FOCUSED GROUND-WATER FEASIBILITY STUDY

FOR THE

570 MAIN STREET MANUFACTURING FACILITY WESTBURY, NEW YORK NYSDEC SITE CODE #130043A

SEPTEMBER 1999

PREPARED FOR:

IMC EASTERN CORPORATION

PREPARED BY:

HULL & ASSOCIATES, INC.
4700 DUKE DRIVE, SUITE 172
MASON, OHIO 45040
(513) 459-9677

FOCUSED GROUND-WATER
FEASIBILITY STUDY
FOR THE
570 MAIN STREET
MANUFACTURING FACILITY
WESTBURY, NEW YORK
NYSDEC SITE CODE #130043A
(HAI DOCUMENT # NMB007.200.0019)

DISTRIBUTION:

Joseph Jones, NYSDEC (three copies, one unbound)
Chittibabu Vasudevan, Ph.D., P.E., NYSDEC (one copy)
G. Anders Carlson, Ph.D., NY State Department of Health (one copy)
Ray Cowen, Director, NYSDEC (one copy)
Jeanna E. Hussey, Esq., Division of Environmental Enforcement (one copy)
Chris M. Rawnsley, IMC, c/o New Hampshire Ball Bearings, Inc. (one copy)
J Brian Molloy, Esq., Piper & Marbury, LLP (one copy)
Timothy L. Douthit, Handex of New York (one copy)
Syl Lamarca, Castle Collision (one copy)
HAI Internal Copies (two copies)

Craig A. Kasper, P.E.

FOCUSED GROUND-WATER FEASIBILITY STUDY
FOR THE
570 MAIN STREET MANUFACTURING FACILITY
WESTBURY, NEW YORK

TABLE OF CONTENTS

FOCUSED GROUND-WATER FEASIBILITY STUDY
FOR THE
570 MAIN STREET MANUFACTURING FACILITY
WESTBURY, NEW YORK

TABLE OF CONTENTS (Continued)

Page Number

TABLE OF CONTENTS (Continued)

LIST OF TABLES

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

LIST OF PLATES

LIST OF APPENDICES

1.0 INTRODUCTION

1.1 General

Hull & Associates, Inc. (HAI) was retained by IMC Eastern Corp. (IMC) to conduct a focused ground-water feasibility study at 570 Main Street in Westbury, New York, New York State Department of Environmental Conservation (NYSDEC) Code #130043A (Site). The Site is within the New Cassel Industrial Area (NCIA), a Class 2 inactive hazardous waste site as designated by the NYSDEC.

The preparation of this document and all activities performed at the Site have been, to the maximum extent practicable, in accordance with the provisions of Consent Order Index # 1-W1-0750-96-02 effective May 12, 1998 (the Order).[1] Field work and reporting have also been, to the maximum extent practicable, consistent with the April 1998 Focused Ground-Water Investigation and Focused Ground-Water Feasibility Study Work Plan (Addendum 1 – HAI Document # NMB004.300.0074) and supporting documents contained therein.

This report is arranged in six sections. Section 1.0 provides an introduction including the Site description, Site history and operations, a summary of previous investigations and an overview of project objectives. Section 2.0 describes remedial action objectives for ground water at the Site. Section 3.0 develops and screens preliminary remedial action alternatives. Section 4.0 presents a detailed analysis of remedial action alternatives. Results of comparative evaluation for remedial action alternatives are presented in Section 5.0.

1.2 Site Description

The Site is located at 570 Main Street in Westbury, New York, and is within the 170-acre NCIA. The NCIA contains approximately 200 industrial or commercial enterprises. A Site Location Map is presented on Figure 1. The Site was occupied by IMC from the early 1950s until 1992. The property is slightly over two acres with one manufacturing building and a paved parking lot covering most of the area. The Site is currently owned and occupied by Castle Collision, an entity unrelated to IMC.

[1] The Order addresses "Development and Implementation of a Focussed Remedial Investigation/Focussed Feasibility Study for Operable Unit 2 of an Inactive Hazardous Waste Disposal Site, Under Article 27, Title 13, and Article 71, Title 27 of the Environmental Conservation Law of the State of New York."

1.3 Previous Investigations

1.3.1 Anson Environmental, Ltd.

Anson Environmental, Ltd. (Anson) performed preliminary investigative activities related to the closure of the IMC manufacturing operation at the Site.[2] Anson reportedly developed a closure plan for the IMC facility in 1992; however, this closure plan was not available for review. Implementation of this closure plan began in March 1993, and consisted of exposing abandoned leaching pools and septic tanks from three areas of the Site, designated as Area 1, Area 2, and Area 3 (refer to Plate 1). Sediment and soil samples were collected from these locations for laboratory testing of volatile organic compounds (VOCs). Sediment samples were also collected from four floor drains in the building for laboratory VOC analyses. Finally, a composite sample of water was collected during power washing of floors in the building and samples of concrete floors were submitted for laboratory analyses.

Laboratory analyses revealed the presence of VOCs in soils and floor drain sediment samples. The highest concentrations were detected beneath Area 2.

Based upon findings from the field activities, Anson identified the following three main potential source areas:

1. Area 1, located outside the building in the Site's northeast corner;
2. Area 2, located outside the building in the Site's northwest corner; and
3. Area 3, located outside the building near the Site's southwest corner.

In addition to these areas, Anson identified five probable floor drains that were also considered potential source areas.

---

[2] 1993 *Closure Plan Implementation, Volume I, IMC Magnetics Corp.*, Anson Environmental, Ltd. undated; an untitled report from Anson Environmental, Ltd. to representatives of IMC Magnetics Corp., July 21, 1993; *Closure Plan, History, IMC Magnetics Corp.*, Anson Environmental, Ltd., December 3, 1993; and *Closure Plan, IMC Magnetics Corp.*, Anson Environmental, Ltd., December 3, 1993.

Anson installed and sampled three ground-water monitoring wells in 1994. The monitoring wells were apparently screened from above the water table to a depth of approximately ten feet below the water table. VOCs were detected in all monitoring wells.

1.3.2 Lawler, Matusky & Skelly Engineers, February 1995

Lawler, Matusky & Skelly Engineers (LMS) was contracted by NYSDEC to conduct a site investigation of the NCIA.[3] The investigation consisted of a file review, ground-water sampling and analysis from 56 existing monitoring wells, and ground-water sampling and analysis from direct-push soil boring locations installed during the investigation. The Site was identified as a potential source of ground-water contamination in the VOC plume designated as the "570 Main Street plume;" however, this was never confirmed by investigations conducted by LMS or Anson.

1.3.3 Interim Remedial Measure (Soils), February 1997

HAI and Land Tech Remedial, Inc. (LTR – presently Handex of New York) conducted an Interim Remedial Measure (IRM) Investigation of soils at the Site from May to July 1996. Investigative activities were conducted per an approved Work Plan and included: completion of a detailed file review and source and release identification study; collection of unsaturated soil samples at various depths in eighty-eight direct-push borings; collection of five shallow ground-water samples; and completion of a soil vapor extraction (SVE) pilot test.[4] The Final Investigation Report documents the results of the IRM.[5]

Based on a file review and source and release identification study, four general areas of concern were evaluated including Areas 1, 2, and 3 and several dry well-type floor drains identified by previous investigations.

---

[3] *Site Investigation Report, New Cassel Industrial Area Site, North Heampstead, Nassau County,* Lawler, Matusky & Skelly Engineers, February 1995.

[4] *Work Plan for the Investigation and Design of the Interim Remedial Measure for the Vadose Zone* (HAI Document # NMB004D.009), March 1996.

[5] *Final Investigation Report* (HAI Document # NMB004D.032), August 1996.

The primary contaminants detected in soil and ground water were VOCs. The highest concentrations of VOCs were beneath Area 2.

The IRM Investigation determined that heavy metals in soils did not require remediation based on their concentrations and distribution. Based on pathway completeness evaluations for VOCs, the IRM Investigation determined that active intervention would be required in Area 2. Considering the volatility of VOCs detected in Area 2 and the results of a pilot study, HAI and LTR selected soil vapor extraction (SVE) as the interim remedial measure and prepared a plan to describe operation, monitoring and maintenance of the system.

HAI and LTR installed a SVE system in August 1997 by connecting it to nested vapor extraction wells in Area 2 that were used for the pilot test. The system began continuous operation in October 1997. The SVE system continues to operate in accordance with the approved Soil Vapor Extraction Operation, Monitoring and Maintenance Plan.[6]

1.3.4 Focused Ground-Water Investigation, September 1998

HAI and LTR conducted a Focused Ground-Water Investigation at the Site. Field investigations were conducted between June 18, 1998 through July 30, 1998. The objective of the work was to gather data for evaluating the fate and vertical and horizontal distribution of selected volatile organic compounds (VOCs) and metals in ground water upgradient and downgradient of Area 2, as described in the revised Work Plan for the Focused Ground-Water Investigation and Focused Ground-Water Feasibility Study (HAI Document # NMB004.300.0074).

Major field activities for the Focused Ground-Water Investigation included: installation of twelve monitoring wells in four three-well clusters; measurement of static water levels in the wells to confirm the direction of ground-water flow; sampling of wells and testing for VOCs and selected heavy metals; and completion of biodegradation studies. Findings from the investigation are summarized in sections 1.4 and 1.5.

---

[6] *Soil Vapor Extraction System Operations, Maintenance, and Monitoring Plan* (HAI Document # NMB004D.040), February 1997.

1.3.5 Ongoing NYSDEC-Lead Investigations

During 1997 the NYSDEC conducted environmental investigations at Atlas Graphics, located on 567 Main Street, in a general upgradient (northern) direction from the Site. Based on August 1998 conversations between Lance Turley of HAI and Joe Jones, NYSDEC Division of Environmental Remediation, a portion of the investigation focused on a "cesspool" that received liquid wastes from the facility. Mr. Jones also indicated that investigative activities may be ongoing at Atlas Graphics and that NYSDEC is currently finalizing a report and feasibility study for work conducted at Atlas Graphics.

IMC expressed interest in reviewing analytical data from NYSDEC's investigations at Atlas Graphics as ground-water contamination from that property is likely to have migrated onto the Site. HAI and IMC believed that knowledge of upgradient contaminant distributions could assist in interpreting the distribution of VOCs and metals beneath the Site. In September 1998 Mr. Jones sent to HAI preliminary ground-water analytical data for two samples collected via direct-push technology near the water table in the vicinity of the "cesspool" on Atlas Graphics Property. Results of NYSDEC's sampling effort are summarized in Appendix A of the Focused Ground-Water Investigation Report.

Ground-water samples at Atlas Graphics contained VOCs, with the highest concentrations detected near the "cesspool." Based on the proximity of Atlas Graphics to the Site and the general direction of ground-water flow, HAI determined VOCs detected near the "cesspool" will likely migrate onto the Site. As it is likely that VOCs entered ground water via the "cesspool" several years ago, based on discussions between Joe Jones and HAI, HAI also interpreted a portion of the VOCs detected in Site ground water during the Focused Ground-Water Investigation probably originated from Atlas Graphics property. NYSDEC is currently evaluating remedial options for Atlas Graphics but has not, to date, provided information of preferred remedial options for the site with the IMC or HAI.

1.3.6 Supplemental Sampling of Off-Property Wells

During October 1998, IMC identified two monitoring wells, UN-22 and UN-24 (NYSDEC designations), located west of the Site. These were sampled to more completely define the

distribution of VOCs downgradient of Area 2. The locations of UN-22 and UN-24 are shown on Plate 1.

Well soundings indicated that UN-22 and UN-24 are screened at or just below the water table. Chemical analysis of samples collected from the wells in November 1998 indicated the presence of VOCs in both wells.

1.4 Geology/Hydrogeology Summary

1.4.1 Regional Geology/Hydrogeology

The majority of the ground water underlying NCIA is in unconsolidated glacial deposits of Pleistocene age and coastal-plain deposits, of both continental and marine origin, of late Cretaceous age. These unconsolidated deposits consist of gravel, sand, silt, and clay and are underlain by bedrock of lower Paleozoic and/or Precambrian age. The bedrock, which is virtually impermeable, forms the base of the ground-water reservoir. The two primary aquifers in the area of the Site are the Upper Glacial Aquifer and the Magothy aquifer. The Magothy aquifer is underlain by the Raritan clay.

The Upper Glacial Aquifer consists of outwash deposits of late Pleistocene age. The Upper Glacial Aquifer overlies the Magothy aquifer in the investigation area, and its deposits form the present land surface. The upper Pleistocene glacial outwash deposits consist of stratified deposits of sand and gravel with some cobbles and may locally contain thin clay beds. These deposits are highly permeable and allow recharge water to percolate downward with relative ease to the water table and, subsequently, to the underlying aquifers.

The Upper Glacial Aquifer, as defined and used by the USGS on Long Island, includes both the unsaturated and saturated portions of the upper Pleistocene deposits. USGS maps indicate that the thickness of the Upper Glacial Aquifer in the area of the Site is approximately 50 feet.[7] Data collected by HAI during investigation of the Site and by the NYSDEC during investigations in the NCIA indicate that the upper Pleistocene deposits in the NCIA are unsaturated; therefore, the water

[7] U.S. Geological Survey, in cooperation with the Nassau County Department of Public Works, *Geology of the Town of North Hempstead, Nassau County, Long Island, New York*. 1979.

table may locally occur in the underlying Magothy aquifer approximately 55 feet below grade. Regional ground-water flow direction local to the NCIA, as determined by the USGS and the Nassau County Department of Public Works, is towards the southwest, as shown on Plate 2.

The Magothy aquifer is the principal aquifer underlying Long Island and is the island's main source of potable water. The aquifer is composed of upper Cretaceous sediments that overlie the Raritan clay. Its deposits consist primarily of lenticular and discontinuous beds of very fine to medium sand, commonly clayey or containing thin clay lenses that are interbedded with clay and sandy clay silt, and some sand and gravel. Coarse beds of sand and gravel commonly occur in the lower 100 to 150 feet of the aquifer. Previous investigations have indicated that the aquifer sediments appear to grade upward from coarser grained at the base to finer grained at the top. The greater proportion of the clay and sandy clay occurs in the upper half of the aquifer. Beds of clay occur locally towards the top of the aquifer and seem to be distributed irregularly throughout the Town of North Hempstead. This is evident in the well completion logs generated for public supply well numbers N-8956 and N-8957 in the Westbury Water District (Bowling Green Wells), which are located approximately 3,000 feet southeast of the Site (refer to Plate 2). A solid brown clay layer was logged during the drilling of well number N-8956 at 95 feet below grade. This same clay layer was not encountered during the drilling of well number N-8957, which was installed only 140 feet to the southeast of N-8956.

The Magothy aquifer is approximately 500 feet thick beneath the NCIA, and is encountered at a depth of approximately 50 feet below grade. According to the USGS it is quite possible that the uppermost part of the Magothy contains deposits of Pleistocene age, or, conversely, that the lower part of the upper glacial aquifer contains deposits of Cretaceous age. The boundary between the Cretaceous and Pleistocene deposits is often indistinguishable in Nassau County because the sediments are of similar composition and show no significant lithological difference.

1.4.2 Site Geology/Hydrogeology

Unsaturated soils at the Site consist primarily of a heterogeneous mixture of brown to tan fine sands with lesser amounts of silt, medium sands, coarse sands and gravels. A discontinuous layer with increased silt content exists in the interval between grade and approximately 10 feet below grade. Below this silty layer, soil composition remains generally constant with a slight fining-downward

trend (progressively less coarse sands and gravels with depth) to approximately 50 feet below grade. No clay lenses, or other impermeable features were encountered at the unsaturated deposits.

Saturated deposits were encountered at approximately 50 feet below grade. These deposits consist primarily of brown to tan, fine to medium and fine to coarse sands. In the northwestern portion of the Site, extending to Main Street's north right-of-way, lenses of fine sand, silty fine and silty fine to medium sand, and clayey, silty fine to medium sand were encountered at depths between approximately 57 and 120 feet below grade. Occasional thin silty clay seams were encountered during drilling of the MW-4 cluster in the north right-of-way for Main Street. These seams appear to pinch out toward the south. Saturated deposits are relatively homogeneous south of the MW-5 well cluster along the western boundary of the Site.

Soil organic carbon content at the Site was tested during the IRM Investigation and found to average approximately 0.2 percent total organic carbon (TOC). Higher TOC values were detected in the silty layer encountered in the near-surface sediments, with values as high as approximately 0.8 percent.

Water level measurements during the IRM Investigation and the Focused Ground-Water Investigation indicated a ground-water flow at the Site to be toward the southwest, consistent with the regional ground-water flow direction in the NCIA. The average ground-water gradient was determined to be approximately 0.0015 ft/ft. Figure 2 shows the piezometric surface, as measured in water table wells.

Minimal variations in heads were identified in clustered wells during the Focused Ground-Water Investigation. This indicates that ground-water flow within the upper ninety feet of the aquifer is essentially horizontal.

1.5 Environmental Conditions

1.5.1 Soils

1.5.1.1 Contaminants

VOCs

The following VOCs were detected in soils exceeding method detection limits (MDLs) during the IRM Investigation:

- benzene;
- toluene;
- ethylbenzene;
- m&p-xylenes;
- o-xylenes;
- 1,1-dichloroethene (1,1-DCE);
- 1,1,1-trichloroethane (1,1,1-TCA);
- trichloroethene (TCE); and
- tetrachloroethene (PCE).

Metals

The following metals were detected in soils exceeding method detection limits (MDLs) during the IRM Investigation:

- lead;
- barium;
- cadmium; and
- chromium.

1.5.1.2 Contaminant Distribution

VOCs

Soil analytical data from the IRM Investigation indicated that VOC contamination does not extend off-Site. PCE had the greatest areal distribution across the Site, and was found in 51 of 88 direct-push borings. PCE was generally detected at greater depths than other VOCs, extending to the water table in Area 2. Overall, the highest concentrations of VOCs detected Site-wide were at depths between 10 and 24 feet below grade, directly beneath a former leaching pool in Area 2.

The highest concentration of PCE detected at the Site was almost 40,000,000 µg/kg, located at a depth of 10-12 feet beneath the aforementioned former leaching pool. Identification of PCE in excess of 1% of the soil mass provides strong indication of the presence of residual dense nonaqueous phase liquid (DNAPL) beneath Area 2.[8]

With the exception of PCE, no VOCs exceeded 100 µg/kg in soils outside of Area 2. Furthermore, no VOCs other than PCE were detected below a depth of 10 ft. outside Area 2.

Metals

The highest metals concentrations were found in Area 2 and under the building, generally at depths between 4 and 12 ft. below grade. The highest lead concentration was 31,000 µg/kg in the central portion of the building. The highest barium concentration was 49,000 µg/kg in the north-central portion of the building. The highest cadmium concentration was 2,500 µg/kg in the central portion of the building. The highest chromium concentration was 740,000 µg/kg in Area 2.

1.5.1.3 Contaminant Fate

VOCs

Reduction of VOC concentrations in soils via partitioning to air and water and biodegradation is expected to occur slowly under natural conditions. As the Site is almost entirely covered by impervious material (e.g., asphalt, building foundation, etc.), very little water would move through the unsaturated zone to promote leaching. Furthermore, migration of volatilized VOCs to the atmosphere would be restricted.

The IRM Investigation determined that due to relatively low concentrations and limited vertical extent in unsaturated soils, VOCs outside Area 2 would not migrate to ground water. However, VOCs beneath Area 2, and particularly beneath the former leaching pool, are likely to leach to the water table.

[8] Cohen, Robert M. and J.W. Mercer. 1993. *DNAPL Site Evaluation.* CRC Press, Inc. Boca Raton, FL.

Operation of the SVE system in Area 2 since October 1997 has removed significant contaminant mass from unsaturated soils. Considering the ongoing success of the SVE System as source remediation, no significant addition of VOC mass from Site soils to ground water is anticipated.

Metals

During the IRM Investigation, Toxicity Characteristic Leaching Procedure (TCLP) analyses were conducted on soil samples containing elevated concentrations of metals. Results of the testing indicated that leaching of metals would have a negligible impact on ground water beneath the Site.

1.5.2 Ground Water

1.5.2.1 Contaminants

VOCs

The following VOCs were detected exceeding MDLs in water samples collected from monitoring wells during the IRM Investigation and the Focused Ground-Water Investigation:

- toluene;
- 1,1-dichloroethane (1,1-DCA);
- cis-1,2-dichloroethene (cis-1,2-DCE);
- 1,1-DCE;
- 1,1,1-TCA;
- TCE; and
- PCE.

The above VOCs are considered to be contaminants of concern for ground water at the Site.

Chloroform, methylene chloride and trichlorofluoromethane were detected in samples collected from monitoring wells during the IRM investigation. These VOCs are not considered contaminants of concern for the following reasons:

1. they were not detected in soils during the IRM Investigation;
2. they were not detected in ground water during the Focused Ground-Water Investigation; and
3. chloroform and methylene chloride are common laboratory artifacts.

For reasons similar to those provided above, bromoform, detected in one sample during the Focused Ground-Water Investigation, is not considered a contaminant of concern.

Metals

The following heavy metals were detected exceeding MDLs in water samples collected from monitoring wells during the IRM Investigation and the Focused Ground-Water Investigation:

- mercury;
- lead;
- barium;
- cadmium; and
- chromium.

As the IRM Investigation demonstrated that metals are unlikely to have migrated to the water table at the Site, and based on the distribution of metals in ground water (described in section 1.5.2.2), metals are not contaminants of concern.

1.5.2.2 Contaminant Distribution

VOCs

Analytical results show that chlorinated VOCs are the primary contaminants in most of the wells at the Site; toluene is prevalent in middle and lower wells in downgradient portions of the Site. Of the chlorinated VOCs detected, PCE was found at the highest concentrations: up to 2,680 µg/L in a direct-push water sample collected directly beneath a leaching pool in Area 2; 660 µg/L in MW-2;and 160 µg/L in MW-5U, located near to and downgradient of Area 2. While no DNAPL was directly observed during the IRM Investigation or the Focused Ground-Water Investigation, detection of PCE at a concentration greater than 1 ppm indicates that DNAPL may exist beneath the water table.[9] The depth at which PCE was detected at the MW-5 well cluster (approximately 80 feet below the water table at MW-5L) is also indicative of the vertical migration of DNAPL via gravity in the absence of a downward ground-water gradient.

[9] Cohen, Robert M. and J.W. Mercer. 1993. *DNAPL Site Evaluation.* CRC Press, Inc. Boca Raton, FL.

TCE and 1,1,1-TCA were detected at concentrations of up to 34 µg/L and 60 µg/L, respectively, in the MW-5 well cluster. At least one of the typical biodegradation daughter products 1,1-DCE, 1,1-DCA and/or cis 1,2-DCE was detected in all wells except MW-1.

Evaluation of the distribution of VOCs indicates that chlorinated VOCs, primarily PCE, 1,1,1-TCA, and TCE, are entering the Site from one or more upgradient sources and combining with VOCs in Area 2 ground water. A likely source of TCE is Atlas Graphics, located in a general upgradient direction of Area 2, and where TCE was recently detected in ground water at a concentration of 3,900 µg/L by NYSDEC. Furthermore, elevated concentrations of TCE at UN-22 and UN-24 (230 and 68µg/L, respectively) relative to concentrations detected in the MW-5 well cluster (located near to and downgradient of Area 2), are suggestive of migration from Atlas Graphics rather than from Area 2. Finally, analytical results from multi-level sampling at LMS probe location GP-20, installed just south of the corner of Main Street and Swalm Avenue in October 1993 (refer to Plate 1), indicate that TCE is the predominant VOC, further supporting an interpretation that VOCs have migrated near to and beneath the Site from Atlas Graphics.[10]

Elevated concentrations of PCE and TCE (660 and 330 µg/L, respectively) were detected in MW-2 during the IRM investigation. As MW-2 was located near the property's northern property line, upgradient of known potential source areas at the Site and approximately 80 feet east of Area 2, it is likely that the detected VOCs originated from one or more off-Site source.

As shown on Figures 3 through 6, VOC concentrations show marked reduction with distance from Area 2. As noted above, likely contribution of VOCs from one or more sources upgradient of Area 2 and potential contribution from downgradient sources make it impossible to define the limits of VOCs originating from the Site.

---

[10] *Preliminary Site Assessment Report – Revised Draft, New Cassel Industrial Area Site, North Hempstead, Nassau County*, Lawler, Matusky & Skelly Engineers, October 1994. At a depth interval of 89-94 ft. below grade, ground water at GP-20 contained 2,000 ug/L TCE and 150 ug/L PCE

Metals

Metals analyses show that total cadmium and mercury are not present above MDL in ground water. The highest total barium concentration was detected in the most downgradient well (0.25 mg/L at MW-7U). The highest concentrations of lead and chromium are upgradient of Area 2 in MW-4U (0.054 mg/L and 0.223 mg/L, respectively) and downgradient of the Site in MW-7U (0.09 mg/L and 0.155 mg/L, respectively). The lowest concentrations of lead and chromium detected in the upper portion of the aquifer are in MW-5U and MW-6U, downgradient of Area 2. The distribution of metals suggests that contribution (i.e. pond and cesspool) to ground water occur largely from off-Site sources.

1.5.2.3 Contaminant Fate

VOCs

VOCs entering ground water beneath Area 2 mix with VOCs from upgradient sources and move via advection and dispersion coincident with the southwesterly direction of ground-water flow. To the extent that DNAPL exists beneath Area 2, product would be slowly dissolved as ground water passes through and around the DNAPL, creating elevated concentrations of dissolved VOCs downgradient of the DNAPL relative to concentrations upgradient.

Upon migrating downgradient of Area 2, dissolved VOCs would be subject to several physical and chemical processes, including continued dispersion, adsorption, partitioning within the geologic media, biodegradation and commingling with downgradient VOC sources. With the exception of commingling of VOCs, the above processes will contribute to attenuation of the plume with distance from Area 2.

Detection of daughter products in ground water at the Site indicates that biodegradation of chlorinated VOCs has occurred. In particular, detection of cis-1,2-DCE shows degradation of PCE and TCE. Furthermore, microbial studies conducted during the Focused Ground-Water Investigation showed that at all wells sampled bacterial strains exist that are capable of biodegrading chlorinated VOCs. The strain most adaptable to VOC concentrations found at the Site was identified in ground water collected from MW-5U, providing strong evidence of active biodegradation in the vicinity of Area 2, where nutrient sources are likely to be the most abundant.

Metals

The presence of metals in ground water beneath the Site is likely the result of natural background conditions or off-Site sources or a combination of these conditions. Migration of metals in ground water beneath the Site would be similar to that described for VOCs, particularly with respect to the direction of movement. However, metals in ground water are subject to complexation reactions and ion exchange reactions, and may be strongly influenced by redox chemistry.

1.5.3 Identification of Exposure Pathways

An exposure pathway is the course a contaminant takes from a source to an organism. An exposure pathway describes a unique mechanism by which an individual or population may be exposed to chemicals at or originating from the Site. Each exposure pathway includes a source or release from a source, an exposure route, and an exposure point. If the exposure point is different from the source, a transport media must also be included. Without these three components, an exposure pathway is incomplete (i.e., no exposure can occur).

1.5.3.1 On-Site Exposure

Current on-Site exposure to ground water is an incomplete pathway as ground water is not currently used and the property is connected to a public water supply for potable and non-potable uses. Furthermore, there are no ground-water discharges to surface water and volatilization of VOCs off the water table, situated more than 50 ft. below grade, is unlikely to create exposures in indoor air.

In the absence of relevant institutional controls (i.e., deed restrictions on the installation of wells), future exposures to ground water could occur. The potential therefore exists for future completion of the ground-water exposure pathway.

1.5.3.2 Off-Site Exposures

Review of data for the NCIA indicates that businesses and residences are provided public water supply. HAI has gathered information on water supply well fields near the NCIA, including general well construction and chemical testing results, to evaluate the potential for VOCs originating from the Site to have contributed to the VOCs that have been detected in some of the wells.

As described in Section 1.3.2, LMS identified many areas containing VOCs. LMS also tentatively delineated several VOC plumes, and identified properties that have potentially contributed to ground-water contamination (of which the Site is included).[11]

VOC distribution maps included within the LMS reports indicate that seven generalized chlorinated solvent plumes have thus far been identified. Based on the distribution of VOC concentrations in the tentatively delineated plumes, the maps indicate a probable southwesterly transport of dissolved VOCs in ground water, as was identified for VOCs at the Site.

As shown on Plate 2, regional piezometric data support interpretation of transport direction based on VOC distribution, and indicate that ground-water flow in the NCIA is to the south-southwest at an approximate gradient of approximately 0.0014 ft/ft.[12] Measurements collected by HAI from monitoring wells at the Site indicate a southwesterly gradient of 0.0015 ft/ft.

Water supply wells near the NCIA include the Bowling Green Water District wells and the Westbury Water District Wells. The following provides general information on the wells as determined by records searches.

Bowling Green Wells

The Bowling Green well field contains two production wells (Local Well #s 1 and 2) located approximately 2,900 feet southeast of the Site. The wells are essentially side gradient of the Site with respect to regional ground-water flow. Of the two wells, Local Well #2 is located closest to the Site. General information about the production wells is included in Table 1.

---

[11] *New York State Superfund Contract Multisite PSA Report, New Cassel Industrial Area Site, North Hempstead, Nassau County,* Lawler, Matusky & Skelly Engineers, February 1995.

[12] The piezometric surface for Nassau County is shown on the March 1995 *Nassau County Water Table Elevation Map*, Prepared by the Nassau County Department of Public Works, Water Management Unit, Division of Sanitation & Water Supply, 1:24,000 scale.

The wells have been sampled and tested for VOCs several times per year since November 1987.[13] TCE, the first compound tentatively identified in extracted ground water, was detected at 1 µg/L in Local Well #1 on May 5, 1983. VOCs were not tentatively identified in Local Well #2 until March 22, 1989 (TCE at 2 µg/L). Assuming that the wells operate at similar pumping rates and have similar capture profiles (both vertically and laterally), detection of VOCs in Local Well #1 prior to detection at Local Well #2 (which is closest to the Site) may point to source areas east of the Site.

As shown on Tables 2 and 3, besides TCE, other chlorinated compounds were detected in the wells including PCE, 1,1,1-TCA, 1,1-DCE, 1,1-DCA and 1,2-DCA. TCE has been detected at the highest concentrations in both of the wells. The highest TCE concentration in Local Well #1 was 31 µg/L (September 9, 1998) and the highest TCE concentration detected in Local Well #2 was 42 µg/L (March 3, 1999 - the most recent analytical data obtained by HAI).

Westbury Water District Wells

The Westbury Water District operates eleven wells. Two Westbury Water District well fields, each containing two wells, are located within 5,000 of the Site. Local Well #s 9 and 16 are located approximately 4,000 feet west-southwest of the Site and Local Well #s 12 and 12A are located roughly 4,000 feet northeast of the Site. Westbury Water District Local Well #s 12 and 12A are upgradient of the Site. Local Well #s 9 and 16 are approximately side gradient of the Site. General information about the production wells is included in Table 4.

The wells have been sampled and tested for VOCs several times per year since April 1986. 1,1,1-TCA and 1,1-DCA were the first compounds tentatively identified in extracted ground water. 1,1,1-TCA and 1,1-DCA were both detected at 1 µg/L in Local Well #12 on April 30, 1986. VOCs were also tentatively identified in Local Well #12A on April 30, 1986 (1,1-DCA at 4 µg/L). Based on data available to HAI, no VOCs have been detected in Local Well #s 9 and 16.

As shown on Tables 5 and 6, besides 1,1,1-TCA and 1,1-DCA, other chlorinated compounds detected at Local Well #s 12 and 12A include TCE, PCE, 1,1-DCE and 1,2-DCA. Of the chlorinated

[13] Data obtained from the Town of Hempstead Department of Conservation and Waterways.

solvents detected, TCE is typically at the highest concentration in Local Well #12. The highest TCE concentration in Local Well #12 was approximately 5 µg/L on August 22, 1995 (the most recent analytical data obtained by HAI). The highest PCE concentration detected in Local Well #12A was 7 µg/L as of September 2, 1987.

Plate 2 is modified from a March 1995 piezometric surface map of Nassau County that shows ground-water flow conditions in the NCIA and in the vicinity of nearby water supply wells.[14] Graphical flowpath analysis of the map indicates that it is unlikely for VOCs potentially originating at the Site to be intercepted by either of the Bowling Green or the Westbury Water District wells. However, the map's large scale, large spacings between control points (observation wells), and use of a ten-foot contour interval inhibits to some extent the utility of this analysis.

The finite-difference ground-water flow model MODFLOW was used to supplement the above graphical flowpath evaluation and simulate aquifer influences under conservatively high combined pumping rates for Westbury Water District wells within a few thousand feet of the Site.[15] MODFLOW was used as the numerical engine for generation of head distributions and to support particle tracking using MODPATH.[16] MODFLOW and MODPATH are widely accepted and have undergone external and internal peer review by U.S. Geological Survey and the U.S. EPA.

The model domain covered an area of 2,000 acres, encompassing the three municipal well fields (six municipal wells) and the NCIA, including the Site. The MODFLOW model was set up to be a one-layer model representing the unconfined Magothy aquifer where five of the six wells are completed. Westbury Water District Well #9 (NYSDEC Well #2602) is screened within the Lloyd aquifer at a depth interval of 760-853 feet; however, as a conservative simplifying assumption, it was modeled as drawing water from the Magothy aquifer.

---

[14] *March 1995 Nassau County Water Table Elevation Map,* Prepared by the Nassau County Department of Public Works, Water Management Unit, Division of Sanitation & Water Supply, 1:24:000 scale.

[15] McDonald, M.G., and A.W. Harbaugh, *A Modular Three-Dimensional Finite Difference Ground-water Flow Model*, U.S. Geological Survey Open-File Report 83-875, 1988.

[16] Pollock, D. W., *User's Guide for MODPATH/MODPATH-PLOT, version 3: A particle Tracking post-processing package for MODFLOW, the USGS finite difference ground-water model*, U.S. Geological Survey, Open-File Report 94-464, 1994.

The northern and southern boundaries of the model domain consist of constant head cells set at elevations extrapolated from water table contours shown on Plate 2. No-flow boundaries were defined on the east and west limits of the model domain based on no-flow streamlines perpendicular to the major southwesterly flow in the region. The distances between boundaries was set to be remote from well locations such that stresses incurred during simulation would not reach the boundaries. The finite-difference grid was designed to have finer descretization in areas where pumping stresses were expected to occur. This grid design enabled more precise tracking near the influence areas for the pumping wells. The grid design is presented in Appendix A.

The simulated head distribution from MODFLOW was input into MODPATH for particle tracking. Six starting locations were established at the locations of the municipal wells. The model was set to backward-track the trajectory of particles within five years from each of the wells using a head distribution generated from MODFLOW. The solution from MODPATH was used to determined the zones of influence for the municipal wells.

Input values used in MODFLOW and MODPATH were:

1. Hydraulic Conductivity – 134 ft./day
2. Aquifer Thickness – 500 ft.
3. Effective Porosity – 0.3
4. Specific Yield – 0.3
5. Hydraulic Gradient – 0.0015
6. Recharge – 0.0004 ft/day
7. Tracking Time – 1,825 days, or five years
8. Top Elevation of Unconfined Aquifer – 120 ft. MSL
9. Bottom Elevation of Unconfined Aquifer – (-)380 ft. MSL

10. Pumping Rates

- Bowling Green Well #1 (NYSDEC Well #8956) – 1,000 gpm
- Bowling Green Well #2 (NYSDEC Well #8957) – 1,000 gpm
- Westbury Water District Well #9 (NYSDEC Well #2602) – 1,000 gpm
- Westbury Water District Well #16 (NYSDEC Well #8497) – 1,400 gpm
- Westbury Water District Well #12 (NYSDEC Well #5655) – 1,000 gpm
- Westbury Water District Well #12A (NYSDEC Well #6819) – 1,000 gpm

The three capture zones delineated using the MODFLOW/MODPATH are shown on Plate 3. Capture zones shown on Plate 3 are conservatively extensive as the municipal wells were simulated pumping constantly at their respective capacities for a period of five years. In practice, such wells typically operate below their capacities. In some cases, average pumping rates are significantly below listed capacities. Nonetheless, the relatively simple model simulations described above support empirical observations based on Site and regional ground-water flow patterns, and indicate that VOCs originating at the Site are unlikely to be captured by municipal wells.

Based on the above analyses, current off-Site exposure to contaminated ground water originating at the Site is therefore an incomplete exposure pathway. Furthermore, human and ecological exposures to VOCs originating at the Site and discharging to surface waters are not expected as such discharges do not occur within one mile of the Site. Finally, exposures via volatilization from ground water are not expected as the water table remains relatively deep downgradient of the Site.

In the absence of relevant institutional controls, and under an unlikely scenario that off-Site properties reject the public water supply and install wells, future exposures to ground water could occur. The potential therefore exists for future completion of the ground-water exposure pathway.

2.0 REMEDIAL ACTION OBJECTIVES

2.1 Identification of Objectives

Pursuant to the Order, Section III.A., the objective of this Focused Ground-Water Feasibility Study is to identify, compare and evaluate remedial alternatives that eliminate, to the maximum extent practicable, all health and environmental hazards and potential hazards relating to ground-water contamination originating from the existing disposal of hazardous waste at the Site. The alternatives take into account factors including contaminant fate and transport, exposure route, contaminant concentration and potential receptors.

2.2 Development of Remediation Goals

The overall goal of the remedial action is to restore portions of the aquifer contaminated by Site activities such that all significant threats to public health and the environment are eliminated to the extent feasible. The following sections describe considerations for identifying cleanup standards that demonstrate achievement of the remediation goal.

2.2.1 Available Standards and Criteria for Ground-Water Remediation

As described in Section 1.5.3, the Site does not currently pose a risk to human health or the environment. However, portions of the aquifer contain VOC contamination at concentrations greater than State Drinking Water maximum contaminant limits (MCLs). State and federal guidance suggest that drinking water standards or MCLs are applicable or relevant and appropriate for ground water that may be or are potentially available for drinking water.

As MCLs promulgated by the state meet or exceed the MCLs set under the Safe Drinking Water Act, the state's MCLs would normally form a basis to set standards to which ground water at the Site would be remediated. However, VOCs originating at one or more uncontrolled sources located upgradient of the Site may be migrating onto the Site at concentrations up to or over 1,000 ug/L (testing of MW-2 during the IRM Investigation), creating "background" conditions with elevated VOC concentrations. Several remedial alternatives assessed within this Focused Feasibility Study (e.g., ground-water extraction, ground-water containment) would likely capture contamination

originating from off-Site sources, resulting in increased contaminant concentrations on-Site. Moreover, VOCs migrating from Area 2 are likely commingling with downgradient VOC sources, making it impossible to identify attainment during a remedial action. Finally, the Focused Ground-Water Investigation presented evidence that DNAPL may exist in ground water beneath Area 2, posing potential problems with respect to attaining cleanup within a reasonable time frame.

For the above reasons, attainment of MCLs will be technically impracticable until:

1. contaminant sources upgradient of the Site are contained; and
2. potential DNAPL beneath Area 2 is removed.

HAI proposes establishment of background concentrations as Site-specific cleanup targets for contaminants of concern during the Remedial Action (RA) based on monitoring of ground water at the upgradient (northern) edge of the property. Establishment of background during RA is proposed because the selected remedy may influence concentrations of contaminants entering the Site from off-Site sources. HAI further proposes that background concentrations of contaminants of concern serve as Site-specific cleanup levels to the extent that these concentrations exceed state MCLs. If a given contaminant's background concentration is below its MCL, the Site-specific cleanup level will default to that MCL.

2.2.2 Remediation Goals for Ground Water

As described in Section 2.3.1, Site-specific cleanup levels are proposed as cleanup standards for the Site. The Site specific cleanup levels will be based on background concentrations for contaminants of concern entering the Site via ground-water flow. To the extent that background concentrations are below state MCLs, Site-specific cleanup levels will default to the MCLs. Contaminants of concern and their corresponding state MCLs are listed below:

Contaminant of Concern	State MCL[17]
Toluene	5 ug/L
1,1-DCA	5 ug/L
cis-1,2-DCE	5 ug/L
1,1-DCE;	5 ug/L
1,1,1-TCA	5 ug/L
TCE	5 ug/L
PCE	5 ug/L

[17] 6 NYCRR 700-706 – Classifications and Standards of Quality and Purity.

3.0 DEVELOPMENT AND PRELIMINARY SCREENING OF REMEDIAL ACTION ALTERNATIVES

3.1 Identification and Preliminary Screening of Remedial Technologies

3.1.1 Identification of General Response Measures

HAI evaluated numerous broad response measures capable of meeting remedial objectives in contaminated ground water. Whereas some of the response measurements are capable of meeting remedial objectives on their own, others would be used in combination. The following general response measures may be appropriate for Site conditions:

1. **No Action** – No Action typically refers to an absence of efforts to reduce contaminant mass, treat contamination or contain contamination. No Action commonly includes limited action such as periodic monitoring, and may be appropriate in areas where potential endangerment is negligible, or where an active response could cause unacceptable increases in endangerment to human health or the environment.

2. **Containment** – Structural or hydraulic barriers may be used to achieve remedial objectives by containing contaminants within an area where risk to human health and the environment is acceptable.

3. **Removal** – Removal and treatment or disposal would achieve remedial objectives by reducing the mass of contaminants in ground water.

4. **In-Situ Treatment** – Achievement of remedial objectives may be accomplished through in-situ reduction of contaminant mass, toxicity, and/or mobility.

Remedial technologies associated with each of the above response measures have been identified and evaluated, as described below.

3.1.2 Development and Preliminary Screening of Remedial Technologies

Potentially applicable remedial technologies for ground water are listed in Table 7. Data developed from the focused ground-water investigation and previous studies were used to eliminate technologies that do not suit Site conditions and/or cannot be easily implemented. Technologies that meet general criteria for implementability, cost and effectiveness are given further consideration in Section 4.0.

The following lists the technologies that have been retained through the preliminary screening:

1. **No Action** – The NCP requires that a no action alternative be evaluated throughout the Focused Feasibility Study to provide a baseline for evaluating other options.

2. **Limiting Aquifer Use** – This action could eliminate risks posed by ingestion of contaminated ground water and is a feasible and proven option.

3. **Monitoring** – A feasible and implementable method of obtaining information on migration and/or cleanup of contaminated ground water.

4. **Intrinsic Remediation** – Represents a demonstrated technology that could complement a number of other remedial technologies.

5. **Pumping** – A reliable and proven technique for containment and aquifer restoration.

6. **In-Situ Biological Treatment** – An innovative technology that could complement a number of other remedial technologies.

7. **In-Situ Oxidation** – An innovative technology primarily useful for source area remediation that can destroy contaminants and eliminate a significant volume of DNAPL mass.

8. **Air Sparging** – An in-situ stripping technology typically used in conjunction with SVE that can also promote biodegredation of some classes of VOCs.

9. **Hot Water/Hot Air/Steam Injection** – Enhances partitioning of adsorbed VOCs into the aqueous phase for removal via ground-water extraction.

10. **Air Stripping** – Feasible and proven method for removing VOCs from ground water.

11. **Liquid Phase Carbon** – Feasible and proven method for removing VOCs from extracted ground water.

12. **UV Oxidation** – Relatively fast and effective in ex-situ destruction contaminants.

13. **Catalytic Oxidation** – May effectively treat chlorinated-VOC-laden airstream with use of precious metal catalysts.

14. **Vapor Phase Carbon** – Feasible and proven method for removing VOCs from contaminated air streams.

15. **Discharge of Treated Ground Water to POTW** – Feasible and implementable alternative given attainment of pretreatment requirements.

3.2 Evaluation and Selection of Representative Remedial Technologies

Remedial technologies are evaluated relative to each other using the following criteria:

1. **Effectiveness** – The potential effectiveness of each technology in meeting contaminant reduction goals and in addressing estimated volumes or areas of contaminated media will be evaluated. Reliability of each technology with respect to the contaminants and conditions on the Site, and the effectiveness of the option in protecting human health and the environment during construction and implementation will be assessed.

2. **Implementability** – The technical and institutional feasibility of implementing each technology will be evaluated. Institutional feasibility includes availability of necessary equipment and skilled workers, and the ability to obtain any permits that may be necessary.

3. **Cost** – Relative capital and O&M costs of technology, rather than detailed cost estimates, will be used.

Table 8 summarizes the results of the technology evaluation.

3.3 Development of Remedial Alternatives

Remedial Technologies retained from the screening process in Section 3.2 are carried through with a "No Action" alternative and combined below to provide viable and representative remedial alternatives for ground water at the Site.

Alternative #	Description
GW #1	**No Action** Allows natural attenuation of VOCs to restore the aquifer.
GW #2	**Ground-Water Extraction with Air Stripping and Discharge to the POTW (pumping at 20-40 gpm in Area 2)** Extract ground water from beneath Area 2 and treat with low-profile air stripping. Discharge treated ground water to the POTW. Vapor phase carbon may be added to the stripping system to eliminate air emissions if necessary. Intrinsic remediation with monitoring downgradient of containment provided by the extraction well.

GW #3 **Ground-Water Extraction with Liquid-Phase Carbon Treatment and Discharge to the POTW (pumping at 20-40 gpm in Area 2)**

Extract ground water from beneath Area 2 and treat with activated carbon. Discharge treated ground water to the POTW. Intrinsic remediation with monitoring downgradient of containment provided by the extraction well.

GW #4 **Ground-Water Extraction with UV Oxidation Treatment and Discharge to the POTW (pumping at 20-40 gpm in Area 2)**

Extract ground water from beneath Area 2 and treat with ultra-violet light to destroy contaminants. Discharge treated ground water to the POTW. Intrinsic remediation with monitoring downgradient of containment provided by the extraction well.

GW #5 **In-Situ Oxidation in Area 2**

Inject hydrogen peroxide into source area – at least two applications. Intrinsic remediation with monitoring downgradient of treated area.

3.4 Preliminary Evaluation and Screening of Alternatives

Technologies and remedial alternatives that remain after analyses and screening in Section 3.3 are evaluated against the short- and long-term aspects of three broad criteria: effectiveness, implementability, and cost. Potential alternatives are screened based on these evaluation criteria to arrive at a more manageable number of remedies for detailed evaluation. Only the alternatives judged as the best or most promising on the basis of this evaluation are retained for further consideration and evaluation.

Cost

This phase of the Feasibility Study estimates the cost of each potential remedial alternative to provide a basis for evaluation. Costs evaluated in this section include short-term capital costs, which generally include those costs incurred during the initial remedial action, and longer-term operation and maintenance (O&M) costs, which are incurred over the life of remediation. A present worth analysis is performed to allow for comparison of different remedial action alternatives on the basis of

a single figure for each alternative. Alternatives with significantly higher costs which provide results similar to those of less expensive alternatives may be screened out.

Effectiveness

Alternatives are evaluated with respect to their effectiveness in protecting human health and the environment. This evaluation includes a general assessment of the reduction in toxicity, mobility, or volume that the alternative is expected to achieve. Both short-term effectiveness and long-term effectiveness will be evaluated.

Implementability

Implementability, encompassing both the technical and administrative feasibility of constructing, operating and maintaining a remedial action alternative is evaluated for each potential alternative. The evaluation takes into consideration the reliability of the alternative, feasibility for location and conditions, and the applicability of the remedy to problems at the Site.

The results of the alternative screening are presented in Table 9. The following presents a discussion of screening considerations for the remedial alternatives and identifies those alternatives that have been retained.

GW #1 – No Action – is retained to serve as a baseline for other alternatives.

GW #2 – Ground-Water Extraction with Air Stripping and Intrinsic Remediation Downgradient of Area 2– is retained as an alternative. Site hydrogeology is such that ground-water extraction should create a fairly large zone of capture at relatively low flow rates (e.g., 20 to 40 gpm), making it possible for an extraction well in Area 2 to contain migration of the contaminant source and allowing downgradient portions of the VOC plume to attenuate. At the same time, extraction of ground water in Area 2 would reduce toxicity, mobility and volume of contaminants, thereby mitigating future threats to human health and the environment. Air stripping is a transfer technology that directs volatile contaminants from extracted water to air, producing off-gas. Pre-design studies would identify the desirability and/or necessity of treating off-gas through vapor-phase

carbon. Due to the possible presence of DNAPL in Area 2, containment via ground-water extraction and treatment could be required for an indefinite period.

GW #3 – Ground-Water Extraction with Liquid-Phase Carbon Treatment and Intrinsic Remediation Downgradient of Area 2– is retained as an alternative. Screening considerations for GW #3 are the same as for GW #2, except that air treatment would not be required.

GW #4 – Ground-Water Extraction with UV/Oxidation Treatment and Intrinsic Remediation Downgradient of Area 2– is not retained as an alternative. Higher costs are expected for installation and operation and maintenance of the UV/Oxidation system without greater protectiveness being provided relative to GW #2 and GW #3.

GW #5 – In-Situ Oxidation (Hydrogen Peroxide Injection) and Intrinsic Remediation Downgradient of Area 2 – is retained as an alternative. GW #5 has the potential to significantly reduce toxicity, mobility and volume of contaminants in within a reasonable time frame (weeks to months), and remove potential DNAPL that acts as a persistent source of dissolved VOCs within and downgradient of Area 2.

4.0 DETAILED ANALYSIS OF REMEDIAL ACTION ALTERNATIVES

This section provides a detailed evaluation and comparison of remedial alternatives retained through preliminary screening in section 3.4. The evaluation includes detailed descriptions of each alternative, assessments of the alternatives with respect to nine evaluation criteria described below, and a comparison of the alternatives.

The nine evaluation criteria developed by the EPA and adopted by the state of New York (6 NYCRR 375-1.10) for detailed analysis of remedial alternatives follow:

1. **Short-Term Effectiveness** – This criterion assess the effects of the alternative during Construction and implementation – until remedial response objectives are met. Factors that are addressed include potential risks to workers and the community, potential adverse environmental impacts resulting from the implementation of the alternative, and estimated times for remedial response objectives to be achieved.

2. **Long-Term Effectiveness and Permanence** – Alternatives are assessed based on long-term effectiveness and permanence as well as to the degree of certainty that the remedy will prove successful. This assessment includes an evaluation of risks, which remain following completion of remedial activities and an assessment of the adequacy and long-term reliability of controls, if any, that will be used to manage any untreated wastes that remain at the Site.

3. **Reduction of Toxicity, Mobility or Volume** – The degree to which alternatives employ treatment that reduces toxicity, mobility or volume of contaminants are assessed. The evaluation will focus on the amount of hazardous materials that will be destroyed or treated, the degree of expected reduction in toxicity, mobility of volume, the irreversibility of the treatment, and the type and quantity of residuals that will remain following treatment.

4. **Implementability** – Implementability of each alternative is be assessed with respect to technical feasibility, administrative feasibility, and the availability of services and materials. The reliability and potential technical difficulties associated with each alternative will be addressed as well as the ability to obtain necessary permits, equipment and personnel to implement the alternative.

5. **Cost** – General costs associated with each alternative are assessed. Costs include direct and indirect capital costs, operation and maintenance costs, and any future costs.

6. **Compliance with ARARs** – Alternatives are assessed as to whether they attain legally applicable or relevant and appropriate requirements of state and federal environmental and public health laws.

7. **Overall Protection of Human Health and the Environment** – Alternatives are assessed to determine whether they provide adequate protection of human health and the environment. The evaluation is based on factors assessed under other evaluation criteria, including short-term effectiveness, long-term effectiveness and permanence, and compliance with ARARs

8. **Community Acceptance** – To the extent possible, community acceptance of each alternative is assessed. Community acceptance will be more fully evaluated following review and comment of the Focused Ground-Water Feasibility Study.

4.1 Alternative GW #1: No Action

4.1.1 Description

Under this alternative, no action would be taken to remediate contaminated ground water at the Site. The contaminant plume will eventually attenuate as the source is depleted. However, the potential presence of DNAPL beneath Area 2 suggests that a source to ground-water contamination could be present for a long time (decades), and that attainment of remedial action objective concentrations would not occur within what is generally considered a reasonable time frame.

4.1.2 Assessment

Short-Term Effectiveness

Under circumstances that an exposure pathway for ground water is developed within contamination derived from Area 2, the No Action alternative would not decrease risks to human health over the short term. Since the alternative involves no construction or implementation activities, the alternative would pose no adverse environmental impacts or risks to workers or community health.

As described in section 4.1.1, the No Action alternative could take decades before contaminant concentrations are reduced to Site-specific cleanup levels.

Long-Term Effectiveness and Permanence

The No Action alternative would provide a permanent solution to ground-water contamination. Upon significant attenuation within and downgradient of the source area, risks remaining after completion of the remedy would be acceptable. As noted in section, the time required to achieve a permanent solution will be likely to encompass decades.

Reduction of Toxicity, Mobility or Volume

Reduction of toxicity, mobility or volume would occur under a no action alternative, but at a slow rate.

Implementability

No remediation or action is undertaken for this alternative.

Compliance with ARARs

As described in section 2.3.1, Site conditions will likely preclude meeting chemical-specific ARARs. Remedial action goals will therefore consist of Site-specific cleanup levels. Nevertheless, the No action alternative is unlikely to meet Site-specific cleanup levels within a reasonable time frame.

Cost

Cost is not applicable to the No Action alternative.

Overall Protection of Human Health and the Environment

As reduction in the mobility, toxicity or volume of contaminants is negligible and chemical-specific ARARs are not met, the No Action alternative affords minimal protection to human health and the environment. Until concentrations attenuate over time, human health risk to future ground-water users will remain static.

Community Acceptance

The community would likely find the No Action alternative unacceptable as it does not conform to ARARs and does not provide protection to human health or the environment.

4.2 Alternative GW #2: Ground-Water Extraction with Air Stripping Treatment and Discharge to the POTW and Intrinsic Remediation of the Plume Downgradient from Area 2

4.2.1 Description

This alternative involves extraction of ground water from a pumping well screened in Area 2 and treatment of water using air stripping technology. The extraction well would create hydraulic

containment within the source area, allowing intrinsic remediation of VOCs downgradient from Area 2 to occur. Based on physical characteristics of the aquifer determined during the IRM Investigation and Focused Ground-Water Investigation, and considering the limited areal extent of high concentrations (i.e., >1,000 ug/L) beneath the former leaching pool in Area 2, a single extraction well is expected to achieve a sufficient radius of capture to contain the source area while pumping at a rate of 20 to 40 gpm..

A packed column or low-profile tray stripper would be capable of treating ground water extracted by the well. Treated water would be discharged to the POTW in compliance with a discharge permit. To the extent necessary or desirable, vapor-phase carbon would be used to treat off-gases.

Upon achieving source area containment in Area 2, dispersion and biodegredation is anticipated to cause substantial reduction of VOC concentrations downgradient of Area 2 within one year. The presence or absence of DNAPL beneath Area 2 will have significant influence on the time required to reduce VOC concentrations to Site-specific cleanup goals within the source area. Cleanup could take a year or a few years in the absence of DNAPL, or decades in the presence of DNAPL. Increases in hydraulic gradient due to pumping could increase concentrations of VOCs migrating from upgradient sources, thereby potentially influencing the time required to establish background concentrations and/or the time required to achieve cleanup.

Periodic system and ground-water sampling would be conducted to monitor contaminant concentrations and to assess the effectiveness of the remedial action.

This alternative involves the following major work activities:

1. siting and installing an extraction well within Area 2;
2. installing an air stripping system on-Site; and
3. piping the system to an appropriate discharge location for treated water.

The extraction well would preferentially be installed as near to the location that the highest concentrations of VOCs were detected during past investigation – beneath the former leaching pool. The well would be screened to a depth of at least the depth to which VOCs were detected during the Focused Ground-Water Investigation, or approximately 140 feet below grade.

The air stripping treatment system would be designed or modified based on findings from a pilot test using the new extraction well. Important information to be gained from the test would include appropriate extraction rate(s) for the well and corresponding zones of capture, and influent VOC concentrations and concentration ranges.

System piping would be laid out such that access around Area 2 is unimpeded and continued operation of the SVE system is not disturbed.

4.2.2 Assessment

Short-Term Effectiveness

No adverse impacts to the community are anticipated during implementation of this remedy. Risks to workers at the Site are associated with well installation and trench construction. These risks include exposures to contaminants via inhalation of dusts and vapors and dermal contact with contaminated media. Dust suppressants and/or windscreens would be used to reduce fugitive dust emissions when appropriate.

Environmental impacts from implementation of this alternative include dust emissions during well installation and trench excavation. If necessary, dust control measures could be implemented. Treated ground water would be piped directly to the a buried sewer so exposures to any untreated contaminants in water would be eliminated. Air emissions from the stripping towers would be treated as necessary to acceptable quality standards.

The alternative meets the objectives of reducing contaminant concentrations within and downgradient of Area 2 to Site-specific cleanup levels. Reduction of contaminant concentrations downgradient of Area 2 to Site-specific cleanup levels is expected to take between one and a few

years. The time period for achievement of cleanup within Area 2 is dependent upon the presence or absence of DNAPL, and may take years to decades.

Long-Term Effectiveness and Permanence

Ground-water extraction, air stripping and discharge of treated water is effective over the long term as the treatment permanently removes contaminants from ground water. Upon reduction of contaminant concentrations to below Site-specific cleanup levels, the remedy will be permanent.

The intrinsic remediation component of GW #2 would provide a permanent solution to ground-water contamination. Upon significant attenuation within and downgradient of the source area it is anticipated that acceptable risk to human health and the environment will be attained.

Reduction of Mobility, Toxicity, or Volume

Treatment of contaminated ground water via air stripping and, if necessary, vapor-phase carbon for of-gases, permanently reduces mobility, toxicity and volume of contaminants in the ground water. Further reduction of contaminant mobility within Area 2 would occur due to hydraulic containment produced by the extraction well.

Following initiation of containment within Area 2, the mobility of contaminants downgradient of Area 2 is not likely to increase, and, due to a cessation of contaminants entering the plume, will probably decrease. During the one-time period of attenuation, volume is likely to decrease through biodegradation. Furthermore, mother products PCE and TCE have been observed to degrade into less toxic daughter products: vinyl chloride, a highly toxic product of many chlorinated hydrocarbon biodegradation chains, has never been detected on the Site.

Implementability

Air stripping is a proven and reliable treatment technology for removing VOCs from ground water. Properly designed treatment systems commonly achieve 99.9% and greater removal efficiencies when treating the chlorinated VOCs detected at the Site. Services and technologies necessary to implement this technology are readily available.

An additional ground-water remedial action that may be necessary in conjunction with this alternative includes vapor-phase carbon adsorption of off-gases. This action would be easily added to the remedial alternative if required.

Periodic sampling of wells located on the Site would monitor effectiveness of the remedy. This monitoring would verify the effectiveness of the treatment systems and track reduction of plume volume and concentration.

Cost

Estimated costs for this alternative are provided below. Operation and maintenance costs are based on a 20-year period of operation.

Item	Estimated Cost
Total Direct Capital Costs	$120,000
Total Indirect Capital Costs	$60,000
Subtotal	*$180,000*
Cost Contingency	$18,000
Overhead & Profit	$18,000
Total Capital Costs	*$216,000*
Total Present Worth O&M Costs ($25,000/year annual O&M) Based on 5% rate of return over 20 years (A/P, i%,n) (A/P, 5, 20) P = $25,000 (12.462 (taken from compound interest tables)) P =	$312,000
Total Costs for GW #2	***$528,000***

Total additional costs associated with the use of vapor-phase carbon to eliminate air stripper off-gas emissions are $120,000. The total includes capital costs and present worth O&M costs.

Compliance with ARARs

As described in section 2.3.1, Site conditions will likely preclude meeting chemical-specific ARARs. Remedial action goals will therefore consist of Site-specific cleanup levels, to be determined during Remedial Action.

Overall Protection of Human Health and the Environment

Ground-water alternative GW #2 would reduce risks to human health and the environment associated with a future completed exposure pathway for ground-water ingestion. The short-term effectiveness evaluation determined that there would be no adverse impacts to the community during implementation. Most adverse environmental impacts and risks to workers could be controlled by implementation of appropriate safety measures and control technologies as described in the short-term evaluation. The air stripping technology permanently removes contaminants, providing long-term effectiveness and permanence. Finally, the alternative should attain Site-specific cleanup levels. In consideration of the above evaluation criteria, ground-water alternative GW #2 provides good overall protection of human health and the environment.

Community Acceptance

The community would likely find ground-water alternative GW #2 acceptable as it provides good overall protectiveness to human health and the environment.

4.3 Alternative GW #3: Ground-Water Extraction with Liquid-Phase Carbon Treatment and Discharge to the POTW and Intrinsic Remediation of the Plume Downgradient from Area 2

4.3.1 Description

Alternative GW #3 would involve extraction of contaminated ground water followed by carbon adsorption and discharge of treated water to the POTW. The extraction well would create hydraulic containment within the source area, allowing intrinsic remediation of VOCs downgradient from Area 2 to occur, as described in Section 4.2.1. The configuration of the system would be very similar to that of ground-water alternative GW #2, with the only significant difference being the method of treatment of extracted ground water.

4.3.2 Assessment

Short-Term Effectiveness

Evaluation results are the same as described for alternative GW #2.

Long-Term Effectiveness and Permanence

Evaluation results are the same as described for alternative GW #2, except that spent carbon will be removed for off-Site regeneration and/or disposal, ensuring that no risks associated with treatment residuals will exist on-Site following remediation.

Reduction of Mobility, Toxicity, or Volume

Evaluation results are the same as described for alternative GW #2.

Implementability

Carbon adsorption is a well proven technology for removing VOCs from ground water, and the services and technologies necessary to implement this technology are readily available. Evaluation results for implementability are otherwise the same as described for alternative GW #2.

Cost

Estimated costs for this alternative are provided below. Operation and maintenance costs are based on a 20-year period of operation.

Item	Estimated Cost
Total Direct Capital Costs	$120,000
Total Indirect Capital Costs	$60,000
Subtotal	*$180,000*
Cost Contingency	$18,000
Overhead & Profit	$18,000
Total Capital Costs	*$216,000*
Total Present Worth O&M Costs ($30,000/year annual O&M) Based on 5% rate of return over 20 years (A/P, i%,n) (A/P, 5, 20) P = $30,000(12.462 (taken from compound Interest tables)) P =	$374,000
Total Costs for GW #3	***$590,000***

Compliance with ARARs

Evaluation results are the same as described for alternative GW #2.

Overall Protection of Human Health and the Environment.

Evaluation results are the same as described for alternative GW #2.

Community Acceptance

Evaluation results are the same as described for alternative GW #2.

4.4 Alternative GW #5: In-Situ Oxidation (hydrogen peroxide injection) and Intrinsic Remediation of the Plume Downgradient from Area 2

4.4.1 Description

Alternative GW #5 is an innovative remediation technology that would involve installing carbon steel application wells in the vicinity of the former leaching pool in Area 2 , injecting hydrogen peroxide at controlled flows into the source area, and thereby inducing oxidation-reduction reactions that degrade organic contaminants in ground water and saturated soil. The technology involves the application of a Fenton-like chemistry to create and migrate hydroxyl radicals, which in turn degrade organic contamination into carbon dioxide and water. Alternative GW #5 has demonstrated cleanup not only of VOCs dissolved in ground water and adsorbed to saturated soils, but also destruction of DNAPL.

The radius of effective treatment around an application well is expected to be on the order of 15 to 20 feet in granular soil textures found at the Site. Well screen lengths would be fifteen feet. In order to achieve sufficient vertical and horizontal coverage of the source area beneath the leaching pool, three well clusters of six application wells each would be installed, with the deepest well extending approximately 90 feet below the water table. Progressively more shallow application wells would be screened at even intervals above the deepest well such that the shallowest well crosses the water table. One of the well clusters would be positioned directly beneath the leaching pool in Area 2, and the other clusters would be located downgradient of the leaching pool.

During application well installation, saturated soil and ground-water samples would be collected for bench testing to identify appropriate reagent dosage amounts and confirm that the in-situ treatment technology will be capable of lowering pH to a desired range that will allow effective oxidation of contamination. Treatment efficiency measured during bench testing would also be used to confirm whether multiple rounds of reagent application would be required during field application.

Following application well installation, ground-water samples would be collected from the new and existing wells and analyzed for VOCs to provide a set of baseline concentration with which to compare treatment effectiveness.

Two cycles of reagent application would take place, with each application occurring over an approximately two-week period. Following the second round of treatment, a round of samples would be collected at all Site monitoring wells to evaluate effectiveness of the remedial technology and identify the need for additional application(s). Altogether, the time required to complete in-situ oxidation is anticipated to be from six to eight months.

Following cleanup of the source area using in-situ oxidation, intrinsic remediation would occur in ground water downgradient of Area 2. Dispersion and biodegradation is anticipated to cause substantial reduction of VOC concentrations downgradient of Area 2 within one year.

Periodic ground-water sampling would be conducted over a two-year period to evaluate the permanence of in-situ treatment. Periodic monitoring would also be conducted in wells downgradient of Area 2 to track the progress of intrinsic remediation.

4.4.2 Assessment

Short-Term Effectiveness

No adverse impacts to the community are anticipated during implementation of this remedy. Risks to workers at the Site are associated with application well installation and handling hydrogen peroxide. These risks include exposures to contaminants via inhalation of dusts and vapors, dermal contact with contaminated media, and hazards inherent to handling hydrogen peroxide. Dust

suppressants and/or wind screens would be used to reduce fugitive dust emissions when appropriate. OSHA, RCRA and Air Quality regulations will also be met to address these risks . Finally, only personnel trained in the handling of hydrogen peroxide will participate in the injection process.

Environmental impacts from implementation of this alternative include dust emissions during application well installation and potential generation of heat and inert gases during the hydrogen peroxide injection process. If necessary, dust control measures could be implemented during application well installation. Work-area perimeter control will be exercised during hydrogen peroxide injection. Bench scale testing will have provided a basis for the appropriate volume and rate of reagent to be added to ground water. Buffering between the water table and the water table combined with applicable reagent injection techniques is not expected to result in noticeable changes in temperature and is therefore not anticipated to result in negative environmental impacts.

Alternative GW #5 meets the objectives of reducing contaminant concentrations within and downgradient of Area 2. Reduction of contaminant concentrations downgradient of Area 2 is anticipated to occur within a year to over a few years. The time period for achievement of cleanup in Area 2 is anticipated to be six to eight months.

Long-Term Effectiveness and Permanence

In-situ oxidation is effective over the long term as the treatment permanently removes contaminants from ground water. Upon reduction of contaminant concentrations to below Site-specific cleanup levels, the remedy will be permanent. However, as noted for the above remedies, potential sources of VOCs upgradient of the Site could influence establishment and achievement of Site-specific cleanup levels.

The intrinsic remediation component of GW #5 would provide a permanent solution to ground-water contamination. Upon significant attenuation within and downgradient of the source area, risks remaining after completion of the remedy would be acceptable.

Reduction of Mobility, Toxicity, or Volume

Treatment of contaminated ground water using in-situ oxidation permanently reduces mobility, toxicity and volume of contaminants in the ground water. Following completion of in-situ oxidation in Area 2, the mobility of contaminants downgradient of Area 2 is not likely to increase, and, due to a cessation of contaminants entering the plume, will probably decrease. During the period of intrinsic remediation, volume is likely to decrease through biodegradation. Furthermore, mother products PCE and TCE have been observed to degrade into less toxic daughter products: vinyl chloride, a highly toxic product of many chlorinated hydrocarbon biodegradation chains, has never been detected on the Site.

Implementability

In-situ oxidation is an innovative technology. Nevertheless, it has been used at over 100 contaminated sites and has demonstrated effectiveness in destroying organic compounds in ground water, adsorbed to saturated soil, and as DNAPL. Site conditions are particularly amenable to use of the technology as the sandy, relatively homogeneous aquifer would promote relative large effective radii of treatment from application wells. The source area in ground water is also well constrained, allowing for focused efforts in the destruction of VOCs.

Services and equipment for in-situ oxidation will be provided by specialty contractors. These contractors will be on-Site during duration of injection activities.

Costs

Estimated costs for this alternative are provided below. Operation and maintenance costs are based on two years of ground-water monitoring within Area 2 following completion of in-situ oxidation and five years of ground-water monitoring downgradient of Area 2 for intrinsic remediation.

Item	Estimated Cost
Total Direct Capital Costs	$160,000
Total Indirect Capital Costs	$80,000
Subtotal	*$240,000*
Cost Contingency	$24,000

Overhead & Profit	$24,000
Total Capital Costs	*$288,000*
Total Present Worth O&M Costs	
($13,000/year annual O&M)	
Based on 5% rate of return over 5 years	
(A/P, i%,n)	
(A/P, 5, 5)	
P = 13,000 (4.329 taken from compound interest tables)	
P =	$56,000
Total Costs for GW #5	***$344,000***

Compliance with ARARs

As described in section 2.3.1, Site conditions will likely preclude meeting chemical-specific ARARs. Remedial action goals will therefore consist of Site-specific cleanup levels, to be determined during Remedial Action.

Overall Protection of Human Health and the Environment

Alternative GW #5 would reduce risks to human health and the environment associated with a future completed exposure pathway for ground-water ingestion. The short-term effectiveness evaluation determined that there would be no adverse impacts to the community during implementation. Most adverse environmental impacts and risks to workers could be controlled by implementation of appropriate safety measures and control technologies as described in the short-term evaluation. In-situ oxidation degrades contaminants into carbon dioxide and water, generates no waste streams requiring treatment or disposal, and therefore, in conjunction with intrinsic remediation downgradient of Area 2, provides long-term effectiveness and permanence. The alternative should be able to attain Site-specific cleanup levels. In consideration of the above evaluation criteria, alternative GW #5 provides good overall protection of human health and the environment.

Community Acceptance

The community would likely find ground-water alternative GW #5 acceptable as it provides good overall protectiveness to human health and the environment.

5.0 COMPARATIVE EVALUATION OF REMEDIAL ALTERNATIVES

This section presents a comparative analysis of the remedial alternatives evaluated in section 4 to assess the relative performance of each alternative in relation to the specific evaluation criteria described in at the beginning of section 4.

5.1 Short-Term Effectiveness

GW #1: No Action – This alternative is evaluated throughout the Feasibility Study in compliance with the NCP to serve as a baseline for comparison with other alternatives. The alternative does not offer short-term protection to human health or the environment. Due to the potential presence of DNAPL in Area 2 and continued contribution of contaminants to ground water, GW #1 is not likely to attain Site-specific cleanup levels within a reasonable period of time.

GW #2: Ground-Water Extraction with Air Stripping Treatment and Discharge to the POTW and Intrinsic Remediation of the Plume Downgradient from Area 2 – This is effective in the short term. Implementation may result in increased direct contact and inhalation risks to Site workers associated with well installation and trenching, but these risks would be addressed through control measures and adherence to appropriate OSHA, RCRA and Air Quality regulations. Adverse environmental impacts associated with air stripper emissions can be controlled if necessary with vapor-phase carbon. No adverse impacts to the community are anticipated as a result of implementing GW #2. The time period required for attainment of Site-specific cleanup levels in Area 2 is dependent upon the presence or absence of DNAPL, and may take years to decades. Reduction of concentrations for contaminants of concern downgradient of Area 2 to Site-specific cleanup levels is expected to take between one and a few years. Short-term effectiveness of GW #2 is essentially the same as that of GW #4.

GW #3: Ground-Water Extraction with Liquid-Phase Carbon Treatment and Discharge to the POTW and Intrinsic Remediation of the Plume Downgradient from Area 2 – This alternative will have the same short-term effectiveness as GW #2, except that treatment of air emissions will not

be necessary. Cleanup of contaminated ground water will take the same amount of time for GW #3 as for GW #2.

GW #5: In-Situ Oxidation (hydrogen peroxide injection) and Intrinsic Remediation of the Plume Downgradient from Area 2 – This alternative is effective in the short term, and has the same considerations for risk to Site workers for well installation as for GW #2 and GW #3. Potential risk also exists for workers handling hydrogen peroxide. Potential impacts to the environment also exist with respect to injection of the reagent into ground water. Work area perimeter control, use of trained personnel, appropriate application of the technology and adherence to applicable health and safety guidelines would minimize potential risks to workers and impacts to the environment. No adverse impacts to the community are anticipated as a result of implementing GW #5. The estimated time period required for attainment of Site-specific cleanup levels in Area 2 is considerably less than for GW #2 and GW #3, ranging from six to eight months. Time required for reduction of contaminant concentrations downgradient of Area 2 to Site-specific cleanup levels is expected to be similar to GW #2 and GW #3.

5.2 Long-Term Effectiveness and Permanence

GW #1: No Action – This alternative will likely not provide a permanent solution within a reasonable time frame, particularly if DNAPL exists in Area 2. Risks to human health and the environment associated with a future completed exposure pathway for ground-water ingestion will be decreased in small increments over a very long time period. GW #2 includes no controls to protect human health or the environment.

GW #2: Ground-Water Extraction with Air Stripping Treatment and Discharge to the POTW and Intrinsic Remediation of the Plume Downgradient from Area 2 – This alternative offers both long-term effectiveness and permanence. Following completion of remedial activities, ground-water contaminant concentrations will not exceed Site-specific cleanup levels. Ground-water treatment with air stripping is a permanent remedy since contaminants are permanently and irreversibly removed from the water. The intrinsic remediation component of GW #2 would, given time, also provide a permanent solution to ground-water contamination.

GW #3: Ground-Water Extraction with Liquid-Phase Carbon Treatment and Discharge to the POTW and Intrinsic Remediation of the Plume Downgradient from Area 2 – This alternative offers the same long-term effectiveness and permanence as GW #2. Residual risks and monitoring activities will also be the same.

GW #5: In-Situ Oxidation (hydrogen peroxide injection) and Intrinsic Remediation of the Plume Downgradient from Area 2 – This alternative offers the same long-term effectiveness and permanence as GW #2 and GW #3. Monitoring of performance would be conducted during the application process and periodically after completion of application in Area 2. Monitoring of intrinsic remediation would be the same as for GW #2 and GW #3.

5.3 Reduction of Toxicity, Mobility or Volume

GW #1: No Action – This alternative offers no reduction of toxicity, mobility or volume of contaminants within a reasonable time frame.

GW #2: Ground-Water Extraction with Air Stripping Treatment and Discharge to the POTW and Intrinsic Remediation of the Plume Downgradient from Area 2 – Extraction and air stripping reduces the toxicity, mobility and volume of contaminated media by permanently removing contaminants from the ground water. Contaminant toxicity, mobility and volume are also reduced since contamination will quickly degrade in the atmosphere (if emitted directly from the air stripper) or destroyed following carbon regeneration (if collected using vapor-phase carbon). Upon achieving containment of the source area by ground-water extraction, contaminants will no longer enter the plume downgradient of Area 2, and contaminants within that portion of the plume are likely to experience decreased mobility due to sorption processes. During the period of intrinsic remediation, volume and toxicity are likely to decrease through biodegradation of mother products to less toxic daughter compounds.

GW #3: Ground-Water Extraction with Liquid-Phase Carbon Treatment and Discharge to the POTW and Intrinsic Remediation of the Plume Downgradient from Area 2 – This alternative will have the same effects on reduction of toxicity, mobility or volume of contaminants as GW #3.

The primary difference is the removal of contaminants with carbon adsorption rather than air stripping, and the subsequent destruction of those contaminants following carbon regeneration.

GW #5: In-Situ Oxidation (hydrogen peroxide injection) and Intrinsic Remediation of the Plume Downgradient from Area 2 – This alternative will have the same effects on reduction of toxicity, mobility or volume of contaminants as GW #3. The primary difference is the destruction of contaminants in-situ.

5.4 Implementability

GW #1: No Action – This alternative requires no implementation.

GW #2: Ground-Water Extraction with Air Stripping Treatment and Discharge to the POTW and Intrinsic Remediation of the Plume Downgradient from Area 2 – This alternative is easily implemented and uses technologies that are proven and reliable. Services and materials are readily available.

GW #3: Ground-Water Extraction with Liquid-Phase Carbon Treatment and Discharge to the POTW and Intrinsic Remediation of the Plume Downgradient from Area 2 – This alternative is easily implemented and uses technologies that are proven and reliable. Services and materials are readily available. Implementability for GW #3 is essentially the same as for GW #2.

GW #5: In-Situ Oxidation (hydrogen peroxide injection) and Intrinsic Remediation of the Plume Downgradient from Area 2 – This alternative is readily implemented. In-situ oxidation is an innovative technology that has been used at over 100 contaminated sites and has demonstrated effectiveness. Services and equipment for in-situ oxidation will be provided by specialty contractors who will be on-Site during duration of injection activities. Maintenance activities over the first few months of remediation would be frequent. Following completion of in-situ oxidation, maintenance activities for GW #5 would be less frequent, and probably of less duration, than for GW #2 and GW #3.

5.5 Cost

GW #1: No Action – This alternative involves no costs.

GW #2: Ground-Water Extraction with Air Stripping Treatment and Discharge to the POTW and Intrinsic Remediation of the Plume Downgradient from Area 2 – This alternative will cost $528,000. The total cost includes capital and present worth of annual O&M costs based on an operation period of 20 years. Additional costs for addition vapor-phase carbon for treating air stripper emissions is estimated to be $120,000.

GW #3: Ground-Water Extraction with Liquid-Phase Carbon Treatment and Discharge to the POTW and Intrinsic Remediation of the Plume Downgradient from Area 2 – This alternative will cost $590,000. The total cost includes capital and present worth of annual O&M costs based on an operation period of 20 years. Cost is the most significant difference between GW #3 and GW #2, as both alternatives will achieve the same remediation results in the same time period.

GW #5: In-Situ Oxidation (hydrogen peroxide injection) and Intrinsic Remediation of the Plume Downgradient from Area 2 – This alternative will cost $344,000. The total cost includes capital and average present worth of annual O&M costs based on an operation period of 5 years.

5.6 Compliance with ARARs

GW #1: No Action – This alternative does not comply with ARARs and it will not attain Site-specific cleanup levels within a reasonable time frame.

GW #2: Ground-Water Extraction with Air Stripping Treatment and Discharge to the POTW and Intrinsic Remediation of the Plume Downgradient from Area 2 –As described in section 2.3.1, Site conditions will likely preclude meeting chemical-specific ARARs. Remedial action goals will therefore consist of Site-specific cleanup levels, to be determined during Remedial Action.

GW #3: Ground-Water Extraction with Liquid-Phase Carbon Treatment and Discharge to the POTW and Intrinsic Remediation of the Plume Downgradient from Area 2 – Compliance for GW #3 is the same as for GW #2.

GW #5: In-Situ Oxidation (hydrogen peroxide injection) and Intrinsic Remediation of the Plume Downgradient from Area 2 – Compliance for GW #5 is the same as for GW #2 and GW #3.

5.7 Overall Protectiveness of Human Health and the Environment

GW #1: No Action – This alternative affords minimal protection to human health and the environment. Until concentrations attenuate with time, human health risk to future ground-water users will remain static.

GW #2: Ground-Water Extraction with Air Stripping Treatment and Discharge to the POTW and Intrinsic Remediation of the Plume Downgradient from Area 2 –This alternative offers good overall protection of human health and the environment by reducing current contaminant concentrations to Site-specific cleanup levels. No adverse impacts to the community, Site workers or environmental receptors will result from implementation of this alternative.

GW #3: Ground-Water Extraction with Liquid-Phase Carbon Treatment and Discharge to the POTW and Intrinsic Remediation of the Plume Downgradient from Area 2 – This alternative will provide the same overall protection of human health and the environment as GW #2.

GW #5: In-Situ Oxidation (hydrogen peroxide injection) and Intrinsic Remediation of the Plume Downgradient from Area 2 – This alternative will provide similar overall protection of human health and the environment as GW #2. GW #5 is likely to attain Site-specific cleanup levels more quickly than GW #2 or GW #3.

6.0 REFERENCES

A variety of technical documents and publications were referred to during the course of this project. Some of the references consulted are presented below. Referenced documents and publications may or may not have been reviewed in their entirety. The guidelines and procedures presented in the referenced documents and publications have not been strictly adhered to unless otherwise stated.

Anson Environmental Ltd., *Geologic logs for MW-1, MW-2 and MW-3*, April 26, 1994.

Anson Environmental Ltd., *Untitled report to representatives of IMC Magnetics Corp.*, July 21, 1993.

Anson Environmental Ltd., *Closure Plan Implementation, Volume 1*, IMC Magnetics Corp., July 21, 1993.

Anson Environmental Ltd., *Closure Plan, IMC Magnetics Corp.*, December 3, 1993.

Hull & Associates, Inc., *Final Investigation Report for the Investigation and Design of the Interim Remedial Measure for the Vadose Zone*, Inc., February 1997.

Hull & Associates, Inc., *Work Plan for the Investigation and Design of the Interim Remedial Measure for the Vadose Zone*, March 1996.

Hull & Associates, Inc., *Focused Ground-Water Investigation and Focused Ground-Water Feasibility Study Work Plan (Addendum 1)*, April 1998.

Lawler Matusky & Skelly Engineers, *Revised Draft Preliminary Assessment Report*, New Cassel Industrial Area, October, 1994.

Lawler Matusky & Skelly Engineers, *Site Investigation Report*, New Cassel Industrial Area Site, North Hempstead, Nassau County, February 1995.

McDonald, M.G., and A.W. Harbaugh, *A Modular Three-Dimensional Finite Difference Ground-water Flow Model*, U.S. Geological Survey Open-File Report 83-875, 1988.

New York Department of Environmental Conservation, *Order on Consent Index #1-W1-0750-96-02, Site Code #1-30-0434*, Signed on May 6, 1998.

New York State Statutes, *Article 27, Title 13 - Inactive Hazardous Waste Disposal Sites.*

New York State Regulations, *Title 6, Chapter IV, Subchapter B, Part 375 - Inactive Hazardous Waste Disposal Site Remedial Program.*

6.0 REFERENCES

A variety of technical documents and publications were referred to during the course of this project. Some of the references consulted are presented below. Referenced documents and publications may or may not have been reviewed in their entirety. The guidelines and procedures presented in the referenced documents and publications have not been strictly adhered to unless otherwise stated.

Anson Environmental Ltd., *Geologic logs for MW-1, MW-2 and MW-3*, April 26, 1994.

Anson Environmental Ltd., *Untitled report to representatives of IMC Magnetics Corp.*, July 21, 1993.

Anson Environmental Ltd., *Closure Plan Implementation, Volume 1*, IMC Magnetics Corp., July 21, 1993.

Anson Environmental Ltd., *Closure Plan, IMC Magnetics Corp.*, December 3, 1993.

Hull & Associates, Inc., *Final Investigation Report for the Investigation and Design of the Interim Remedial Measure for the Vadose Zone*, Inc., February 1997.

Hull & Associates, Inc., *Work Plan for the Investigation and Design of the Interim Remedial Measure for the Vadose Zone*, March 1996.

Hull & Associates, Inc., *Focused Ground-Water Investigation and Focused Ground-Water Feasibility Study Work Plan (Addendum 1)*, April 1998.

Lawler Matusky & Skelly Engineers, *Revised Draft Preliminary Assessment Report*, New Cassel Industrial Area, October, 1994.

Lawler Matusky & Skelly Engineers, *Site Investigation Report*, New Cassel Industrial Area Site, North Hempstead, Nassau County, February 1995.

McDonald, M.G., and A.W. Harbaugh, *A Modular Three-Dimensional Finite Difference Ground-water Flow Model*, U.S. Geological Survey Open-File Report 83-875, 1988.

New York Department of Environmental Conservation, *Order on Consent Index #1-W1-0750-96-02, Site Code #1-30-0434*, Signed on May 6, 1998.

New York State Statutes, *Article 27, Title 13 - Inactive Hazardous Waste Disposal Sites.*

New York State Regulations, *Title 6, Chapter IV, Subchapter B, Part 375 - Inactive Hazardous Waste Disposal Site Remedial Program.*

Pollock, D. W., *User's Guide for MODPATH/MODPATH-PLOT, version 3: A particle Tracking post-processing package for MODFLOW, the USGS finite difference ground-water model*, U.S. Geological Survey, Open-File Report 94-464, 1994.

U.S. Geological Survey, in cooperation with the Nassau County Department of Public Works, *Geology of the Town of North Hempstead, Nassau County, Long Island, New York.* 1979.

Wiedemeier, M.A., et al., *Overview of the Technical Protocol for Natural Attenuation of Chlorinated Aliphatic Hydrocarbons in Ground Water, Under Development for the U.S. Air Force Center for Environmental Excellence.* Proceedings from the Symposium on Natural Attention of Chlorinated Organics in Ground Water, 1996.

Personal Communications

Personal communication between Joe Jones, New York State Dept. of Environmental Conservation and W. Lance Turley of Hull & Associates, Inc., August 1998.

TABLES

FOCUSED GROUND-WATER FEASIBILITY STUDY
FORMER IMC MAGNETICS FACILITY
WESTBURY, NEW YORK

TABLE 1

SUMMARY INFORMATION FOR THE BOWLING GREEN WELLS

Local Well Number	NYSDEC Well Number	Total Depth (ft)	Top-of-Screen Depth (ft)	Aquifer Screened	Capacity (gpm)	Treatment
1	8956	530	470	Magothy	1,400	Liquid Chlorine (Sodium or Calcium Hypochlorite), Lime, and Air Stripping for VOC Removal
2	8957	584	524	Magothy	1,400	Liquid Chlorine (Sodium or Calcium Hypochlorite), Lime, and Air Stripping for VOC Removal

Focused Ground-Water Feasibility Study
Former IMC Magnetics Facility
Westbury, New York

Table 2

Analytical Data for Bowling Green
Well #1 (NYSDEC Well #8956)

Date (mo./day/yr.)	1,1,1-trichloroethane (µg/l)	1,1-dichloroethane (µg/l)	1,1-dichloroethene (µg/l)	Tetrachloroethene (µg/l)	Trichloroethene (µg/l)
10/06/77	ND	NT	NT	ND	ND
12/07/77	ND	NT	NT	ND	ND
05/10/78	ND	NT	NT	ND	ND
10/31/78	ND	ND	ND	ND	ND
06/19/79	NT	NT	NT	ND	NT
08/09/79	ND	NT	NT	NT	ND
03/13/80	ND	NT	NT	NT	NT
02/09/81	ND	NT	NT	ND	ND
08/04/81	ND	NT	NT	ND	ND
02/04/82	ND	NT	NT	ND	ND
02/25/82	ND	NT	NT	ND	ND
04/15/83	ND	NT	NT	ND	NT
05/05/83	ND	ND	ND	ND	1
05/05/83	ND	NT	NT	ND	ND
08/01/83	ND	ND	ND	ND	ND
08/01/83	ND	ND	ND	ND	ND
08/11/83	ND	ND	ND	ND	ND
09/19/83	ND	ND	ND	ND	3
01/24/84	ND	ND	ND	ND	ND
01/24/84	ND	NT	NT	ND	ND
03/02/84	ND	NT	NT	ND	ND
12/11/84	ND	NT	NT	NT	NT
02/21/85	ND	NT	NT	ND	ND
04/11/85	NT	NT	NT	ND	ND
04/14/86	ND	ND	ND	ND	ND
11/14/86	ND	NT	NT	ND	2
02/09/87	ND	ND	ND	ND	1
09/10/87	ND	ND	ND	ND	1
10/30/87	ND	NT	NT	ND	2
11/24/87	ND	ND	ND	ND	1
12/22/87	ND	ND	ND	ND	ND
01/22/88	ND	ND	ND	ND	ND
02/25/88	ND	ND	ND	ND	ND
04/26/88	ND	ND	ND	ND	ND
05/30/88	ND	ND	ND	ND	ND
06/29/88	ND	ND	ND	ND	ND
06/30/88	ND	ND	ND	ND	ND
07/27/88	ND	ND	ND	ND	ND
08/29/88	ND	ND	ND	ND	1
09/21/88	ND	ND	ND	NT	NT

Table Continues

Focused Ground-Water Feasibility Study
Former IMC Magnetics Facility
Westbury, New York

Table 2 (Continued)

Analytical Data for Bowling Green
Well #1 (NYSDEC Well #8956)

Date (mo./day/yr.)	1,1,1-trichloroethane (µg/l)	1,1-dichloroethane (µg/l)	1,1-dichloroethene (µg/l)	Tetrachloroethene (µg/l)	Trichloroethene (µg/l)
10/27/88	2	ND	ND	NT	NT
11/30/88	ND	ND	ND	NT	1
12/27/88	ND	ND	ND	NT	1
12/28/88	ND	ND	ND	NT	1
03/20/89	ND	ND	ND	NT	2
06/08/89	ND	ND	ND	1	1
08/29/89	NT	ND	ND	1	ND
11/10/89	NT	NT	NT	1	1
01/09/90	NT	ND	ND	NT	NT
03/09/90	ND	NT	NT	NT	NT
05/30/90	ND	ND	ND	1	ND
06/26/90	ND	ND	ND	1	ND
07/05/90	ND	ND	ND	1	1
07/10/90	1	ND	ND	1	ND
12/10/90	ND	ND	ND	ND	ND
12/14/90	ND	ND	ND	1	ND
03/14/91	ND	ND	ND	2	2
06/11/91	1	ND	1	2	1
09/11/91	1	ND	ND	ND	4
12/03/91	ND	ND	ND	1	ND
03/09/92	ND	ND	ND	1	2
06/11/92	2	NT	NT	2	13
08/14/92	1	ND	2	1	2
09/03/92	ND	ND	ND	1	2
12/02/92	ND	ND	ND	ND	ND
02/11/93	ND	ND	ND	ND	ND
02/16/93	ND	ND	1	1	10
05/11/93	1	ND	ND	1	1
06/09/93	1	ND	1	1	3
09/01/93	1	ND	ND	1	1
10/13/93	2	NT	NT	4	1
03/17/94	ND	NT	NT	3	3
04/05/94	3	1	2	3	2
05/23/94	ND	ND	ND	ND	ND
06/08/94	4	ND	2	3	3
06/16/94	3	ND	2	3	7
07/25/94	5	ND	3	5	3
08/17/94	5	ND	3	6	6
08/24/94	2	ND	1	NT	NT
09/20/94	5	ND	3	NT	NT
10/24/94	5	ND	3	NT	NT
11/15/94	5	ND	3	3	9
12/06/94	5	1	3	3	11
12/22/94	6	1	3	6	6

Table Continues

Focused Ground-Water Feasibility Study
Former IMC Magnetics Facility
Westbury, New York

Table 2 (Continued)

Analytical Data for Bowling Green
Well #1 (NYSDEC Well #8956)

Date (mo./day/yr.)	1,1,1-trichloroethane (µg/l)	1,1-dichloroethane (µg/l)	1,1-dichloroethene (µg/l)	Tetrachloroethene (µg/l)	Trichloroethene (µg/l)
12/14/97	8	1	6	6	30
09/02/97	8	1	5	5	27
06/17/97	9	1	6	6	8
01/16/97	4	1	2	4	12
03/21/98	8	1	5	5	5
06/19/98	10	2	7	6	13
09/09/98	8	2	7	6	31
10/08/98	9	1	8	6	23
03/04/99	8	2	6	7	30

Notes: ND - Results below method detection limit.
NT - Analyte not tested for.

Focused Ground-Water Feasibility Study
Former IMC Magnetics Facility
Westbury, New York

Table 3 .

Analytical Data For Bowling Green
Well # 2 (NYSDEC Well # 8957)

Date (mo./day/yr.)	1,1,1-trichloroethane (µg/l)	1,1-dichloroethane (µg/l)	1,1-dichloroethene (µg/l)	Tetrachloroethene (µg/l)	Trichloroethene (µg/l)
10/6/77	ND	NT	NT	ND	ND
12/2/77	ND	NT	NT	ND	ND
5/3/78	ND	NT	NT	ND	ND
11/1/78	ND	ND	ND	ND	ND
8/9/79	ND	NT	NT	ND	ND
11/14/79	ND	NT	NT	NT	NT
3/13/80	NT	NT	NT	ND	ND
9/18/80	ND	NT	NT	NT	NT
2/9/81	NT	NT	NT	ND	ND
4/24/81	ND	NT	NT	NT	NT
7/24/81	NT	NT	NT	ND	ND
11/25/81	ND	NT	NT	NT	NT
2/25/82	NT	NT	NT	ND	ND
10/18/82	ND	NT	NT	ND	NT
4/15/83	NT	NT	NT	ND	ND
4/26/83	ND	NT	NT	NT	NT
5/5/83	ND	NT	NT	ND	ND
8/1/83	ND	ND	ND	ND	ND
8/1/83	ND	ND	ND	ND	ND
8/11/83	ND	ND	ND	ND	ND
9/15/83	ND	NT	NT	NT	NT
9/22/83	NT	ND	ND	ND	ND
3/2/84	ND	NT	NT	ND	ND
7/18/84	NT	ND	ND	ND	ND
1/28/85	ND	NT	NT	ND	ND
2/6/85	ND	ND	ND	ND	ND
11/25/85	ND	NT	NT	NT	NT
1/29/86	NT	ND	ND	ND	ND
12/4/86	ND	NT	NT	ND	ND
1/30/87	ND	ND	ND	ND	ND
9/10/87	ND	ND	ND	ND	ND
10/30/87	ND	NT	NT	ND	ND
11/24/87	NT	ND	ND	ND	ND
12/22/87	NT	ND	ND	ND	ND
1/22/88	ND	ND	ND	ND	ND
2/25/88	ND	ND	ND	ND	ND
4/26/88	ND	ND	ND	ND	ND
5/10/88	ND	ND	ND	ND	ND
6/6/88	ND	ND	ND	ND	ND
6/29/88	ND	ND	ND	ND	ND
6/30/88	ND	ND	ND	ND	ND

Table Continues

Focused Ground-Water Feasibility Study
Former IMC Magnetics Facility
Westbury, New York

Table 3 (Continued)

Analytical Data For Bowling Green
Well # 2 (NYSDEC Well # 8957)

Date (mo./day/yr.)	1,1,1-trichloroethane (µg/l)	1,1-dichloroethane (µg/l)	1,1-dichloroethene (µg/l)	Tetrachloroethene (µg/l)	Trichloroethene (µg/l)
7/27/88	ND	ND	ND	ND	ND
8/29/88	ND	ND	ND	ND	ND
9/21/88	ND	ND	ND	ND	ND
10/27/88	ND	ND	ND	ND	ND
11/30/88	ND	ND	ND	ND	ND
12/28/88	ND	NT	NT	ND	ND
3/22/89	ND	ND	ND	ND	2
4/6/89	ND	ND	ND	ND	2
6/8/89	ND	ND	ND	ND	2
8/29/89	ND	ND	ND	ND	1
11/10/89	ND	ND	ND	ND	1
2/14/90	ND	ND	ND	ND	1
3/26/90	ND	ND	ND	ND	ND
5/30/90	ND	ND	ND	ND	ND
6/27/90	ND	ND	ND	ND	1
7/5/90	ND	ND	ND	ND	1
12/11/90	ND	ND	ND	ND	ND
12/14/90	ND	ND	ND	ND	ND
1/23/91	ND	ND	ND	ND	2
3/14/91	ND	ND	ND	ND	2
4/4/91	ND	ND	ND	ND	2
6/11/91	ND	ND	ND	ND	2
9/11/91	ND	ND	ND	ND	ND
12/3/91	ND	ND	ND	1	ND
3/9/92	ND	ND	ND	1	6
6/11/92	ND	ND	ND	ND	1
9/3/92	ND	ND	ND	ND	9
9/8/92	1	ND	ND	1	8
5/11/93	1	ND	ND	ND	4
6/9/93	ND	ND	1	1	8
9/1/93	1	ND	ND	ND	8
10/13/93	NT	ND	ND	1	13
3/17/94	NT	ND	ND	ND	8
4/5/94	1	ND	1	ND	10
5/23/94	1	ND	ND	1	13
6/8/94	ND	ND	ND	ND	4
6/16/94	1	ND	ND	1	12
7/25/94	1	ND	ND	ND	14
8/17/94	1	ND	1	2	20
8/24/94	1	ND	ND	1	13
9/20/94	1	ND	1	1	16
10/24/94	1	ND	1	1	18
11/15/94	ND	ND	ND	ND	8
12/6/94	ND	ND	ND	ND	7
12/22/94	1	ND	1	1	23

Table Continues

Focused Ground-Water Feasibility Study
Former IMC Magnetics Facility
Westbury, New York

Table 3 (Continued)

Analytical Data For Bowling Green
Well # 2 (NYSDEC Well # 8957)

Date (mo./day/yr.)	1,1,1-trichloroethane (µg/l)	1,1-dichloroethane (µg/l)	1,1-dichloroethene (µg/l)	Tetrachloroethene (µg/l)	Trichloroethene (µg/l)
12/17/97	ND	ND	ND	ND	5
9/2/97	1	ND	1	2	20
6/17/97	1	ND	ND	1	21
1/16/97	1	ND	1	1	24
3/22/98	1	ND	ND	2	23
6/19/98	1	ND	ND	2	23
9/9/98	1	ND	2	3	26
10/8/98	1	ND	1	3	42
3/4/99	1	ND	ND	1	13

Notes: ND - Results below method detection limit.
NT - Analyte not tested for.

FOCUSED GROUND-WATER FEASIBILITY STUDY
FORMER IMC MAGNETICS FACILITY
WESTBURY, NEW YORK

TABLE 4

SUMMARY INFORMATION FOR THE WESTBURY WATER DISTRICT WELLS

Local Well Number	NYSDEC Well Number	Total Depth (ft)	Top-of-Screen Depth (ft)	Aquifer Screened	Capacity (gpm)	Treatment
9	2602	853	760	Lloyd	950	Chlorination, Emergency: Liquid Chlorine (Sodium or Calcium Hypochlorite),Corrosion Control: Caustic Soda
12	5655	255	205	Magothy	1,050	Chlorination, Emergency: Liquid Chlorine (Sodium or Calcium Hypochlorite),Corrosion Control: Caustic Soda
12A	6819	265	215	Magothy	1,050	Chlorination, Emergency: Liquid Chlorine (Sodium or Calcium Hypochlorite),Corrosion Control: Caustic Soda
16	8497	539	456	Magothy	1,400	Chlorination, Emergency: Liquid Chlorine (Sodium or Calcium Hypochlorite),Corrosion Control: Caustic Soda

Focused Ground-Water Feasibility Study
Former IMC Magnetics Facility
Westbury, New York

Table 5

Analytical Data For Westbury
Water District Well # 12 (NYSDEC Well # 8957)

Date (mo./day/yr.)	1,1,1-trichloroethane (µg/l)	1,1-dichloroethane (µg/l)	1,1-dichloroethene (µg/l)	Tetrachloroethene (µg/l)	Trichloroethene (µg/l)
4/30/86	1	1	ND	ND	ND
5/13/87	NT	NT	NT	ND	ND
6/23/87	ND	ND	ND	ND	ND
9/2/87	4	1	ND	ND	ND
3/2/88	1	1	ND	ND	ND
5/11/88	2	1	ND	ND	ND
11/8/88	NT	1	ND	ND	ND
2/8/89	NT	ND	ND	ND	ND
5/10/89	1	1	ND	ND	ND
8/9/89	ND	ND	ND	ND	ND
11/21/89	ND	ND	ND	ND	ND
2/14/90	1	1	ND	ND	ND
5/22/90	1	0	ND	ND	ND
7/17/90	1	1	ND	ND	ND
7/25/90	1	1	1	ND	ND
8/7/90	2	1	ND	ND	ND
11/13/90	1	1	ND	ND	ND
2/11/91	1	1	ND	ND	ND
5/14/91	1	1	ND	ND	ND
5/21/91	2	1	ND	ND	1
8/20/91	2	2	ND	ND	1
11/20/91	1	1	ND	ND	1
12/26/91	1	2	ND	ND	1
2/11/92	1	1	ND	ND	ND
5/5/92	ND	ND	ND	ND	ND
8/11/92	2	1	ND	ND	1
11/17/92	2	2	ND	1	2
2/2/93	ND	ND	ND	ND	ND
4/19/93	2	2	ND	1	2
8/17/93	ND	ND	ND	ND	ND
11/9/93	2	2	ND	1	3
2/15/94	2	2	ND	1	3
5/3/94	2	1	ND	ND	3
6/7/94	2	2	ND	1	3
8/23/94	3	3	ND	1	5
11/29/94	2	2	1	1	4
2/14/95	2	2	ND	1	4
5/16/96	2	1	ND	1	4
8/22/95	2	1	ND	1	5

Notes: ND - Results below method detection limit.
NT - Analyte not tested for.

Focused Ground-Water Feasibility Study
Former IMC Magnetics Facility
Westbury, New York

Table 6

Analytical Data For Westbury
Water District Well # 12A (NYSDEC Well # 8957)

Date (mo./day/yr.)	1,1,1-trichloroethane (µg/l)	1,1-dichloroethane (µg/l)	1,1-dichloroethene (µg/l)	Tetrachloroethene (µg/l)	Trichloroethene (µg/l)
4/30/86	ND	4	ND	NT	ND
5/13/87	ND	ND	ND	ND	ND
6/23/87	10	ND	ND	5	1
9/2/87	9	6	6	7	1
3/2/88	ND	2	ND	NT	ND
5/11/88	6	2	1	3	ND
8/11/88	ND	5	ND	ND	1
11/8/88	ND	1	ND	1	ND

Notes: ND - Results below method detection limit.
NT - Analyte not tested for.

570 MAIN STREET
FORMER IMC MAGNETICS FACILITY
FOCUSED GROUND-WATER FEASIBILITY STUDY
TABLE 7
TECHNOLOGY SCREENING

Technology	Screening Comment	Screening Conclusion
No Action		
No Action	Carried through the Feasibility Study as a Baseline.	Retained
Institutional Actions		
Develop Alternative Water Supply	May be Used Alone or in Conjunction with Other Technologies.	Eliminated
Wellhead Treatment	Currently Conducted in Westbury and Bowling Green Wellfields. May be Used Alone or in Conjunction with Other Technologies.	Eliminated
Limit Aquifer Use	May be Used Alone or in Conjunction with Other Technologies.	Retained
Monitoring	Ongoing Monitoring of Wells can Provide Information on Migration and Cleanup of Contamination	
Other Treatment		
Intrinsic Remediation	Unlikely to Occur within Property Boundaries. Likely to Occur Before Reaching Existing Water Supply Wells. May be Used Alone or in Conjunction with Other Technologies	Retained
Extraction		
Pumping	Proven, Effective Technology for Removing Contaminated Ground Water. Typically not Effective in Removing DNAPL. May Draw in Contamination from Off-Site. Typically Used in Conjunction with Other Technologies	Retained
Deep Soil Excavation	Depth Required for Excavation, Limited Work Space and Location near Load-Bearing Wall of Building make this Technology Infeasible.	
Containment		
Pumping	Proven, Effective Technology for Removing Contaminated Ground Water. May Draw in Contamination from Off-Site. Typically Used in Conjunction with Other Technologies.	Retained
Slurry Walls	Depth of Contamination, Limited Work Area Near Source and Dense Development on Surrounding Properties Preclude Us.	Eliminated
Grout Curtains	Depth of Contamination, Limited Work Area Near Source and Dense Development on Surrounding Properties Preclude Use.	Eliminated
Sheet Piling	Depth of Contamination, Limited Work Area Near Source and Dense Development on Surrounding Properties Preclude Use.	Eliminated
In-Situ Biological Treatment		
Co-Metabolic Treatment (Dissolved Methane Injection/Circulation)	Innovative Technology with Limited Field Evaluation. Treatment Unlikely to Occur within Property Boundaries. Unlikely to Significantly Reduce DNAPL Mass.	Retained

Table Continues

570 MAIN STREET
FOCUSED GROUND-WATER FEASIBILITY STUDY
FORMER IMC MAGNETICS FACILITY
TABLE 7 (Continued)
TECHNOLOGY SCREENING

Technology	Screening Comment	Screening Conclusion
In-Situ Physical/Chemical Treatment		
Oxidation (Hydrogen Peroxide Injection)	Innovative Technology with Limited Field Evaluation. Provides In-Situ Destruction of Contaminants. May Significantly Reduce DNAPL Mass.	Retained
Air Sparging	In-Situ Stripping of VOCs. Typically Operated in Conjunction with Soil Vacuum Extraction (SVE). Can Cause Mobilization of DNAPL. Could Require Off-Site SVE wells. Unlikely to Significantly Reduce Mass of DNAPL.	Retained
Dual Phase Extraction	Primarily for Low-Permeability and/or Heterogeneous Soils. Effective SVE System Already in Operation	Eliminated
How Water/Hot Air/Steam	Typically Used in Conjunction with Ground-Water Pumping. May Mobilize DNAPL.	Retained
Passive Treatment Walls	Innovative Technology with Limited Field Evaluation. Depth of Contamination and Limited Work Area Near Source Preclude Use.	Eliminated
Ex-Situ Biological Treatment (Assumes Pumping)		
Bioreactors	Typically Ineffective for Chlorinated Hydrocarbons.	Eliminated
Ex-Situ Physical/Chemical Treatment (Assumes Pumping)		
Air Stripping	Chlorinated Hydrocarbons at the Site are Amenable to Air Stripping, a Proven Treatment Technology. May Require Treatment of Air Exhaust.	Retained
Liquid Phase Carbon	Chlorinated Hydrocarbons at the Site are Amenable to Carbon Adsorption, a Proven Treatment. Technology.	Retained
UV Oxidation	Chlorinated Hydrocarbons at the Site are Amenable to UV Oxidation, a Proven Treatment Technology. May Require Treatment of Air Exhaust.	Retained
Air Emissions/Off-Gas		
Biofiltration	Results in Contaminant Destruction Rather than Transfer. Typically less effecteve for chlorinated than for Other VOCs.	Eliminated
Catalytic Oxidation	Historically Used for Destructive Treatment of Non-Chlorinated Hydrocarbons. However, Use of Precious Metal Catalaists has Achieved Success with Chlorinated Hydrocarbons.	Retained
Vapor Phase Carbon	A Prove, Effective Contaminant Transfer Technology. Typically Low Efficience when Influent Concentrations Are Low.	Retained
Discharge of Treated Ground Water		
Discharge to POTW	Pretreated ground water could be discharged to the local POTW subject to pretreatment requirements.	Retained
Reinjection into Ground	Reinjection of treated ground water via injection wells or recharge trench(es) could have deleterious effect on ongoing SVE operations	Eliminated

570 MAIN STREET
FOCUSED GROUND-WATER FEASIBILITY STUDY
FORMER IMC MAGNETICS FACILITY
TABLE 8
EVALUATION AND SELECTION OF PRELIMINARY REMEDIAL TECHNOLOGIES

General Response Action	Remedial Technology (1.)	Effectiveness	Implementability	Cost
No Action	Natural Attenuation	Does not Achieve Remedial Action Objectives.	Easily Implemented	None
Institutional Actions	Limit Aquifer Use	Effective in Preventing Ingestion of Contaminated Ground Water. Does not Achieve Remedial Action Goals.	Easily Implemented. Requires Local Approval and Cooperation	Low Capital, Low O&M
	Ground-Water Monitoring	Useful for for Documenting Conditions. Does not Achieve Remedial Action Goals by Itself. Important Component of Most Remedial Actions	Easily Implemented.	Low Capital, Moderate O&M
Other Treatment	Intrinsic Remediation	Does not Achieve Remedial Action Objectives by Itself. Can be an Important Component of Remedial Action.	Easily Implemented	Low Capital, Low O&M
Extraction	Pumping	Effective in Removing Dissolved Constituents. Will not Appreciably Affect DNAPL.	Readily Implemented in Source Area, Restricted Outside Property Boundaries	Moderate Capital, Moderate O&M
Containment	Pumping	Effective Means of Source Area Containment.	Readily Implemented in Source Area, Restricted Outside Property Boundaries	Moderate Capital, Moderate O&M

Table Continues

570 MAIN STREET
FOCUSED GROUND-WATER FEASIBILITY STUDY
FORMER IMC MAGNETICS FACILITY
TABLE 8 (Continued)
EVALUATION AND SELECTION OF PRELIMINARY REMEDIAL TECHNOLOGIES

General Response Action	Remedial Technology (1.)	Effectiveness	Implementability	Cost
In-Situ Biological Treatment	Co-Metaboloic Treatment (Dissolved Methane Injection/Circulation)	Will not Appreciable Affect DNAPL. Will be Difficult to Introduce into Off-Site Areas.	Readily Implemented in Source Area, Restricted Outside Property Boundaries	Low Capital, Low O&M
In-Situ Physical/Chemical Treatment	Oxidation (Hydrogen Peroxide Injection)	Innovative Technology. Source Area Treatment that May Substantially Remove DNAPL via In-Situ Destruction. Will not Directly Address Dilute Portions of Plume.	Readily Implemented in Source Area, Restricted Outside Property Boundaries	Moderate Capital, Low O&M
	Air Sparging	Enhances volatilization beneath Water Table. Typically Requires Operation of a SVE System. Will not Remove DNAPL. May Mobilize DNAPL	Readily Implemented in Source Area, Restricted Outside Property Boundaries	Moderate Capital, Low O&M
	Hot Water/Air/Steam Injection	Enhances Contaminant Removal. Will not Remove DNAPL.. May Mobilize DNAPL	Readily Implemented in Source Area, Restricted Outside Property Boundaries	Moderate Capital, Moderate O&M
Ex-Situ Physical/Chemical Treatment	Air Stripping	Effective and Reliable Technology. Assumes that Ground Water is Extracted Via Pumping	Easily Implemented	Moderate Capital, Moderate O&M
	Liquid Phase Carbon	Effective and Reliable Technology. Assumes that Ground Water is Extracted Via Pumping	Easily Implemented	Moderate Capital, High O&M
	UV Oxidation	Effective and Reliable Technology. Assumes that Ground Water is Extracted Via Pumping	Readily Implemented	High Capital, Moderate O&M

Table Continues

570 MAIN STREET
FOCUSED GROUND-WATER FEASIBILITY STUDY
FORMER IMC MAGNETICS FACILITY
TABLE 8 (Continued)
EVALUATION AND SELECTION OF PRELIMINARY REMEDIAL TECHNOLOGIES

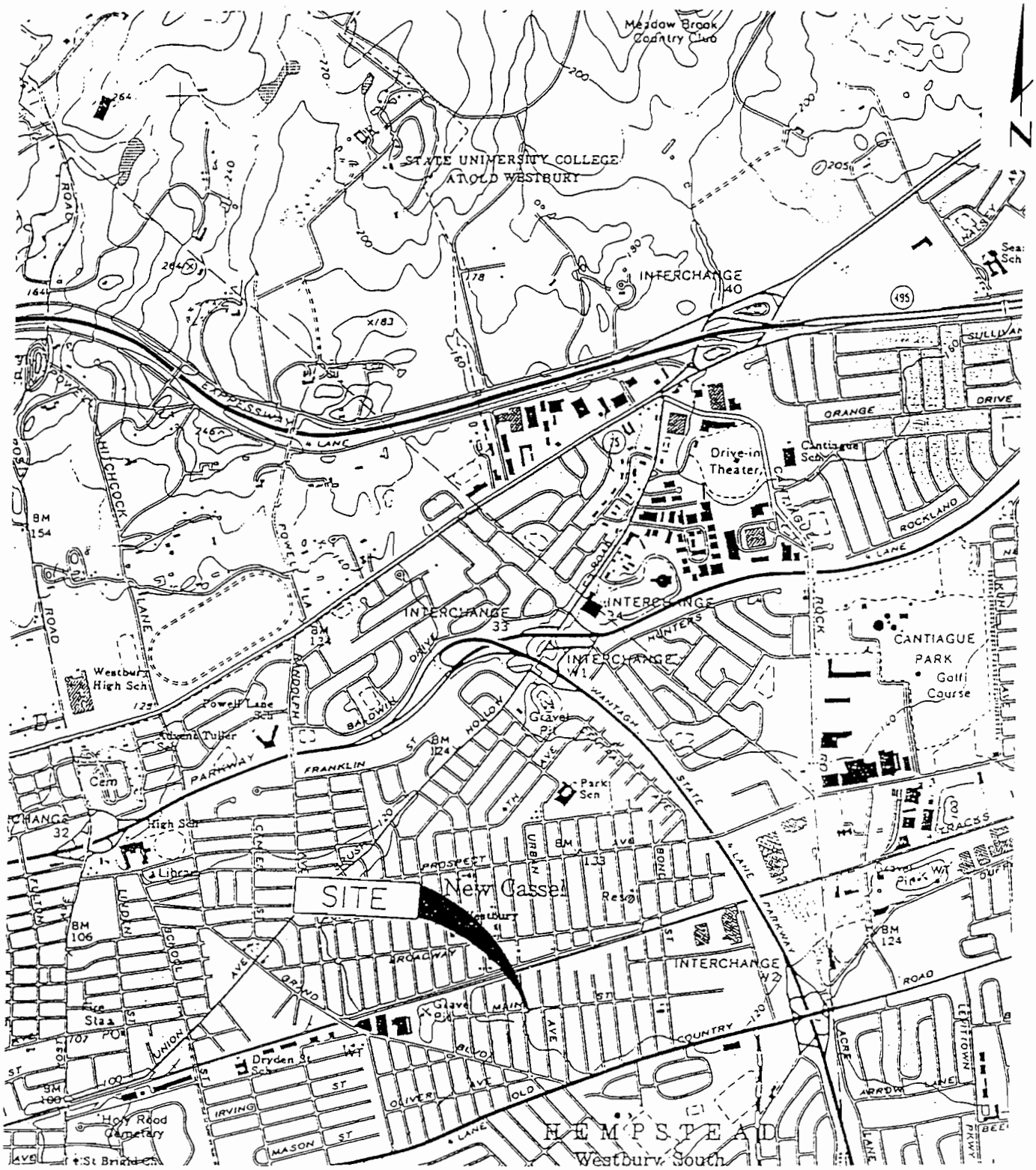
General Response Action	Remedial Technology (1.)	Effectiveness	Implementability	Cost
Air Emissions/Off-Gas	Catalytic Oxidation	Innovative Use in Treatment of Chlorinated VOCs. Requires Use of Precious Metal Catalyst. Assumes that Ground Water is Extracted Via Pumping.	Readily Implemented	High Capital, Moderate O&M
	Vapor Phase Carbon	Effective and Reliable Technology. Assumes that Ground Water is Extracted Via Pumping.	Easily Implemented	Moderate Capital, High O&M
Discharge of Treated Ground Water	Discharge to POTW	Effective and Reliable.	Available w/Permit	Low Capital, Low O&M

Note: Technologies shown in boxes are selected as representative.

570 MAIN STREET
FOCUSED GROUND-WATER FEASIBILITY STUDY
FORMER IMC MAGNETICS FACILITY
TABLE 9
EVALUATION AND SELECTION OF PRELIMINARY REMEDIAL TECHNOLOGIES

Remedial Alternative	Description	Effectiveness	Implementability	Cost	Screening Comment
GW #1	No Action	Not effective in mitigating human and environmental hazards or in reducing toxicity, mobility or volume within a reasonable time frame.	Technically Implementable	None	Required to be retained by the NCP
GW #2	Ground-Water Extraction with Air Stripping - Vapor-Phase Carbon used on Air Emissions as Necessary - Intrinsic Remediation in Downgradient Portions of Plume	Effective in reducing toxicity, mobility and volume of ground-water contamination. Mitigates human and environmental hazards through removal of ground-water contamination.	Technically Implementable	Moderate to High	As source in Area 2 is hydraulically contained by pumping, attenuation will gradually provide improvement in water quality downgradient of Area 2. Due to the potential for DNAPL in Area 2, operation of the pump/treat system could operate for decades. Extraction well is likely to capture and treat VOCs migrating on site from upgradient sources.
GW #3	Ground-Water Extraction with Liquid-Phase Carbon Treatment - Intrinsic Remediation in Downgradient Portions of Plume	Effective in reducing toxicity, mobility and volume of ground-water contamination. Mitigates human and environmental hazards through removal of ground-water contamination.	Technically Implementable	Moderate to High	Same Comment as for GW #2. Will not require treatment of air emissions.
GW #4	Ground-Water Extraction with UV/Oxidation Treatment - Intrinsic Remediation in Downgradient Portions of Plume	Effective in reducing toxicity, mobility and volume of ground-water contamination. Mitigates human and environmental hazards through removal of ground-water contamination.	Technically Implementable	High	Same Comment as for GW #2. Will not require treatment of air emissions.
GW #5	In-Situ Oxidation (Hydrogen Peroxide Injection) - Intrinsic Remediation in Downgradient Portions of Plume	Effective in reducing toxicity, mobility and volume of ground-water contamination. Mitigates human and environmental hazards through removal of ground-water contamination. May remove DNAPL and effectively clean up Area 2.	Technically Implementable	Low to Moderate	The technology is expected to achieve cleanup of the source within Area 2 within weeks or months. O & M efforts and costs will be low, consisting of ground-water monitoring of cleanup in Area 2 and of natural attenuation downgradient of Area 2.

FIGURES



SCALE: 1" = 2000'
SOURCE: USGS 7.5 MIN. QUADRANGLE
HICKSVILLE, NEW YORK - 1967
(PHOTOREVISED - 1979)

0 500 1000 2000
SCALE IN FEET

FIGURE 1

Hull & Associates, Inc.
MASON, OHIO

570 MAIN STREET PROPERTY
FOCUSED GROUND-WATER FEASIBILITY STUDY

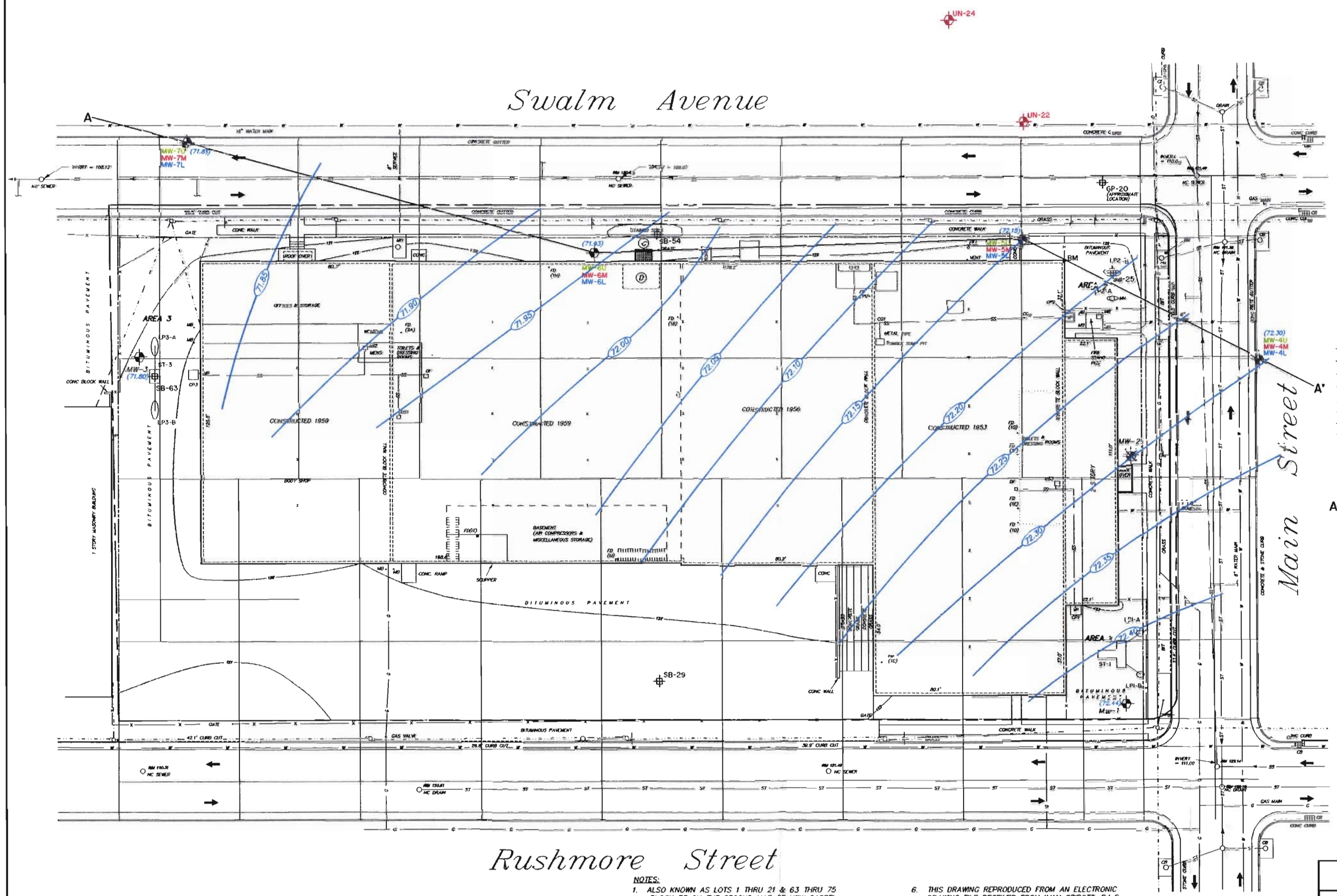
SITE LOCATION MAP

WESTBURY, NEW YORK

DATE: SEPTEMBER 1999

PROJECT: NM8007

NM8007.200.0008
8/1/99 ab
UNIT 3 DISK 1



N

0 - 25 - 50

SCALE IN FEET

LEGEND:

UP	UTILITY POLE WITH GUY WIRE
MB	METAL BUMPER
	HYDRANT
	TRAFFIC SIGN
CP1	CLEAN-OUT PIT FOR SANITARY SEWER
BIT	BITUMINOUS PAVEMENT
CO1	CLEAN-OUT
LP	LEACHING POOL
ST	SEPTIC TANK
US1	UTILITY SINK
DF	DRINKING FOUNTAIN
VP	VENT PIPE
CB	CATCH BASIN
MH	MANHOLE
CJ	CONSTRUCTION JOINT
	TRAFFIC FLOW
	WATER VALVE
	COLUMNS
120	CONTOUR LINE
OH	OVERHEAD WIRES
ST	STORM SEWER
SS	SANITARY SEWER
G	GAS LINE
W	WATER LINE
	PROPERTY LINE
	CHAIN LINK FENCE
NC SEWER	NEW CASTLE SANITARY SEWER
NC DRAIN	NEW CASTLE STORM SEWER
BM	BENCHMARK "B" CUT ON CATCH BASIN. ELEVATION = 121.59' NASSAU COUNTY DATUM
A—A'	PROFILE LINE FOR GEOLOGIC CROSS SECTIONS
MW-1	GROUND-WATER MONITORING WELL (EXISTING PRIOR TO FOCUSED GROUND-WATER INVESTIGATION)
MW-2	GROUND-WATER MONITORING WELL, APPARENTLY DESTROYED BY LANDSCAPING.
SB-25	GEOPROBE LOCATIONS WHERE GROUND-WATER SAMPLES WERE COLLECTED
MW-4U	GROUND-WATER MONITORING WELL-UPPER INTERVAL (INSTALLED 6/98 AND SCREENED ACROSS THE WATER TABLE).
MW-4M	GROUND-WATER MONITORING WELL-MIDDLE INTERVAL (INSTALLED 6/98 AND SCREENED WITHIN AN INTERVAL OF APPROX. 40 AND 60 FEET BELOW).
MW-4L	GROUND-WATER MONITORING WELL-LOWER INTERVAL (INSTALLED 6/98 AND SCREENED WITHIN AN INTERVAL OF APPROX. 80 AND 90 FEET BELOW).
(72.30)	GROUND-WATER SURFACE ELEVATION (MEASURED 7/8/98)
72.00	PIEZOMETRIC CONTOUR LINE
	AVERAGE PIEZOMETRIC SURFACE GRADIENT =0.001-0.002 ft/ft

NOTES:

1. ALSO KNOWN AS LOTS 1 THRU 21 & 63 THRU 75 BLOCK 73 ON THE SECOND MAP OF NEW CASSEL.
2. ELEVATIONS REFER TO NASSAU COUNTY DATUM.
3. LOCATION OF UNDERGROUND UTILITIES COMPILED FROM AVAILABLE RECORDS - NOT GUARANTEED.
4. GROSS PROPERTY AREA 85,000 SF, 1.951 AC.
5. LOCATIONS OF SEPTIC TANKS AND LEACHING POOLS IN AREAS 1, 2, AND 3 ARE ESTIMATED.
6. THIS DRAWING REPRODUCED FROM AN ELECTRONIC DRAWING FILE RECEIVED FROM IVAN CZIPOTT, P.L.S., HICKSVILLE, N.Y. IN SEPTEMBER 1995 TITLED "SURVEY OF SECTION 11, BLOCK 73, LOTS 1-21 & 63-65 NASSAU COUNTY LAND & TAX MAP". HAI MAKES NO GUARANTEES TO THE ACCURACY OF THIS DRAWING AND IT SHOULD BE USED FOR INFORMATIONAL PURPOSES ONLY.
7. LOCATIONS AND ELEVATIONS OF MONITORING WELLS INSTALLED DURING 6/98 SURVEYED BY NEW YORK STATE LICENSED LAND SURVEYOR ALBERT W. TAY ON JULY 15, 1998.

FIGURE 2

Hull & Associates, Inc.
MASON, OHIO

570 MAIN STREET PROPERTY
FOCUSED GROUND-WATER FEASIBILITY STUDY
PIEZOMETRIC CONTOUR MAP
UPPER WELLS (7/8/98 MEASUREMENT EVENT)
WESTBURY, NEW YORK

DATE: SEPTEMBER 1999
PROJECT: NMB007

NMB007.200.0009
6/4/99
UNIT 3 DISK 1

SOUTH

A

NORTH

A'

ELEVATION (NASSAU COUNTY DATUM)

ELEVATION (FT)

MW-7L MW-7M MW-7U

SWALM AVENUE

CONCRETE SIDEWALK

MW-6L MW-6M MW-6U

CONCRETE

CONCRETE

CONC. ENTRANCEWAY

MW-5L MW-5M MW-5U

GENERAL LOCATION OF AREA 2

CONCRETE SIDEWALK

MAIN STREET

MW-4L MW-4M MW-4U

2.3

2.4

14

7.7

ND (<1.0)

5.6

60

11

4.5

1.3

ND (<1.0)

1.5

5

10

5

10

5

LEGEND

- PROPERTY LINE
- ASPHALT PAVEMENT
- CONCRETE
- GRASSY AREA
- FINE TO MEDIUM/FINE TO COARSE SAND *
- FINE SAND
- SILTY FINE SAND/SILTY FINE TO MEDIUM SAND
- CLAYEY, SILTY FINE TO MEDIUM SAND, OCC. SILTY CLAY SEAM
- 5 — ISO CONCENTRATION LINE FOR 1,1,1-TCA (ug/l)

* SOILS ABOVE THE WATER TABLE WERE NOT LOGGED. BASED ON PREVIOUS DRILLING IN THE UNSATURATED ZONE AS PART OF THE IRM FOR OU-1, THESE SOILS CONSIST PRIMARILY OF FINE TO MEDIUM AND FINE TO COURSE SANDS.

MW-#

PID HEADSPACE READING FOR SOIL SAMPLE — (98)

STATIC WATER LEVEL AS MEASURED IN UPPER WELLS 7/30/98

SCREENED INTERVAL

MONITORING WELL RISER

14 — CONCENTRATION OF 1,1,1-TCA IN ug/l (7/98 SAMPLING EVENT)

H 1"=50'

0 25 50

0 5 10 20

V 1"=20'

VERTICAL EXAGGERATION= 2.5

NMB007.200.0003
9/29/98 as
UNIT 3 DISK 1

FIGURE 5

Hull & Associates, Inc.
MASON, OHIO

570 MAIN STREET PROPERTY
FOCUSED GROUND-WATER FEASIBILITY STUDY

VERTICAL DISTRIBUTION OF 1,1,1-TCA IN GROUND-WATER

WESTBURY, NEW YORK

DATE: SEPTEMBER 1999

PROJECT: NMB007

SOUTH

A

NORTH

A'

ELEVATION (NASSAU COUNTY DATUM)

ELEVATION (FT)

MW-7L MW-7M MW-7U

SWALM AVENUE

CONCRETE SIDEWALK

MW-6L MW-6M MW-6U

CONCRETE

CONCRETE

CONC. ENTRANCEWAY

MW-5L MW-5M MW-5U

GENERAL LOCATION OF AREA 2

CONCRETE SIDEWALK

MAIN STREET

MW-4L MW-4M MW-4U

28

77

210.1

22.9

5.6

13.1

121

15.1

7.7

5.7

6.2

7.8

10

100

LEGEND

- PROPERTY LINE
- ASPHALT PAVEMENT
- CONCRETE
- GRASSY AREA
- FINE TO MEDIUM/FINE TO COARSE SAND *
- FINE SAND
- SILTY FINE SAND/SILTY FINE TO MEDIUM SAND
- CLAYEY, SILTY FINE TO MEDIUM SAND, OCC. SILTY CLAY SEAM
- ISO CONCENTRATION LINE FOR TOTAL CHLORINATED SOLVENTS (ug/l)

* SOILS ABOVE THE WATER TABLE WERE NOT LOGGED. BASED ON PREVIOUS DRILLING IN THE UNSATURATED ZONE AS PART OF THE IRM FOR OU-1, THESE SOILS CONSIST PRIMARILY OF FINE TO MEDIUM AND FINE TO COURSE SANDS.

MW-*

PID HEADSPACE READING FOR SOIL SAMPLE — (98)

STATIC WATER LEVEL AS MEASURED IN UPPER WELLS 7/30/98

SCREENED INTERVAL

MONITORING WELL RISER

121 — CONCENTRATION OF TOTAL CHLORINATED SOLVENTS (1,1-DCE, 1,1-DCA, CIS-1,2DCE, 1,1,1-TCA, TCE AND PCE) IN ug/l (7/98 SAMPLING EVENT)

H 1"=50'

0 - 25 - 50

0 5 10 20

V 1"=20'

VERTICAL EXAGGERATION= 2.5

FIGURE 6

Hull & Associates, Inc.

MASON, OHIO

570 MAIN STREET PROPERTY
FOCUSED GROUND-WATER FEASIBILITY STUDY

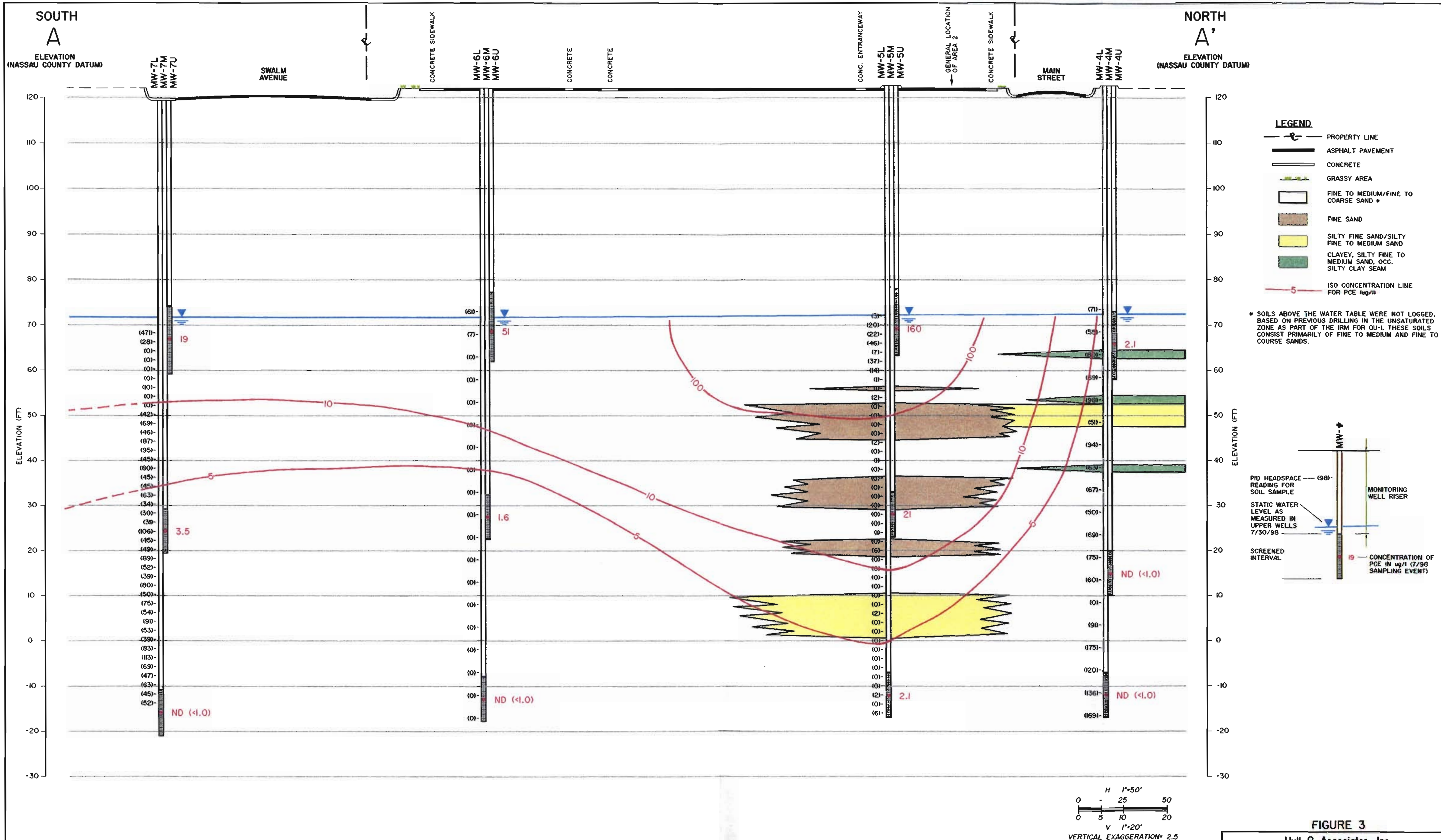
VERTICAL DISTRIBUTION OF TOTAL CHLORINATED VOC's IN GROUND WATER

WESTBURY, NEW YORK

DATE: SEPTEMBER 1999

PROJECT: NMB007

NMB007.200.0003
9/29/99 db
UNIT 3 DISK 1



NMB007.200.0003
9/29/98 db
UNIT 3 DISK f

FIGURE 3

Hull & Associates, Inc.
MASON, OHIO

570 MAIN STREET PROPERTY
FOCUSED GROUND-WATER FEASIBILITY STUDY

VERTICAL DISTRIBUTION OF PCE IN GROUND-WATER
WESTBURY, NEW YORK

DATE: SEPTEMBER 1999
PROJECT: NMB007

SOUTH

A

NORTH

A'

ELEVATION (NASSAU COUNTY DATUM)

ELEVATION (NASSAU COUNTY DATUM)

MW-7L MW-7M MW-7U

SWALM AVENUE

CONCRETE SIDEWALK

MW-6L MW-6M MW-6U

CONCRETE

CONCRETE

CONC. ENTRANCEWAY

MW-5L MW-5M MW-5U

GENERAL LOCATION OF AREA 2

CONCRETE SIDEWALK

MAIN STREET

MW-4L MW-4M MW-4U

ELEVATION (FT)

120 110 100 90 80 70 60 50 40 30 20 10 0 -10 -20 -30

3

20

34

10

ND (<1.0)

ND (<1.0)

ND (<1.0)

ND (<1.0)

1.5

5

10

LEGEND

- PROPERTY LINE
- ASPHALT PAVEMENT
- CONCRETE
- GRASSY AREA
- FINE TO MEDIUM/FINE TO COARSE SAND *
- FINE SAND
- SILTY FINE SAND/SILTY FINE TO MEDIUM SAND
- CLAYEY, SILTY FINE TO MEDIUM SAND, OCC. SILTY CLAY SEAM
- 5 — ISO CONCENTRATION LINE FOR TCE (ug/l)

* SOILS ABOVE THE WATER TABLE WERE NOT LOGGED. BASED ON PREVIOUS DRILLING IN THE UNSATURATED ZONE AS PART OF THE IRM FOR OU-1, THESE SOILS CONSIST PRIMARILY OF FINE TO MEDIUM AND FINE TO COURSE SANDS.

MW-

PID HEADSPACE READING FOR SOIL SAMPLE — (98)

STATIC WATER LEVEL AS MEASURED IN UPPER WELLS 7/30/98

SCREENED INTERVAL

MONITORING WELL RISER

11 — CONCENTRATION OF TCE IN ug/l (7/98 SAMPLING EVENT)

H 1"=50'

0 - 25 - 50

0 5 10 20

V 1"=20'

VERTICAL EXAGGERATION= 2.5

NMB007.200.0003
9/29/98 db
Unit 3 Disk 1

FIGURE 4

Hull & Associates, Inc.
MASON, OHIO

570 MAIN STREET PROPERTY
FOCUSED GROUND-WATER FEASIBILITY STUDY

VERTICAL DISTRIBUTION OF TCE IN GROUND-WATER
WESTBURY, NEW YORK

DATE: SEPTEMBER 1999

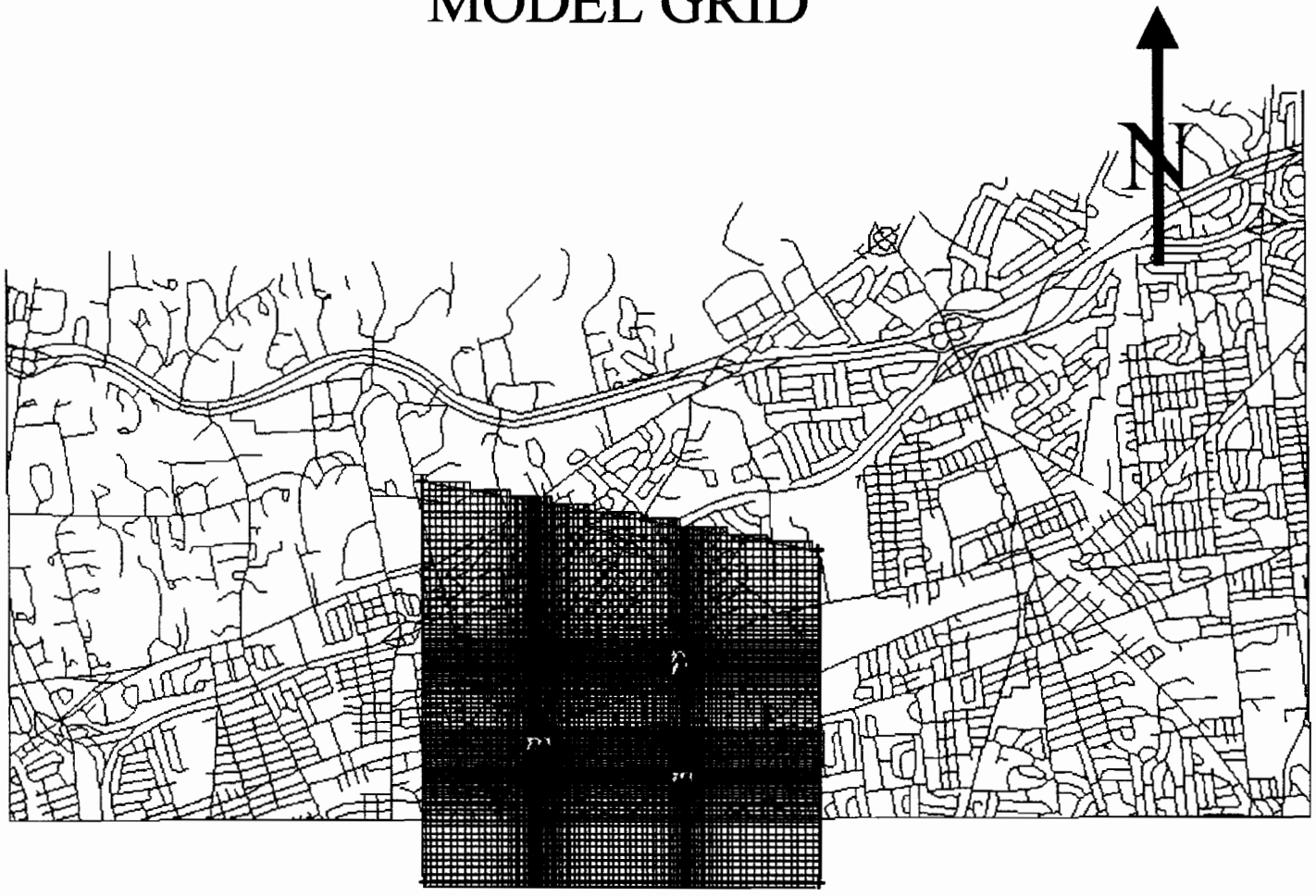
PROJECT: NMB007

PLATES

APPENDIX A

MODFLOW GRID DESCRETIZATION AND GRAPHICAL OUTPUTS

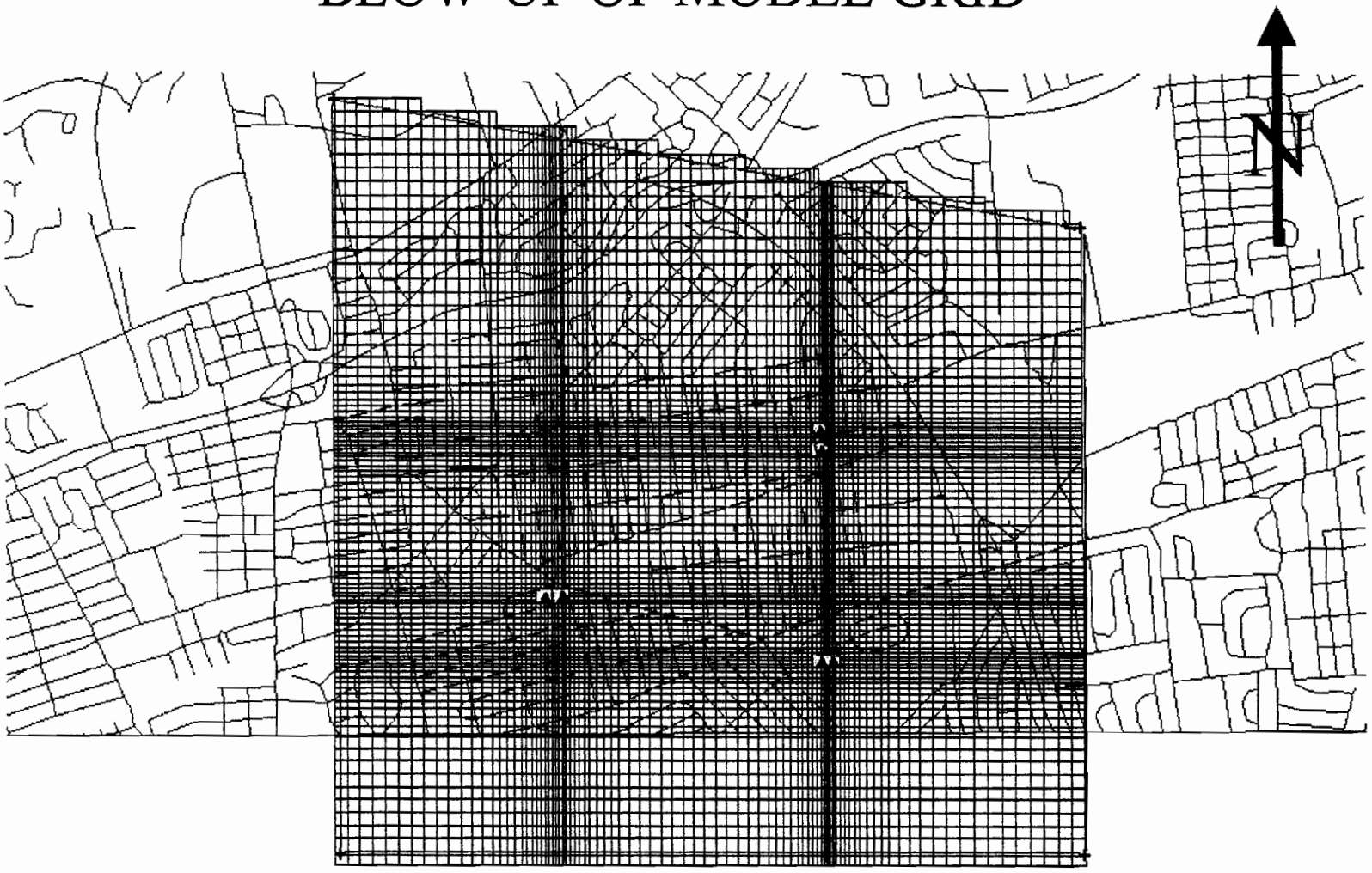
A-1
MODEL GRID

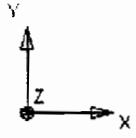


HULL & ASSOCIATES, INC.
MASON, OHIO

NMB007.200.0019A1
SEPTEMBER 1999

A-2
BLOW-UP OF MODEL GRID

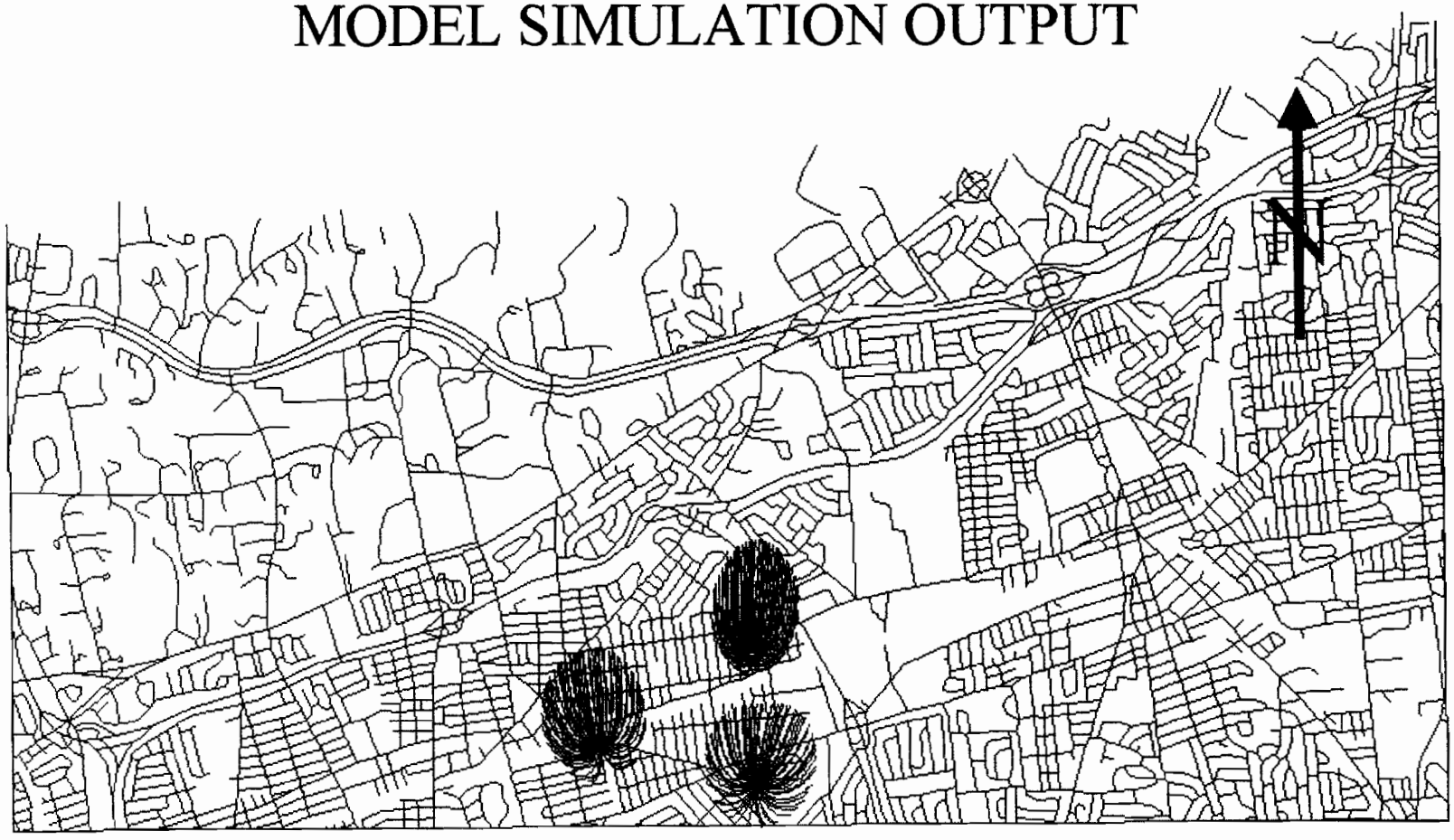


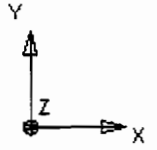


HULL & ASSOCIATES, INC.
MASON, OHIO

NMB007.200.0019A1
SEPTEMBER 1999

A-3
MODEL SIMULATION OUTPUT

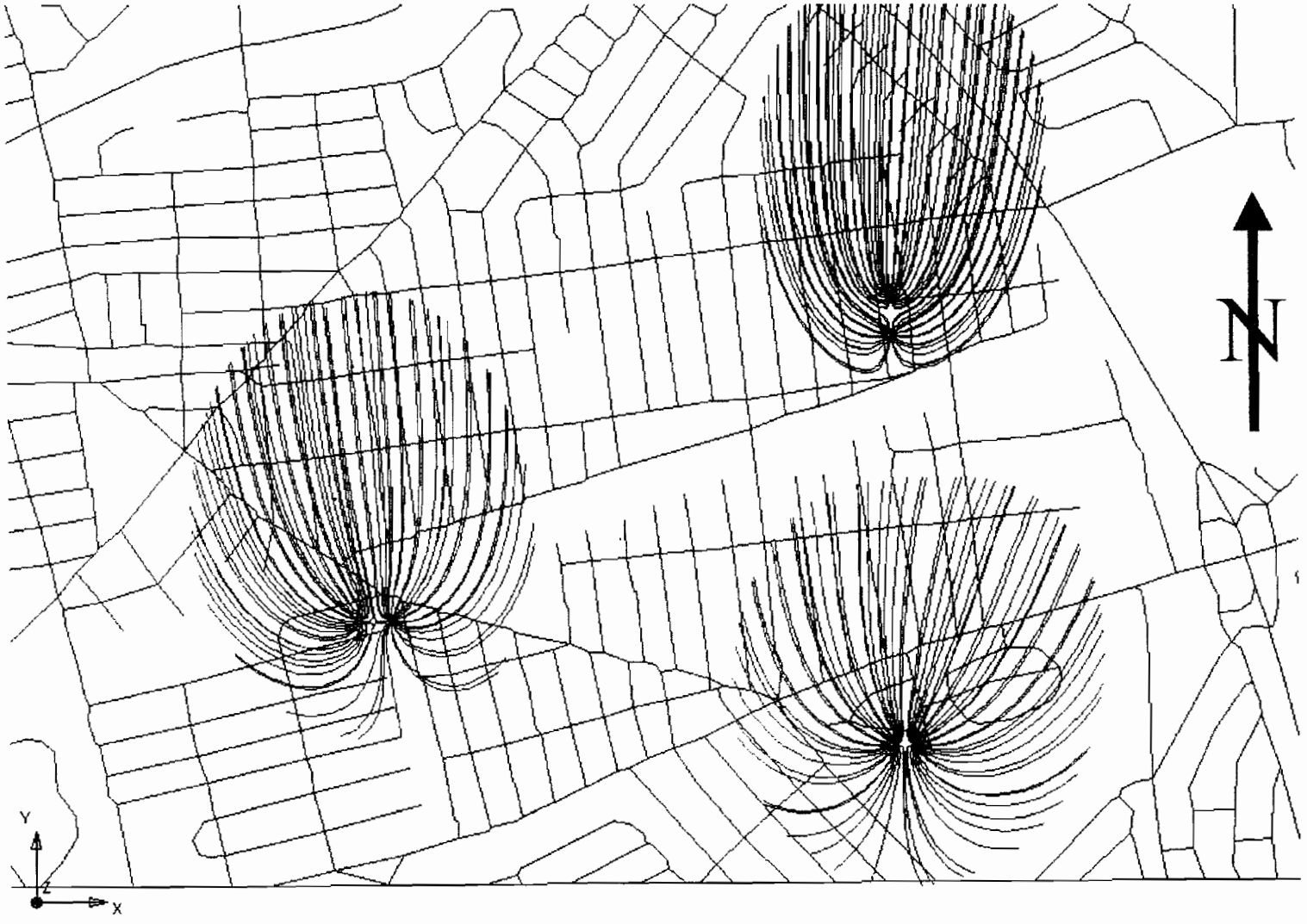




HULL & ASSOCIATES, INC.
MASON, OHIO

NMB007.200.0019A1
SEPTEMBER 1999

A-4
BLOW-UP OF MODEL SIMULATION OUPUT



HULL & ASSOCIATES, INC.
MASON, OHIO

NMB007.200.0019A1
SEPTEMBER 1999