzene	89	D
100-42-5	Styrene	50	U
1330-20-7	Xylene (total)	430	D

J 5/20/97 use for Chloroethane & xylenes only

000119

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

NYSDEC SAMPLE NO.

MW-5DDL

Lab Name: NYTEST ENV INC   Contract: 9723128

Lab Code: NYTEST   Case No.: 30793   SAS No.:   SDG No.: 30793

Matrix: (soil/water) WATER   Lab Sample ID: 3079309

Sample wt/vol: 5.0 (g/mL) ML   Lab File ID: P5734.D

Level: (low/med) LOW   Date Received: 03/17/97

% Moisture: not dec. ________   Data Analyzed: 03/20/97

GC Column:CAP   ID: 0.53 (mm)   Dilution Factor: 5.0

Soil Extract Volume: ________(uL)   Soil Aliquot Volume: ______(uL)

Number TICs found: 10

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.	UNKNOWN HYDROCARBON	17.801	78	JD
2.	UNKNOWN AROMATIC	17.999	110	JD
3.	UNKNOWN AROMATIC	18.259	200	JD
4.	UNKNOWN HYDROCARBON	18.373	150	JD
5.	UNKNOWN AROMATIC	18.966	140	JD
6.	UNKNOWN AROMATIC	19.289	430	JD
7.	UNKNOWN HYDROCARBON	19.559	91	JD
8.	UNKNOWN AROMATIC	20.402	180	JD
9.	UNKNOWN AROMATIC	20.662	77	JD
10.	UNKNOWN AROMATIC	21.026	96	JD
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				
26.				
27.				
28.				
29.				
30.				

Use Initial Analyses Results TC 5/10/97

000120

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

NYSDEC SAMPLE NO.

MW-6C

Lab Name: NYTEST ENV INC   Contract: 9723128

Lab Code: NYTEST   Case No.: 30793   SAS No.:   SDG No.: 30793

Matrix: (soil/water) WATER   Lab Sample ID: 3079307

Sample wt/vol: 5.0 (g/mL) ML   Lab File ID: P5726.D

Level: (low/med) LOW   Date Received: 03/17/97

% Moisture: not dec. ________   Date Analyzed: 03/20/97

GC Column: CAP   ID: 0.53 (mm)   Dilution Factor: 1.0

Soil Extract Volume: _______(uL)   Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	10	U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (total)	10	U
67-66-3	Chloroform	17	
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	4	J
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-88-3	Toluene	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Xylene (total)	10	U

J
5/20/97

000137

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

NYSDEC SAMPLE NO.

MW-6C

Lab Name: NYTEST ENV INC Contract: 9723128

Lab Code: NYTEST Case No.: 30793 SAS No.: SDG No.: 30793

Matrix: (soil/water) WATER Lab Sample ID: 3079307

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: P5726.D

Level: (low/med) LOW Date Received: 03/17/97

% Moisture: not dec. ________ Data Analyzed: 03/20/97

GC Column:CAP ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _______(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				
26.				
27.				
28.				
29.				
30.				

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

NYSDEC SAMPLE NO.

MW-7A

Lab Name: NYTEST ENV INC Contract: 9723128

Lab Code: NYTEST Case No.: 30793 SAS No.: SDG No.: 30793

Matrix: (soil/water) WATER Lab Sample ID: 3079305

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: P5724.D

Level: (low/med) LOW Date Received: 03/17/97

% Moisture: not dec. ________ Date Analyzed: 03/20/97

GC Column:CAP ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _______(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U J
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	10	U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (total)	10	U
67-66-3	Chloroform	2	J
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-88-3	Toluene	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Xylene (total)	10	U

5/20/97

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

NYSDEC SAMPLE NO.

MW-7A

Lab Name: NYTEST ENV INC Contract: 9723128

Lab Code: NYTEST Case No.: 30793 SAS No.: SDG No.: 30793

Matrix: (soil/water) WATER Lab Sample ID: 3079305

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: P5724.D

Level: (low/med) LOW Date Received: 03/17/97

% Moisture: not dec. ________ Data Analyzed: 03/20/97

GC Column:CAP ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _______(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				
26.				
27.				
28.				
29.				
30.				

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

NYSDEC SAMPLE NO.

MW-8C

Lab Name: NYTEST ENV INC Contract: 9723128

Lab Code: NYTEST Case No.: 30793 SAS No.: SDG No.: 30793

Matrix: (soil/water) WATER Lab Sample ID: 3079306

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: P5725.D

Level: (low/med) LOW Date Received: 03/17/97

% Moisture: not dec. ________ Date Analyzed: 03/20/97

GC Column:CAP ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _______(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U J
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	10	U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (total)	10	U
67-66-3	Chloroform	10	U
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-88-3	Toluene	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Xylene (total)	10	U

5/20/97

000147

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

NYSDEC SAMPLE NO.

MW-8C

Lab Name: NYTEST ENV INC   Contract: 9723128

Lab Code: NYTEST   Case No.: 30793   SAS No.:   SDG No.: 30793

Matrix: (soil/water) WATER   Lab Sample ID: 3079306

Sample wt/vol: 5.0   (g/mL) ML   Lab File ID: P5725.D

Level: (low/med) LOW   Date Received: 03/17/97

% Moisture: not dec. ________   Data Analyzed: 03/20/97

GC Column:CAP   ID: 0.53 (mm)   Dilution Factor: 1.0

Soil Extract Volume: ______(uL)   Soil Aliquot Volume: _____(uL)

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				
26.				
27.				
28.				
29.				
30.				

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

NYSDEC SAMPLE NO.

MW-9

Lab Name: NYTEST ENV INC   Contract: 9723128

Lab Code: NYTEST   Case No.: 30793   SAS No.:   SDG No.: 30793

Matrix: (soil/water) WATER   Lab Sample ID: 3079301

Sample wt/vol: 5.0 (g/mL) ML   Lab File ID: P5718.D

Level: (low/med) LOW   Date Received: 03/17/97

% Moisture: not dec. ______   Date Analyzed: 03/20/97

GC Column:CAP   ID: 0.53 (mm)   Dilution Factor: 1.0

Soil Extract Volume: ______(uL)   Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	10	U
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (total)	10	U
67-66-3	Chloroform	10	U
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-88-3	Toluene	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Xylene (total)	10	U

J 5/20/97

000151

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

NYSDEC SAMPLE NO.

MW-9

Lab Name: NYTEST ENV INC   Contract: 9723128

Lab Code: NYTEST   Case No.: 30793   SAS No.:   SDG No.: 30793

Matrix: (soil/water) WATER   Lab Sample ID: 3079301

Sample wt/vol: 5.0   (g/mL) ML   Lab File ID: P5718.D

Level: (low/med) LOW   Date Received: 03/17/97

% Moisture: not dec. ________   Data Analyzed: 03/20/97

GC Column:CAP   ID: 0.53 (mm)   Dilution Factor: 1.0

Soil Extract Volume: _______(uL)   Soil Aliquot Volume: _____(uL)

Number TICs found: 0

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				
26.				
27.				
28.				
29.				
30.				

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

NYSDEC SAMPLE NO.

TB-1

Lab Name: NYTEST ENV INC Contract: 9723128

Lab Code: NYTEST Case No.: 30793 SAS No.: SDG No.: 30793

Matrix: (soil/water) WATER Lab Sample ID: 3079313

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: P5716.D

Level: (low/med) LOW Date Received: 03/17/97

% Moisture: not dec. ________ Date Analyzed: 03/20/97

GC Column: CAP ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _______(uL) Soil Aliquot Volume: _____(uL)

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/Kg) UG/L	Q
74-87-3	Chloromethane	10	U J
74-83-9	Bromomethane	10	U
75-01-4	Vinyl Chloride	10	U
75-00-3	Chloroethane	10	U
75-09-2	Methylene Chloride	2	JB
67-64-1	Acetone	10	U
75-15-0	Carbon Disulfide	10	U
75-35-4	1,1-Dichloroethene	10	U
75-34-3	1,1-Dichloroethane	10	U
540-59-0	1,2-Dichloroethene (total)	10	U
67-66-3	Chloroform	10	U
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	10	U
71-55-6	1,1,1-Trichloroethane	10	U
56-23-5	Carbon Tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	10	U
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	10	U
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-Pentanone	10	U
591-78-6	2-Hexanone	10	U
127-18-4	Tetrachloroethene	10	U
79-34-5	1,1,2,2-Tetrachloroethane	10	U
108-88-3	Toluene	10	U
108-90-7	Chlorobenzene	10	U
100-41-4	Ethylbenzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Xylene (total)	10	U

5/20/97

000155

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

NYSDEC SAMPLE NO.

TB-1

Lab Name: NYTEST ENV INC Contract: 9723128

Lab Code: NYTEST Case No.: 30793 SAS No.: SDG No.: 30793

Matrix: (soil/water) WATER Lab Sample ID: 3079313

Sample wt/vol: 5.0 (g/mL) ML Lab File ID: P5716.D

Level: (low/med) LOW Date Received: 03/17/97

% Moisture: not dec. ________ Data Analyzed: 03/20/97

GC Column:CAP ID: 0.53 (mm) Dilution Factor: 1.0

Soil Extract Volume: _______(uL) Soil Aliquot Volume: _____(uL)

Number TICs found: 1

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/L

CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
1. 91-20-3	NAPHTHALENE	26.069	7	NJ
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				
26.				
27.				
28.				
29.				
30.				

Appendix D
Manual LNAPL Recovery Field Testing Results

Appendix D
Manual LNAPL Recovery Field Test Measurements
Former Red Devil Facility, Mount Vernon, New York

DATE	WELL	RECOVERY METHOD	DTP (FT)	DTW (FT)	PRODUCT THICKNESS (FT)	AMOUNT RECOVERED (QTS)	TOTALS (GALS)
2/14/95	DW-2D	Keck Canister	12.40	13.31	0.91	NA-initial deployment	
2/21/95	DW-2D	Keck Canister	12.26	13.50	1.24	0.7	
2/28/95	DW-2D	Keck Canister	11.98	13.35	1.37	1	
3/7/95	DW-2D	Keck Canister	12.30	13.42	1.12	0.5	
3/15/95	DW-2D	Soakease	11.12	13.18	2.06	1	
3/21/95	DW-2D	Soakease	12.22	13.31	1.09	0.5	
3/29/95	DW-2D	Soakease	12.28	13.36	1.08	0.7	
4/4/95	DW-2D	Soakease	12.42	13.42	1.00	1.0	
4/11/95	DW-2D	Soakease	WELL INACCESSIBLE DUE TO PARKED TRUCK				
4/18/95	DW-2D	Soakease	WELL INACCESSIBLE DUE TO PARKED TRUCK				
4/26/95	DW-2D	Soakease	12.60	13.50	0.90	0.5	
5/2/95	DW-2D	Soakease	12.32	13.15	0.83	1.0	
5/8/95	DW-2D	Soakease	12.57	13.45	0.88	1.0	
5/16/95	DW-2D	Soakease	12.60	13.80	1.20	1.0	
5/23/95	DW-2D	Soakease	12.78	13.51	0.73	1.0	
6/1/95	DW-2D	Soakease	12.77	18.10	5.33	0.5	
6/7/95	DW-2D	Soakease	12.80	13.54	0.74	0.5	
6/13/95	DW-2D	Soakease	12.54	13.36	0.82	0.5	
6/20/95	DW-2D	Soakease	12.90	13.61	0.71	1.0	
6/27/95	DW-2D	Soakease	WELL INACCESSIBLE DUE TO LARGE DIRT PILE				
10/26/95	DW-2D	Soakease	12.42	13.65	1.23	NA-initial deployment	
10/31/95	DW-2D	Soakease	12.46	13.18	0.72	0.5	
11/7/95	DW-2D	Soakease	12.50	13.14	0.64	0.75	
12/5/95	DW-2D	Soakease	12.52	13.05	0.53	0.5	
1/22/96	DW-2D	Soakease	11.32	11.69	0.37	1	
1/31/96	DW-2D	Soakease	11.19	11.19	0	1	
2/14/96	DW-2D	Soakease	11.41	11.89	0.48	NA-initial deployment	
2/21/96	DW-2D	Soakease	11.39	11.63	0.24	0.3	
2/28/96	DW-2D	Soakease	11.54	11.55	0.01	0.3	
3/4/96	DW-2D	Soakease	11.95	11.95	0.00	0.0	
3/12/96	DW-2D	Soakease	11.55	12.20	0.65	0.0	
3/17/96	DW-2D	Soakease	11.82	11.83	0.01	0.5	
3/25/96	DW-2D	Soakease	11.77	11.77	0	0.0	4.3
12/6/94	DW-11D	Keck Canister	10.88	11.38	0.50	NA-initial deployment	
12/12/94	DW-11D	Keck Canister	10.89	11.34	0.45	2	
12/19/94	DW-11D	Keck Canister	10.99	11.70	0.71	2	
12/27/94	DW-11D	Keck Canister	NR	NR	NR	1	
1/4/95	DW-11D	Keck Canister	10.88	11.59	0.71	2	
1/10/95	DW-11D	Keck Canister	10.75	11.58	0.83	2.1	
1/16/95	DW-11D	Keck Canister	10.84	11.63	0.79	0.1	
1/24/95	DW-11D	Keck Canister	10.45	11.39	0.94	2	

Appendix D
Manual LNAPL Recovery Field Test Measurements
Former Red Devil Facility, Mount Vernon, New York

DATE	WELL	RECOVERY METHOD	DTP (FT)	DTW (FT)	PRODUCT THICKNESS (FT)	AMOUNT RECOVERED (QTS)	TOTALS (GALS)
1/31/95	DW-11D	Keck Canister	10.78	11.68	0.90	1.3	
2/7/95	DW-11D	Soakease	NR	NR	NR	NR	
2/14/95	DW-11D	Soakease	11.05	11.83	0.78	1.1	
2/21/95	DW-11D	Soakease	10.80	11.64	0.84	1.0	
2/28/95	DW-11D	Soakease	10.56	11.15	0.59	1.0	
3/7/95	DW-11D	Soakease	10.77	11.58	0.81	1.0	
3/15/95	DW-11D	Keck Canister	10.72	11.75	1.03	2.0	
3/21/95	DW-11D	Keck Canister	10.75	11.72	0.97	2.0	
3/29/95	DW-11D	Keck Canister	10.92	11.84	0.92	0.7	
4/4/95	DW-11D	Keck Canister	11.13	11.98	0.85	1.0	
4/11/95	DW-11D	Keck Canister	11.00	11.60	0.60	0.3	
4/18/95	DW-11D	Keck Canister	11.02	11.85	0.83	0.1	
4/26/95	DW-11D	Keck Canister	11.23	12.10	0.87	0.1	
5/2/95	DW-11D	Keck Canister	10.93	11.75	0.82	0.5	
5/8/95	DW-11D	Keck Canister	11.15	12.00	0.85	0.25	
5/16/95	DW-11D	Keck Canister	11.17	12.14	0.97	0.25	
5/23/95	DW-11D	Keck Canister	11.18	11.35	0.17	0.25	
6/1/95	DW-11D	Keck Canister	11.30	12.20	0.90	2.0	
6/7/95	DW-11D	Keck Canister	11.35	12.27	0.92	2.0	
6/13/95	DW-11D	Keck Canister	11.25	11.85	0.60	2.0	
6/20/95	DW-11D	Keck Canister	11.50	12.23	0.73	2.0	
6/27/95	DW-11D	Keck Canister	11.56	12.07	0.51	1.3	
10/26/95	DW-11D	Keck Canister	10.86	11.75	0.89	NA-initial deployment	
10/31/95	DW-11D	Keck Canister	10.78	11.67	0.89	2.0	
11/7/95	DW-11D	Keck Canister	10.79	11.49	0.70	1.5	
12/5/95	DW-11D	Keck Canister	11.00	11.74	0.74	0.0	
2/14/96	DW-11D	Soakease	9.64	10.39	0.75	NA-initial deployment	
2/21/96	DW-11D	Soakease	9.27	9.28	0.01	0.5	
2/28/96	DW-11D	Soakease	9.93	10.95	1.02	0.3	
3/4/96	DW-11D	Soakease	10.55	11.50	0.95	0.3	
3/12/96	DW-11D	Soakease	10.10	11.41	1.31	0.3	
3/17/96	DW-11D	Soakease	10.35	11.45	1.10	1.0	
3/25/96	DW-11D	Soakease	10.40	11.25	0.85	0.5	10.0
3/29/95	DW-1D	Soakease	12.53	14.25	1.72	NA-initial deployment	
4/4/95	DW-1D	Soakease	12.79	13.56	0.77	1.0	
4/11/95	DW-1D	Soakease	12.70	13.45	0.75	1.0	
4/18/95	DW-1D	Soakease	12.78	13.44	0.66	1.0	
4/26/95	DW-1D	Soakease	12.92	13.73	0.81	1.0	
5/2/95	DW-1D	Soakease	12.68	13.93	1.25	1.0	
5/8/95	DW-1D	Soakease	12.85	13.62	0.77	1.0	
5/16/95	DW-1D	Soakease	12.92	13.18	0.26	1.0	
5/23/95	DW-1D	Soakease	13.00	13.80	0.80	0.25	

Appendix D
Manual LNAPL Recovery Field Test Measurements
Former Red Devil Facility, Mount Vernon, New York

DATE	WELL	RECOVERY METHOD	DTP (FT)	DTW (FT)	PRODUCT THICKNESS (FT)	AMOUNT RECOVERED (QTS)	TOTALS (GALS)
6/1/95	DW-1D	Soakease	13.00	13.60	0.60	1.0	
6/7/95	DW-1D	Soakease	13.01	13.83	0.82	0.5	
6/13/95	DW-1D	Soakease	WELL INACCESSIBLE DUE TO PARKED WELDERS' TRUCK				
6/20/95	DW-1D	Soakease	13.15	13.56	0.41	1.0	
6/27/95	DW-1D	Soakease	13.09	13.79	0.70	0.5	
10/26/95	DW-1D	Soakease	12.67	14.61	1.94	NA-initial deployment	
10/31/95	DW-1D	Soakease	12.71	13.00	0.29	1.0	
11/7/95	DW-1D	Soakease	12.67	12.90	0.23	0.8	
12/5/95	DW-1D	Soakease	12.74	13.37	0.63	0.8	
1/22/96	DW-1D	Soakease	11.62	11.70	0.08	1.0	
1/31/96	DW-1D	Soakease	11.50	11.51	0.01	1.0	
2/14/96	DW-1D	Soakease	11.47	11.49	0.02	Negligible	
2/21/96	DW-1D	Soakease	11.63	11.63	0.00	1.0	
2/28/96	DW-1D	Soakease	11.66	11.67	0.01	0.3	
3/4/96	DW-1D	Soakease	12.21	12.31	0.10	0.5	
3/12/96	DW-1D	Soakease	11.76	12.11	0.35	0.0	
3/17/96	DW-1D	Soakease	11.52	11.52	0.00	1.0	
3/25/96	DW-1D	Soakease	12.00	12.80	0.80	1.0	4.6
1/11/96	DW-10D	Soakease	14.72	15.77	1.05	0.25	
1/18/96	DW-10D	Soakease	14.40	15.36	0.96	0.5	
1/22/96	DW-10D	Soakease	13.12	14.99	1.87	1.0	
1/31/96	DW-10D	Soakease	13.75	15.78	2.03	1.0	
2/21/96	DW-10D	Soakease	WELL INACCESSIBLE DUE TO PALLETS OF MATERIALS				
2/28/96	DW-10D	Soakease	WELL INACCESSIBLE DUE TO PALLETS OF MATERIALS				
3/12/96	DW-10D	Soakease	13.84	16.00	2.16	1.0	
3/17/96	DW-10D	Soakease	13.55	15.45	1.90	1.0	
3/25/96	DW-10D	Soakease	14.00	15.85	1.85	1.0	1.4
1/31/96	DW-4D	Soakease	13.08	14.98	1.90	NA-initial deployment	
2/21/96	DW-4D	Soakease	13.28	14.78	1.50	1.0	0.3
2/28/96	DW-4D	Soakease	WELL INACCESSIBLE DUE TO PALLETS OF MATERIALS				
12/6/94	DW-8D	Soakease	10.76	12.70	1.94	NA-initial deployment	
12/12/94	DW-8D	Soakease	11.14	11.71	0.57	1	
12/19/94	DW-8D	Soakease	10.84	11.65	0.81	0.75	
12/27/94	DW-8D	Soakease	NR	NR	NR	1	
1/4/95	DW-8D	Soakease	10.85	11.44	0.59	1	
1/10/95	DW-8D	Soakease	10.76	11.20	0.44	1	
1/16/95	DW-8D	Soakease	10.86	11.34	0.48	1	

Appendix D
Manual LNAPL Recovery Field Test Measurements
Former Red Devil Facility, Mount Vernon, New York

DATE	WELL	RECOVERY METHOD	DTP (FT)	DTW (FT)	PRODUCT THICKNESS (FT)	AMOUNT RECOVERED (QTS)	TOTALS (GALS)
1/24/95	DW-8D	Soakease	10.45	12.12	1.67	1	
1/31/95	DW-8D	Soakease	10.60	11.11	0.51	1.5	
2/7/95	DW-8D	Keck Canister	11.80	12.95	1.15	0.25	
2/14/95	DW-8D	Keck Canister	NR	NR	NR	0.1	
5/2/95	DW-8D	Soakease	10.86	11.61	0.75	0.33	
5/8/95	DW-8D	Soakease	10.94	11.94	1.00	0.33	
5/16/95	DW-8D	Soakease	11.50	12.60	1.10	1.0	
5/23/95	DW-8D	Soakease	11.19	11.83	0.64	1.0	
6/1/95	DW-8D	Soakease	11.20	12.82	1.62	0.5	
6/7/95	DW-8D	Soakease	11.76	12.38	0.62	0.5	
6/13/95	DW-8D	Soakease	11.62	12.22	0.60	0.5	
6/20/95	DW-8D	Soakease	11.30	12.05	0.75	0.5	
6/27/95	DW-8D	Soakease	11.59	12.53	0.94	0.2	
1/11/96	DW-8D	Soakease	11.08	11.88	0.80	0.3	
1/18/96	DW-8D	Soakease	10.88	11.27	0.39	0.5	
1/22/96	DW-8D	Soakease	9.74	9.78	0.04	0.5	
1/31/96	DW-8D	Soakease	9.47	9.48	0.01	0.3	
2/21/96	DW-8D	Soakease	9.58	11.52	1.94	0.3	
2/28/96	DW-8D	Soakease	9.58	11.34	1.76	0.7	
3/4/96	DW-8D	Soakease	10.45	11.20	0.75	0.8	
3/12/96	DW-8D	Soakease	9.90	10.61	0.71	0.8	
3/25/96	DW-8D	Soakease	10.05	12.00	1.95	0.5	4.5
1/24/95	DW-13D	Soakease	11.75	12.34	0.59	NA-initial deployment	
1/31/95	DW-13D	Soakease	11.67	13.92	2.25	0.2	
2/7/95	DW-13D	Soakease	12.54	13.24	0.70	1	
2/14/95	DW-13D	Soakease	12.16	13.12	0.96	1	
2/21/95	DW-13D	Soakease	12.08	12.71	0.63	1	
2/28/95	DW-13D	Soakease	12.02	12.51	0.49	1	
3/7/95	DW-13D	Soakease	12.03	12.39	0.36	1	
3/15/95	DW-13D	Soakease	11.91	12.36	0.45	1	
3/21/95	DW-13D	Soakease	11.98	12.43	0.45	0.5	
3/29/95	DW-13D	Soakease	12.20	12.60	0.40	0.5	
4/11/95	DW-13D	Soakease	10.72	13.75	3.03	NA-initial deployment	
4/18/95	DW-13D	Soakease	11.30	12.33	1.03	0.5	
4/26/95	DW-13D	Soakease	11.08	12.62	1.54	0.5	
5/2/95	DW-13D	Soakease	12.02	13.61	1.59	NA-initial deployment	
5/8/95	DW-13D	Soakease	12.21	13.36	1.15	0.75	
5/16/95	DW-13D	Soakease	12.35	16.00	3.65	0.75	
5/23/95	DW-13D	Soakease	12.51	13.42	0.91	1.0	
6/1/95	DW-13D	Soakease	12.41	13.93	1.52	0.5	
6/7/95	DW-13D	Soakease	12.55	13.32	0.77	0.33	

Appendix D
Manual LNAPL Recovery Field Test Measurements
Former Red Devil Facility, Mount Vernon, New York

DATE	WELL	RECOVERY METHOD	DTP (FT)	DTW (FT)	PRODUCT THICKNESS (FT)	AMOUNT RECOVERED (QTS)	TOTALS (GALS)
6/13/95	DW-13D	Soakease	12.56	12.76	0.20	0.5	
6/20/95	DW-13D	Soakease	12.69	12.75	0.06	0.5	
6/27/95	DW-13D	Soakease	12.67	12.72	0.05	0.25	
1/11/96	DW-13D	Soakease	12.35	12.91	0.56	0.25	
1/18/96	DW-13D	Soakease	11.91	12.00	0.09	1	
1/22/96	DW-13D	Soakease	10.65	12.56	1.91	0.5	
1/31/96	DW-13D	Soakease	10.17	13.24	3.07	1	
2/14/96	DW-13D	Soakease	9.78	10.38	0.60	1	
2/21/96	DW-13D	Soakease	10.78	13.45	2.67	0.7	
2/28/96	DW-13D	Soakease	10.73	13.75	3.02	0.8	
3/4/96	DW-13D	Soakease	11.15	13.66	2.51	0.8	
3/12/96	DW-13D	Soakease	11.75	13.70	1.95	0.8	
3/17/96	DW-13D	Soakease	11.27	14.48	3.21	0.9	
3/25/96	DW-13D	Soakease	11.00	14.25	3.25	0.8	5.3
							30.4

NA: Not Applicable - unit deployed
NR: No Reading

RECOVERY METHOD	TOTALS (GALS)
Soakease	21.5
Keck Canister	8.8

Appendix E
Laboratory Data Reports for LNAPL Located
Beneath the Bronx River Bank

Leberco • Celsis Testing

123 Hawthorne Street
Roselle Park, NJ 07204-0206
908.245.1933 / 800.523.LABS
Fax 908.245.6253

December 12, 1996

SUBMITTED TO: ERM-NORTHEAST

ASSAY NUMBER: 9620637

RECEIVED: 11-Nov-96

TEST MATERIAL: Insilco Riverbank Product 488-010-4

PURPOSE:

A submitted liquid sample was analyzed by gas chromatography (GC), infrared spectroscopy (FTIR), and wet chemical analysis. The purpose of the analysis was to characterize the sample. The sample is an amber, cloudy, non-viscous liquid with an odor similar to gasoline.

RESULTS:

% Ash	0.005%
pH	4.7
Specific Gravity	0.806
Viscosity	7.5 cps
% Water	1.5%
Solubility in Water	insoluble
% Solids	12.8%
% Solvent (100%-Solids & Water)	85.8%

Semiquantitative analysis was not performed on the residues of the ash analysis since the % ash values were 0 or very close to 0. The GC chromatogram is a pattern of peaks consistent with petroleum distillate, probably gasoline.

The FTIR spectrum of the solid is similar to reference spectra of alkyd resins.

CONCLUSION:

The sample is thought to be primarily composed of gasoline and a polymeric material, probably an alkyd resin.

Leberco • Celsis Testing

9620637

Work Approved by:

R. Lewis

Robert H. Lewis, Manager
Method Development

Leberco.Celsis Testing

W. S. Gilman

William S. Gilman, MS
Director, Chemical Service
or
Edwin C. Rothstein, Ph. D.
Laboratory Director

Leberco • Celsis Testing

123 Hawthorne Street
Roselle Park, NJ 07204-0206
908.245.1933 / 800.523.LABS
Fax 908.245.6253

January 10, 1997

SUBMITTED TO:	ERM Northeast
ASSAY NUMBER:	97114 to 97117
RECEIVED:	06-Jan-97
TEST MATERIAL:	Insilco 488-112

Four submitted liquid samples were analyzed by gas chromatography (GC), infrared spectroscopt (FTIR) and wet chemical analysis. The purpose of the analysis was to characterize the samples. The samples are 2 layered amber, cloudy, non-viscous liquids with the odor of gasoline.

RESULTS:

Test	RW16	RW17	RW18	RW19
% Ash		0.01%	0.01%	0.01%
pH		5.55	5.55	5.38
Specific Gravity		0.814	0.805	0.804
Viscosity		8cps	7cps	7cps
% Water	0.15	0.26	0.39	0.33
% Solids	15.6	14.2	11.7	11.1
% Solvent	84.3	85.5	87.9	88.6

The samples were two layered liquids. As instructed, only the top layer of each sample was analyzed. The breakdown of the layers is as follows.

	RW16	RW17	RW18	RW19
Top Layer	1.3%	85.2%	68.8%	64.5%
Bottom Layer	98.7&	14.8%	31.2%	35.5%

As instructed, not all analyses were performed on the top layer of Sample RW16 since it was such a small portion of the entire sample.

The Gc chromatograms for all 4 samples are similar to each other and are patterns consistent with a petroleum distillate, probably gasoline. The FTIR spectra of the 4 samples are similar to each other and to reference spectra of alkyd resins.

Leberco•Celsis Testing

Work Approved by:

R. Lewis

Robert H. Lewis,
Manager, Method Development

Leberco.Celsis Testing

W. S. Gil

William S. Gilman
Director, Chemical Services
or
Edwin C. Rothstein, Ph.D.
Laboratory Director

ECOTEST LABORATORIES, INC. *ENVIRONMENTAL TESTING*

377 SHEFFIELD AVE. • N. BABYLON, N.Y. 11703 • (516) 422-5777 • FAX (516) 422-5770

LAB NO.C970040 01/14/97

ERM Northeast
175 Froehlich Farm Boulevard
Woodbury, NY 11797
ATTN: James Rocco

SOURCE OF SAMPLE: Insilco 488.012, TCLPZHE
COLLECTED BY: Client DATE COL'D:01/02/97 RECEIVED:01/06/97

SAMPLE: Liquid waste, Riverbank product (170)

ANALYTICAL PARAMETERS		
Dichlordifluomethane	ug/L*	<50000
Chloromethane	ug/L*	<50000
Vinyl Chloride	ug/L*	<50000
Bromomethane	ug/L*	<50000
Chloroethane	ug/L*	<50000
Trichlorofluomethane	ug/L*	<50000
1,1 Dichloroethene	ug/L*	<50000
Methylene Chloride	ug/L*	<50000
t-1,2-Dichloroethene	ug/L*	<50000
1,1 Dichloroethane	ug/L*	<50000
2,2-Dichloropropane	ug/L*	<50000
c-1,2-Dichloroethene	ug/L*	<50000
Bromochloromethane	ug/L*	<50000
Chloroform	ug/L*	<50000
111 Trichloroethane	ug/L*	<50000
Carbon Tetrachloride	ug/L*	<50000
1,1-Dichloropropene	ug/L*	<50000
Benzene	ug/L*	<50000
1,2 Dichloroethane	ug/L*	<50000
Trichloroethylene	ug/L*	<50000
1,2 Dichloropropane	ug/L*	<50000
Dibromomethane	ug/L*	<50000
Bromodichloromethane	ug/L*	<50000
c-1,3Dichloropropene	ug/L*	<50000
Toluene	ug/L*	1600000

ANALYTICAL PARAMETERS		
t-1,3Dichloropropene	ug/L*	<50000
112 Trichloroethane	ug/L*	<50000
Tetrachloroethene	ug/L*	<50000
1,3-Dichloropropane	ug/L*	<50000
Chlorodibromomethane	ug/L*	<50000
1,2 Dibromoethane	ug/L*	<50000
Chlorobenzene	ug/L*	<50000
Ethyl Benzene	ug/L*	480000
1112Tetrachloroethan	ug/L*	<50000
m + p Xylene	ug/L*	2200000
o Xylene	ug/L*	1100000
Styrene	ug/L*	<50000
Bromoform	ug/L*	<50000
Isopropylbenzene	ug/L*	560000
Bromobenzene	ug/L*	<50000
1122Tetrachloroethan	ug/L*	<50000
123-Trichloropropane	ug/L*	<50000
n-Propylbenzene	ug/L*	1100000
2-Chlorotoluene	ug/L*	<50000
135-Trimethylbenzene	ug/L*	3700000
4-Chlorotoluene	ug/L*	<50000
tert-Butylbenzene	ug/L*	65000

cc:

REMARKS: * Analysis performed on TCLP Leachate according to USEPA Method 1311.
Analysis was performed by GC/MS, EPA Method 8260.
Page 1 of 2.

DIRECTOR ____________________

rn= 194 NYSDOH ID# 10320

ECOTEST LABORATORIES, INC. *ENVIRONMENTAL TESTING*

377 SHEFFIELD AVE. • N. BABYLON, N.Y. 11703 • (516) 422-5777 • FAX (516) 422-5770

LAB NO.C970040 01/14/97

ERM Northeast
175 Froehlich Farm Boulevard
Woodbury, NY 11797
ATTN: James Rocco

SOURCE OF SAMPLE: Insilco 488.012, TCLPZHE
COLLECTED BY: Client DATE COL'D:01/02/97 RECEIVED:01/06/97

SAMPLE: Liquid waste, Riverbank product (170)

ANALYTICAL PARAMETERS			ANALYTICAL PARAMETERS
p-Isopropyltoluene	ug/L*	560000	
1,3 Dichlorobenzene	ug/L*	<50000	
1,4 Dichlorobenzene	ug/L*	<50000	
n-Butylbenzene	ug/L*	<50000	
1,2 Dichlorobenzene	ug/L*	<50000	
Dibromochloropropane	ug/L*	<50000	
124-Trichlorobenzene	ug/L*	<50000	
Hexachlorobutadiene	ug/L*	<50000	
Naphthalene	ug/L*	750000	
123-Trichlorobenzene	ug/L*	<50000	
sec-Butylbenzene	ug/L*	550000	
124-Trimethylbenzene	ug/L*	7700000	

cc:

REMARKS: * Analysis performed on TCLP Leachate according to USEPA Method 1311.
Analysis was performed by GC/MS, EPA Method 8260.
Page 2 of 2.

DIRECTOR

rn= 195 NYSDOH ID# 10320

ECOTEST LABORATORIES, INC. **ENVIRONMENTAL TESTING**

377 SHEFFIELD AVE. • N. BABYLON, N.Y. 11703 • (516) 422-5777 • FAX (516) 422-5770

LAB NO.C970065/1 01/20/97

ERM Northeast
175 Froehlich Farm Boulevard
Woodbury, NY 11797
ATTN: Jim Rocco

SOURCE OF SAMPLE: Insilco, #488.012.4, TCLPZHE
COLLECTED BY: Client DATE COL'D:01/07/97 RECEIVED:01/07/97

SAMPLE: Water sample, RW 18D, 2:00 pm

(170)

ANALYTICAL PARAMETERS			ANALYTICAL PARAMETERS		
Dichlordifluomethane	ug/L*	<50000	t-1,3Dichloropropene	ug/L*	<50000
Chloromethane	ug/L*	<50000	112 Trichloroethane	ug/L*	<50000
Vinyl Chloride	ug/L*	<50000	Tetrachloroethene	ug/L*	<50000
Bromomethane	ug/L*	<50000	1,3-Dichloropropane	ug/L*	<50000
Chloroethane	ug/L*	<50000	Chlorodibromomethane	ug/L*	<50000
Trichlorofluomethane	ug/L*	<50000	1,2 Dibromoethane	ug/L*	<50000
1,1 Dichloroethene	ug/L*	<50000	Chlorobenzene	ug/L*	<50000
Methylene Chloride	ug/L*	<50000	Ethyl Benzene	ug/L*	270000
t-1,2-Dichloroethene	ug/L*	<50000	1112Tetrachloroethan	ug/L*	<50000
1,1 Dichloroethane	ug/L*	<50000	m + p Xylene	ug/L*	1300000
2,2-Dichloropropane	ug/L*	<50000	o Xylene	ug/L*	580000
c-1,2-Dichloroethene	ug/L*	<50000	Styrene	ug/L*	<50000
Bromochloromethane	ug/L*	<50000	Bromoform	ug/L*	<50000
Chloroform	ug/L*	<50000	Isopropylbenzene	ug/L*	370000
111 Trichloroethane	ug/L*	<50000	Bromobenzene	ug/L*	<50000
Carbon Tetrachloride	ug/L*	<50000	1122Tetrachloroethan	ug/L*	<50000
1,1-Dichloropropene	ug/L*	<50000	123-Trichloropropane	ug/L*	<50000
Benzene	ug/L*	<50000	n-Propylbenzene	ug/L*	670000
1,2 Dichloroethane	ug/L*	<50000	2-Chlorotoluene	ug/L*	<50000
Trichloroethylene	ug/L*	<50000	135-Trimethylbenzene	ug/L*	3000000
1,2 Dichloropropane	ug/L*	<50000	4-Chlorotoluene	ug/L*	<50000
Dibromomethane	ug/L*	<50000	tert-Butylbenzene	ug/L*	60000
Bromodichloromethane	ug/L*	<50000			
c-1,3Dichloropropene	ug/L*	<50000			
Toluene	ug/L*	<50000			

cc:

REMARKS: * Analysis performed on TCLP Leachate according to USEPA Method 1311.
Analysis was performed by GC/MS, EPA Method 8260.
Page 1 of 2.

DIRECTOR ____________

rn= 341 NYSDOH ID# 10320

ECOTEST LABORATORIES, INC. *ENVIRONMENTAL TESTING*

377 SHEFFIELD AVE. • N. BABYLON, N.Y. 11703 • (516) 422-5777 • FAX (516) 422-5770

LAB NO.C970065/1 01/20/97

ERM Northeast
175 Froehlich Farm Boulevard
Woodbury, NY 11797
ATTN: Jim Rocco

SOURCE OF SAMPLE: Insilco, #488.012.4, TCLPZHE
COLLECTED BY: Client DATE COL'D:01/07/97 RECEIVED:01/07/97

SAMPLE: Water sample, RW 18D, 2:00 pm

ANALYTICAL PARAMETERS			ANALYTICAL PARAMETERS
p-Isopropyltoluene	ug/L*	510000	
1,3 Dichlorobenzene	ug/L*	<50000	
1,4 Dichlorobenzene	ug/L*	<50000	
n-Butylbenzene	ug/L*	<50000	
1,2 Dichlorobenzene	ug/L*	<50000	
Dibromochloropropane	ug/L*	<50000	
124-Trichlorobenzene	ug/L*	<50000	
Hexachlorobutadiene	ug/L*	<50000	
Naphthalene	ug/L*	630000	
123-Trichlorobenzene	ug/L*	<50000	
sec-Butylbenzene	ug/L*	460000	
124-Trimethylbenzene	ug/L*	5700000	

cc:

REMARKS: * Analysis performed on TCLP Leachate according to USEPA Method 1311.
Analysis was performed by GC/MS, EPA Method 8260.
Page 2 of 2.

DIRECTOR ____________

rn= 342 NYSDOH ID# 10320

ECOTEST LABORATORIES, INC. ENVIRONMENTAL TESTING

377 SHEFFIELD AVE. • N. BABYLON, N.Y. 11703 • (516) 422-5777 • FAX (516) 422-5770

LAB NO.C970065/2 01/20/97

ERM Northeast
175 Froehlich Farm Boulevard
Woodbury, NY 11797
ATTN: Jim Rocco

SOURCE OF SAMPLE: Insilco, #488.012.4, TCLPZHE
COLLECTED BY: Client DATE COL'D:01/07/97 RECEIVED:01/07/97

SAMPLE: Water sample, RW 19D, 2:00 pm

ANALYTICAL PARAMETERS		
Dichlordifluomethane	ug/L*	<50000
Chloromethane	ug/L*	<50000
Vinyl Chloride	ug/L*	<50000
Bromomethane	ug/L*	<50000
Chloroethane	ug/L*	<50000
Trichlorofluomethane	ug/L*	<50000
1,1 Dichloroethene	ug/L*	<50000
Methylene Chloride	ug/L*	<50000
t-1,2-Dichloroethene	ug/L*	<50000
1,1 Dichloroethane	ug/L*	<50000
2,2-Dichloropropane	ug/L*	<50000
c-1,2-Dichloroethene	ug/L*	<50000
Bromochloromethane	ug/L*	<50000
Chloroform	ug/L*	<50000
111 Trichloroethane	ug/L*	<50000
Carbon Tetrachloride	ug/L*	<50000
1,1-Dichloropropene	ug/L*	<50000
Benzene	ug/L*	<50000
1,2 Dichloroethane	ug/L*	<50000
Trichloroethylene	ug/L*	<50000
1,2 Dichloropropane	ug/L*	<50000
Dibromomethane	ug/L*	<50000
Bromodichloromethane	ug/L*	<50000
c-1,3Dichloropropene	ug/L*	<50000
Toluene	ug/L*	3800000

ANALYTICAL PARAMETERS		
t-1,3Dichloropropene	ug/L*	<50000
112 Trichloroethane	ug/L*	<50000
Tetrachloroethene	ug/L*	<50000
1,3-Dichloropropane	ug/L*	<50000
Chlorodibromomethane	ug/L*	<50000
1,2 Dibromoethane	ug/L*	<50000
Chlorobenzene	ug/L*	<50000
Ethyl Benzene	ug/L*	440000
1112Tetrachloroethan	ug/L*	<50000
m + p Xylene	ug/L*	1900000
o Xylene	ug/L*	1100000
Styrene	ug/L*	<50000
Bromoform	ug/L*	<50000
Isopropylbenzene	ug/L*	430000
Bromobenzene	ug/L*	<50000
1122Tetrachloroethan	ug/L*	<50000
123-Trichloropropane	ug/L*	<50000
n-Propylbenzene	ug/L*	810000
2-Chlorotoluene	ug/L*	<50000
135-Trimethylbenzene	ug/L*	3200000
4-Chlorotoluene	ug/L*	<50000
tert-Butylbenzene	ug/L*	75000

cc:

REMARKS: * Analysis performed on TCLP Leachate according to USEPA Method 1311.
Analysis was performed by GC/MS, EPA Method 8260.
Page 1 of 2.

DIRECTOR_______________

rn= 343 NYSDOH ID# 10320

ECOTEST LABORATORIES, INC. *ENVIRONMENTAL TESTING*

377 SHEFFIELD AVE. • N. BABYLON, N.Y. 11703 • (516) 422-5777 • FAX (516) 422-5770

LAB NO.C970065/2 01/20/97

ERM Northeast
175 Froehlich Farm Boulevard
Woodbury, NY 11797
ATTN: Jim Rocco

SOURCE OF SAMPLE: Insilco, #488.012.4, TCLPZHE
COLLECTED BY: Client DATE COL'D:01/07/97 RECEIVED:01/07/97

SAMPLE: Water sample, RW 19D, 2:00 pm

ANALYTICAL PARAMETERS			ANALYTICAL PARAMETERS
p-Isopropyltoluene	ug/L*	600000	
1,3 Dichlorobenzene	ug/L*	<50000	
1,4 Dichlorobenzene	ug/L*	<50000	
n-Butylbenzene	ug/L*	<50000	
1,2 Dichlorobenzene	ug/L*	<50000	
Dibromochloropropane	ug/L*	<50000	
124-Trichlorobenzene	ug/L*	<50000	
Hexachlorobutadiene	ug/L*	<50000	
Naphthalene	ug/L*	700000	
123-Trichlorobenzene	ug/L*	<50000	
sec-Butylbenzene	ug/L*	590000	
124-Trimethylbenzene	ug/L*	6000000	

cc:

REMARKS: * Analysis performed on TCLP Leachate according to USEPA Method 1311.
Analysis was performed by GC/MS, EPA Method 8260.
Page 2 of 2.

DIRECTOR ____________

rn= 344 NYSDOH ID# 10320

ECOTEST LABORATORIES, INC. *ENVIRONMENTAL TESTING*

377 SHEFFIELD AVE. • N. BABYLON, N.Y. 11703 • (516) 422-5777 • FAX (516) 422-5770

LAB NO. C964686 11/14/96

ERM Northeast
175 Froehlich Farm Boulevard
Woodbury, NY 11797
ATTN: Jim Rocco

SOURCE OF SAMPLE: Insilco, 488.010.4
COLLECTED BY: Client DATE COL'D:11/07/96 RECEIVED:11/08/96

SAMPLE: Wastewater sample, Riverbank Product*

ANALYTICAL PARAMETERS			ANALYTICAL PARAMETERS		
Benzene	ug/L	<5000	1,2 Dichloropropane	ug/L	<5000
Bromobenzene	ug/L	<5000	2,2-Dichloropropane	ug/L	<5000
Bromochloromethane	ug/L	<5000	1,1-Dichloropropene	ug/L	<5000
Bromodichloromethane	ug/L	<5000	1,3-Dichloropropene	ug/L	<5000
Bromoform	ug/L	<5000	Ethyl Benzene	ug/L	140000
n-Butylbenzene	ug/L	<5000	Hexachlorobutadiene	ug/L	<5000
tert-Butylbenzene	ug/L	<5000	Isopropylbenzene	ug/L	150000
sec-Butylbenzene	ug/L	150000	p-Isopropyltoluene	ug/L	380000
Carbon Tetrachloride	ug/L	<5000	Methylene Chloride	ug/L	<5000
Chlorobenzene	ug/L	<5000	Naphthalene	ug/L	250000
Chloroform	ug/L	<5000	n-Propylbenzene	ug/L	300000
4-Chlorotoluene	ug/L	<5000	Styrene	ug/L	<5000
2-Chlorotoluene	ug/L	<5000	1112Tetrachloroethan	ug/L	<5000
Chlorodibromomethane	ug/L	<5000	1122Tetrachloroethan	ug/L	<5000
1,2 Dibromoethane	ug/L	<5000	Tetrachloroethene	ug/L	<5000
Dibromomethane	ug/L	<5000	Toluene	ug/L	360000
1,3 Dichlorobenzene	ug/L	<5000	123-Trichlorobenzene	ug/L	<5000
1,2 Dichlorobenzene	ug/L	<5000	124-Trichlorobenzene	ug/L	<5000
1,4 Dichlorobenzene	ug/L	<5000	111 Trichloroethane	ug/L	<5000
1,1 Dichloroethane	ug/L	<5000	112 Trichloroethane	ug/L	<5000
1,2 Dichloroethane	ug/L	<5000	Trichloroethylene	ug/L	<5000
c-1,2-Dichloroethene	ug/L	<5000	123-Trichloropropane	ug/L	<5000
t-1,2-Dichloroethene	ug/L	<5000	124-Trimethylbenzene	ug/L	6000000
1,1 Dichloroethene	ug/L	<5000	Dibromochloropropane	ug/L	<5000
1,3-Dichloropropane	ug/L	<5000			

cc:

REMARKS: Analysis was performed by GC/MS, EPA Method 8260.
Page 1 of 2.
* Sample was collected at 2:00 pm.

DIRECTOR ____________________

rn= 26767 NYSDOH ID# 10320

ECOTEST LABORATORIES, INC. *ENVIRONMENTAL TESTING*

377 SHEFFIELD AVE. • N. BABYLON, N.Y. 11703 • (516) 422-5777 • FAX (516) 422-5770

LAB NO. C964686 11/14/96

ERM Northeast
175 Froehlich Farm Boulevard
Woodbury, NY 11797
ATTN: Jim Rocco

SOURCE OF SAMPLE: Insilco, 488.010.4
COLLECTED BY: Client DATE COL'D:11/07/96 RECEIVED:11/08/96

SAMPLE: Wastewater sample, Riverbank Product*

ANALYTICAL PARAMETERS			ANALYTICAL PARAMETERS
135-Trimethylbenzene	ug/L	2600000	
o Xylene	ug/L	760000	
m + p Xylene	ug/L	1700000	
Xylene	ug/L	2500000	
Bromomethane	ug/L	<5000	
Chloroethane	ug/L	<5000	
Chloromethane	ug/L	<5000	
Dichlordifluomethane	ug/L	<5000	
Vinyl Chloride	ug/L	<5000	

cc:

REMARKS: Analysis was performed by GC/MS, EPA Method 8260.
Page 2 of 2.
* Sample was collected at 2:00 pm.

DIRECTOR ____________

rn= 26768 NYSDOH ID# 10320

Appendix F
Backup Calculations for Estimation of LNAPL Located Between the Site and the Bronx River

NAPL Volume Calculation
Former Red Devil Facility, Mount Vernon, New York

Apparent Thickness Range, ft.	Area Between Isopleth Lines, sf [1]	Average Apparent NAPL Thickness, ft	Apparent Thickness Correction Factor [2]	Porosity	Conversion Factor, gal/cf	Volume of On-Site NAPL, gallons
0-1	48,206.70	0.5	0.3	0.3	7.48	16,226.38
1-2	1,285.48	1.5	0.3	0.3	7.48	1,298.07
						17,524.45

1 Area between isopleth lines obtained from Figure 3-8, which uses product measurement data from the 12 February 1997 round

2 Apparent Thickness Correction Factor was determined by product baildown tests performed during the RI and the Design Investigation.