ROY F. WESTON, INC.

REGION II ALTERNATIVE
REMEDIAL CONTRACTS STRATEGY (ARCS)
U.S. EPA CONTRACT NO. 68-W9-0022

FINAL FOCUSED FEASIBILITY STUDY FOR INTERIM GROUNDWATER ACTION

LIBERTY INDUSTRIAL FINISHING SITE
Farmingdale, New York

5 JANUARY 1998

U.S. EPA Work Assignment No. 009-2LT3
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This document has been prepared by Roy F. Weston, Inc., expressly for the U.S. Environmental Protection Agency under Contract No.: 68-W9-0022.

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Approved by:

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LIBERTY INDUSTRIAL FINISHING SITE
FINAL FOCUSED FEASIBILITY STUDY FOR
INTERIM GROUNDWATER ACTION

TABLE OF CONTENTS

WESTON

LIBERTY INDUSTRIAL FINISHING SITE
FINAL FOCUSED FEASIBILITY STUDY FOR
INTERIM GROUNDWATER ACTION

TABLE OF CONTENTS (CONTINUED)

LIBERTY INDUSTRIAL FINISHING SITE
FINAL FOCUSED FEASIBILITY STUDY FOR
INTERIM GROUNDWATER ACTION

TABLE OF CONTENTS (CONTINUED)

LIBERTY INDUSTRIAL FINISHING SITE
FINAL FOCUSED FEASIBILITY STUDY FOR
INTERIM GROUNDWATER ACTION

TABLE OF CONTENTS (CONTINUED)

LIBERTY INDUSTRIAL FINISHING SITE
FINAL FOCUSED FEASIBILITY STUDY FOR
INTERIM GROUNDWATER ACTION

TABLE OF CONTENTS (CONTINUED)

LIBERTY INDUSTRIAL FINISHING SITE
FINAL FOCUSED FEASIBILITY STUDY FOR
INTERIM GROUNDWATER ACTION

TABLE OF CONTENTS (CONTINUED)

LIST OF APPENDICES

LIBERTY INDUSTRIAL FINISHING SITE
FINAL FOCUSED FEASIBILITY STUDY FOR INTERIM GROUNDWATER ACTION

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES

LIBERTY INDUSTRIAL FINISHING SITE
FINAL FOCUSED FEASIBILITY STUDY FOR
INTERIM GROUNDWATER ACTION

TABLE OF CONTENTS (CONTINUED)

LIST OF FIGURES

PREAMBLE TO FOCUSED FEASIBILITY STUDY
FOR
INTERIM GROUNDWATER ACTION
FOR THE
LIBERTY INDUSTRIAL FINISHING SITE
FARMINGDALE, NEW YORK

ENGINEERING EVALUATION/ COST ANALYSIS

The United States Environmental Protection Agency (EPA) is proposing to take an interim groundwater action at the Liberty Industrial Finishing Site, Farmingdale, New York (the "Liberty Site"). EPA plans to take this action as a "removal" action pursuant to Section 104(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA), 40 Code of Federal Regulations (CFR) Part 300 (National Contingency Plan [NCP]) and specifically, 40 CFR § 300.415.

EPA has determined that a sufficient planning period exists before on-site activities for this interim action must be initiated, and accordingly, this action will be conducted as a non-time-critical removal action (see 40 CFR § 300.415(b)(4)).

EPA prepared a Focused Feasibility Study (FFS) for the Liberty Site that evaluated interim groundwater containment response options. The FFS, which is being released to the public together with this "Preamble," is an analysis of the removal alternatives for this interim action and is the equivalent of an engineering evaluation/cost analysis (EE/CA) as required by 40 CFR § 300.415(b)(4)(i).

The final selection of the removal response action for the Liberty Site will be made by EPA and documented in an Action Memorandum, which will be issued following a public comment period, and evaluation and response by EPA to significant comments.

The purpose of this interim groundwater action is to prevent contaminated groundwater underlying the Liberty Site from migrating beyond the Liberty Site property boundary. This action will be consistent with any future long-term, comprehensive groundwater action that may be selected by EPA to restore the aquifer to drinking-water quality.

EPA anticipates that the interim groundwater action at the Liberty Site, including any post-removal site control (or operation and maintenance) to implement the removal action following its implementation, will be performed by potentially responsible parties (PRPs) for the Liberty Site under an administrative order to be issued by EPA pursuant to Section 106(a) of CERCLA. In the event that the response action is not performed by the PRPs, then EPA anticipates that it will perform the action using the resources of the Superfund. Although CERCLA Section

104(c)(1) generally limits the time and money of Superfund-financed removal actions, it is likely that the proposed action would be exempt from such limitations, primarily because it would be appropriate and consistent with any long-term remedial action likely to be taken at the Liberty Site.

The removal response action to be selected by EPA is required by 40 CFR § 300.415(j) to comply with, to the extent practicable considering the exigencies of the situation, applicable or relevant and appropriate requirements (ARARs) under federal environmental or state environmental or facility laws. ARARs for this action may include Resource Conservation and Recovery Act (RCRA) standards for owners and operators of hazardous waste treatment, storage, and disposal facilities, the Clean Air Act (e.g., ambient air quality standards) requirements, and the Department of Transportation manifest standards for transporters of hazardous waste. In addition, the response alternative requiring conventional technology would also need to comply, to the extent practicable, with additional ARARs, such as standards for the discharge of the treated groundwater.

In accordance with 40 CFR 300.415(n), EPA has established a local information repository at the following locations:

Farmingdale Library 116 Merrits Road Farmingdale, NY 11735	United States Environmental Protection Agency Superfund Records Center 90 Broadway, 18th Floor New York, NY 10007-1866

EPA has published an announcement in a major local newspaper of the availability of the EE/CA and of the administrative record file for this interim response action, as well as the commencement of a 30-day public comment period on the EE/CA through February 7, 1998.

In addition to the other authorities cited in the FFS, reference is made to the following EPA publications:

- "Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA" (August 1993) (Publication 9360.0-32) in connection with the selection of the proposed interim groundwater action.

- Guidance on "Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Groundwater at CERCLA Sites" (October 1996) (Publication 9283.1-12), which provides that removal action authority under CERCLA is appropriate for "early" or interim actions in a phased approach to address contaminated groundwater sites.

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EXECUTIVE SUMMARY

The United States Environmental Protection Agency (EPA) contracted Roy F. Weston, Inc. (WESTON®) to conduct a Remedial Investigation/Feasibility Study (RI/FS) at the Liberty Industrial Finishing Site, a former aircraft parts manufacturing and metal plating facility. The RI included the sampling of air, surface water, groundwater, soil, and sediment media at or in the vicinity of the Liberty Site. The results of the RI were presented in a separate report (*Final Remedial Investigation Report for the Liberty Industrial Site, Farmingdale, New York,* WESTON, 1994). Supplemental soil characterization was performed in January 1997 (WESTON, 1997). An FS to address contaminated soils, sludges, and debris in the western portion of the site was completed in July 1997 (WESTON, 1997). Since April 1997 the Potential Responsible Parties (PRPs) have been conducting a Continuing Remedial Investigation (CRI) to address contaminated soils and groundwater in the eastern portion of the property and contaminated groundwater downgradient of the site. This document presents the findings of a focused FS to evaluate interim response action alternatives for the Upper Glacial aquifer under the Liberty property, until the final comprehensive remedy is put in place.

Discharges of metal-laden wastewaters at this facility and their associated impacts on downgradient groundwater and surface water were identified as early as 1942. The Liberty Site was further studied by the Nassau County Department of Health (NCDOH) in 1949. That study of the discharges at Liberty resulted in the first awareness in Nassau County of the potential damage to groundwater from chromium wastes. The first determination of elevated cadmium in Nassau County groundwater was made as part of a comprehensive United States Geological Survey (USGS) groundwater investigation that focused on the Liberty Site and the plume of contamination. By 1962, the plume of groundwater contamination was documented by the USGS to have a length of approximately 4,300 feet, a width of 1,000 feet, and a vertical extent of up to 70 feet. The plume was determined to consist of elevated concentrations of inorganics such as cadmium and hexavalent chromium. Cadmium concentrations ranged from a high of 10 parts per million (ppm) on-site to 1 ppm in most areas of the plume. The highest concentration of hexavalent chromium (40 ppm) was reported in 1949, with a decrease in concentration to less than 5 ppm in 1962.

Limited cleanup activities were conducted at the site in 1978. An RI by the owner of the property (Four Js Company) was conducted in 1985, with a limited interim removal action conducted to remove Resource Conservation and Recovery Act (RCRA) hazardous sludges from on-site disposal basins and a sludge-drying bed. Groundwater sampling during both the 1985 RI and also during WESTON's investigation reported concentrations of inorganics and organics significantly elevated above New York State drinking water standards.

The significant findings of WESTON's RI report were that numerous on-property contamination source areas still exist at the Liberty Site, with site-related organic and inorganic contamination evident in site soils, sludges, and underlying groundwater in the Upper Glacial aquifer.

The groundwater plume was determined to consist of elevated concentrations of organics (primarily trichloroethene and 1,2-dichloroethene) and inorganics (primarily cadmium, total chromium, and hexavalent chromium), which have migrated up to approximately 8,000 feet beyond the southern property line of the Liberty Site. The plume has a width of approximately 700 to 900 feet and extends vertically into the lower portion of the Upper Glacial aquifer (which extends from approximately 0 to 85 feet below ground surface).

Elevated concentrations of organic contaminants are also present in the upper portion of the Magothy aquifer. The extent and source of organic contamination in the Magothy aquifer could not be determined during WESTON's RI. Recommendations were made for further study of the Magothy aquifer prior to determining the need for and feasibility of remediation.

The findings and conclusion of the RI, based upon exceedances of New York State Department of Environmental Conservation (NYSDEC) Ambient Water Quality Standards or Guidance Values for Class GA groundwater, as well as the human health and ecological risk assessments, indicated that response action is warranted at the Liberty Site. Based upon the results of the RI, which defined the nature and extent of the contamination in the Upper Glacial aquifer, EPA directed WESTON to prepare a focused feasibility study (FFS) for an interim response action to minimize the migration of contaminated groundwater in the Upper Glacial aquifer underlying the site beyond the site property boundary. Concerns about off-site contamination in the Upper Glacial and the Magothy aquifers, as well as other on-site source area issues, will be addressed by separate RI/FS activities.

The format of this FFS follows the guidelines in the EPA 1988 document *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA*.

Three potential interim response action alternatives were evaluated in the FFS for the groundwater in the Upper Glacial aquifer. The evaluation of the groundwater interim response alternatives is intended to lead to the selection of a groundwater interim response action alternative by EPA that will be in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). These interim response alternatives included:

GW-A: No Action. No interim response action is proposed under this alternative.

GW-B: Groundwater Pumping and Treatment. Contaminated groundwater would be pumped at the downgradient side of the site and treated to remove volatile organic compounds (VOCs) and metals. The treated water would be discharged to the stormwater conveyance system.

GW-C: <u>In-Situ Air Stripping with Metals Treatment</u>. A series of groundwater circulation cell wells, outfitted with in-situ air stripping equipment, would be installed to control the migration of VOCs. The system would be combined with either in-situ precipitation (GW-C-I) or chelation treatment (GW-C-II) to minimize metals migration.

The three groundwater interim response action alternatives were subsequently evaluated against the following criteria:

Overall Protection of Human Health and the Environment

Alternatives GW-B and GW-C provide the greatest overall protection of human health and the environment through control of the contaminant plume. Alternative GW-A, which offers no groundwater treatment, is the least protective alternative.

Compliance with Applicable or Relevant and Appropriate Requirements

No Applicable or Relevant and Appropriate Requirements (ARARs) apply to Alternative GW-A because no response actions take place. Because this is an interim response action, Alternatives GW-B and GW-C would comply with only action-specific ARARs. Alternatives GW-B and GW-C would comply with ARARs such as the RCRA standards for owners and operators of hazardous waste treatment, storage, and disposal facilities, the Clean Air Act (e.g., ambient air quality standards), and manifest requirements for transporters of hazardous waste. Alternative GW-B would also comply with additional ARARs, such as State Pollutant Discharge Elimination System (SPDES) standards for the discharge of the treated groundwater.

Long-Term Effectiveness and Permanence

Although this FFS relates to what constitutes an interim action, Alternatives GW-B and GW-C offer long-term effectiveness and permanence by removing or degrading the contaminants. Alternative GW-A provides no treatment and is not considered to be effective.

Reduction of Toxicity, Mobility, and Volume

Alternatives GW-B and GW-C reduce the mobility and toxicity and volume of groundwater contaminants by the removal and treatment of VOCs and metals and by the destruction of VOCs in the contaminated groundwater. Alternative GW-A offers no treatment of the contaminated groundwater.

Short-Term Effectiveness

Alternatives GW-B and GW-C in the short term would halt the spread of contaminated groundwater in the Upper Glacial aquifer. Alternatives GW-B and GW-C may present potential risks to human health and the environment during construction, due to the disturbance of contaminated soils and groundwater. Alternative GW-A provides no treatment of groundwater and is not considered to be effective in the short term because residual risks are not reduced.

Implementability

Alternative GW-B, which involves conventional technology with proven reliability, offers the greatest implementability. Alternative GW-C is constructable with commonly available equipment and supplies. However, pilot testing would be required to determine the alternative's efficacy at this site. Alternative GW-A is implementable.

Cost

Alternative GW-A has no cost because no actions take place. Alternative GW-B has a higher capital and Operations and Maintenance (O&M) cost for the construction and operation of the treatment system, than does Alternative GW-C.

State Acceptance

Comments from the New York State agencies received in response to this FFS will be addressed in the Responsiveness Summary section of the EPA decision document.

Community Acceptance

After public comments regarding the FFS are received, they will be included in the Responsiveness Summary section of the EPA decision document.

SECTION 1.0

INTRODUCTION

1.1 GENERAL

In 1990 the United States Environmental Protection Agency (EPA) authorized Roy F. Weston, Inc. (WESTON®) to conduct a Remedial Investigation/Feasibility Study (RI/FS) of the Liberty Industrial Finishing Site (Liberty) located in the Town of Farmingdale, New York. The RI/FS was performed in response to Work Assignment Number 009-2LT3 under EPA Alternative Remedial Contracts Strategy (ARCS) Region II Contract Number 68-W9-0022. The RI field investigation of the Liberty Site was completed in July 1992. The results of the RI were presented in the *Final Remedial Investigation Report for the Liberty Industrial Site, Farmingdale, New York,* (WESTON, 1994). Supplemental soil characterization was performed in January 1997 (WESTON, 1997). An FS to address contaminated soils, sludges, and debris in the western portion of the site was completed in July 1997. Since April 1997 the Potential Responsible Parties (PRPs) have been conducting a Continuing Remedial Investigation (CRI) to address contaminated soils and groundwater in the eastern portion of the property and contaminated groundwater downgradient of the site.

The significant findings of the RI report were that numerous on-property contamination source areas still exist at the Liberty Site, with site-related organic and inorganic contamination evident in site soils, sludges, and underlying groundwater in the Upper Glacial aquifer.

The groundwater plume consists of elevated concentrations of organics (primarily trichloroethene and 1,2-dichloroethene) and inorganics (primarily cadmium, total chromium, and hexavalent chromium) which have migrated up to approximately 8,000 feet beyond the southern property line of the Liberty Site. The plume has an associated width of approximately 700 to 900 feet and extends vertically into the lower portion of the Upper Glacial aquifer.

Elevated concentrations of organic contaminants are also present in the upper portion of the Magothy aquifer. The extent of organic contamination in the Magothy aquifer was not fully delineated by the RI. Recommendations were made for further study of the Magothy aquifer prior to determining the need for and feasibility of remediation.

The findings and conclusion of the RI, based upon exceedances of New York State Department of Environmental Conservation (NYSDEC) Ambient Water Quality Standards or Guidance Values for Class GA groundwater, as well as the human health and ecological risk assessments, indicated that a response action is warranted at the Liberty Site. Based upon the results of the RI, which defined the nature and extent of the contamination in the Upper Glacial aquifer, EPA directed WESTON to prepare a focused feasibility study (FFS) for an interim response action to minimize the migration of contaminated groundwater in the Upper Glacial aquifer underlying the site beyond the site property boundary. Concerns about contamination in the off-site portion of the Upper Glacial and Magothy aquifers, as well as other on-site source area issues, will be addressed by separate RI/FS activities.

1.2 BASIS OF THE FOCUSED FEASIBILITY STUDY

This FFS identifies and evaluates interim response action alternatives that prevent contaminated groundwater, present in the Upper Glacial aquifer, from migrating beyond the site property boundary. The contamination was caused by past waste disposal practices at the Liberty Industrial Finishing facility. WESTON prepared the FFS under the supervision and oversight of EPA-Region II, in accordance with the EPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (EPA, 1988), EPA's *Guidance on Conducting Non-Time-Critical Removal Action under CERCLA* (EPA, 1993), and EPA's *Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Groundwater at CERCLA Sites* (EPA, 1996).

The Upper Glacial aquifer is part of a sole source aquifer system. The interim response action is warranted to control the portion of the contaminant plume underlying the site, as it feeds and maintains the off-site portion of the contaminant plume. The interim response action will also protect the underlying Magothy aquifer (which is an important production unit of the sole source aquifer system) from contamination present in the Upper Glacial aquifer.

The Magothy aquifer is the primary aquifer for public water supply in Nassau County. Numerous public water supply well fields draw water from the Magothy aquifer in areas downgradient from the Liberty Site. The RI data and other data sources indicate that the Upper Glacial and Magothy aquifers are hydraulically interconnected. No confining clay barriers exist between the two aquifers. Such clay barriers would preclude the public supply pumping wells from inducing the downward migration of contamination into the Magothy aquifer.

The groundwater in the Upper Glacial aquifer has been identified by WESTON (WESTON, 1994) to contain metals (inorganics), and volatile organic compounds (VOCs) at concentrations above the NYSDEC Ambient Water Quality Standards or Guidance Values for Class GA groundwater. A summary of the groundwater analytical data is presented in Appendix A.

The evaluation of the groundwater interim response action alternatives presented herein is intended to lead to the selection of a groundwater interim response action alternative that will be in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

1.3 FOCUSED FEASIBILITY STUDY APPROACH

This FFS is intended to support an interim response action for groundwater contamination present in the Upper Glacial aquifer under the site caused by past waste disposal practices from the operations at the Liberty Industrial Finishing facility. It does not address the groundwater contamination caused by any other facility/site, nor does it address the contamination present in the site soils, sludges, and/or sediment downgradient from the site. These have been or will be addressed in other documents.

The format of this FFS follows the guidelines outlined in the U.S. EPA 1988 *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA*. Accordingly, the Liberty FFS is divided into the following three phases:

- Phase I - IDENTIFICATION AND SCREENING OF TECHNOLOGIES
  - Identification of general response actions for each interim response action objective.
  - Determination of feasible technologies associated with each general response action.
  - Screening of each technology based on effectiveness, implementability, and relative cost.
  - Assembling the technologies into interim response action alternatives.
- Phase II - DEVELOPMENT AND SCREENING OF RESPONSE ACTION ALTERNATIVES
  - Description of each interim response action alternative and the basis for its development.
  - Screening of alternatives based on short-term and long-term analyses of effectiveness, implementability, and cost.
  - Selection of alternatives for detailed evaluation and analysis.
- Phase III - DETAILED ANALYSES OF ALTERNATIVES
  - Further delineation of each interim response action alternative with respect to the volumes of hazardous substances to be addressed, the technologies to be used, and any performance requirements associated with those technologies.
  - Evaluation and comparison of alternatives with respect to the criteria of:

- Overall protection of human health and the environment.
- Compliance with Applicable or Relevant and Appropriate Requirements (ARARs).
- Long-term effectiveness and permanence.
- Reduction of toxicity, mobility, and volume.
- Short-term effectiveness.
- Implementability.
- Cost.
- State acceptance.
- Community acceptance.

Figure 1-1 outlines the three phases and the steps involved in completing the FFS process. In this FFS, Section 1.4 identifies the FFS General Response Objective; Section 1.5 provides site background information regarding site location and description, site history and previous sampling activities, the nature and extent of groundwater contamination, and the results of a baseline groundwater risk assessment; Sections 2.0, 3.0, and 4.0 present Phases I, II, and III of the FFS process, respectively.

1.4 GENERAL RESPONSE OBJECTIVE

The interim response action objective of the Liberty Site FFS is to:

- Minimize the migration of contaminated groundwater in the Upper Glacial aquifer underlying the site to areas beyond the site property boundary.

1.5 SITE BACKGROUND INFORMATION

1.5.1 Site Location and Description

The Liberty Industrial Finishing Site is located approximately 1 mile south of Bethpage State Park in the unincorporated Village of Farmingdale, in the Town of Oyster Bay, Nassau County, New York. A site location map is presented in Figure 1-2. The 30-acre site is bordered by the Long Island Railroad to the north, Motor Avenue to the south, Main Street to the east, and the Ellsworth/Allen Park to the west. The northwest corner of the site abuts property owned by the South Farmingdale Water District, which operates two deep public water supply wells. The surrounding area is primarily residential, with several commercial establishments on Motor Avenue. Figure 1-3 presents a map depicting the former Liberty process facilities and potential contaminant source areas.

The site terrain is generally flat with no streams or drainage ditches on-site. However, the headwaters of Massapequa Creek originate to the south within 0.5 mile of the Liberty Site. Massapequa Creek flows through the Massapequa Preserve before ultimately discharging into South Oyster Bay on the southern coast of Long Island. A preliminary health assessment performed for the Liberty Site by the New York State Department of Health (NYSDOH) did not identify wetland areas on-site nor did it establish the presence of any on-site endangered species

1.5.2 Site History

The Liberty plant was founded in 1932 as Kircham Engineering and Manufacturing Company, which manufactured gear boxes, vacuum cylinders, shock struts, propeller hubs, and various other aircraft-related equipment. In the 1940s the Defense Plant Corporation (DPC) established operations at the site for the manufacture of aircraft parts by the lessee, Liberty Aircraft Products Corporation. Liberty Aircraft Products Corporation and its successors operated the facility as a metal plating operation up to 1978, when the operations moved to Brentwood, Suffolk County. A detailed site history is provided in the 1994 RI Report.

Currently, approximately half the site has been developed and includes several large warehouses, the remains of past industrial operations including foundations of former process buildings, and three excavated basins previously used for the disposal of metal finishing wastewaters. The remaining property (western portion) is undeveloped and unsecured, and this has resulted in the periodic dumping of refuse and debris by unknown parties.

1.5.3 Site Geology and Hydrogeology

The Liberty Site is directly underlain by the Upper Glacial outwash deposits of the Pleistocene age. The Upper Glacial aquifer, which is composed of fine to coarse sands with trace gravel, is approximately 85 feet thick beneath the Liberty Site. Between the lower portion of the Upper Glacial aquifer and underlying Magothy aquifer, thin (1- to 3-inch) sequences of sand interbedded with silty sand, sandy clay, and clay exist. These sequences have been noted to underlie a portion of the valley of the Massapequa Creek and is believed to extend at least as far north as the vicinity of Plitt Avenue. The lateral extent and the continuity of these interbedded fine-grained sediments are presently unknown. It has been suggested that the occurrence of this clay may be a northern extension of the Gardiner's Clay (Perlmutter, et al., 1963).

The top of the Magothy Formation beneath the site is approximately 85 feet below grade with an anticipated thickness of 700 feet. The Magothy is underlain by the Raritan Clay, a confining unit comprised of impermeable clay.

A hydrogeologic cross section detailing the geologic/hydrogeologic relationship of the Upper Glacial and Magothy aquifers was developed based upon the remedial investigative monitoring well data, United States Geological Survey (USGS) data, and information from previous investigations (Figure 1-4).

The depth to groundwater ranges from approximately 10 to 22 feet below grade at the Liberty Site (WESTON 1997) and decreases to approximately 2 feet below grade in the vicinity of Massapequa Creek located downgradient of the site. The Upper Glacial aquifer within the area of investigation is unconfined and possesses aquifer characteristics that are within the range of the regional aquifer system published values (Franke et al., 1972; Perlmutter, et al., 1963).

Recharge to the Upper Glacial aquifer system primarily occurs through precipitation and recharge from recharge basins. Discharge of groundwater beneath the site occurs through evapotranspiration and subsurface outflow downgradient in the aquifer.

The predominant flow direction for both the Upper Glacial and the Magothy aquifers is horizontal towards the creeks and ultimately towards the South Shore and the Atlantic Ocean. In the vicinity of the Liberty Site, a portion of the Upper Glacial groundwater discharges into Massapequa Creek, while the remainder continues to move south as underflow beneath the creek towards downgradient areas (Figure 1-5).

Average regional hydraulic conductivity values for the Upper Glacial aquifer are 2,000 gallons per day per square foot (gpd/ft^2) (270 ft/day) in the horizontal direction, as compared to 200 gpd/ft^2 (27 ft/day) in the vertical direction. Site-specific horizontal hydraulic conductivities determined during the WESTON RI indicated values in the range of 214 ft/day.

1.5.4 <u>Nature and Extent of Groundwater Contamination</u>

Impacts to groundwater as a result of activities at the Liberty property were documented as early as 1942. A Nassau County Department of Health (NCDOH) report issued in 1949 indicated the presence of a zone of chromium contamination approximately several hundred feet wide in the top few feet of the aquifer and extending about 0.5 mile downgradient of the site (NCDOH, 1949). Groundwater samples from downgradient private wells contained levels of hexavalent chromium greater than 0.5 milligram per liter (mg/L), cadmium up to 0.24 mg/L, copper up to 0.16 mg/L, and aluminum up to 0.1 mg/L.

By 1962 the groundwater contaminant plume (defined by hexavalent chromium and cadmium concentrations) extended 4,300 feet downgradient of the site and had a width of up to 900 feet and a thickness of up to 70 feet. Hexavalent chromium, which was found in the groundwater at concentrations up to 40 mg/L in 1949, decreased to less than 5 mg/L in most areas of the plume after chromium-treatment operations begin in 1958. Cadmium concentrations were less than 1 mg/L in most of the monitoring wells with the exception of a high concentration of approximately 10 mg/L in one well adjacent to the on-site basins. Additionally, chromium and cadmium were detected at concentrations of 3 mg/L and 0.1 mg/L, respectively, in the headwaters of Massapequa Creek, where the groundwater plume was believed to be discharging into the surface waters (Perlmutter, et al., 1970).

The 1994 WESTON RI data indicate that the leading edge of the plume presently extends up to 8,000 feet downgradient of the site. Table 1-1, based on the 1994 and 1997 data, summarizes the range of detected concentrations of contaminants in the groundwater. Concentrations of total chromium exceeded 500 ug/L at downgradient wells (MW-9/9B) located approximately 5,100 feet from the Liberty property boundary. Elevated concentrations of other site-related contaminants were also detected in wells downgradient of the site.

Elevated levels of chromium and cadmium were also found in surface water and sediment samples collected from Massapequa Creek near monitoring wells MW-9/9B, which had the highest chromium detections. Detectable levels of some VOCs were also found in the same samples.

The flow of Massapequa Creek is sustained by natural groundwater seepage from the Upper Glacial aquifer. The location of the start-of-flow of Massapequa Creek varies seasonally in accordance with changes in water table elevations. At any location along the creek, the water table elevation is approximately equal to the surface water elevation at that point. During the WESTON RI, the start-of-flow of the creek was observed to vary over a distance of over 1,000 feet. At the time of the RI surface water sampling effort, flow was observed along the full length of the creek bed. Detectable levels of chromium and cadmium were measured in samples from the creek, indicating discharge of the groundwater plume.

1.5.4.1 On-Property Groundwater Quality

The shallow groundwater quality underlying the Liberty property was evaluated during the WESTON RI effort by the sampling and analysis of 11 on-property monitoring wells. Elevated concentrations of trichloroethene and 1,2-dichloroethene (total) were reported in the monitoring wells directly downgradient of the former disposal basins and wastewater treatment/process areas in the shallow Upper Glacial aquifer. These two chlorinated organics were also identified at elevated concentrations in on-site soils. Low concentrations of semivolatile organic compounds (SVOCs) were reported in on-site groundwater, generally below the NYSDEC Class GA standards. Pesticides were reported above the NYSDEC Class GA standard of non-detection at several monitoring well locations. Polychlorinated biphenyls (PCBs) were not reported above detection limits in the on-site monitoring wells.

The highest concentrations of site-related elevated inorganics (cadmium, total and hexavalent chromium, and cyanide) were reported at the shallow Upper Glacial monitoring wells located downgradient of the former disposal basin area, process treatment buildings, and sludge-drying bed. Elevated concentrations of iron, manganese, and sodium were also reported in the on-property groundwater in both upgradient and downgradient monitoring wells, but these detections do not appear to be site-related (see Figures 1-6, 1-7, 1-8, and 1-9).

1.5.4.2 Off-Property Groundwater Quality

Fifteen off-property monitoring wells were sampled during the RI to define the off-property groundwater plume. The same VOCs (1,2-dichloroethene [total] and trichloroethene) that were elevated on-site were reported in the off-property wells at concentrations well above NYSDEC Class GA standards. Lower concentrations of other VOCs that are degradation products of trichloroethene were also quantified in samples from off-property wells at concentrations above NYSDEC Class GA standards.

The highest concentrations of VOCs were reported at locations directly downgradient of the Liberty facility and the former disposal basins, with the highest concentrations in the middle portion of the Upper Glacial aquifer. The only monitoring well completed in the Magothy aquifer contained elevated concentrations of similar VOCs, as compared to its shallower Upper Glacial aquifer cluster wells. The source and extent of volatile organic contamination in the Magothy aquifer were not determined under the RI effort.

The leading edge of the off-property VOC plume is estimated to be approximately 8,000 feet south of the Liberty property with a width of approximately 700 feet. The leading edge of the plume is well defined, north of monitoring well MW-12. The vertical extent of the VOC plume extends into the basal portion of the Upper Glacial aquifer, with the highest concentrations reported in the middle portion of the aquifer. However, contaminants detected in MW-11 suggest that the plume may extend into the underlying Magothy aquifer.

Concentrations of SVOCs below NYSDEC Class GA standards were reported in the off-property groundwater. Pesticides were also reported in the off-property wells, above the NYSDEC standard of non-detection. The presence of pesticides is consistent with past land usage and agricultural practices. Pesticides are not considered to be site-related contaminants.

Elevated concentrations of site-related inorganic contamination (cadmium, total and hexavalent chromium, and hexavalent chromium) were reported at monitoring well locations directly downgradient of the Liberty property. Contaminant isopleth maps show that the inorganic plume exists as a segmented off-site plume with elevated concentrations, located approximately 5,100 feet downgradient of the Liberty property, in the vicinity of monitoring wells MW-9/9B. This pattern of contamination is consistent with waste disposal practices, which were extremely heavy in the past, reduced in later years, and terminated in the 1970s. The vertical extent of the inorganic plume is similar to that of the VOC plume; however, the inorganic plume has not traveled as far downgradient to the south-southwest.

During the RI Round 2 groundwater sampling event, groundwater samples were collected and analyzed for both total and filtered (dissolved) inorganic concentrations. In general, the comparison between filtered and unfiltered indicated only a slight decrease in inorganic concentrations upon filtration. This indicates that cadmium and chromium occur in the dissolved phase and are not adsorbed onto the soil matrix. Consequently, cadmium and chromium are available to migrate in the aquifer.

SECTION 2.0

IDENTIFICATION AND SCREENING OF TECHNOLOGIES

2.1 GENERAL RESPONSE ACTIONS

General response actions are those response actions that will satisfy the interim response objective. The objective of this interim response action is to minimize the migration of contaminated groundwater in the Upper Glacial aquifer underlying the site to areas beyond the site property boundary. The groundwater in the Upper Glacial aquifer has been identified (WESTON, 1994) to contain metals and VOCs at concentrations above NYSDEC Class GA Standards.

Other contaminated media (soil/sediment, sludges, miscellaneous artifacts, and debris) present in the western portion of the site have been addressed in the July 1997 FS. Concerns about the contamination in the Magothy aquifer and in the soils of the eastern portion of the site will be addressed by separate RI/FS activities.

The following general response actions are considered to be appropriate and applicable for the control of the contaminated groundwater plume in the shallow Upper Glacial aquifer:

(a) No Action

Under this response action, no interim response actions will be attempted on the groundwater. Under the National Contingency Plan (NCP), this response is required to be considered to provide a baseline for all other general response actions.

(b) Subsurface Barrier Containment

Under this interim response action, contaminant flow would be reduced or eliminated by installing subsurface barriers. While subsurface barriers are not effective in removing the contaminants of concern from the environment, they can be effective in controlling their areal distribution and protecting downgradient receptors from becoming impacted, thereby protecting human health and the environment from the further spread of an existing contaminant plume.

(c) Groundwater Collection

A collection interim response action removes or collects the contaminants from the environment without altering either the physical state or the chemistry of the contaminants. In the case of groundwater contaminant plumes, the collection interim response action is coupled with either treatment or disposal interim response actions for the overall interim response strategy.

(d) Treatment

This interim response action alters the contaminants of concern in the groundwater plume to render the contaminants less toxic, less mobile, or of reduced volume. Treatment actions may be performed in-situ, or, when coupled with collection interim response actions, ex-situ. The treatment interim response action encompasses physical, chemical, biological, or thermal treatment technologies.

(e) Placement

This interim response action addresses the ultimate location of contaminants, treated media, and treatment residuals. It generally encompasses on-site recharge of treated groundwater, off-property discharge (either to groundwater, surface water, or publicly owned treatment works) of treated and/or pretreated groundwater, and off-site disposal of treatment residuals such as treatment plant sludges and exhausted treatment media (activated carbon, ion exchange resins, etc.).

(f) In-Situ Remediation

This interim response action removes contaminants from the environment without the need to extract groundwater from the aquifer. This approach minimizes the wastes generated and avoids groundwater withdrawal for nonproductive purposes. Generally, in-situ remediation relies on biological, physical, or chemical treatment, or a combination of these processes, to achieve the response objectives.

2.2 IDENTIFICATION AND SCREENING OF RESPONSE TECHNOLOGIES AND TECHNOLOGY PROCESS OPTIONS

The response technologies and technology process options applicable to each general response action for the contaminated Upper Glacial groundwater are identified below. Table 2-1 presents a summary of the response technology types and process options.

During the initial screening step, process options and response technologies are removed from further consideration if they fail a screening for technical implementability. The response technology screening was performed using information gained from the RI conducted at the site. The response technology process options shown in Table 2-1 are described below.

2.2.1 No Action

Description: Under this response action, no action would be taken to address concerns regarding contaminated groundwater. Under the NCP, the no action alternative is required to be considered to provide a baseline against which all other alternatives may be compared.

Initial Screening: No Action will be retained.

2.2.2 Subsurface Barrier Containment

2.2.2.1 Subsurface Barriers

Subsurface containment barriers are low-permeability cut-off or diversion walls installed to minimize or contain contaminant migration in groundwater both on-site and off-site.

Slurry Walls

Description: Soil/bentonite and cement/bentonite slurry walls are used for long-term waste containment, and groundwater diversion and control. Slurry wall construction typically entails the excavation and backfilling of a trench with either a soil/bentonite or cement/bentonite slurry mixture. Soil/bentonite slurry walls are more flexible, achieve low hydraulic conductivities, and are cheaper than cement/bentonite slurry walls. Where superior strengths are required, cement/bentonite slurry walls can be constructed. To prevent underflow of contaminated groundwater, the slurry walls are typically keyed into underlying confining clay layers below an aquifer.

Initial Screening: Slurry walls are high-performance containment barriers applicable to plume control and can be used with various technologies and process options to achieve site closure. Chemical compatibility studies of the slurry mix with the groundwater would be necessary. This option was not retained for further consideration because of the absence of a competent and laterally continuous clay confining layer beneath the Upper Glacial aquifer at the Liberty Site. In the absence of such a layer, it is possible that contaminated groundwater from the upper aquifer could be diverted into the underlying Magothy Aquifer, which is utilized as a drinking water supply source.

Sheet Piling

Description: Sheet pile barrier walls are formed by driving interlocking sheet piles constructed of wood, concrete, or steel to achieve short-term groundwater containment and diversion, as well as to achieve structural stability of soil masses. As with a slurry wall, sheet piling is commonly keyed into lower confining layers to prevent groundwater underflows.

Initial Screening: Unpredictable wall integrity and costs make the use of sheet piling viable only for short-term containment, diversion control, and structural stability in areas where they cannot be keyed into bedrock or a competent confining layer. This option was not retained for further evaluation.

Grout Curtains

Description: Grout curtains are fixed, subsurface barriers formed by the pressure injection of grout in a regular pattern of drilled holes. Typically, the grout is injected into pipes arranged in a pattern of two or three adjacent rows. The injected grout fills open pore spaces and sets or gels in the soil voids, reducing the permeability of the grouted area.

Initial Screening: Grout curtains are applicable where they can be anchored in bedrock or a stable confining layer. Therefore, this process option was not retained for further evaluation.

Diaphragm Walls

Description: Diaphragm walls are barriers composed of reinforced concrete panels emplaced by slurry trenching techniques. They may be cast-in-place or pre-cast and are capable of supporting heavy loads. Diaphragm walls can only be expected to have permeabilities comparable to cement/bentonite walls if the joints between the cast panels are made correctly. As with other containment methods, these would have to be keyed into a lower confining layer to prevent groundwater underflow.

Initial Screening: This process was not retained for further evaluation because the high degree of strength achieved is not required at the site and a low-permeability layer into which to key the system is not present.

2.2.3 Groundwater Collection

Groundwater pumping techniques actively manipulate groundwater to contain or remove a plume or to adjust groundwater levels to prevent the migration of a plume. Well types used in groundwater collection may include well points, ejector wells, and pumping wells, with the selection of the appropriate well type depending on the depth of contamination and the hydrogeologic characteristics of the aquifer.

2.2.3.1 Well Point Dewatering Systems

Description: A well point dewatering system consists of an array of well points (constructed of steel pipes with perforated tips) that are driven into the aquifer and connected at the surface by a manifold hooked up to a vacuum system.

Initial Screening: Well point dewatering systems are best suited for shallow aquifers where extraction is not needed below 22 feet. At the Liberty Site, the groundwater contamination is also present at greater depths; therefore, well point dewatering systems were not retained for further evaluation.

2.2.3.2 Ejector Wells

Description: Ejector well construction specifications are similar to those of well points. Pumping and extraction of groundwater are achieved by bubbling air upward through the well casing and allowing the air pressure to lift the groundwater to the surface. Ejector wells are applicable for high-lift, low-flow conditions.

Initial Screening: Ejector well specifications require high-lift, low-flow conditions. These conditions are not met at the Liberty Site; hence, ejector wells were not further evaluated.

2.2.3.3 Pumping Wells

Description: Pumping wells are similar to traditional wells and are installed in a boring consisting of riser casing, well screen, and sand filter pack. The wells can be installed at regular intervals across a site to allow for the overlapping of the cones of depression (capture zones) created by simultaneous pumping to achieve the collection of contaminated groundwater and halt the migration of a plume.

Initial Screening: Pumping wells will be retained for further evaluation.

2.2.3.4 Subsurface Drains

Description: Subsurface drains include any type of buried conduit used to convey and collect groundwater by gravity flow. They function like an infinite line of extraction wells, creating a continuous zone of influence, enabling groundwater within these zones to flow toward the drain. Subsurface drains installed at regular intervals across a site are constructed by the excavation of trenches in the aquifer of concern, placement of a perforated drainage pipe in the base of the trench, and backfilling of the trench with aggregate. The individual drain pipes subsequently drain into a collection sump, which can be emptied periodically.

Initial Screening: Subsurface drains are most effective for shallow depths of less than 20 feet. At the Liberty Site, the groundwater contamination is also present at deeper depths; hence, subsurface drains were not retained for further evaluation.

2.2.4 Treatment - Groundwater

2.2.4.1 Physical

Coagulation, Flocculation, and Sedimentation

Description: Coagulation, flocculation, and sedimentation are the combination of three processes for the removal of solids in water. Sedimentation is the separation of suspended particles that are heavier than water by gravitational settling. Coagulation is a chemical technique directed towards the destabilization of colloidal particles in the water into larger particles which can settle out. Flocculation is a slow mixing technique which promotes the agglomeration of the destabilized particles to precipitate them out of the water.

Initial Screening: Coagulation, flocculation, and sedimentation are an integral part of any aqueous treatment system and are used specifically for the removal of suspended solids. Reduction of organics and dissolved inorganics will also require treatment via other physical or chemical processes. This treatment technology will be retained for further evaluation.

Filtration

Description: Filtration is the separation and removal of suspended solids from a liquid by passing the liquid through a porous medium comprised of a fibrous fabric, a screen, or a bed of granular material. To aid filtration, ground cellulose or diatomaceous earth is commonly added to the filter medium. Fluid flow through the filter medium may be accomplished by gravity, by inducing partial vacuum on one side of the medium, or by exerting a mechanical pressure on a dewatered sludge enclosed by filter media.

Initial Screening: Filtration is used primarily to remove any residual suspended solids remaining in the water following coagulation/sedimentation. This treatment technology will be retained and considered.

Granular Activated Carbon

Description: Chemical contaminants can be removed from water by the physical and chemical adsorption of organics onto the surface of carbon particles. Wastewater is pumped through a bed of granular activated carbon where close contact with carbon particles promotes adsorption of contaminants. Carbon adsorption removes a broad range of organic contaminants and a select number of inorganic contaminants. The exhausted carbon must be removed for disposal or regeneration.

Initial Screening: The technology is very effective for the removal of VOCs and achieves a high level of contaminant removal. Operational guidelines for this technology are that contaminant concentrations should be less than 10,000 parts per million (ppm) with suspended solids less than 50 ppm (EPA, 1985). The process will be retained for further evaluation.

Ion Exchange

Description: Ion exchange is a process by which ions of a given species are displaced from an insoluble exchange material by ions of a different species in solution. Ion exchangers can be operated in either a batch or a continuous mode. Spent resin is usually regenerated by exposing it to a very concentrated solution of the original exchange ion, enabling a reverse exchange to take place, resulting in regenerated resin and a concentrated solution of the removed ion which can then be processed for recovery and reuse.

Initial Screening: The process is used to treat metal-containing wastes including cations and anions. Limitations to the ion exchange process are compound selectivity/competition, pH, and suspended solids. High solid concentrations sometimes lead to resin blinding. This technology is conventionally applied ex-situ although it could in principle be applied in-situ if suitable reactor configurations exist. The ion exchange process will be retained for further evaluation.

Chelation

Description: Chelation is a chemical process in which ionic species, such as cationic metals, form coordination bonds with ions or molecules called ligands, modifying the properties of the metal ions. Ligands attached to insoluble species or matrices would have the effect of tying metals to the solid phase. When the removal capacity is saturated, the medium must be regenerated or replaced.

Initial Screening: The process is used to treat metal-containing waters. Limitations to the process are compound selectivity/competition, pH, and suspended solids. This technology is conventionally applied ex-situ although it could in principle be applied in-situ if suitable reactor configurations exist. The ion chelation process will be retained for further evaluation.

Air Stripping

Description: Air stripping is a mass transfer process in which volatile contaminants in water are transferred into the air. Air stripping is frequently accomplished in a packed tower equipped with an air blower. The factors important in the removal of organics from water include Henry's Law constants, temperature, pressure, air-to-water ratios, and the surface area available for mass transfer. The recovery of volatilized hazardous gases by means of emission control apparatuses may be required for subsequent treatment to preclude air pollution concerns, if the emission rates exceed ARARs.

Initial Screening: Air stripping is most effective for the removal of VOCs as a pretreatment step prior to activated carbon. The process will be retained for further evaluation.

Steam Stripping

Description: Steam stripping uses steam to evaporate VOCs from aqueous waste streams. Stream stripping is essentially a continuous fractional distillation process carried out in a packed or tray tower. Clean steam provides direct heat to the column in which gas flows from the bottom to the top of the tower. The resulting residuals are contaminated steam condensate, recovered solvent, and stripped effluent. The organic vapor and the bottoms would require further treatment.

Initial Screening: Steam stripping will treat less volatile and more soluble wastes than will air stripping and can handle concentrations from less than 100 ppm to approximately 10 percent organics. Because of the relatively lower concentrations of VOCs in the Upper Glacial aquifer, steam stripping was not considered further.

Critical Fluid Extraction

Description: Critical fluid extraction involves extraction of the aqueous constituents using special solvents, and subsequent separation of the solvent and organics, with reuse of the solvents. The aqueous stream enters near the top of an extractor, while the solvent is fed countercurrently into the bottom. At or near the gas's critical point, the organics in the aqueous stream dissolve into the solvent. Organic-laden extract can then be removed from the top of the column while clean water exits from the bottom. The extract then goes to a separator, where the temperature and pressure are decreased, causing the organics to separate from the solvent, which is recycled and returned to the extractor.

Initial Screening: Critical fluid extraction can remove chlorinated hydrocarbons, phenols, benzene and its derivatives, alcohols, ketones, acids, oil, and greases. The relatively low concentrations of these compounds precludes the effective use of this technology at the Liberty Site. Therefore, it will not be considered further.

Reverse Osmosis

Description: Reverse osmosis uses a semipermeable membrane which will allow the passage of only certain components of a solution, and a driving force to separate these components at a useful rate. The membrane is permeable to the solvent (groundwater), but impermeable to most dissolved organics and inorganics.

Initial Screening: Reverse osmosis may be used to concentrate dilute solutions of many inorganic and some organic solutes. Reprocessing may be necessary to optimize pH, remove strong oxidants, and filter out suspended solids. Reverse osmosis is a high-cost treatment alternative, suitable for low-volume applications. Because the anticipated volumes that will need treatment are large, reverse osmosis will not be considered further.

Oil-Water Separation

Description: Gravitational forces are used to separate two or more immiscible liquids having sufficiently different densities. Flow rates in continuous processes are kept low to enable liquid/liquid separation when the liquid mix is allowed to settle. Floating oil can be skimmed off the top using an oil skimmer, while the water flows out of the lower portion of the chamber. Acids may be used to break an oil/water emulsion and enhance separation to allow for greater oil removal efficiencies.

Initial Screening: Oil-water separation is usually a pretreatment process whose effectiveness is influenced by the aqueous waste stream's flow rate, temperature, and pH. Oil-water separation will not be considered further, because there are no free-phase immiscible liquids present.

Thickening/Dewatering

Description: Thickening/dewatering is a process used to increase the solids content of sludge by removing a portion of the liquid fraction by such unit processes as filtration, etc.

Initial Screening: The process is generally proposed for wastewater treatment sludges (such as those that may be generated from a pump-and-treat system) and will be retained for further evaluation.

2.2.4.2 Chemical

Neutralization

Description: Neutralization is the interaction of an acid with a base to enable the adjustment of the pH to 7.0, at which level the concentrations of hydrogen and hydroxyl ions are equal. The primary products of the reaction are salt and water. Neutralization is used to treat waste acids and alkalis in order to eliminate or reduce their reactivity and corrosivity.

Initial Screening: The process is generally proposed for wastewater treatment. Neutralization will be retained for further consideration.

Chemical Precipitation

Description: Chemical precipitation is widely used for the removal of heavy metals. The chemical equilibrium of a waste is changed through the addition of an acid or alkali to reduce the solubility of the undesired components. This causes them to precipitate out of solution in the form of colloidal or solid particulates.

Initial Screening: Chemical precipitation may be utilized as part of a pump-and-treat train, for the treatment of metals. The process is limited in that not all metals have a common pH at which they precipitate. Chelating and complexing agents can interfere with the precipitation process. This technology is conventionally applied ex-situ although it could in principle be applied in-situ if suitable reactor configurations exist. Chemical precipitation will be retained for further evaluation.

Ultraviolet/Hydrogen Peroxide

Description: Ultraviolet radiation is electromagnetic radiation that has a wavelength shorter than visible, but longer than x-ray radiation. Ultraviolet radiation causes the rearrangement of molecular structures, resulting in the formation of new chemical compounds. Hydrogen peroxide is an unstable, highly reactive oxidizing agent which, when coupled with the ultraviolet radiation, has been shown to be successful in the degradation of certain organics.

Conventional ultraviolet/hydrogen peroxide techniques utilize a liquid-phase reaction wherein hydrogen peroxide is bubbled through the aqueous waste. The mixture is then exposed to ultraviolet radiation in a mixing tank, leading to the degradation of the contaminants and the splitting of the peroxide into free oxygen, causing further oxidation of the contaminants.

Initial Screening: Ultraviolet/hydrogen peroxide is generally restricted to waters with a 1% or lower concentration of hazardous contaminants. The process will be retained for further evaluation for the treatment of VOCs.

2.2.4.3 Biological

Suspended Growth - Activated Sludge

Description: The activated sludge process only treats aqueous organic waste streams having less than a 1% suspended solids content. During the process, organic contaminants in the aqueous wastes are broken down through the activity of aerobic microorganisms which metabolize biodegradable organics. The treatment includes conventional activated sludge processes, as well as modifications such as sequencing batch reactors. The aeration process includes pumping the aqueous waste into an aeration tank where the biological treatment occurs. This is followed by the stream being sent to a clarifier where the treated aqueous waste is separated from the sludge biomass.

Initial Screening: Activated sludge processes are not suitable for removing highly chlorinated organics, aliphatics, amines, and aromatic compounds from an aqueous waste stream. In addition, some heavy metals and organic chemicals can be harmful to the microorganisms. The process will not be further evaluated, due to the low content of organics in the groundwater and the presence of chlorinated organics and metals.

Fixed Film Growth - Rotating Biological Contactor, Trickling Filters, Etc.

Description: Rotating biological contactors employ microorganisms attached to a fixed medium that is rotated through the aqueous waste stream in a closed reactor. In a trickling filter, the influent wastewater is distributed over fixed media that serve as a substrate for the microbes. The fixed film growth systems aerobically treat aqueous waste streams containing alcohols, phenols, phthalates, cyanide, and ammonia.

Initial Screening: The fixed film growth systems are essentially applicable to the same waste streams as the activated sludge treatment process. The process will not be further evaluated, due to the low content of organics in the groundwater and the presence of chlorinated organics and metals.

2.2.4.4 Thermal

Liquid Injection Incineration

Description: Liquid injection incinerators are usually cylindrical refractory secondary combustors for low-calorific material. Liquid wastes are introduced to the combustion chamber by means of specifically designed nozzles that mix with air and fuel as needed. The resulting gases, following combustion, are collected and treated to remove particulates and to neutralize acid gases. Pretreatment may be required for feeding some aqueous wastes to specific nozzles to provide efficient mixing with the oxygen source and to maintain a continuous waste flow.

Initial Screening: The burners are susceptible to clogging by particulates or caked material at the nozzles. Heavy metal wastes and wastes having high inorganic contents are not suitable for treatment. The process will not be retained for further evaluation.

Pyrolysis

Description: Pyrolysis is the chemical decomposition of wastes accomplished in an oxygen-deficient atmosphere. The system involves the use of two chambers. The separation of the volatile components from the nonvolatile components and ash is achieved in the primary chamber (pyrolyzer). In the secondary combustion chamber, volatile components are burned under proper operating conditions to destroy any remaining hazardous components. Temperatures in the pyrolyzer range from 1,000 to 1,300° F.

Initial Screening: Pyrolysis is only applicable to wastes containing pure organics. Systems are usually designed for specific wastes and are not readily adaptable to a variety of wastes. In addition, pyrolysis of chlorinated organics can lead to the formation of hazardous products of incomplete combustion (PICs). The process will not be retained for further evaluation.

Wet Air Oxidation

Description: Wet air oxidation uses high-temperature oxidation under controlled conditions to destroy dissolved or suspended organic waste constituents, oxidizable inorganics, and wastes not readily amenable to biological treatment. Aqueous phase oxidation of organic constituents is achieved at temperatures between 350 and 650°F and pressures ranging from 300 to 3,000 pounds per square inch (psi). Liquid wastes are pumped into the system and are mixed with compressed air or oxygen. The air-waste mixture then passes through a heat exchanger before entering the reactor, where the oxygen in the air reacts with organic constituents in the waste. The gas and liquid phase are separated following oxidation.

Initial Screening: Wet air oxidation is not suitable for inorganics or for wastes containing low concentrations of organics. The process will not be considered further.

2.2.5 Disposal - Groundwater/Wastewater Sludges

2.2.5.1 Off-Site Disposal

Discharge to Local Publicly Owned Treatment Works

Description: In this option, groundwater would be routed to a nearby publicly owned treatment works (POTW) following pretreatment to comply with the facility's pretreatment standards.

Initial Screening: At present, this option is feasible, assuming that the POTW's requirements can be met. This option will be retained for further evaluation.

Disposal to Off-Site Treatment, Storage, and Disposal Facility (TSDF)

Description: This option entails off-site hauling of wastes treated to the levels necessary for acceptance at an approved off-site treatment, storage, and disposal facility (TSDF).

Initial Screening: This option is not applicable to groundwater at the site because of the large volume of groundwater that would have to be transported to the TSDF. However, this may be a viable alternative for treatment sludges, and will be retained for that application.

2.2.5.2 On-Site Disposal

Discharge to Surface Water

Description: In this disposal option, treated groundwater would be directly discharged to the stormwater conveyance system at the site.

Initial Screening: This disposal option is feasible assuming that direct discharge effluent quality requirements can be met. This option will be retained for further evaluation.

Reinjection

Description: Reinjection involves recharge of groundwater treated to the subsurface for plume recovery.

Initial Screening: Reinjection for plume recovery must occur outside the plume boundaries to be effective. This option will be retained for further evaluation.

2.2.6 In-Situ Remediation

2.2.6.1 Biological

Bioremediation

Description: Various potential bioremediation methods have been investigated and/or developed for trichloroethene and/or 1,2-dichloroethene bioremediation (methanotrophic, reductive dechlorination, etc.). For the purposes of this alternative, anaerobic reductive dechlorination has been selected as the process option for analysis because of the nature of the contamination. Other methods could be considered during the remedial design phase.

Anaerobic reductive dechlorination would be accomplished by injection of co-metabolic substrates such as but not limited to methanol, butyric acid, molasses, or similar fermentable substrates, into and upgradient of the contamination, followed by anaerobic reductive dechlorination for treatment of trichloroethene and 1,2-dichloroethene. Groundwater would likely be extracted at the downstream boundary of the site for reinjection upgradient. If degradation rates are sufficiently high, direct injection at wellheads without recirculation may be sufficient. The system would be monitored for the effectiveness of biodegradation and to ensure that partial breakdown products (e.g., vinyl chloride) do not accumulate. Although the primary focus of anaerobic bioremediation is typically organics, the low redox potentials resulting from the biological removal of the oxygen may contribute to precipitation of metals within the aquifer.

Initial Screening: The treatment has been successfully applied to halogenated organics and may also address metals. The process will be retained for further evaluation.

2.2.6.2 Physical

Air Sparging

Description: In-situ air sparging of the site groundwater would be conducted by constructing sparge points (wells) to the appropriate depths into the contaminated groundwater. Aeration would be provided at each sparge point by blowers/compressors and, as necessary, an aboveground header/distribution system. A soil vapor extraction system (SVE) (vents and vacuum blowers) with off-gas treatment could be used to attempt to capture VOC-laden air from the vadose zone above the sparge point system. Emissions controls (off-gas treatment) would be required on the SVE exhaust.

Initial Screening: Air sparging is effective in removing VOCs from the groundwater. The process will be retained for further evaluation.

In-Well Vapor Stripping

Description: In-well vapor stripping technology involves the creation of a groundwater circulation pattern and simultaneous aeration within the stripping well to volatilize VOCs from the circulating groundwater. Air-lift pumping is used to lift groundwater and strip it of contaminants. Contaminated vapors may be drawn off for aboveground treatment or released to the vadose zone for biodegradation. Partially treated groundwater is forced out of the well into the vadose zone where it reinfiltrates to the water table. Untreated groundwater enters the well at its base, replacing the water lifted through pumping. Eventually, the partially treated water is cycled back through the well until contaminant concentration levels are reduced.

Applications of in-well stripping have generally involved chlorinated organic solvents (e.g., trichloroethene) and total petroleum product contamination (e.g., benzene, toluene, ethylbenzene, xylene [BTEX], and total petroleum hydrocarbons [TPH]). In-well stripping has been used in a variety of soil types from silty clay to sandy gravel.

Initial Screening: The treatment has been successfully applied to VOC-contaminated groundwater. The process will be retained for further evaluation.

2.2.6.3 Chemical

Permeable Barrier Treatment Walls

Description: Treatment walls involve construction of permanent, semipermanent, or replaceable units across the flow path of a contaminant plume. As the contaminated groundwater moves passively through the treatment wall, the contaminants are removed by physical, chemical, and/or biological processes, including precipitation, sorption, oxidation/reduction, fixation, or degradation. These simple mechanical barriers may contain metal-based catalysts, chelating agents, nutrients and oxygen, or other agents that are placed either in the path of the plumes to prevent further migration or immediately downgradient of the contaminant source to prevent plume formation. The reactions that take place in such systems depend on a number of parameters such as pH, oxidation/reduction potential, concentrations, and kinetics. Therefore, successful application of this technology requires a sufficient characterization of contaminants, groundwater flow regime, and subsurface geology.

Initial Screening: Treatment walls can be designed for the abatement of metals and VOCs. An important uncertainty in this option is the operating life of the in-situ removal technology (carbon adsorption and/or ion exchange and/or zero-valence metals) and the feasibility of replacing or regenerating this capacity when exhausted. The process will be retained for further evaluation.

Funnel-and-Gate Treatment Walls

Description: The funnel-and-gate system for in-situ treatment of contaminated plumes consists of low hydraulic conductivity (e.g., $1x10^{-6}$ cm/s) cutoff walls with gaps that contain in-situ reaction zones. Cutoff walls (the funnel) modify flow patterns so that groundwater primarily flows through high-conductivity gaps (the gates). The type of cutoff walls most likely to be used in the current practice are slurry walls, sheet piles, or soil admixtures applied by soil mixing or jet grouting.

Major issues associated with the design of a treatment wall include selecting the reactive media (chemical makeup, particle size distribution, proportion and composition of admixtures, etc.), residence time in the reaction zone, and the reaction zone size for appropriate life span, as well as addressing issues like the effect of the reaction zone medium on groundwater quality and the ultimate fate or disposition of a treatment wall.

Initial Screening: This method is limited by the uncertainties of the impermeable wall installation and the operating life of the in-situ removal technology (carbon adsorption and/or ion exchange). The impermeable barrier may deflect groundwater flow to underlying units unless it is keyed into a low-permeability unit. Since an appropriate low-permeability unit is not present at the site, the process will not be considered further.

2.2.6.4 Physicochemical

In-Situ Direct Precipitation

Description: This group of approaches would involve injection of amendments into the contaminated aquifer zone to result in the precipitation of metals in and on soil aquifer materials. If the approach is successful, the precipitated metals would be bound within the aquifer with limited or significantly reduced mobility and/or potential for remobilization under future groundwater conditions. At least two options exist for this process. In the first, reducing agents and/or precipitants would be added to directly precipitate the metals. In the case of chromium the chemical addition would include a reducing agent to convert hexavalent chromium to trivalent chromium.

A second option would be a patented process that relies upon addition of an organic substrate (such as molasses) to the aquifer to stimulate microbial activity. Under suitable conditions (including the presence of sufficient sulfate species in the groundwater), the biological activity results in lowering of the redox potential and production of precipitants (e.g., sulfides) to bind the metals.

Whether generated chemically or by biologically mediated processes, the metal sulfides and other precipitate species are considered to be generally stable under most conditions. However, as these are innovative in-situ processes, there are few long-term monitoring data on their permanence. In the complex aquifer conditions at the site, a mixture of oxidizing and reducing conditions are likely to exist; oxidizing conditions may occur by infiltration of oxygenated surface water and by other potential in-situ VOC treatment technologies such as air sparging. The transition zones between the oxidizing and reducing conditions would warrant careful consideration to ensure that metals are effectively immobilized. In addition, the precipitation of metals would require a source of sulfide, either chemically or biologically generated. In general, anaerobic fermentative activity may tend to produce organic acids and contribute to metals mobilization; therefore, the prompt transition to sulfate-reducing conditions to effectively precipitate metals as sulfides is critical. Excess sulfide present as hydrogen sulfide could also in theory be oxidized to sulfuric acid by sulfur oxidizing bacteria, leading to pH reductions. Finally, the long-term stability of the metal sulfide species under future aquifer conditions must be carefully considered.

Initial Screening: In-situ direct precipitation methods are innovative, and their permanence will warrant monitoring. However, they have the potential for success at significantly reduced cost as compared to ex-situ options. They will be retained for further consideration.

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Natural Attenuation

Description: Natural attenuation would involve the demonstration that natural processes can halt or attenuate migration of site contaminants. Natural attenuation differs from "no action" in that natural attenuation is implemented only if it can be demonstrated and proven that natural attenuation will reduce the contaminant levels to meet ARARs. Metals would be attenuated by, precipitated on, and/or adsorbed to, aquifer materials. VOCs would be adsorbed to aquifer materials or biodegraded. Due to the potential for migration of contaminants, a site-specific demonstration of its applicability is needed. This demonstration would involve periodic sampling and analyses on a monitoring well network (existing and supplemented with additional wells) for contaminants of concern as well as indicator parameters for natural attenuation. Appropriate modeling would be conducted to demonstrate attenuation of contaminants based upon monitoring data.

Initial Screening: At this time natural attenuation cannot be fully evaluated because the necessary physical, chemical, and microbiological data are not available to document its effectiveness. Detailed modeling study would need to be conducted prior to implementation to determine the contaminant travel time and the applicability of natural attenuation to this site. Natural attenuation will be retained for further evaluation.

2.3 EVALUATION OF TECHNOLOGY PROCESS OPTIONS

The technology process options considered to be technically implementable are evaluated in greater detail. The objective of this screening step is to reduce the number of representative process options for each response technology type to simplify the subsequent development and evaluation of alternatives without limiting flexibility during the remedial design.

The representative processes selected provide a basis for developing performance specifications during the preliminary design stage; however, the specific process or processes actually used in the implementation of the response action at the site may/may not be selected until the remedial design phase.

The process options are evaluated using the criteria of effectiveness, implementability, and cost. An important distinction made at this point is that these criteria are applied only to the response technologies and the general response actions they are intended to satisfy, and not to the site as a whole. In addition, the evaluation focuses on the effectiveness criterion, with lesser emphasis directed towards the implementability and cost criteria.

The technology process evaluation criteria are summarized as follows:

- Effectiveness

Specific technology process options identified are evaluated relative to other processes within the same technology type. The evaluation focuses on:

1. The potential effectiveness of the process options in handling the contaminated groundwater and in meeting the goals identified in the response action objectives.
2. Potential impacts to human health and the environment during the construction and implementation stages.
3. Proven performance and reliability of the technology with respect to the constituents and conditions at the site.

- Implementability

Implementability encompasses both the technical and institutional feasibility of implementing the technology process options addressing the treatment of contaminated groundwater at the Liberty Site. Emphasis is placed on the institutional aspects of implementability, such as the ability to obtain necessary permits for on-site/off-site actions and the availability of necessary equipment and services.

- Cost

Cost plays a limited role in the screening of the process options. Detailed cost estimates are not generated for each technology. Relative cost bases on engineering judgment are instead used for comparing technologies that are able to achieve similar remediation objectives.

Table 2-2 is a listing of the technology process options and their screening evaluations for the control of contaminated groundwater at the Liberty Site. Table 2-3 summarizes the detailed screening of in-situ technologies.

As mandated by EPA, the "No Action" option remains for baseline comparison. None of the "containment" general response actions relating to subsurface barriers have been retained because of unfavorable hydrogeologic conditions. Pumping wells have been retained under the "groundwater collection" general response action.

Several treatment technologies have been retained under the "treatment" general response action due to the complexity of the groundwater matrix, which will require more than one treatment technology to remove both organics and inorganics. The retained treatment technologies include:

Air Stripping
Ion Exchange

Thickening/Dewatering
Neutralization
Granular Activated Carbon
Coagulation, Flocculation, and Sedimentation
Filtration
Chemical Precipitation
Chelation

Under the "disposal-groundwater/wastewater sludges" general response action, the on-site reinjection and disposal of treated groundwater into Massapequa Creek via the storm water conveyance systems have been retained. The off-site disposal via a TSDF has been retained only for the wastewater sludges, as the extremely large volumes of pumped groundwater preclude the cost-effectiveness of this option.

Under the "In-Situ Remediation" general response action, bioremediation, air-stripping, permeable treatment wall, in-situ direct precipitation, and natural attenuation have been retained.

2.4 INTERIM RESPONSE ACTION ALTERNATIVES

In this section, the technologies/process options identified previously and retained are grouped into potential interim response action alternatives for the groundwater.

GW-1: No Action

GW-2: Groundwater Pumping and Treatment. Groundwater would be collected by a system of recovery wells, and put though a treatment train consisting of a combination of previously identified treatment options, to remove VOCs and metals. The treatment sludges would be disposed of off-site, and the treated groundwater would be discharged to the stormwater conveyance system.

GW-3 In-Situ Physical/Chemical Treatment. A reactive, permeable wall would be installed across the plume, along the downgradient side of the property. As contaminated groundwater flows through the wall, the contaminants would be removed.

GW-4 In-Situ Air Stripping with In-Situ Direct Precipitation or Metals Treatment through Chelation. A system of groundwater circulation cell wells, outfitted with in-situ air stripping equipment would be installed at the downgradient side of the property. These wells would capture the contaminated groundwater and through the air-stripping action will remove the VOCs. The removed VOCs would be treated by one of the previously described options. The treated groundwater would be returned directly to the aquifer. In conjunction with this treatment for VOCs, direct injection of amendments would be used within the on-site metals contamination plume to effect the reduction and precipitation of cadmium and chromium within and on aquifer materials. Alternatively, metals removal could take place adjacent to the circulation well, in a chelation reaction unit.

The above alternatives were selected based on the following considerations:

- The interim response alternatives were formulated using the technologies retained from the screening process. This required formulating alternatives that consisted of combinations of the individual technologies.

- It is not possible to develop alternatives that include every possible combination of process options. Therefore, the alternatives were chosen to span a variety of options. These alternatives include all of the types of options that were retained during the screening process. However, variations of certain technologies may be considered during the remedial design stage.

- With the exception of Alternative GW-1 (No Action), all alternatives will satisfy the interim response action objectives. Alternative GW-1 was retained as required under CERCLA to serve as a baseline comparison.

- Alternative GW-2 (Pumping and Treatment) was developed because it is conventional, is easily implemented, and provides the potential for effective treatment.

- Alternatives GW-3 (In-Situ Physical/Chemical Treatment) and GW-4 (In-Situ Air Stripping with In-Situ Direct Precipitation or Metals Treatment through Chelation) were developed because they provide the potential for effective treatment and generate limited or no waste streams. Furthermore, they meet the regulatory policy of utilizing innovative treatment technologies, when applicable.

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SECTION 3.0

DEVELOPMENT AND SCREENING OF GROUNDWATER INTERIM RESPONSE ACTION ALTERNATIVES

3.1 EVALUATION CRITERIA AND APPROACH

3.1.1 Criteria

The three evaluation criteria (effectiveness, implementability, and cost) evaluated for each alternative are discussed in EPA's *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (EPA, 1988) and the handbook for *Remedial Action at Waste Disposal Sites* (EPA, 1985). A description of each of these criteria follows.

3.1.1.1 Effectiveness

The effectiveness evaluation considers the capacity of each interim response action alternative to protect human health and the environment during the construction and implementation phase (short term) and the period after remediation is complete (long term). Effectiveness in the short-term and long-term is related to the reduction in toxicity, mobility, and/or volume of contamination each alternative provides.

3.1.1.2 Implementability

The implementability evaluation is used to assess the technical and administrative feasibility of constructing, operating, and maintaining each interim response action alternative. In addition, the availability of the technologies involved in an interim response alternative is considered.

3.1.1.3 Cost

The cost evaluation considers both capital costs and annual operation and maintenance (O&M) costs. These costs are presented on a qualitative basis.

A description of each interim response action alternative, including a summary of the effectiveness, implementability, and cost for each of the alternatives, is presented below.

3.2 DESCRIPTION AND EVALUATION OF INTERIM RESPONSE ACTION ALTERNATIVES

3.2.1 Alternative GW-1: No Action

The No Action alternative would not require any interim response actions. The NCP requires that this alternative be considered to provide a baseline against which all other alternatives may be compared.

3.2.1.1 Effectiveness

The No Action alternative does not satisfy the interim response action objectives. In addition, this alternative provides no reduction in the toxicity, mobility, or volume for the contaminants of concern and does not inhibit or control the migration of contaminants.

In summary, the No Action alternative has very limited effectiveness because there would still be unacceptable risks to human health and the environment, including the potential for adverse environmental and human health effects as a result of the continued migration of contaminated groundwater underlying the site beyond the site property boundary.

3.2.1.2 Implementability

This alternative is easily implementable.

3.2.1.3 Cost

There are no capital and O&M costs for this alternative.

3.2.2 Alternative GW-2: Groundwater Pumping and Treatment

Groundwater will be collected using one or two extraction wells. It is anticipated that the extraction wells will be recovering a total of 200 gallons per minute (gpm). The groundwater will be treated by chemical precipitation or ion exchange for the removal of metals, and air stripping coupled to liquid and vapor phase carbon for the removal of VOCs. The vapor phase carbon units will be designed to be able to be regenerated. Reclaimed metals and filter cake from the metals treatment will be disposed of off-site, most likely as a hazardous waste. The treatment system will be designed to handle flows up to 300 gpm to accommodate variability in future pumping requirements.

Most of the treated groundwater will be discharged into the stormwater conveyance systems to maintain flow conditions in Massapequa Creek. Any water that cannot be discharged (e.g., due to capacity limitations) could be directed towards infiltration galleries that can be located along the northern property boundary. For the purposes of this report it has been assumed that the entire volume will be discharged to Massapequa Creek.

3.2.2.1 Effectiveness

This alternative satisfies the interim response action objectives because it controls plume migration. This alternative is also highly effective in reducing the mass and concentration of contaminants.

3.2.2.2 Implementability

Installation of the groundwater treatment and recovery system is readily implementable. The technologies involved are proven and reliable, and the necessary equipment and supplies are commercially available. Sufficient numbers and capacities of off-site TSDFs exist for the treatment and/or disposal of the groundwater treatment residues.

3.2.2.3 Cost

Capital costs are expected to be high because of the large volume of groundwater that must be treated and the range of contaminants that must be removed. The O&M costs are expected to be moderate.

3.2.3 Alternative GW-3: In-Situ Physical/Chemical Treatment

This alternative involves the installation of a reactive wall system. A reactive treatment medium (such as zero-valence iron) is emplaced into the aquifer via trenching or injection to form a permeable barrier (wall) through which groundwater flows. As groundwater moves through the permeable wall, the contaminants react with the treatment medium and degrade or become immobilized.

3.2.3.1 Effectiveness

Permeable reactive wall systems are capable of degrading organic compounds and immobilizing metals. A treatability study is necessary to determine the type of reaction medium and effectiveness of contaminant removal. This method is expected to be at least moderately effective in removing contaminants from the groundwater and controlling plume migration.

3.2.3.2 Implementability

This interim response action is implementable at shallow depths as it requires only conventional trenching or injection construction equipment. The constructability, however, is limited by the depth to which the wall must be completed. The estimated formation thickness (85 feet) is greater than the presently reported attained depths (50 feet), and treatment of the deeper contamination may be difficult. Specialized or innovative construction methods (such as use of caisson methods or injection) may be necessary.

3.2.3.3 Cost

The capital costs for this interim response action are high. O&M and long-term monitoring costs are moderate.

3.2.4 Alternative GW-4: In-Situ Air Stripping and In-Situ Direct Precipitation or Metals Treatment through Chelation

This alternative is based upon circulation cell technology and involves the installation of double-cased wells ("well-within-a-well") with hydraulically separated upper and lower screened intervals within the same saturated zone (aquifer). The lower screen, through which groundwater enters, is placed at or near the bottom of the contaminated aquifer, and the upper screen, through which groundwater is discharged, is installed across or above the water table. Air is injected into the inner casing, decreasing the density of the groundwater and allowing it to rise within the inner casing. Through this air-lift pumping, VOCs in the groundwater are transferred from the dissolved phase to the vapor phase by the rising air bubbles through an air stripping process. Contaminated vapors are treated above ground.

The groundwater, which has been partially stripped of VOCs, continues to move upward within the inner casing and is eventually discharged into the outer casing, moving through the upper screened interval into the vadose zone or the upper portion of the aquifer. Once returned to the subsurface, groundwater flows vertically downward, eventually reaching the lower portion of the aquifer where it is cycled back through the well into the lower screened interval, replacing the water that rose due to the density gradient. This cycling of water in the aquifer around the well creates a hydraulic circulation pattern or cell that allows continuous cycling of groundwater in-situ through the air stripping process. Groundwater is repeatedly circulated through the system until sufficient contaminant removal has taken place.

In addition, direct injection of amendments could be used within the on-site metals contamination plume to effect the reduction and precipitation of cadmium and chromium within and on aquifer materials. This would be conducted throughout the on-site plume upgradient of the in-situ stripping wells to precipitate metal in the aquifer. Alternatively, a chelation reaction unit could be used in conjunction with the circulation cell. This chelation reaction unit would be located adjacent to the circulation cell well. These metals treatment alternatives will be evaluated separately.

3.2.4.1 Effectiveness

In-situ air stripping is effective in controlling VOCs. Although pilot testing is needed to establish design criteria and well spacing, aquifer conditions at the Liberty Site are expected to be suitable for in-situ stripping. The chemical steps involved in chemical precipitation are well understood; however, there are fewer data on their application in-situ. If successful, metals levels in the groundwater flow will be significantly reduced; however, the metals would remain within and on aquifer materials, and long-term monitoring would be required to verify the permanence of this approach.

Metals treatment in a chelating unit is also a proven method; however, selection of the proper chelating agent for use with the site groundwater would be required. The migration of metals-contaminated groundwater would also be controlled with the use of this technology.

3.2.4.2 Implementability

This interim response action is implementable, as all the equipment and supplies needed are commercially available.

3.2.4.3 Cost

The capital costs for this interim response action are moderately high. O&M and long-term monitoring costs are moderate.

3.3 <u>INITIAL SCREENING OF GROUNDWATER INTERIM RESPONSE ACTION ALTERNATIVES</u>

Table 3-1 summarizes the initial screening process of interim remedial action alternatives. Three of the interim response alternatives will undergo further screening in Section 4. Alternative GW-3 will not undergo further evaluation because of the potential constructability difficulties, stemming from the large formation thickness.

Alternative GW-4 provides innovative approaches to the control of VOC and metals migration. Because of the many variables that control the biochemical reactions necessary for the successful implementation of this alternative, it will be necessary to conduct a pilot study to evaluate whether the site-specific conditions can be addressed.

SECTION 4.0

DETAILED ANALYSIS OF GROUNDWATER INTERIM RESPONSE ACTION ALTERNATIVES

4.1 INTRODUCTION

This section provides a description, detailed analysis, and comparative analysis of each alternative that passed the initial screening of alternatives. Each alternative will be assessed against the following evaluation criteria based on CERCLA requirements of:

- Overall protection of human health and the environment.
- Compliance with ARARs.
- Long-term effectiveness and permanence.
- Reduction of toxicity, mobility, and volume through treatment.
- Short-term effectiveness.
- Implementability.
- Cost.
- State acceptance.
- Community acceptance.

An overview of each of the nine criteria is presented below.

4.2 OVERVIEW OF EVALUATION CRITERIA

4.2.1 Overall Protection of Human Health and the Environment

This criterion provides a final check to assess whether the alternatives are protective of human health and the environment. The overall assessment of protectiveness is based on a composite of factors assessed under the evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

4.2.2 Compliance with ARARs

This criterion includes evaluating the ability of each alternative to comply with ARARs. In general, because this is an interim response action intended to minimize the migration of contaminated groundwater rather than restore the aquifer, compliance with only action-specific ARARs will be considered. The ARARs identified for application to the Liberty Site are listed in Appendix B. This appendix also contains information on chemical-specific ARARs and other federal and state criteria, advisories, guidance, and proposed standards and local ordinances that are not legally binding but may provide useful information or recommended procedures, referred to as "To Be Considered" (TBC) criteria.

4.2.3 Long-Term Effectiveness and Permanence

This criterion involves the evaluation of the long-term effectiveness of alternatives for protecting human health and the environment after the interim response objectives have been completed. The primary focus of this evaluation is the extent and effectiveness of the controls that may be required to manage the potential risks posed by treatment residuals and/or untreated wastes.

4.2.4 Reduction of Toxicity, Mobility, and Volume through Treatment

This criterion includes evaluating the anticipated performance of specific treatment technologies. This evaluation addresses the statutory preference for selecting interim response actions that employ treatment technologies to permanently and significantly reduce toxicity, mobility, or volume of wastes.

4.2.5 Short-Term Effectiveness

This criterion examines the effectiveness of alternatives for protecting human health and the environment during the construction and implementation period until the interim response objectives have been met.

4.2.6 Implementability

The implementability criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during implementation.

4.2.7 Cost

Cost evaluation of each alternative includes consideration of capital costs and annual costs based on existing vendor information and previous site remediation experience. The accuracy provided by these cost estimates is reflected by using a contingency of 25%. A present worth analysis is also conducted (7% compounded annually over 3 years), allowing all interim response action alternatives to be compared on the basis of a single cost.

4.2.8 State Acceptance

This criterion evaluates the technical and administrative issues and concerns that the State (or support agency) may have regarding each of the alternatives. Because the State has not yet been provided with a formal opportunity to review the detailed analysis of the interim response alternatives, no formal comments from the State are currently available for evaluation against this criterion. These comments will be addressed in the Responsiveness Summary section of the EPA decision document.

4.2.9 Community Acceptance

This criterion incorporates public comments into the evaluation of the interim response alternatives. Because the public has not yet been provided with a formal opportunity to review the detailed analysis of the interim response alternatives, no formal comments from the public are currently available for evaluation of this criterion. It is anticipated that the formal comments from the public will be provided during the public comment period on this FFS Report. These comments will then be addressed in the Responsiveness Summary section of the EPA decision document.

4.3 INDIVIDUAL ANALYSIS OF GROUNDWATER INTERIM RESPONSE ACTION ALTERNATIVES

4.3.1 Groundwater Interim Response Action Alternative GW-A: No Action

4.3.1.1 Description of Alternative

The No Action alternative is required by the NCP to provide a baseline to which all other alternatives may be compared. Under the No Action alternative, no interim response actions would be initiated.

4.3.1.2 Overall Protection of Human Health and the Environment

This alternative prevents neither the migration of contaminated groundwater into the Upper Glacial aquifer underlying and downgradient of the Liberty Site, nor the degradation of hydraulically connected media. The groundwater contaminants would continue to migrate into as yet uncontaminated portions of the Upper Glacial aquifer. An unacceptable risk to human health and the environment would exist relative to the future use of the Upper Glacial aquifer. The migration of the groundwater plume into Massapequa Creek and possibly its sediments will continue to exist. This migration may create additional points of exposure within Massapequa Creek as well as adverse ecological effects.

4.3.1.3 Compliance with ARARs

The No Action alternative does not address ARARs.

4.3.1.4 Long-Term Effectiveness and Permanence

This alternative does not prevent the degradation of groundwater in the Upper Glacial aquifer or the degradation of other hydraulically connected media. Contaminants in the groundwater could be expected to remain at hazardous levels for decades to come.

4.3.1.5 Reduction of Toxicity, Mobility, and Volume through Treatment

There is no reduction in toxicity, mobility, or volume since no interim response action is employed in this alternative.

4.3.1.6 Short-Term Effectiveness

The No Action alternative will not prevent the continued migration of contaminated groundwater in the Upper Glacial aquifer. This alternative does not pose an unacceptable short-term risk to on-site workers or the surrounding community, since no interim response activities would occur on-site.

4.3.1.7 Implementability

This alternative is easily implementable, as there are no actions that must be undertaken.

4.3.1.8 Cost

There is no cost associated with this alternative, because no actions are taking place.

4.3.1.9 State Acceptance

Comments from the New York State agencies received concerning this alternative will be addressed in the Responsiveness Summary section of the EPA decision document.

4.3.1.10 Community Acceptance

After public comments regarding this alternative are received, they will be included in the Responsiveness Summary section of the EPA decision document.

4.3.2 Groundwater Interim Response Action Alternative GW-B: Groundwater Pumping and Treatment

4.3.2.1 Description of Alternative

The major components of this alternative are as follows:

- Installing a groundwater treatment system capable of handling flows up to 200 gpm.
- Drilling one or two recovery wells, depending upon space limitations. The well(s) will be installed at or just downgradient of the property line. The wells will be screened across the entire Upper Glacial aquifer (approximately 85 feet deep).
- Connecting the recovery wells to the treatment system through a system of piping, pumps, valves and associated instrumentation, supports, etc.
- Completing a stormwater conveyance system hookup to the treatment system.
- Monitoring site groundwater and providing O&M services.

Multiple unit processes are required to capture and remove the various site contaminants. The primary technology for VOC removal is conventional air stripping. Granular activated carbon (GAC) adsorption is used following stripping to remove any SVOCs that may be captured; since this backup is needed based upon groundwater data for SVOCs, the air stripper can also be downsized slightly to allow some VOC capture by the GAC.

The variety of inorganic species present also requires several steps for complete removal. Ion exchange is used initially to remove hexavalent chromium. Hydroxide precipitation with coagulation is used to remove cationic heavy metals. Greensand filtration is used to remove manganese and residual solids prior to air stripping to prevent fouling of the downstream organics removal processes. The treated groundwater will be discharged into the stormwater conveyance systems to maintain flow conditions in Massapequa Creek. Appendix C presents a detailed process description. The detailed groundwater capture analysis is presented in Appendix D. While these appendices estimate that a 200-gpm capacity will be sufficient for plume capture, capability to treat up to 300 gpm is proposed to be provided in this alternative. This will allow for plume capture, if required.

4.3.2.2 Overall Protection of Human Health and the Environment

This alternative entails complete removal of VOCs and metals, to meet discharge criteria. Therefore, it provides good overall protection of human health and the environment as it prevents the further degradation of the Upper Glacial aquifer and other hydraulically connected media. The proposed groundwater monitoring program will monitor effectiveness over the duration of the response action.

4.3.2.3 Compliance with ARARs

Because this is an interim response action, only action-specific ARARs will be complied with Alternative GW-B will comply with ARARs such as the Resource Conservation and Recovery

Act (RCRA) standards for owners and operators of hazardous waste treatment, storage and disposal facilities, the Clean Air Act (e.g., ambient air quality standards), and manifest requirements for transporters of hazardous waste. Alternative GW-B will also comply with additional ARARs, such as State Pollutant Discharge Elimination System (SPDES) standards for the discharge of the treated groundwater, because the treatment train (presented in Appendix C) is expected to reduce the contaminant concentrations to the required limits.

4.3.2.4 Long-Term Effectiveness and Permanence

This constitutes an interim response action. Therefore, long term-effectiveness and permanence are not strictly applicable to this evaluation. However, overall, long-term effectiveness and permanence of this alternative are good because the alternative removes the contaminants from the groundwater.

4.3.2.5 Reduction of Toxicity, Mobility, and Volume through Treatment

The recovery of groundwater from the Upper Glacial aquifer will substantially reduce the toxicity, mobility, and volume of the groundwater contaminants.

Groundwater treatment using filtration, ion exchange, air stripping, and carbon allows for the removal of the existing groundwater contaminants. Treatment residuals will be disposed of off-site.

4.3.2.6 Short-Term Effectiveness

The proposed groundwater interim response action will halt the migration of the contaminated plume in the Upper Glacial aquifer at the Liberty property line. A short-term risk to the workers exists from exposure to soil and groundwater contaminants during the construction of the off-site groundwater recovery wells. These concerns can be mitigated by the use of appropriate health and safety procedures.

4.3.2.7 Implementability

Installation of the groundwater treatment and recovery system will be readily implementable. The technologies involved are proven and reliable. The existing network of monitoring wells should be sufficient to monitor the effectiveness of the remedy. Sufficient numbers and capacities of off-site disposal facilities exist for the treatment and/or disposal of the groundwater treatment residues. In addition, the equipment to be used in the treatment and recovery system is readily available. A pump test will be required to determine aquifer parameters, prior to initiating system design.

4.3.2.8 Cost

The estimated costs for this alternative are provided in Table 4-1. The estimated capital cost is \$2,648,000. The estimated annual O&M cost for this alternative is \$402,000 per year. Using a present-worth analysis of 7% interest compounded annually over 3 years, the total present worth estimated O&M cost of the alternative is \$1,317,000. The total present worth for the pumping and treatment alternative is \$3,965,000.

4.3.2.9 State Acceptance

Comments from the New York State agencies received in response to this alternative will be addressed in the Responsiveness Summary section of the EPA decision document.

4.3.2.10 Community Acceptance

After public comments regarding this alternative are received, they will be included in the Responsiveness Summary section of the EPA decision document.

4.3.3 Groundwater Interim Response Action Alternative GW-C-I: In-Situ Air Stripping with In-Situ Direct Precipitation

4.3.3.1 Description of Alternative

The major components of this alternative are:

- Installation of four groundwater circulation wells, outfitted with in-situ air stripping equipment.
- Installation of 31 well couplets to inject amendments.
- Direct injection of amendments to facilitate metals precipitation.
- System operation and maintenance.
- Groundwater monitoring.

VOCs released to the airstream will be treated by a previously described option (i.e., GAC). The treated groundwater will be returned directly to the aquifer.

4.3.3.2 Overall Protection of Human Health and the Environment

This alternative provides good overall protection of human health and the environment as it controls migration, permanently removes VOCs from the groundwater, and attenuates metals as stable insoluble precipitates on aquifer materials.

4.3.3.3 Compliance with ARARs

Because this is an interim response action, alternative GW-C-I will comply with only action-specific ARARs. This alternative will comply with ARARs such as the RCRA standards for owners and operators of hazardous waste TSDFs, the Clean Air Act (e.g., ambient air quality standards), and manifest requirements for transporters of hazardous waste.

4.3.3.4 Long-Term Effectiveness and Permanence

This constitutes an interim response action. Therefore, long term-effectiveness and permanence are not strictly applicable to this evaluation. However, this alternative provides a permanent removal of VOCs from the aquifer. Although the attenuated metals are believed to be stable, few long-term data are available on the permanence of this solution.

4.3.3.5 Reduction of Toxicity, Mobility, and Volume through Treatment

Toxicity, mobility, and volume of VOCs will be reduced by this alternative because VOCs will be removed from the groundwater. To the extent that metals are bound in insoluble precipitates, the mobility of contaminants will also be reduced. Also, the reduction of hexavalent chromium to trivalent chromium will result in reduction of toxicity. The combined effect of the hydraulic control and the contaminant reduction will minimize contaminated groundwater migration migrating beyond the site boundaries.

4.3.3.6 Short-Term Effectiveness

Short-term risks to site workers will potentially exist during the construction of the system, from exposure to contaminated soil and groundwater from the drilling activities. All activities would be performed under a health and safety plan, utilizing appropriate personal protective equipment to minimize these potential impacts. Potential exposure routes that may need to be addressed include volatilization of the organic contaminants and airborne or overland transport of contaminated solids and liquids from the drilling. Engineering controls to reduce these emissions are readily available.

4.3.3.7 Implementability

This alternative may be implemented with existing, although specialized equipment. All required equipment is commercially available. However, the biochemical reactions necessary for the precipitation of metals are complex. While this alternative may be effective in immobilizing cadmium and chromium by creating reducing conditions in the aquifer, it may lead to the mobilization of iron, which, when exposed to the aerated water, could be deposited in the formation and on the well equipment and lead to loss of well efficiency. The recirculation cells may also introduce oxygen to the formation, thus contravening the efforts to produce a reducing environment. It is also possible the intermediate metabolites may include acids, which in turn lower the pH and thus force the metal speciation into a different stability field. Also, the high groundwater flow velocity (approximately 1 foot/year) may not provide adequate residence time to allow for the micro-biota to develop the needed reducing conditions. The aeration may also stimulate the growth of iron bacteria, causing the decomposition of tenacious biomass, clogging the well screens. Therefore, a detailed pilot study is necessary to fully evaluate the implementability of this alternative

4.3.3.8 Cost

The estimated costs for this alternative are provided in Table 4-2. The estimated capital cost is $1,635,000. The estimated annual O&M cost for this alternative is $99,000 per year. Using a present-worth analysis of 7% interest compounded annually over 3 years, the total present worth estimated O&M cost of the alternative is $260,000. The total present worth for In-Situ Air Stripping with In-Situ Direct Precipitation alternative is $1,895,000.

4.3.3.9 State Acceptance

Comments from the public received in response to this alternative will be addressed in the Responsiveness Summary section of the EPA decision document.

4.3.3.10 Community Acceptance

After public comments regarding this alternative are received, they will be included in the Responsiveness Summary section of the EPA decision document.

4.3.4 Groundwater Interim Response Action Alternative GW-C-II: In-Situ Air Stripping with Metals Treatment through Chelation

4.3.4.1 Description of Alternative

The major components of this alternative are:

- Installation of four groundwater circulation cell wells, outfitted with in-situ air stripping equipment.
- Installation of chelation units, with associated piping, valves, and controls.
- System operation and maintenance.
- Groundwater monitoring.

VOCs released to the airstream will be treated by a previously described option (i.e., GAC). The treated groundwater will be returned directly to the aquifer, after it is treated for metals. Metals will be treated using a chelation treatment system. The chelation process will be supplemented by iron and hexavalent chromium precipitation.

4.3.4.2 Overall Protection of Human Health and the Environment

This alternative provides good overall protection of human health and the environment as it permanently removes VOCs and metals from the groundwater.

4.3.4.3 Compliance with ARARs

Because this is an interim response action, Alternative GW-C-II will comply with only action-specific ARARs. Alternative GW-C-II will comply with ARARs such as the RCRA standards for owners and operators of hazardous waste TSDFs, the Clean Air Act (e.g., ambient air quality standards), and manifest requirements for transporters of hazardous waste.

4.3.4.4 Long-Term Effectiveness and Permanence

This constitutes an interim response action. Therefore, long term-effectiveness and permanence are not strictly applicable to this evaluation. However, this alternative provides a permanent removal of VOCs and metals from the aquifer.

4.3.4.5 Reduction of Toxicity, Mobility, and Volume through Treatment

Toxicity, mobility, and volume of VOCs will be reduced by this alternative because VOCs will be removed from the groundwater. Metals will be removed from the groundwater, and therefore their volume, toxicity, and mobility will be reduced. The combined effect of the hydraulic control and the contaminant reduction will minimize contaminated groundwater migration beyond the site boundaries.

4.3.4.6 Short-Term Effectiveness

Short-term risks to site workers will potentially exist during the construction of the system, from exposure to contaminated soil and groundwater from the drilling and excavation activities. All activities would be performed under a health and safety plan, utilizing appropriate personal protective equipment to minimize these potential impacts. Potential exposure routes that may need to be addressed include volatilization of the organic contaminants and airborne or overland transport of contaminated solids and liquids from the drilling and excavation. Engineering controls to reduce these discharges are readily available.

4.3.4.7 Implementability

This alternative may be implemented with existing, although specialized equipment. All required equipment is commercially available. Although chelation is somewhat selective in the removal of metals, interferences from metal species, which are not targeted for treatment, must be expected. Also, due to the high concentration of iron and manganese in the groundwater, irreversible biofouling of the chelation media is possible. Therefore, a detailed pilot test is necessary to completely evaluate the implementability of this alternative.

4.3.4.8 Cost

The estimated costs for this alternative are provided in Table 4-3. The estimated capital cost is $2,368,000. The estimated annual O&M cost for this alternative is $404,000 per year. Using a present-worth analysis of 7% interest compounded annually over 3 years, the total present worth estimated O&M cost of the alternative is $1,060,000. The total present worth for the In-Situ Air Stripping with Metals Treatment through Chelating Alternative is $3,428,000. This cost can be significantly reduced if treatability testing demonstrates that iron fouling is not occurring and hexavalent chromium reduction is not necessary.

4.3.4.9 State Acceptance

Comments from the New York State agencies received in response to this alternative will be addressed in the Responsiveness Summary section of the EPA decision document.

4.3.4.10 Community Acceptance

After public comments regarding this alternative are received, they will be included in the Responsiveness Summary section of the EPA decision document.

4.4 COMPARATIVE ANALYSIS OF ALTERNATIVES

Table 4-4 summarizes the comparative analysis of the alternatives.

4.4.1 Overall Protection of Human Health and the Environment

Alternatives GW-B, GW-C-I, and GW-C-II provide overall protection of human health and the environment through plume migration control and treatment of groundwater. Alternative GW-A, which offers no groundwater plume migration control, is the least protective alternative.

4.4.2 Compliance with ARARs

No ARARs apply to Alternative GW-A because no response actions take place. Because this is an interim response action, Alternatives GW-B and GW-C will comply with only action-specific ARARs. Alternatives GW-B and GW-C will comply with ARARs such as the RCRA standards for owners and operators of hazardous waste TSDFs, the Clean Air Act (e.g., ambient air quality standards), and manifest requirements for transporters of hazardous waste. Alternative GW-B will also comply with additional ARARs, such as SPDES standards for the discharge of the treated groundwater.

4.4.3 Long-Term Effectiveness and Permanence

This is an interim action. Therefore, long term-effectiveness and permanence are not strictly applicable to this evaluation. Alternatives GW-B and GW-C-II will provide plume migration control during the period of the response action. In addition, Alternatives GW-B and GW-C-II provide long-term benefit by permanently removing contaminants from the groundwater. Alternative GW-C-I permanently removes VOCs from groundwater, but the permanence of the metal precipitates formed in the soil column is not fully known. Alternative GW-A provides no plume migration control and is not considered to be effective.

4.4.4 Reduction of Toxicity, Mobility, and Volume through Treatment

Alternatives GW-B and GW-C-II reduce the toxicity, mobility, and volume of groundwater contaminants by the removal, treatment, and/or destruction of VOCs and metals in the contaminated groundwater. Alternatives GW-B and GW-C-I permanently reduce the toxicity by VOC removal and reduce the mobility of the metals by binding them in insoluble precipitates. However, the permanence of these precipitates is not known. Alternative GW-A offers no reduction of the toxicity, mobility, and volume of the groundwater contaminants.

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4.4.5 Short-Term Effectiveness

Alternatives GW-B, GW-C-I, and GW-C-II in the short term will halt the spread of contaminated groundwater in the Upper Glacial aquifer. Alternatives GW-B, GW-C-I, and GW-C-II may present potential risks to human health (e.g., response action workers) and the environment during construction, from the disturbance of contaminated soil and groundwater. Alternative GW-A provides no control of the migration of the contaminated groundwater plume and is not considered to be effective in the short term because risks are not reduced.

4.4.6 Implementability

Alternative GW-B, which involves conventional technology with proven reliability, offers the greatest implementability. Alternatives GW-C-I and GW-C-II use conventional technology for the installation of the wells. The air-stripping portion of the treatment system is also commonly available. However, the metals treatment portions of these alternatives are not wholly proven. In the case of Alternative GW-C-I, reducing conditions may lead to solubilization of iron. When the groundwater is aerated during air-stripping, the introduction of oxygen may cause the precipitation of the iron, which will reduce the porosity of the aquifer. The aeration may also stimulate the growth of iron bacteria, causing the deposition of tenacious biomass, which will result in the clogging of the well screens. In the case of GW-C-II, biofouling can irreversibly clog the chelation media. Therefore, although the equipment necessary for the implementation of Alternative GW-C is commercially available, the ability of the system to control plume migration is not proven. Therefore, a full-scale field pilot test should be performed, to determine whether the recirculation cells provide adequate hydraulic control and the contaminant migration control technologies will perform as needed, under the site conditions.

4.4.7 Cost

There is no cost for implementation of Alternative GW-A. Alternative GW-B has the highest cost, followed by GW-C-II and GW-C-I.

4.4.8 State Acceptance

Comments from the New York State agencies received in response to this FFS will be addressed in the Responsiveness Summary section of the EPA decision document.

4.4.9 Community Acceptance

After public comments regarding the FFS are received, they will be included in the Responsiveness Summary section of the EPA decision document.

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SECTION 5.0

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TABLE 1-1

RANGE OF DETECTED CONCENTRATIONS OF CONTAMINANTS IN THE GROUNDWATER
LIBERTY INDUSTRIAL FINISHING SITE
FARMINGDALE, NASSAU COUNTY, NEW YORK

Inorganics

Contaminant	Concentration Range (ug/L)	NYSDEC Class GA Standards (ug/L)
Aluminum	ND - 4,870	NLE
Arsenic	ND - 3.6	25
Barium	5.0 - 132	1,000
Cadmium	ND - 609	10
Calcium	277 - 38,200	NLE
Chromium	ND - 888	50
Hex. Chromium	ND - 380	50
Cobalt	ND - 9.2	NLE
Copper	ND - 149	200
Iron	111 - 18,000	300
Lead	1.0 - 14.2	15
Magnesium	1,250 - 5,950	36,000
Manganese	ND - 2,950	50
Nickel	ND - 141	100
Potassium	913 - 27,500	NLE
Selenium	ND - 6.2	10
Sodium	5,490 - 71,500	20,000
Vanadium	ND - 456	NLE
Zinc	ND - 161	300
Cyanide	ND - 381	100

TABLE 1-1 (CONTINUED)

RANGE OF DETECTED CONCENTRATIONS OF CONTAMINANTS IN THE GROUNDWATER
LIBERTY INDUSTRIAL FINISHING SITE
FARMINGDALE, NASSAU COUNTY, NEW YORK

Organics

Volatile Organic Compounds	Concentration Range (ug/L)	NYSDEC Class GA Standards (ug/L)
Benzene	1 (J) - 2 (J)	0.7
Chlorobenzene	ND - 14	5.0
1,1-Dichloroethane	1 (J) - 58 (J)	5.0
1,2-Dichloroethene (total)	1 (J) - 1,800	5.0
Ethylbenzene	ND - 8 (J)	5.0
Tetrachloroethene	1 (J) - 24 (J)	5.0
Trichloroethene	1 (J) - 1,700 (J)	5.0
Xylenc (total)	ND - 8 (J)	5.0
Vinyl Chloride	ND - 72	2.0
Total Volatile Organic Compounds	1 (J) - 3,266	NLE
Total Polynuclear Aromatic Hydrocarbons	0.8 (J) - 6 (J)	NLE
Total Pesticides	0.02 (J) - 2.536	NLE
Total Phthalates	0.5 (J) - 400 (J)	NLE

NOTES:
ND - Not Detected
J - Estimated Concentration
NLE - No Limit Established
ug/L - Micrograms per Liter
Data summarized from WESTON 1994 and WESTON 1997

TABLE 2-1
INITIAL SCREENING OF TECHNOLOGIES FOR INTERIM GROUNDWATER ACTION AT THE LIBERTY INDUSTRIAL FINISHING SITE FARMINGDALE, NASSAU COUNTY, NEW YORK

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	DESCRIPTION	SCREENING COMMENTS & SITE APPLICABILITY
No Action	None	Not Applicable	No action.	Required for consideration by National Contingency Plan.
Containment	Subsurface Barriers	Slurry Walls	Low-permeability subsurface cut-off walls to contain areas of direct groundwater flows.	Not applicable.
		Sheet Piling	Install sheet piling to contain/divert groundwater.	Questionable integrity; temporary barriers, not applicable.
		Grout Curtains	Pressure injection of grout in a regular pattern of drilled holes to contain contamination and/or divert groundwater flows.	Not applicable.
		Diaphragm Walls	Barriers composed of reinforced concrete panels emplaced by slurry trenching techniques.	Not applicable.
Groundwater Collection	Pumping Systems	Well Point Dewatering Systems	Well point systems consist of a group of closely spaced wells connected to a header pipe and pumped by a suction pump.	For maximum operating efficiency, lift attainable by suction pump is about 22 feet. Not applicable.
		Ejector Wells	Groundwater is extracted by bubbling air through well casings, forming a corresponding rise in water levels.	Very low operating efficiencies. Well design is for high-lift, low-flow conditions. Not applicable.

TABLE 2-1 (CONTINUED)
INITIAL SCREENING OF TECHNOLOGIES FOR INTERIM GROUNDWATER ACTION AT THE LIBERTY INDUSTRIAL FINISHING SITE FARMINGDALE, NASSAU COUNTY, NEW YORK

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	DESCRIPTION	SCREENING COMMENTS & SITE APPLICABILITY
		Pumping Wells	Series of conventional groundwater wells used to extract contaminated groundwater.	Potentially applicable.
	Subsurface Drains	Subsurface Drains	A drainage system of tiles or perforated pipe backfilled with permeable media to intercept and collect contaminated groundwater.	Generally limited to shallow depths (1-20 feet). Not applicable.
Treatment - Groundwater/Surface Water	Physical	Coagulation, flocculation, and sedimentation	Agglomeration and settling out of particles in groundwater.	Potentially applicable.
		Filtration	Using porous materials in a filter bed to separate particles in groundwater.	Potentially applicable.
		Granular Activated Carbon	Adsorption of contaminants into activated carbon columns.	Potentially applicable.
		Ion Exchange	Exchange of constituent ions when groundwater passes through resin beds.	Potentially applicable.
		Chelation	Ionic species form coordination bonds with ions or molecules called ligands, modifying the properties of the metal ions.	Potentially applicable.
		Air Stripping	Mass transfer process in which volatile organic contaminants are evaporated into the air.	Potentially applicable.

TABLE 2-1 (CONTINUED)
INITIAL SCREENING OF TECHNOLOGIES FOR INTERIM GROUNDWATER ACTION AT THE LIBERTY INDUSTRIAL FINISHING SITE FARMINGDALE, NASSAU COUNTY, NEW YORK

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	DESCRIPTION	SCREENING COMMENTS & SITE APPLICABILITY
		Steam Stripping	A continuous fractional distillation process using steam to evaporate volatile organic contaminants from aqueous waste.	Not applicable for wastes containing low concentrations of organics.
		Critical Fluid Extraction	Extraction of contaminants from aqueous streams using special solvents at its critical point under high pressure.	Not applicable for wastes containing low concentrations of organic contaminants.
		Reverse Osmosis	Use of high pressures to force aqueous waste streams through semipermeable membranes.	Not applicable.
		Oil-Water Separation	Removing oil and grease from aqueous waste stream by utilizing the difference in terminal velocities existing between substances of different densities.	Not applicable. Separate-phase product was not detected.
		Thickening/ Dewatering	A process used to increase the solids content of sludges.	Potentially applicable.
	Chemical	Neutralization	Introduction of dilute acids and bases into aqueous waste stream to bring the pH to 7.0.	Potentially applicable.
		Chemical Precipitation	Changing the chemical equilibrium of aqueous streams to reduce constituent mobility and hence precipitation.	Potentially applicable.

TABLE 2-1 (CONTINUED)
INITIAL SCREENING OF TECHNOLOGIES FOR INTERIM GROUNDWATER ACTION AT THE LIBERTY INDUSTRIAL FINISHING SITE FARMINGDALE, NASSAU COUNTY, NEW YORK

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	DESCRIPTION	SCREENING COMMENTS & SITE APPLICABILITY
		Ultraviolet/ Hydrogen Peroxide	Uses a simultaneous application of ultraviolet light and ozone for the oxidation of contaminants in aqueous waste stream.	Potentially applicable.
	Biological	Suspended Growth - Activated Sludge	Aerobic degradation of organics using suspended microorganisms in completely mixed reactors.	Not applicable.
		Fixed Film Growth - Rotating Biological Contactor, Trickling Filters.	Aerobic degradation of organics using microorganisms attached to a fixed medium.	Not applicable.
	Thermal	Liquid Injection Incineration	On-site unit will use high-temperature oxidation under controlled conditions to destroy organic constituents in aqueous waste streams.	Burners are susceptible to clogging. Not suitable for treating waste streams having high concentrations of inorganics. Not applicable.
		Pyrolysis	Destroys organics in aqueous wastes by pyrolyzing them into combustible gases.	Not suited for inorganics. Also certain chlorinated organics produce hazardous PICs. Not applicable.
		Wet Air Oxidation	Aqueous-phase oxidation process brought about when an organic and/or oxidizable inorganic-containing aqueous waste stream is mixed with oxygen.	Not suitable for inorganics or for wastes containing low concentrations of organics. Not applicable.

TABLE 2-1 (CONTINUED)
INITIAL SCREENING OF TECHNOLOGIES FOR INTERIM GROUNDWATER ACTION AT THE LIBERTY INDUSTRIAL FINISHING SITE FARMINGDALE, NASSAU COUNTY, NEW YORK

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	DESCRIPTION	SCREENING COMMENTS & SITE APPLICABILITY
Disposal - Groundwater/ Wastewater Sludges	Off-Site	Discharge to Local POTW	Discharge raw, partially treated or treated groundwater to local POTW.	Potentially applicable.
		Disposal to Off-Site TSDF	Off-site disposal to approved TSDF.	Extremely large volumes of groundwater make this option infeasible. Applicable to treatment sludge disposal.
	On-Site	Discharge to Surface Water	Discharge raw, treated groundwater into surface waters.	Potentially applicable.
		Reinjection	Discharge treated groundwater upgradient or side-gradient of existing groundwater plume.	Potentially applicable.
In-Situ Remediation	Biological	Bioremediation	Injection of carbon sources, nutrients and microbial cultures to degrade organics.	Potentially applicable.
	Physical	Air Sparging	Induction of air into the formation to volatilize VOCs.	Potentially applicable.
		In-Well Vapor Stripping	Air-stripping in the well casing and recharge to the formation from within the same well.	Potentially applicable.
	Chemical	Treatment Walls	Permeable wall constructed from reactive media, which degrade site contaminants as they move through the wall.	Potentially applicable.

TABLE 2-1 (CONTINUED)
INITIAL SCREENING OF TECHNOLOGIES FOR INTERIM GROUNDWATER ACTION AT THE LIBERTY INDUSTRIAL FINISHING SITE FARMINGDALE, NASSAU COUNTY, NEW YORK

GENERAL RESPONSE ACTION	REMEDIAL TECHNOLOGY	PROCESS OPTIONS	DESCRIPTION	SCREENING COMMENTS & SITE APPLICABILITY
		Funnel and Gate	An impermeable barrier which guides groundwater to one or more openings, where contaminants are treated by reactive media.	Restriction of lateral flow may force contaminated groundwater into lower aquifer. Not applicable.
	Physicochemical	In-Situ Direct Precipitation	Amendments are added to the groundwater to foster the reduction (where necessary) and precipitation of metals. Metal particulates are retained within the aquifer by physical entrapment or adsorption to aquifer materials.	Potentially applicable.
	Physicochemical	Natural Attenuation	Relies on natural degradation, adsorption, precipitation, and dilution mechanisms to reduce contaminant concentrations.	Potentially applicable.

TABLE 2-2
DETAILED SCREENING OF TECHNOLOGY TYPES AND PROCESS OPTIONS FOR INTERIM GROUNDWATER ACTION AT THE LIBERTY INDUSTRIAL FINISHING SITE FARMINGDALE, NASSAU COUNTY, NEW YORK

GENERAL RESPONSE ACTION	TECHNOLOGY TYPE	PROCESS OPTIONS	SCREENING CRITERIA			RETAIN	REASON FOR ELIMINATION
			EFFECTIVENESS	IMPLEMENTABILITY	COST		
No Action	None	Not Applicable	Does not achieve remedial action objectives; useful for documenting conditions; no contaminant reduction.	Implementable	No cost.	Yes (retained for baseline comparison as required by EPA	---
Groundwater Collection	Pumping Systems	Pumping Wells	Effective and reliable; proven performance.	Implementable	Low capital, low O&M.	Yes	---
Treatment - Groundwater	Physical	Coagulation, Flocculation, and Sedimentation	Effective and reliable; used as a pretreatment step for many chemical processes.	Implementable	Low capital, moderate O&M.	Yes	---
		Filtration	Effective; used for particulate removal in pretreatment; preceded by sedimentation in most cases; may remove suspended metals from solution in conjunction with chemical precipitation.	Implementable; may be subject to clogging; requires frequent backwashing.	Low capital, moderate O&M.	Yes	---

TABLE 2-2 (CONTINUED)
DETAILED SCREENING OF TECHNOLOGY TYPES AND PROCESS OPTIONS FOR INTERIM GROUNDWATER ACTION AT THE LIBERTY INDUSTRIAL FINISHING SITE FARMINGDALE, NASSAU COUNTY, NEW YORK

GENERAL RESPONSE ACTION	TECHNOLOGY TYPE	PROCESS OPTIONS	SCREENING CRITERIA			RETAIN	REASON FOR ELIMINATION
			EFFECTIVENESS	IMPLEMENTABILITY	COST		
		Granular Activated Carbon	Effective and reliable; requires disposal/regeneration of spent carbon; may remove metals.	Implementable	Moderate capital, high O&M.	Yes	---
		Ion Exchange	Not suitable for removal of high concentrations of exchangeable ions; pretreatment necessary in order to prevent adversely affecting the resin.	Implementable; certain aromatics may become irreversibly sorbed by the resin.	Moderate capital, high O&M.	Yes	---
		Chelation	Effective for the removal of metals. May be adversely impacted by metals other than those specifically targeted for removal	Implementable	Moderate capital, high O&M.	Yes	---

TABLE 2-2 (CONTINUED)
DETAILED SCREENING OF TECHNOLOGY TYPES AND PROCESS OPTIONS FOR INTERIM GROUNDWATER ACTION AT THE LIBERTY INDUSTRIAL FINISHING SITE FARMINGDALE, NASSAU COUNTY, NEW YORK

GENERAL RESPONSE ACTION	TECHNOLOGY TYPE	PROCESS OPTIONS	SCREENING CRITERIA			RETAIN	REASON FOR ELIMINATION
			EFFECTIVENESS	IMPLEMENTABILITY	COST		
		Air Stripping	Effective and reliable; requires further off-gas treatment; does not removal metals or nonvolatile organics.	Implementable	Moderate capital, high O&M.	Yes	---
		Thickening/ Dewatering	Effective and reliable for groundwater treatment sludges.	Implementable	Low capital, high O&M.	Yes	---
	Chemical	Neutralization	Effective and reliable.	Implementable	Low capital, low O&M.	Yes	---
		Chemical Precipitation	Effective and reliable conventional technology for metals/solids removal only.	Implementable, requires sludge treatment and disposal.	Low capital, high O&M.	Yes	---
		Ultraviolet/ Hydrogen Peroxide	Pilot test will be required to test effectiveness and reliability; does not remove metals.	Implementable	High capital, high O&M.	No	Uncertain effectiveness

TABLE 2-2 (CONTINUED)
DETAILED SCREENING OF TECHNOLOGY TYPES AND PROCESS OPTIONS FOR INTERIM GROUNDWATER ACTION AT THE LIBERTY INDUSTRIAL FINISHING SITE FARMINGDALE, NASSAU COUNTY, NEW YORK

GENERAL RESPONSE ACTION	TECHNOLOGY TYPE	PROCESS OPTIONS	SCREENING CRITERIA			RETAIN	REASON FOR ELIMINATION
			EFFECTIVENESS	IMPLEMENTABILITY	COST		
Disposal - Groundwater/ Wastewater Sludges	Off-Site	Discharge to local POTW	POTW acceptance criteria to govern effectiveness and reliability.	Implementable; POTW permit required.	Low capital, low O&M.	No	The local POTW will not accept treated or untreated groundwater.
		Disposal to Off-Site TSDF	TSDF acceptance criteria to govern effectiveness and reliability; testing of water and sludges required prior to manifesting and off-site disposal.	Requires manifesting and transportation of extremely large volumes of water; land disposal ban may prevent implementation of sludge disposal.	Low capital, high O&M.	Yes	Process option will be retained only for the disposal of wastewater sludges, from pump-and-treat system.
	On-Site	Discharge to Surface Water	Effective and reliable; SPDES permit required.	Implementable	Low capital, moderate O&M.	Yes	---
		Reinjection	Effective and reliable, SPDES permit required.	Implementable	Moderate capital, moderate O&M.	Yes	---

TABLE 2-3
DETAILED SCREENING OF IN-SITU TREATMENT TECHNOLOGIES FOR INTERIM GROUNDWATER ACTION AT THE LIBERTY INDUSTRIAL FINISHING SITE FARMINGDALE, NASSAU COUNTY, NEW YORK

TECHNOLOGY DESCRIPTION	IMPLEMENTABILITY	EFFECTIVENESS	DEVELOPMENT STATUS	RELATIVE COST	RECOMMENDATION
In-Situ Permeable Treatment Wall					
	Can be implemented in soils using conventional trenching/ slurry wall methods. For application in unconsolidated zone to capture dissolved phase constituents. For depths greater than 50 ft, there can be some construction obstacles in trenching that would render the technology impractical. Upper aquifer depth is greater than 50 feet; therefore, there may be difficulties in installing a permeable treatment wall.	Can be effective in passively treating dissolved-phase constituents as they pass through the wall with groundwater. If treated compounds are not completely dehalogenated or degraded before exiting the wall, toxic compounds may migrate downgradient. Long-term performance may be compromised by fouling due to biological growth or precipitation. Because there is not a confining layer beneath this aquifer, contaminants may be forced downward, possibly into the lower aquifer.	In transition to full scale at sites to treat dissolved-phase constituents. Has been demonstrated in field pilot tests.	High	This technology will not be retained for further consideration. Installation to depths greater than 50 feet requires specialized methods.

TABLE 2-3 (CONTINUED)
DETAILED SCREENING OF IN-SITU TREATMENT TECHNOLOGIES
FOR INTERIM GROUNDWATER ACTION AT THE
LIBERTY INDUSTRIAL FINISHING SITE
FARMINGDALE, NASSAU COUNTY, NEW YORK

TECHNOLOGY DESCRIPTION	IMPLEMENTABILITY	EFFECTIVENESS	DEVELOPMENT STATUS	RELATIVE COST	RECOMMENDATION
Air Sparging					
	Implemented using conventional methods. Delivery and extraction (if desired) of air can be facilitated through vertical or horizontal wells or a combination of the two, to accommodate site conditions. Requires aboveground treatment of extracted vapor stream. Not generally implemented at depths greater than 20 feet.	At depths of approximately 20 feet below the water table, higher pressure requirements result in higher temperatures, which cause precipitation of some inorganics (i.e., fouling of the sparge well). Iron precipitation may be a concern.	Full scale for unconsolidated zone treatment of dissolved phase and LNAPL.	Low	This technology will not be retained for further consideration as its effectiveness is limited to only the top 20 feet of the aquifer.
In-Well Vapor Stripping					
	Uses proprietary equipment and casing, installed using conventional equipment. May require fewer well points than do air sparging systems due to a larger treatment zone.	Effectiveness can be moderate to high for saturated zone dissolved constituents under optimal conditions, i.e., homogenous, porous media.	Full scale for unconsolidated zone treatment of dissolved-phase VOCs; not demonstrated for DNAPL treatment.	Moderate	This technology will be retained for further consideration.

TABLE 2-3 (CONTINUED)
DETAILED SCREENING OF IN-SITU TREATMENT TECHNOLOGIES FOR INTERIM GROUNDWATER ACTION AT THE LIBERTY INDUSTRIAL FINISHING SITE FARMINGDALE, NASSAU COUNTY, NEW YORK

TECHNOLOGY DESCRIPTION	IMPLEMENTABILITY	EFFECTIVENESS	DEVELOPMENT STATUS	RELATIVE COST	RECOMMENDATION
	Predominantly, if not always, applied in consolidated zone. May require aboveground treatment of vapor stream.	May not affect metals concentrations.			
In-Situ Bioremediation					
	Can be implemented using conventional wellhead injection infiltration gallery, and/or horizontal well configurations for delivery of amendments (additional nutrient sources). Requires delivery of electron donors (primary substrates), electron acceptors (i.e., oxygen, nitrates, etc.), and nutrients (i.e., nitrogen, phosphorous, trace metals). For aerobic methanotrophic bacteria, methane would be injected along with air.	Can only be used to address dissolved-phase constituents. Applied at sites with suitable permeability and indigenous microbial populations. Metals concentrations will not be affected. Some aerobic bacteria can use simple chlorinated organics as sole sources of energy. Degradation of TCE typically occurs anaerobically (reductive dechlorination); however, these constituents	Full scale.	Low	This technology will not be retained for further consideration, due to the objectives and time frame of the interim response action.

TABLE 2-3 (CONTINUED)
DETAILED SCREENING OF IN-SITU TREATMENT TECHNOLOGIES FOR INTERIM GROUNDWATER ACTION AT THE LIBERTY INDUSTRIAL FINISHING SITE FARMINGDALE, NASSAU COUNTY, NEW YORK

TECHNOLOGY DESCRIPTION	IMPLEMENTABILITY	EFFECTIVENESS	DEVELOPMENT STATUS	RELATIVE COST	RECOMMENDATION
	For anaerobic methanogenic bacteria, methanol or a similar electron donor would be injected. Requires adequate aquifer permeability (usually $>10^{-4}$ cm/s), a suitable indigenous microbial population, and sufficient hydrodynamic control for constituent containment and delivery of required amendments.	may be degraded by metha-notrophic bacteria utilizing a cometabolic mechanism. For the more chlorinated organics such as TCE, the degradation pathway may involve recalcitrant and/or toxic intermediates, and end products.			
In-Situ Direct Precipitation					
Chemical addition to foster reduction and precipitation of metals on and in aquifer materials.	Can be implemented using conventional chemical injection methods such as injection wells and aboveground chemical feed equipment. Requires monitoring to evaluate and ensure long-term effectiveness and permanence.	Anticipated metal precipitates (e.g., sulfide) are generally considered to be reasonably stable except under extreme conditions. However, data on long-term permanence in situ are limited.	Innovative	Low	This technology will be retained for further consideration.

TABLE 2-3 (CONTINUED)
DETAILED SCREENING OF IN-SITU TREATMENT TECHNOLOGIES FOR INTERIM GROUNDWATER ACTION AT THE LIBERTY INDUSTRIAL FINISHING SITE FARMINGDALE, NASSAU COUNTY, NEW YORK

TECHNOLOGY DESCRIPTION	IMPLEMENTABILITY	EFFECTIVENESS	DEVELOPMENT STATUS	RELATIVE COST	RECOMMENDATION
Natural Attenuation					
Natural processes reduce the mass, toxicity, volume, or concentrations of organic constituents and reduce the toxicity or concentration of metals in groundwater. The natural processes include biodegradation, adsorption, dispersion, dilution from recharge, volatilization, and chemical or biological stabilization or destruction of constituents.	Requires monitoring to track progress of natural attenuation.	Need to demonstrate that attenuation at the site is occurring at rates that are protective of human health and the environment. May need to collect chemical and physical data to show that constituent mass is being removed or attenuated. May need to demonstrate that indigenous biota are capable of degrading constituents.	Natural attenuation of chlorinated solvents has been demonstrated in the field.	Low	This technology will not be retained for further consideration, due to the objectives and time frame of the interim response action.

TABLE 3-1
INITIAL SCREENING OF RESPONSE ACTION ALTERNATIVES FOR INTERIM GROUNDWATER ACTION AT THE LIBERTY INDUSTRIAL FINISHING SITE FARMINGDALE, NASSAU COUNTY, NEW YORK

REMEDIAL ACTION ALTERNATIVE	RELATIVE EFFECTIVENESS	EASE OF IMPLEMENTATION	OVERALL COST	RETAINED	FINAL SITE ALTERNATIVE DESIGNATION
GW-1: No Action	None	High	No cost	Yes	GW-A
GW-2: Groundwater Pumping and Treatment	High	High	High	Yes	GW-B
GW-3: In-Situ Physical/Chemical Treatment	Moderate to high	Moderate	High	No	
GW-4: In-Situ Air Stripping/ In-Situ Direct Precipitation	Moderate	Moderate to high	Moderate	Yes	GW-C-1
GW-4: In-Situ Air Stripping/Metals Treatment through Chelation	Moderate	Moderate to high	Moderate	Yes	GW-C-II

Table 4-1
Cost Estimate - Alternative GW-B
Pumping and Treatment
Liberty Industrial Finishing Site
Farmingdale, Nassau County, New York

Item	Quantity	Unit Price	Installed Cost
CAPITAL COSTS			
Well Installation, 2 clusters	2 each	$ 11,500	$ 23,000
Mobilization/Demobilization	1 each		$ 17,000
Construction of Treatment System	1 each		$1,583,000
Site Construction Cost	1 each		$ 127,000
Construction Equipment	1 each		$ 47,000
Supplies	1 each		$ 24,000
Permitting	1 each		$ 24,000
Taxes and fees (4%)			$ 46,000
Total Direct Construction Costs (TDCC - Rounded)			$1,891,000
Engineering, Legal, Health & Safety, and Construction Management @ 15% of TDCC (Rounded)			$284,000
25% Contingency (Rounded)			$473,000
Estimated Installed Capital Costs			**$2,648,000**
OPERATION AND MAINTENANCE COSTS			
Administrative and Reporting	1 each	$ 5,000	$ 5,000
Quarterly Groundwater Sampling Costs	4 quarters	$ 5,500	$22,000
Treatment Costs (chemicals, resins, GAC)	4 quarters	$ 44,500	$ 178,000
Power and Utilities	1 year	$ 21,000	$ 21,000
Sludge Disposal	4 quarters	$ 2,500	$ 10,000
Labor	1 year	$ 130,000	$ 130,000
Maintenance (parts and supplies)	1 year	$ 36,000	$ 36,000
Subtotal (Annual - Rounded)			$402,000
25% Contingency (Annual - Rounded)			$100,000
Estimated Total Annual O&M			**$502,000**
Estimated total O&M costs assuming 7% Compounded annually over 3 years			$ 1,317,000
TOTAL PRESENT WORTH COSTS (rounded)			**$ 3,965,000**

Table 4-2
Cost Estimate - Alternative GW-C-I
In-Situ Air Stripping with In-Situ Direct Metal Precipitation
Liberty Industrial Finishing Site
Farmingdale, Nassau County, New York

Item	Quantity	Unit Price	Installed Cost
CAPITAL COSTS			
Well Installation			
GW Monitor Wells, 2 clusters	2 each	$ 11,500	$ 23,000
Injection wells, 31 clusters	31 each	$ 12,735	$ 394,800
Stripping wells, including blowers and pumps	4 each	$ 100,000	$ 400,000
Electrical Hookup	4 each well	$ 8,500	$ 34,000
Chelation equipment	1 system	$ 126,840	$ 126,840
Pilot Study	1 each	$ 100,000	$ 100,000
Permitting			$ 10,000
Health & Safety - Level C	60 man-day	$ 60	$ 3,600
Waste Disposal	371 ton	$ 200	$ 74,200
Total Direct Construction Costs (TDCC - Rounded)			$1,168,000
Engineering, Legal, Health & Safety, and Construction Management @ 15% of TDCC (Rounded)			$175,000
25% Contingency (Rounded)			$462,000
Estimated Installed Capital Costs			**$1,635,000**
OPERATION AND MAINTENANCE COSTS			
Electric	71,869 kWhr	0.075	5,390
GAC	10	250	2,500
Injection	4	10,000	40,000
Quarterly Sampling	4 quarters	4665	18,660
Maintenance			12,408
Subtotal (Annual - Rounded)			$79,000
25% Contingency (Annual - Rounded)			$20,000
Estimated Total Annual O&M			**$99,000**
Estimated total O&M costs assuming 7% Compounded annually over 3 years			$ 260,000
TOTAL PRESENT WORTH COSTS (rounded)			**$ 1,895,000**

Table 4-3
Cost Estimate - Alternative GW-C-II
In-Situ Air Stripping with Metals Treatment through Chelation
Liberty Industrial Finishing Site
Farmingdale, Nassau County, New York

Item	Quantity	Unit Price	Installed Cost
CAPITAL COSTS			
Well Installation			
GW Monitor Wells, 2 clusters	2 each	$ 11,500	$ 23,000
Stripping wells, including blowers and pumps	4 each	$ 100,000	$ 400,000
Electrical Hookup	4 each well	$ 8,500	$ 34,000
Injection equipment	1 system	$ 128,000	$ 1,120,000
Pilot Study	1 each	$ 100,000	$ 100,000
Permitting			$ 10,000
Health & Safety - Level C	60 man-day	$ 60	$ 3,600
Total Direct Construction Costs (TDCC - Rounded)			$ 1,691,000
Engineering, Legal, Health & Safety, and Construction Management @ 15% of TDCC (Rounded)			$ 254,000
25% Contingency (Rounded)			$ 423,000
Estimated Installed Capital Costs			**$2,368,000**
OPERATION AND MAINTENANCE COSTS			
Maintenance			
Labor	1 year	$ 78,000	$ 78,000
Chelating media	1 year	$26,000	$26,000
GAC	1 year	$ 49,000	$ 49,000
Sludge Disposal	1 year	$ 8,600	$ 8,600
Chemicals	1 year	$ 50,000	$ 50,000
Maintenance	1 year	$ 25,000	$ 25,000
Power and miscellaneous	1 year	$ 64,000	$ 64,000
Quarterly Sampling	4 quarters	$ 5,500	$22,000
Subtotal (Annual - Rounded)			$323,000
25% Contingency (Annual - Rounded)			$81,000
Estimated Total Annual O&M			**$404,000**
Estimated total O&M costs assuming 7% Compounded annually over 3 years			$ 1,060,000
TOTAL PRESENT WORTH COSTS (rounded)			**$ 3,428,000**

TABLE 4-4
ANALYSIS OF RESPONSE ACTION ALTERNATIVES FOR INTERIM GROUNDWATER ACTION AT THE LIBERTY INDUSTRIAL FINISHING SITE FARMINGDALE, NASSAU COUNTY, NEW YORK

CRITERIA	ALTERNATIVE GW-A NO ACTION	ALTERNATIVE GW-B PUMPING WITH TREATMENT	ALTERNATIVE GW-C-I IN-SITU STRIPPING/IN-SITU DIRECT PRECIPITATION	ALTERNATIVE GW-C-II IN-SITU STRIPPING/ METALS TREATMENT THROUGH CHELATION
Overall Protection of Human Health and the Environment	This alternative does not protect human health and the environment. It is retained for CERCLA compliance to serve as a baseline for comparisons.	This alternative is expected to provide a high degree of protection of human health and the environment as it controls contaminant migration by permanently removing both VOCs and metals from the groundwater.	This alternative is expected to provide good protection of human health and the environment as it controls contaminant migration by permanently removing VOCs and by attenuating metals as stable insoluble precipitates.	This alternative is expected to provide good protection of human health and the environment as it controls contaminant migration by permanently removing both VOCs and metals from the groundwater.
Compliance with ARARs	Does not address ARARs.	Because this is an interim response action, only action-specific ARARs will be complied with (e.g., RCRA standards, ambient air quality standards, manifest requirements and SPDES standards).	Because this is an interim response action, only action-specific ARARs will be complied with (e.g., RCRA standards, ambient air quality standards, and manifest requirements).	Because this is an interim response action, only action-specific ARARs will be complied with (e.g., RCRA standards, ambient air quality standards, and manifest requirements).

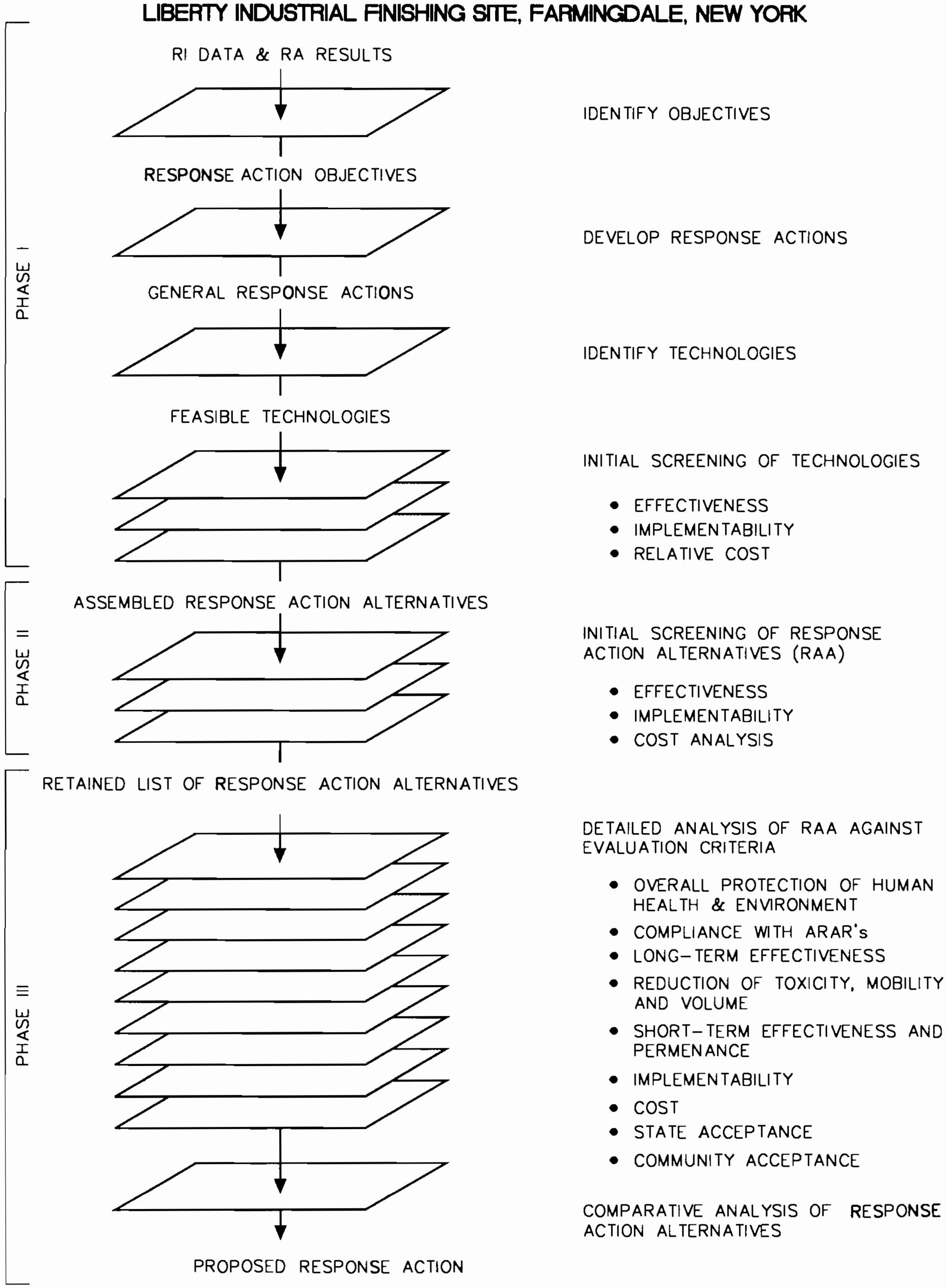
TABLE 4-4 (CONTINUED)
ANALYSIS OF RESPONSE ACTION ALTERNATIVES FOR CONTAMINATED GROUNDWATER AT THE LIBERTY INDUSTRIAL FINISHING SITE FARMINGDALE, NASSAU COUNTY, NEW YORK

CRITERIA	ALTERNATIVE GW-A NO ACTION	ALTERNATIVE GW-B PUMPING WITH TREATMENT	ALTERNATIVE GW-C-I IN-SITU STRIPPING/IN-SITU DIRECT PRECIPITATION	ALTERNATIVE GW-C-II IN-SITU STRIPPING/ METALS TREATMENT THROUGH CHELATION
Short-Term Effectiveness	This alternative can be readily implemented with minimal impacts to the surroundings.	Site activities consist of conventional construction activities. Short-term impacts from the disturbance of contaminated soil and groundwater will be mitigated by appropriate health and safety procedures.	This alternative can be readily implemented with existing, although specialized remediation equipment. Short-term impacts from the disturbance of contaminated soil and groundwater will be mitigated by appropriate health and safety procedures.	This alternative can be readily implemented with existing, although specialized remediation equipment. Short-term impacts from the disturbance of contaminated soil and groundwater will be mitigated by appropriate heal'h and safety procedures.
Implementability	This alternative can be ready implemented.	This alternative uses conventional above-ground equipment and would be readily implemented. Pump-test to determine aquifer parameters is required.	This alternative can be readily implemented using commercially available equipment. Pilot test is required.	This alternative can be readily implemented using commercially available equipment. Pilot test is required.
Cost	No cost	$3,965,000	$1,895,000	$3,428,000
State Acceptance	To be addressed following public review/comment period.	To be addressed following public review/comment period.	To be addressed following public review/comment period.	To be addressed following public review/comment period.
Community Acceptance	To be addressed following public review/comment period.	To be addressed following public review/comment period.	To be addressed following public review/comment period.	To be addressed following public review/comment period.

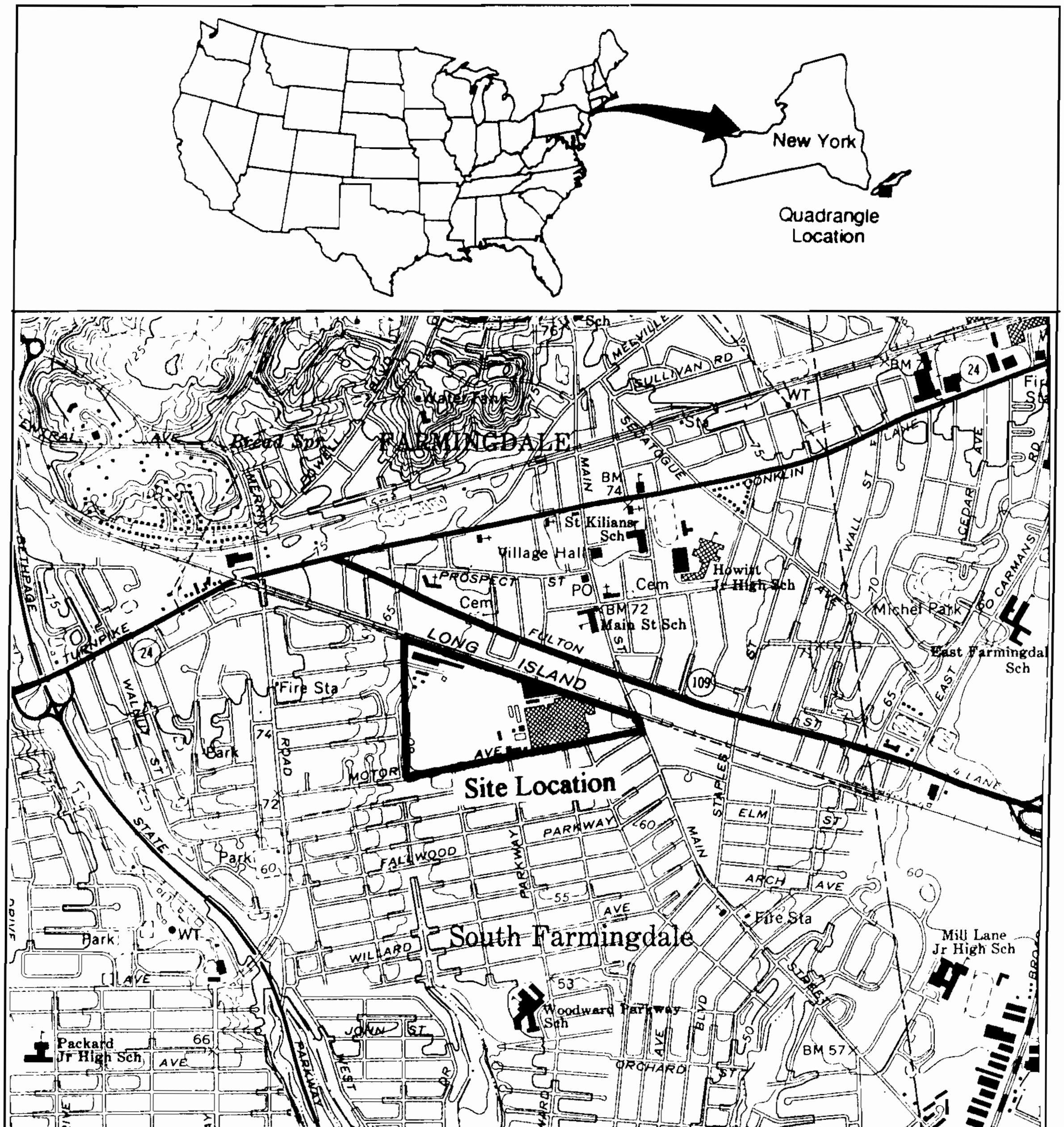
TABLE 4-4 (CONTINUED)
ANALYSIS OF RESPONSE ACTION ALTERNATIVES FOR CONTAMINATED GROUNDWATER AT THE LIBERTY INDUSTRIAL FINISHING SITE FARMINGDALE, NASSAU COUNTY, NEW YORK

CRITERIA	ALTERNATIVE GW-A NO ACTION	ALTERNATIVE GW-B PUMPING WITH TREATMENT	ALTERNATIVE GW-C-I IN-SITU STRIPPING/IN-SITU DIRECT PRECIPITATION	ALTERNATIVE GW-C-II IN-SITU STRIPPING/ METALS TREATMENT THROUGH CHELATION
Long-Term Effectiveness and Permanence	Provides no treatment and is not considered to be effective.	This is an interim action. Therefore, long-term effectiveness and permanence are not strictly applicable to this evaluation. However, overall, long-term effectiveness and permanence of this alternative are good because the alternative reduces the mass and concentration of contaminants in groundwater.	This is an interim action. Therefore, long-term effectiveness and permanence are not strictly applicable to this evaluation. However, overall, long-term effectiveness and permanence of this alternative are good because the alternative reduces the mass and concentration of contaminants in groundwater.	This is an interim action. Therefore, long-term effectiveness and permanence are not strictly applicable to this evaluation. However, overall, long-term effectiveness and permanence of this alternative are good because the alternative reduces the mass and concentration of contaminants in groundwater.
Reduction of Toxicity, Mobility, and Volume	Toxicity, mobility, and volume of site contaminants are not reduced under this alternative.	The recovery of groundwater will substantially reduce the toxicity, mobility, and volume of contaminants.	Contaminant toxicity will be reduced by removing VOCs, and to the extent that metals attenuation are stable, the mobility of contaminants will also be reduced.	Toxicity, mobility, and volume of VOCs and metals will be reduced by their removal from groundwater.

FIGURE 1-1
FOCUSED FEASIBILITY STUDY PROCESS
LIBERTY INDUSTRIAL FINISHING SITE, FARMINGDALE, NEW YORK



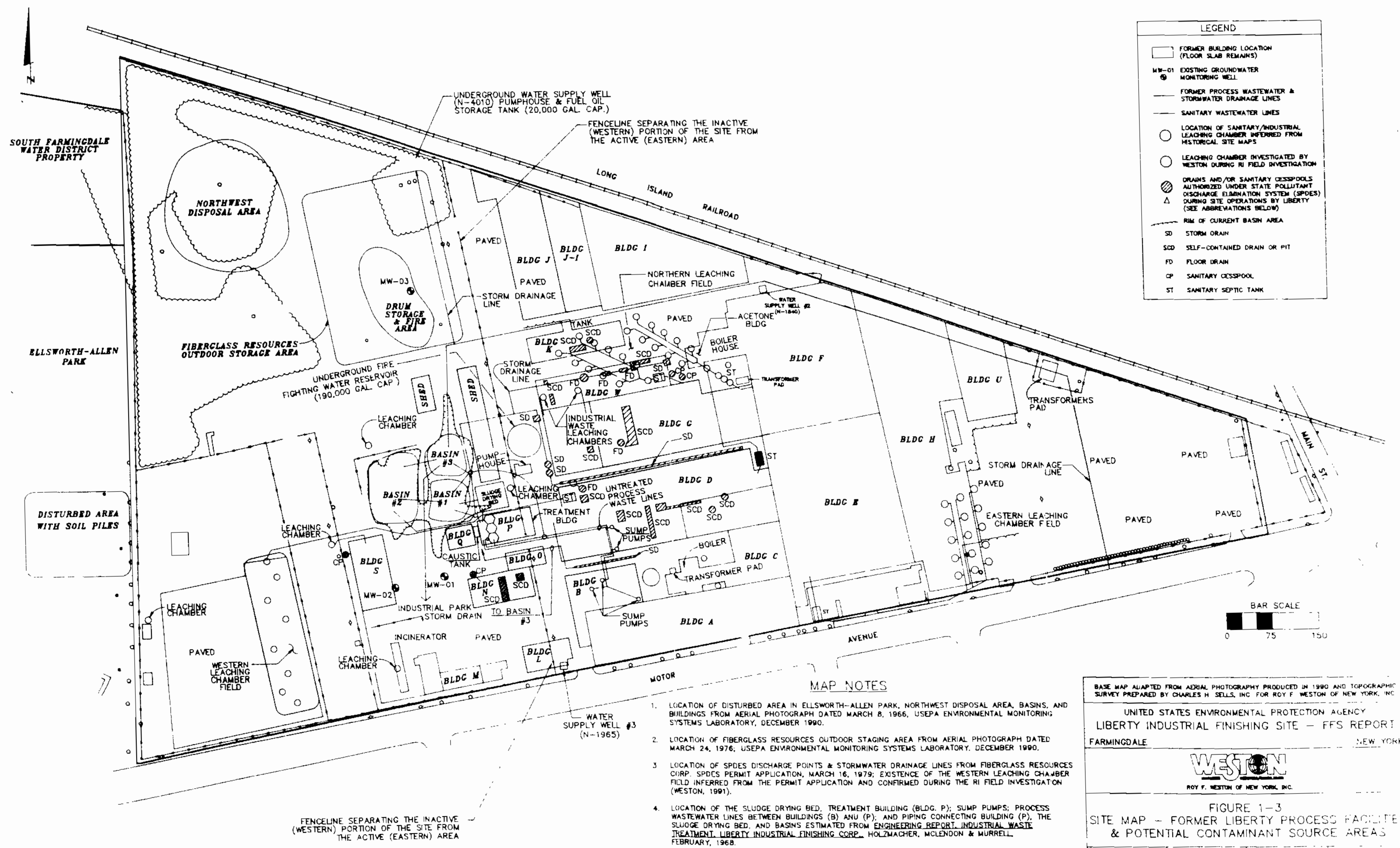
WESTON



Source: United States Geological Survey 7.5 Minute Series
Amityville, N.Y. Quadrangle (1979)

N

FIGURE 1-2 SITE LOCATION MAP, LIBERTY INDUSTRIAL FINISHING SITE, FARMINGDALE, NEW YORK



MAP NOTES

1. LOCATION OF DISTURBED AREA IN ELLSWORTH-ALLEN PARK, NORTHWEST DISPOSAL AREA, BASINS, AND BUILDINGS FROM AERIAL PHOTOGRAPH DATED MARCH 8, 1966, USEPA ENVIRONMENTAL MONITORING SYSTEMS LABORATORY, DECEMBER 1990.
2. LOCATION OF FIBERGLASS RESOURCES OUTDOOR STAGING AREA FROM AERIAL PHOTOGRAPH DATED MARCH 24, 1976; USEPA ENVIRONMENTAL MONITORING SYSTEMS LABORATORY, DECEMBER 1990.
3. LOCATION OF SPDES DISCHARGE POINTS & STORMWATER DRAINAGE LINES FROM FIBERGLASS RESOURCES CORP. SPDES PERMIT APPLICATION, MARCH 16, 1979; EXISTENCE OF THE WESTERN LEACHING CHAMBER FIELD INFERRED FROM THE PERMIT APPLICATION AND CONFIRMED DURING THE RI FIELD INVESTIGATION (WESTON, 1991).
4. LOCATION OF THE SLUDGE DRYING BED, TREATMENT BUILDING (BLDG. P); SUMP PUMPS; PROCESS WASTEWATER LINES BETWEEN BUILDINGS (B) AND (P); AND PIPING CONNECTING BUILDING (P), THE SLUDGE DRYING BED, AND BASINS ESTIMATED FROM ENGINEERING REPORT, INDUSTRIAL WASTE TREATMENT, LIBERTY INDUSTRIAL FINISHING CORP., HOLZMACHER, MCLENDON & MURRELL, FEBRUARY, 1968.
5. LOCATION OF THE NORTHERN & EASTERN LEACHING CHAMBER FIELDS & ALL OTHER SITE STRUCTURES FROM ENGINEER'S REPORT, DEFENSE PLANT CORPORATION, 1944

BASE MAP ADAPTED FROM AERIAL PHOTOGRAPHY PRODUCED IN 1990 AND TOPOGRAPHIC SURVEY PREPARED BY CHARLES H. SELLS, INC FOR ROY F. WESTON OF NEW YORK, INC

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
LIBERTY INDUSTRIAL FINISHING SITE – FFS REPORT
FARMINGDALE NEW YORK

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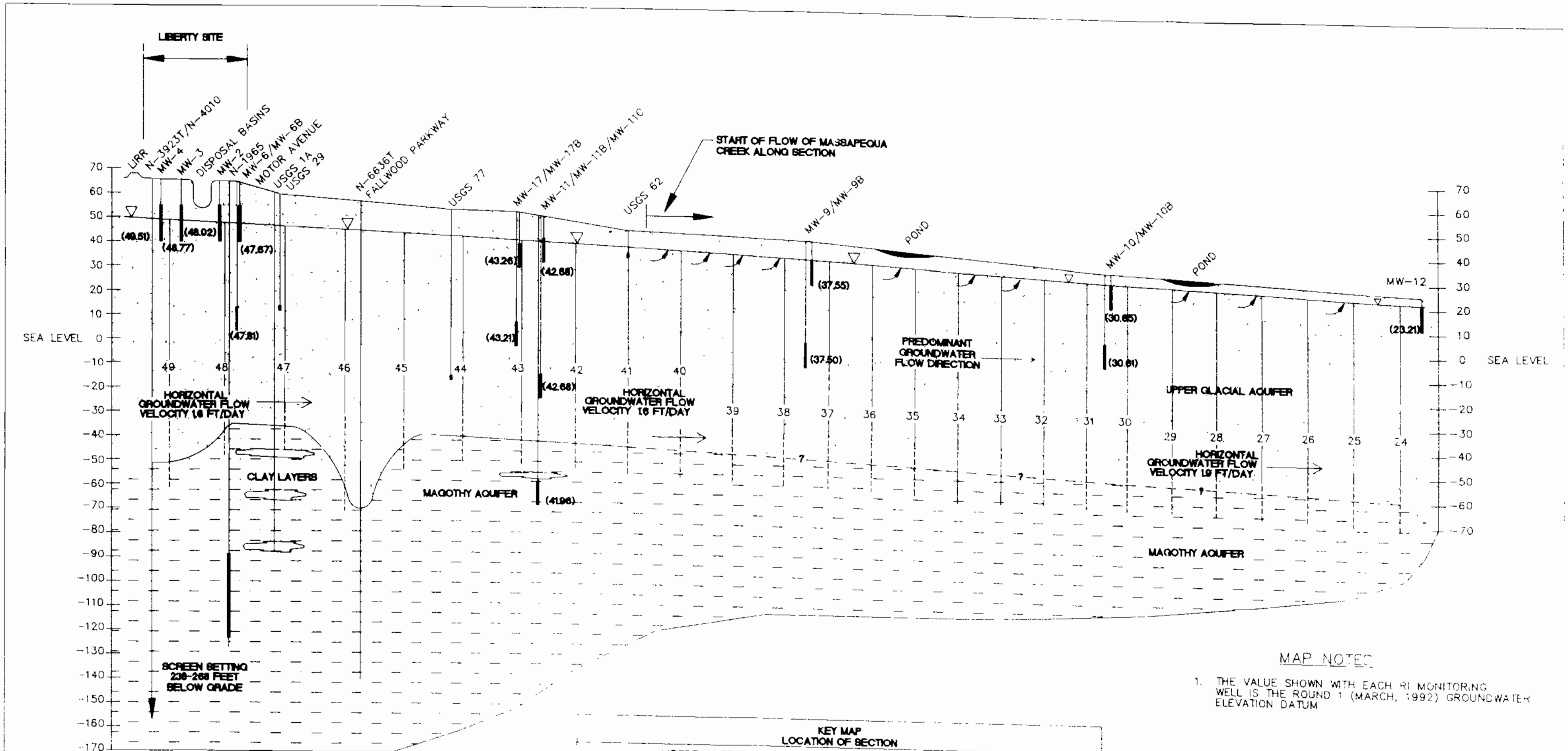
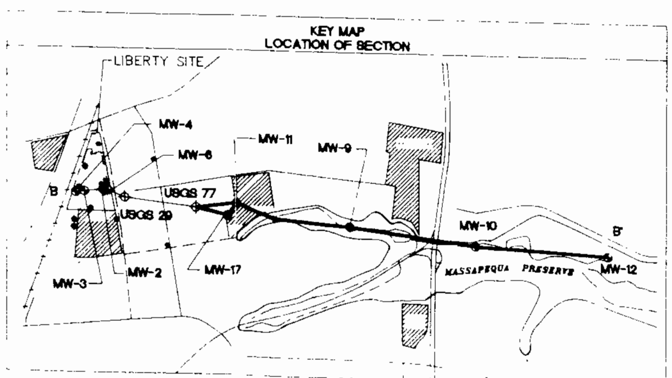
FIGURE 1–3
SITE MAP – FORMER LIBERTY PROCESS FACILITIES & POTENTIAL CONTAMINANT SOURCE AREAS

DRAWN G.A./G.B.	DATE MAY 1993	DWN. NO.
SCALE AS NOTED	W.O. NO. 4200-09-28	SHT.



MAP NOTES

1. THE VALUE SHOWN WITH EACH RI MONITORING WELL IS THE ROUND 1 (MARCH, 1992) GROUNDWATER ELEVATION DATUM



LEGEND

- (43.26) SCREENED ZONE OF WELL, SHOWING MARCH 1992, GROUNDWATER ELEVATION (FT. ABOVE MSL)
- 40 GROUNDWATER EQUIPOTENTIAL LINE
- APPROXIMATE DIRECTION OF GROUNDWATER FLOW
- AREA OF SHALLOW GROUNDWATER DISCHARGE INTO MASSAPEQUA CREEK ALONG SECTION

BASE MAP ADAPTED FROM U.S.G.S QUADRANGLE MAP, AMITYVILLE, NEW YORK, 1979

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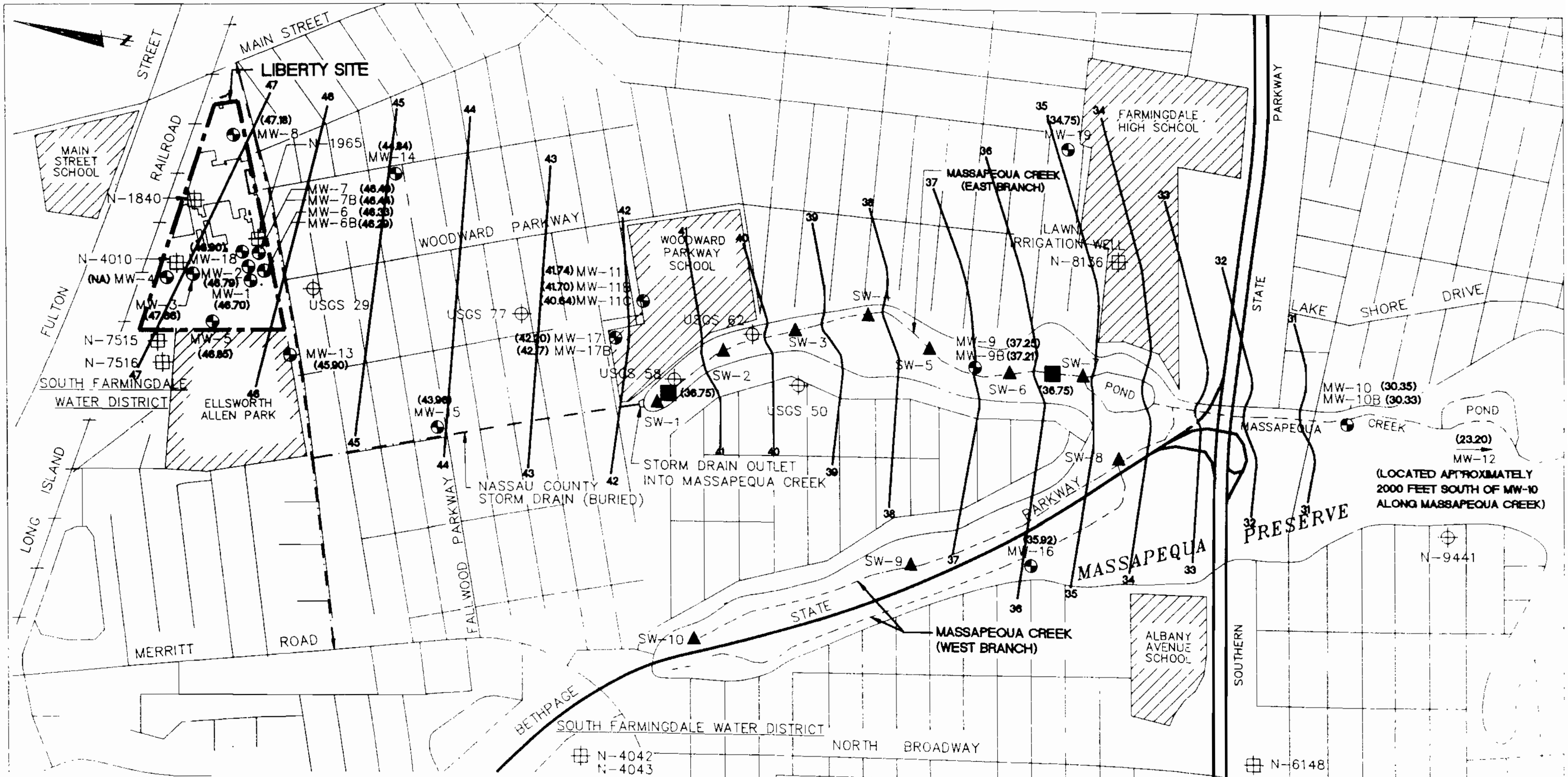
FIGURE 1-4
HYDROGEOLOGIC CROSS-SECTION
DOWNGRADIENT OF THE LIBERTY SITE

DRAWN	DATE		
J.S./G.B.	APRIL 93		
SCALE	W.O. NO. 4200-09-28		



MAP NOTES

1. THE VALUE SHOWN WITH EACH RI MONITORING WELL IS THE GROUNDWATER ELEVATION DATA. THE VALUE SHOWN WITH EACH SURFACE WATER WELL IS THE GROUNDWATER ELEVATION DATA MEASURED ON AUGUST 7, 1992.
2. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL
3. GROUNDWATER ELEVATION CONTOURS ARE SHOWN IN 1 FOOT INTERVALS
4. NA -- ELEVATIONS NOT AVAILABLE.

BAR SCALE
0 700

LEGEND

- RI GROUNDWATER MONITORING WELL (MW-1, 2 & 3 EXISTING; ALL OTHERS NEWLY INSTALLED)
- EXISTING USGS OR NCDPW MONITORING WELL SAMPLED DURING STAGE 1 OF RI
- OTHER WATER SUPPLY WELL
- SURFACE WATER/SEDIMENT SAMPLING LOCATION
- SURFACE WATER GAGE

BASE MAP ADAPTED FROM U.S.G.S. QUADRANGLE MAP, AMITYVILLE, NEW YORK, 1979

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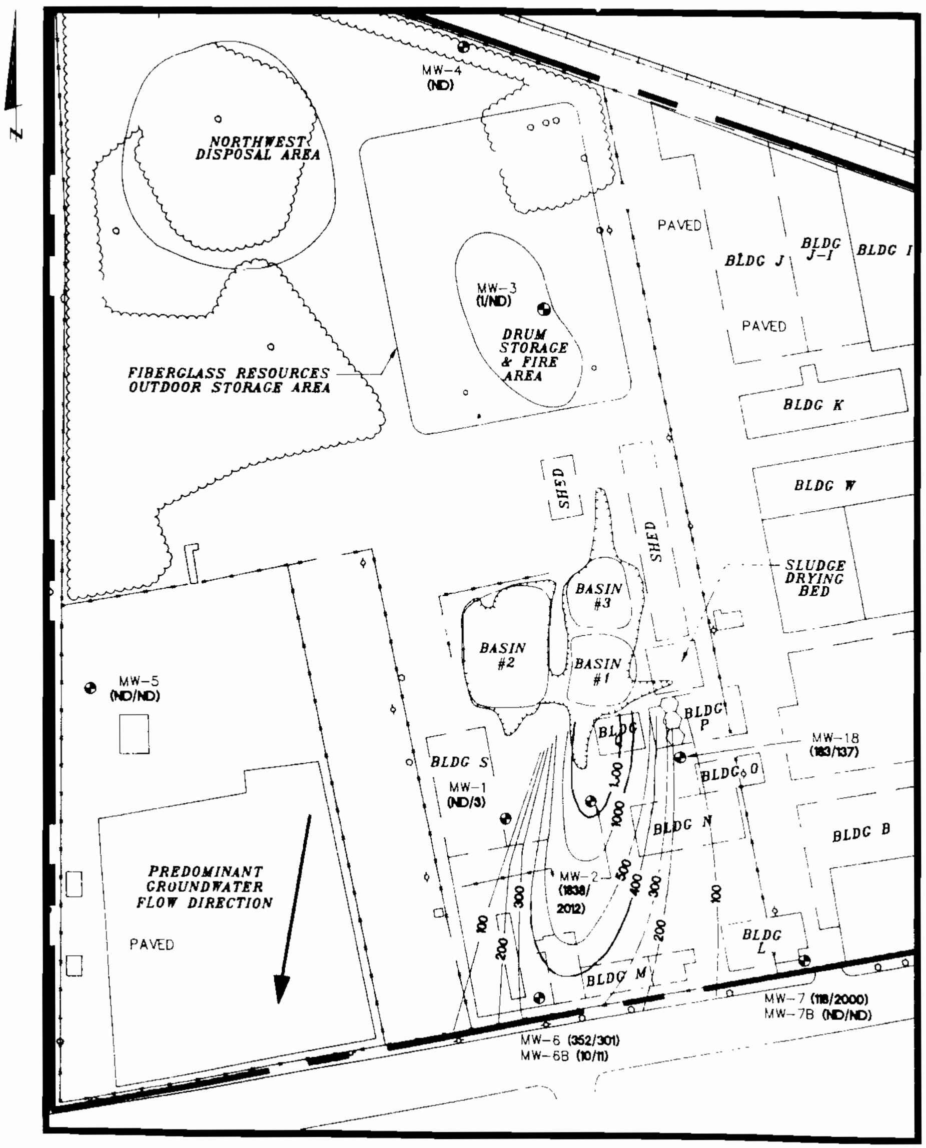
FIGURE 1-5
UPPER GLACIAL AQUIFER
GROUNDWATER ELEVATION MAP
JULY 1992

DRAWN	DATE		
G.A./G.B./J.S.	MARCH 93		
SCALE	W.O. NO. 4200-09-28		



GW-3 Well No Sampling Round Depth Interval (ft)	MW-1-01 Round 1 14.0-29.0	MW-1-02 Round 2 14.0-29.0	MW-2-01 Round 1 11.0-26.0	MW-2-02 Round 2 11.0-26.0	MW-3-01 Round 1 10.0-25.0	MW-3-02 Round 2 10.0-25.0	MW-4-01 Round 1 10.5-25.5	MW-5-01 Round 1 11.5-26.5	MW-5-02 Round 2 11.5-26.5	MW-6-01 Round 1 11.0-26.0	MW-6-02 Round 2 11.0-26.0
Vinyl Chloride	10 U	10 UJ	10 U	100 UJ	10 U	10 UJ	10 U	10 U	10 UJ	10 U	12 UJ
1,1-Dichloroethene	10 U	10 UJ	10 U	100 UJ	10 U	10 UJ	10 U	10 U	10 UJ	10 U	12 UJ
1,1-Dichloroethane	10 U	10 UJ	4 J	100 UJ	10 U	10 UJ	10 U	10 U	10 UJ	10 U	12 UJ
1,2-Dichloroethene(total)	10 U	10 UJ	840	900 J	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	110	120 J
Chloroform	10 U	10 UJ	10 U	100 UJ	1 J	10 UJ	10 U	10 U	10 UJ	10 U	12 UJ
1,2-Dichloroethane	10 U	10 UJ	10 U	100 UJ	10 U	10 UJ	10 U	10 U	10 UJ	10 UJ	12 UJ
1,1,1-Trichloroethane	10 U	10 UJ	6 J	100 UJ	10 U	10 UJ	10 U	10 U	10 UJ	10 U	12 UJ
1,2-Dichloropropane	10 U	10 UJ	10 U	100 UJ	10 U	10 UJ	10 U	10 U	10 UJ	10 U	12 UJ
Trichloroethene	10 U	3 J	980	1100 J	10 U	10 UJ	10 U	10 U	10 UJ	220	160 J
1,1,2-Trichloroethane	10 U	10 UJ	10 U	100 UJ	10 U	10 UJ	10 U	10 U	10 UJ	10 U	12 UJ
Benzene	10 U	10 UJ	10 U	100 UJ	10 U	10 UJ	10 U	10 U	10 UJ	2 J	12 UJ
Tetrachloroethene	10 U	10 UJ	8 J	12 J	10 U	10 UJ	10 U	10 U	10 UJ	20	21 J
Chlorobenzene	10 U	10 UJ	10 U	100 UJ	10 U	10 UJ	10 U	10 U	10 UJ	10 U	12 UJ
Ethylbenzene	10 U	10 UJ	10 U	100 UJ	10 U	10 UJ	10 U	10 U	10 UJ	10 U	12 UJ
Xylene(total)	10 U	10 UJ	10 U	100 UJ	10 U	10 UJ	10 U	10 U	10 UJ	10 U	12 UJ
Total VOC's	ND	3	1838	2012	1	ND	ND	ND	ND	352	301

U = Analyte was note detected at the instrument detection limit given
J = Estimated value
D = Determined after sample dilution

GW-3 Well No. Sampling Round Depth Interval (ft)	MW-6B-01 Round 1 47.7-57.7	MW-6B-02 Round 2 47.7-57.7	MW-7-01 Round 1 10.5-25.5	MW-7-02 Round 2 10.5-25.5	MW-7B-01 Round 1 50.0-60.0	MW-7B-02 Round 2 50.0-60.0	MW-8-01 Round 1 11.0-26.0	MW-8-02 Round 2 11.0-26.0	MW-18-01 Round 1 11.5-26.5	MW-18-02 Round 2 11.5-26.5
Vinyl Chloride	10 U	10 UJ	10 U	100 UJ	10 U	10 UJ	10 U	10 UJ	10 U	10 UJ
1,1-Dichloroethene	10 U	10 UJ	10 U	100 UJ	10 U	10 UJ	10 U	10 UJ	10 U	10 UJ
1,1-Dichloroethane	1 J	2 J	10 U	58 J	10 U	10 UJ	10 U	10 UJ	10 U	10 UJ
1,2-Dichloroethene(total)	10 U	10 UJ	4 J	62 J	10 U	10 UJ	10 U	10 UJ	19	13 J
Chloroform	10 U	10 UJ	10 U	100 UJ	10 U	10 UJ	1 J	10 UJ	10 U	10 UJ
1,2-Dichloroethane	10 UJ	10 UJ	10 U	100 UJ	10 U	10 UJ	10 U	10 UJ	10 U	10 UJ
1,1,1-Trichloroethane	9 J	9 J	12	160 J	10 U	10 UJ	2 J	10 UJ	10 U	1 J
1,2-Dichloropropane	10 U	10 UJ	10 U	100 UJ	10 U	10 UJ	10 U	10 UJ	10 U	10 UJ
Trichloroethene	10 U	10 UJ	100 J	1700 J	10 U	10 UJ	10 U	10 UJ	150	110 J
1,1,2-Trichloroethane	10 U	10 UJ	10 U	100 UJ	10 U	10 UJ	10 U	10 UJ	10 U	10 UJ
Benzene	10 U	10 UJ	10 U	100 UJ	10 U	10 UJ	10 U	10 UJ	10 U	10 UJ
Tetrachloroethene	10 U	10 UJ	2 J	100 UJ	10 U	10 UJ	10 U	10 UJ	14	13 J
Chlorobenzene	10 U	10 UJ	10 U	100 UJ	10 U	10 UJ	10 U	10 UJ	10 U	10 UJ
Ethylbenzene	10 U	10 UJ	10 U	100 UJ	10 U	10 UJ	10 U	8 J	10 U	10 UJ
Xylene(total)	10 U	10 UJ	10 U	100 UJ	10 U	10 UJ	10 U	8 J	10 U	10 UJ
Total VOC's	10	11	116	2000	ND	ND	3	16	183	137

U = Analyte was note detected at the instrument detection limit given
J = Estimated value
D = Determined after sample dilution

MAP NOTES:

1. THE TWO VALUES SHOWN WITH EACH MONITORING WELL ARE THE ROUND 1 / ROUND 2 TOTAL VOLATILE ORGANIC COMPOUNDS (VOCs) CONCENTRATIONS. THE SINGLE VALUE SHOWN WITH MW-4 IS THE ROUND 1 RESULTS; MW-4 COULD NOT BE SAMPLED DURING ROUND 2 DUE TO WELL DAMAGE. ROUND 1 SAMPLING COMPLETED IN MARCH 1992; ROUND 2 SAMPLING COMPLETED IN JULY 1992.
2. ALL ANALYTICAL RESULTS ARE IN UG/L.
3. ND = VOCs NOT DETECTED
4. ISOCONTOURS ARE SHOWN FOR 100, 200, 300, 400, 500, 1000 AND 1500 UG/L TOTAL VOCs BASED ON THE ROUND 1 SHALLOW RI MONITORING WELL RESULTS

BAR SCALE
0 60 120

LEGEND

RI GROUNDWATER MONITORING WELL (MW-1, 2 & 3 EXISTING; ALL OTHERS NEWLY INSTALLED)

BASE MAP ADAPTED FROM AERIAL PHOTOGRAPHY PRODUCED IN 1990 AND TOPOGRAPHIC SURVEY PREPARED BY CHARLES H. SELLS, INC FOR ROY F. WESTON OF NEW YORK, INC

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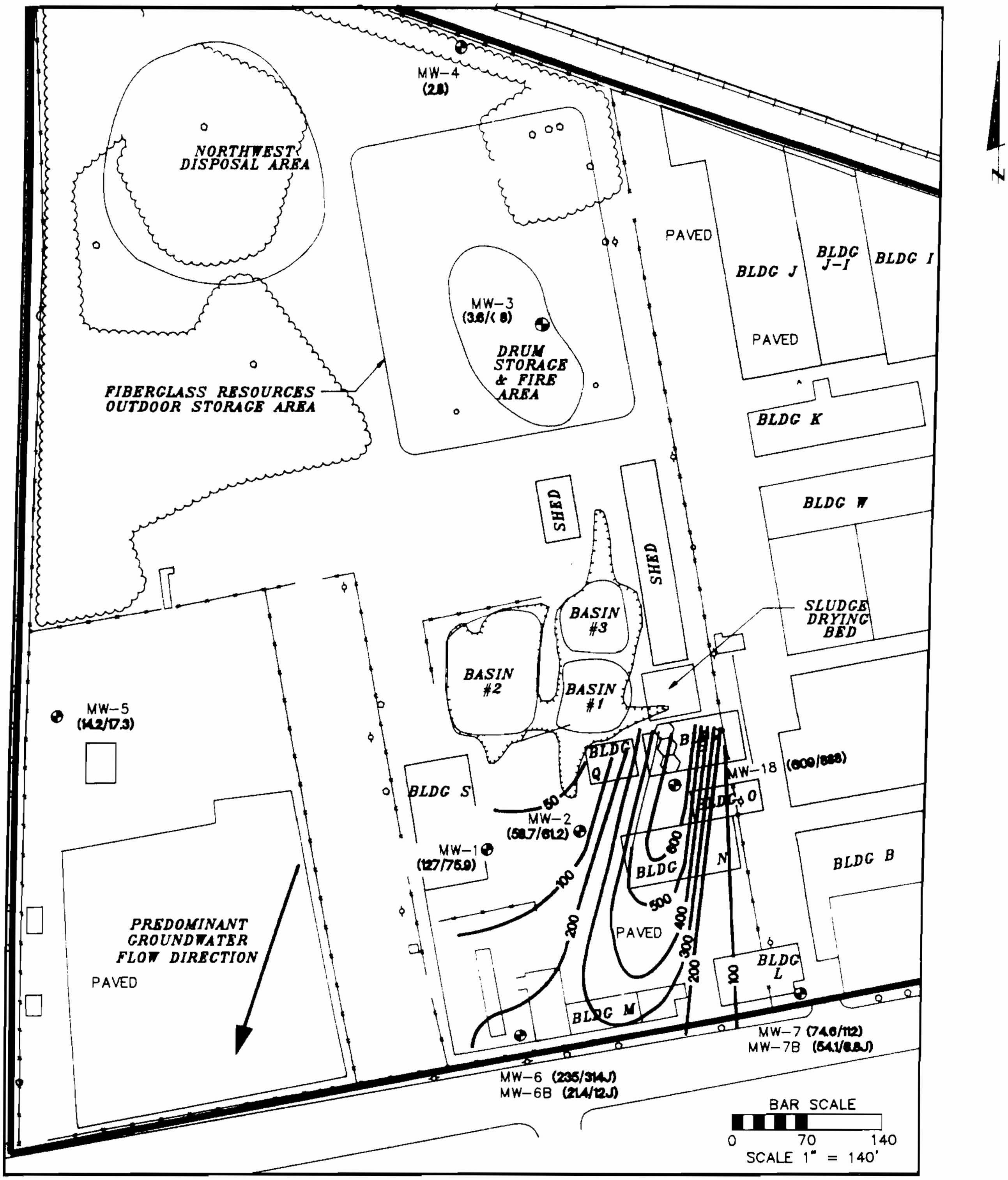
FIGURE 1-6
TOTAL VOC CONCENTRATIONS (IN UG/L) IN ON-PROPERTY SHALLOW UPPER GLACIAL AQUIFER

G.A./G.B. | MARCH 93 | 4200-09-28



LEGEND

RI GROUNDWATER MONITORING WELL (MW-1, 2 & 3 EXISTING; ALL OTHERS NEWLY INSTALLED)

MAP NOTES:

1. THE TWO VALUES SHOWN WITH EACH MONITORING WELL ARE THE ROUND 1 / ROUND 2 TOTAL (UNFILTERED) CHROMIUM CONCENTRATIONS. THE SINGLE VALUE SHOWN WITH MW-4 IS THE ROUND 1 RESULTS; MW-4 COULD NOT BE SAMPLED DURING ROUND 2 DUE TO WELL DAMAGE. ROUND 1 SAMPLING COMPLETED IN MARCH 1992; ROUND 2 SAMPLING COMPLETED IN JULY 1992.
2. ALL ANALYTICAL RESULTS ARE IN ug/L
3. J = ESTIMATED VALUE
   < = UNDETECTED/LESS THAN THE VALUE SHOWN.
4. ISOCONTOURS ARE SHOWN FOR 50, 100, 200, 300, 400, 500 AND 600 ug/L TOTAL CHROMIUM BASED ON THE ROUND 1 SHALLOW RI MONITORING WELL RESULTS.

BASE MAP ADAPTED FROM AERIAL PHOTOGRAPHY PRODUCED IN 1990 AND TOPOGRAPHIC SURVEY PREPARED BY CHARLES H. SELLS, INC. FOR ROY F. WESTON OF NEW YORK, INC.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

LIBERTY INDUSTRIAL FINISHING SITE – FFS REPORT

FARMINGDALE NEW YORK

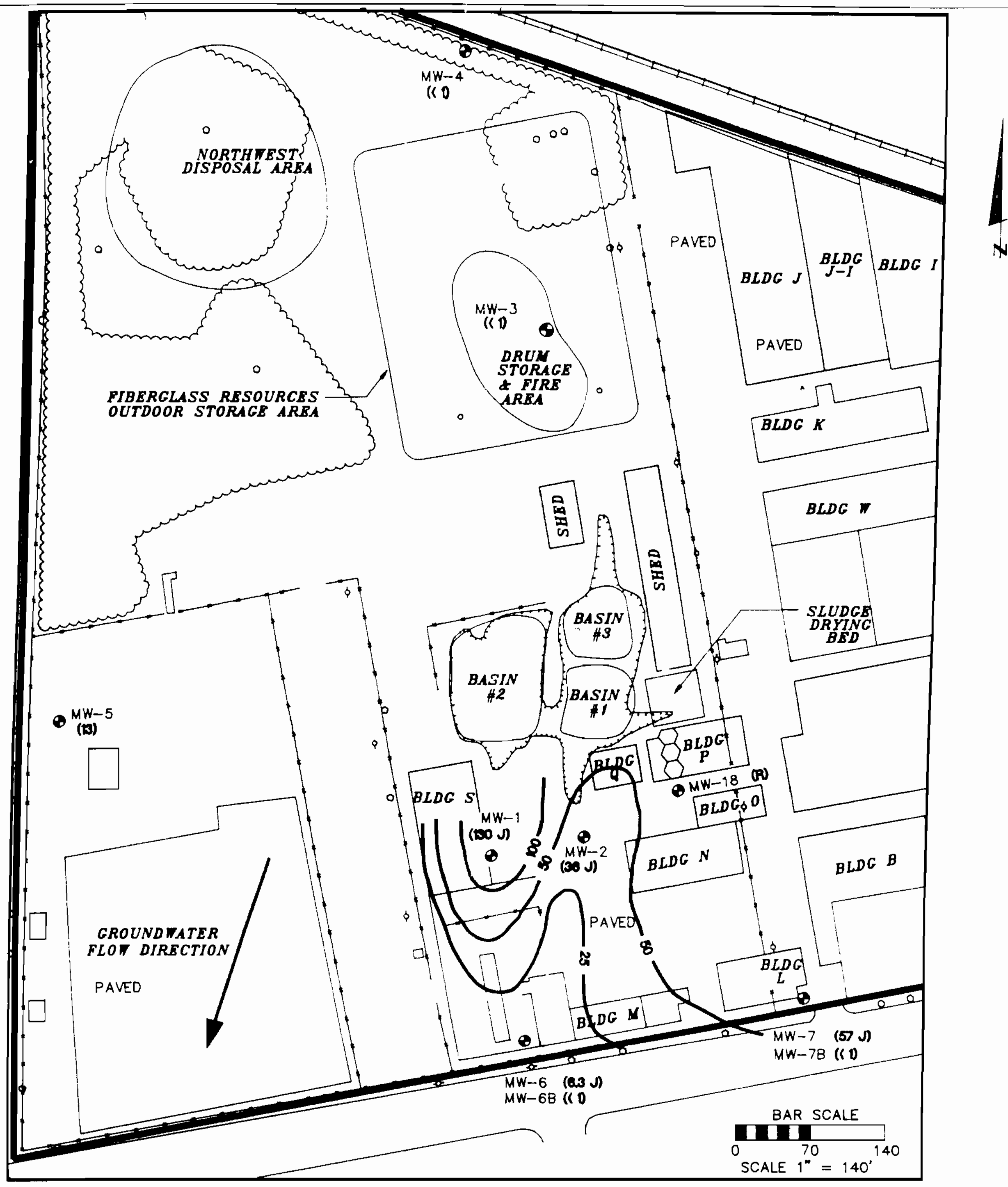
WESTON

ROY F. WESTON OF NEW YORK, INC.

FIGURE 1-7

TOTAL CHROMIUM CONCENTRATIONS (in UG/L) IN ON-PROPERTY SHALLOW UPPER GLACIAL AQUIFER

DRAWN	DATE	DWG. NO.	REV. NO.
G.A./G.B.	MAY 1993		
SCALE	W.O. NO.	SHT.	OF
AS NOTED	4200-09-28		



LEGEND

● RI GROUNDWATER MONITORING WELL (MW-1, 2 & 3 EXISTING; ALL OTHERS NEWLY INSTALLED)

MAP NOTES:

1. THE VALUE SHOWN WITH EACH MONITORING WELL IS THE ROUND 1 TOTAL (UNFILTERED) HEXAVALENT CHROMIUM CONCENTRATION. ROUND 1 SAMPLING COMPLETED IN MARCH 1992
2. ALL ANALYTICAL RESULTS ARE IN ug/L.
3. J = ESTIMATED VALUE
   < = UNDETECTED/LESS THAN THE VALUE SHOWN.
   R = DATA REJECTED
4. ISOCONTOURS ARE SHOWN FOR 25, 50, AND 100 ug/L TOTAL HEXAVALENT CHROMIUM BASED ON THE ROUND 1 SHALLOW RI MONITORING WELL RESULTS.

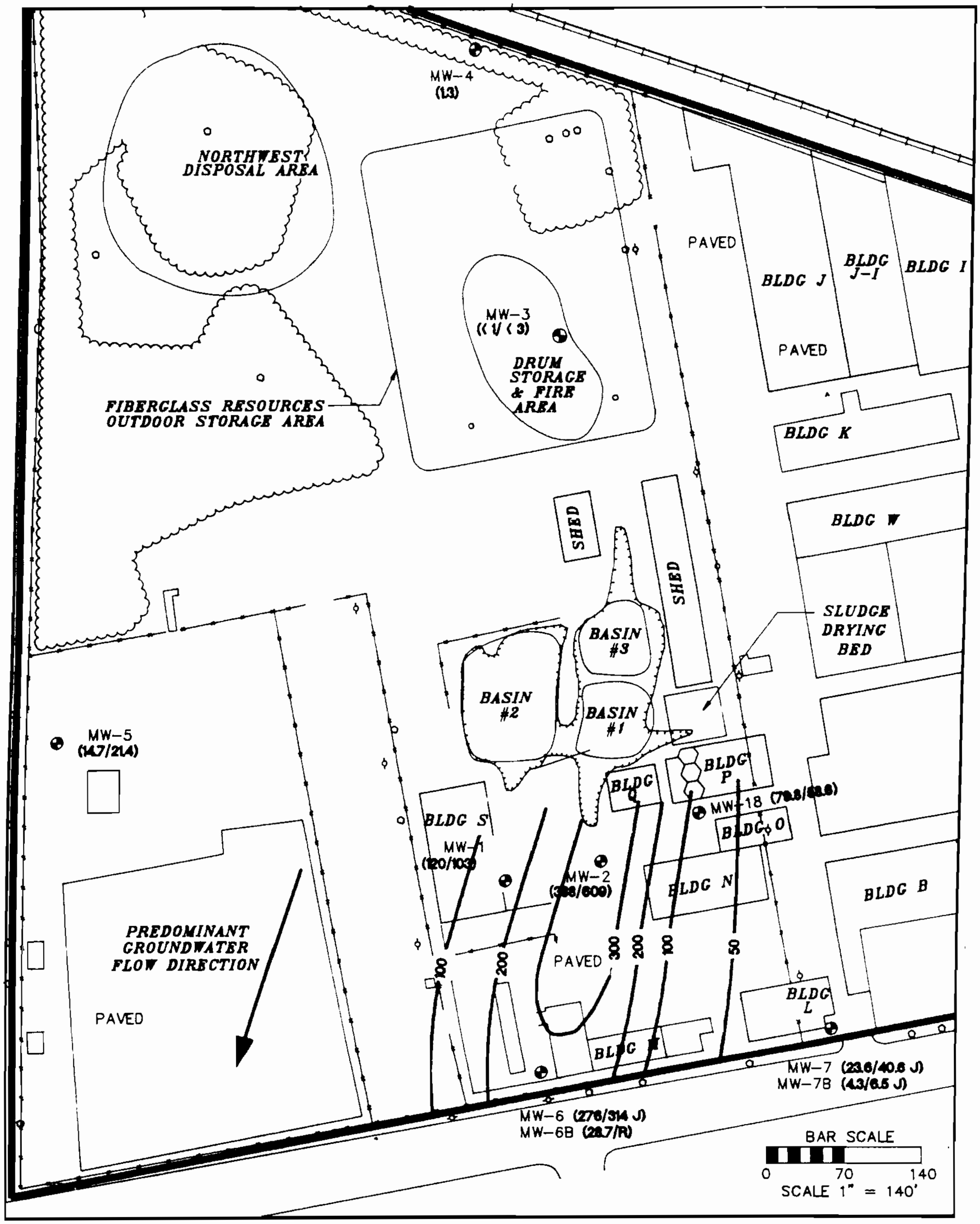
BASE MAP ADAPTED FROM AERIAL PHOTOGRAPHY PRODUCED IN 1990 AND TOPOGRAPHIC SURVEY PREPARED BY CHARLES H. SELLS, INC. FOR ROY F. WESTON OF NEW YORK, INC.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
LIBERTY INDUSTRIAL FINISHING SITE – FFS REPORT
FARMINGDALE NEW YORK

WESTON
ROY F. WESTON OF NEW YORK, INC.

FIGURE 1–8
TOTAL HEXAVALENT CHROMIUM CONCENTRATIONS (IN UG/L) IN ON-PROPERTY SHALLOW UPPER GLACIAL AQUIFER

DRAWN	DATE	DWG. NO.	REV. NO.
G.A./G.B.	MAY 1993		
SCALE	W.O. NO.	SHT.	OF
AS NOTED	4200-09-28		



LEGEND

RI GROUNDWATER MONITORING WELL (MW-1, 2 & 3 EXISTING; ALL OTHERS NEWLY INSTALLED)

MAP NOTES:

1. THE TWO VALUES SHOWN WITH EACH MONITORING WELL ARE THE ROUND 1 / ROUND 2 TOTAL (UNFILTERED) CADMIUM CONCENTRATIONS. ROUND 1 SAMPLING COMPLETED IN MARCH 1992; ROUND 2 SAMPLING COMPLETED IN JULY 1992
2. ALL ANALYTICAL RESULTS ARE IN UG/L.
3. J = ESTIMATED VALUE
   < = UNDETECTED/LESS THAN THE VALUE SHOWN.
   R = DATA REJECTED
4. ISOCONTOURS ARE SHOWN FOR 50, 100, 200 AND 300 UG/L TOTAL CADMIUM BASED ON THE ROUND 1 SHALLOW RI MONITORING WELL RESULTS.

BASE MAP ADAPTED FROM AERIAL PHOTOGRAPHY PRODUCED IN 1990 AND TOPOGRAPHIC SURVEY PREPARED BY CHARLES H. SELLS, INC. FOR ROY F. WESTON OF NEW YORK, INC.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
LIBERTY INDUSTRIAL FINISHING SITE – FFS REPORT

FARMINGDALE NEW YORK

WESTON
ROY F. WESTON OF NEW YORK, INC.

FIGURE 1–9

TOTAL CADMIUM CONCENTRATIONS (in ug/L) IN ON-PROPERTY SHALLOW UPPER GLACIAL AQUIFER

DRAWN	DATE	DWG. NO.	REV. NO.
G.A./G.B.	MAY 1993		
SCALE	W.O. NO.		
AS NOTED	4200-09-28	SHT. ___ OF ___	

APPENDIX A

SUMMARY OF ANALYTICAL DATA

Table A-1

Liberty Industrial Finishing Superfund Site, Farmingdale, New York Analytical Results (in μg/L) For Groundwater Samples Collected in 11/91, 1/92, 3/92, 7/92, and 10-11/96

CONTAMINANT	N-9430 (Off-Property) STAGE 1 (11/91)	N-9430 (Off-Property) STAGE 2 (1/92)	N-9430 (Off-Property) ROUND 1 (3/92)	N-9430 (Off-Property) ROUND 2 (7/92)	N-9430 (Off-Property) ROUND 3 (10-11/96)
CADMIUM	7	NS	NS	NS	NS
CHROMIUM	11.5 J	NS	NS	NS	NS
TRICHLOROETHYLENE (TCE)	10 U	NS	NS	NS	NS
TETRACHLOROETHYLENE (PCE)	10 U	NS	NS	NS	NS
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	10 U	NS	NS	NS	NS

CONTAMINANT	N-9441 (Off-Property) STAGE 1 (11/91)	N-9441 (Off-Property) STAGE 2 (1/92)	N-9441 (Off-Property) ROUND 1 (3/92)	N-9441 (Off-Property) ROUND 2 (7/92)	N-9441 (Off-Property) ROUND 3 (10-11/96)
CADMIUM	5 U	NS	NS	NS	NS
CHROMIUM	22.3	NS	NS	NS	NS
TRICHLOROETHYLENE (TCE)	10 U	NS	NS	NS	NS
TETRACHLOROETHYLENE (PCE)	10 U	NS	NS	NS	NS
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	10 U	NS	NS	NS	NS

CONTAMINANT	USGS 29 (Off-Property) STAGE 1 (11/91)	USGS 29 (Off-Property) STAGE 2 (1/92)	USGS 29 (Off-Property) ROUND 1 (3/92)	USGS 29 (Off-Property) ROUND 2 (7/92)	USGS 29 (Off-Property) ROUND 3 (10-11/96)
CADMIUM	99	NS	NS	NS	NS
CHROMIUM	29.9	NS	NS	NS	NS
TRICHLOROETHYLENE (TCE)	10 U	NS	NS	NS	NS
TETRACHLOROETHYLENE (PCE)	10 U	NS	NS	NS	NS
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	10 U	NS	NS	NS	NS

Table A-1

Liberty Industrial Finishing Superfund Site, Farmingdale, New York Analytical Results (in µg/L) For Groundwater Samples Collected in 11/91, 1/92, 3/92, 7/92, and 10-11/96 (Continued)

CONTAMINANT	USGS 77 (Off-Property) STAGE 1 (11/91)	USGS 77 (Off-Property) STAGE 2 (1/92)	USGS 77 (Off-Property) ROUND 1 (3/92)	USGS 77 (Off-Property) ROUND 2 (7/92)	USGS 77 (Off-Property) ROUND 3 (10-11/96)
CADMIUM	74	NS	NS	NS	NS
CHROMIUM	75	NS	NS	NS	NS
TRICHLOROETHYLENE (TCE)	81	NS	NS	NS	NS
TETRACHLOROETHYLENE (PCE)	6 J	NS	NS	NS	NS
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	20	NS	NS	NS	NS

CONTAMINANT	MW-3 (On-Property) STAGE 1 (11/91)	MW-3 (On-Property) STAGE 2 (1/92)	MW-3 (On-Property) ROUND 1 (3/92)	MW-3 (On-Property) ROUND 2 (7/92)	MW-3 (On-Property) ROUND 3 (10-11/96)
CADMIUM	5 U	NS	1 U	3 U / 1.4 UJ (F)	NS(See Note 4)
CHROMIUM	5.2 J	NS	3.6 B	8 U / 3.7 UJ (F)	NS(See Note 4)
TRICHLOROETHYLENE (TCE)	10 U	NS	10 UJ	10 UJ	NS(See Note 4)
TETRACHLOROETHYLENE (PCE)	10 U	NS	10 U	10 UJ	NS(See Note 4)
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	10 U	NS	10 UJ	10 UJ	NS

CONTAMINANT	MW-1 (On-Property) STAGE 1 (11/91)	MW-1 (On-Property) STAGE 2 (1/92)	MW-1 (On-Property) ROUND 1 (3/92)	MW-1 (On-Property) ROUND 2 (7/92)	MW-1 (On-Property) ROUND 3 (10-11/96)
CADMIUM	58	NS	120	103 / 119 J (F)	24
CHROMIUM	167	NS	127	75.9 / 80.9 J (F)	200
TRICHLOROETHYLENE (TCE)	10 U	NS	10 U	3 J	11
TETRACHLOROETHYLENE (PCE)	10 U	NS	10 U	10 UJ	0.6 J
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	10 U	NS	10 U	10 U	10 U (TRANS 1.2-DCE) (See Note 8.)

Table A-1

Liberty Industrial Finishing Superfund Site, Farmingdale, New York Analytical Results (in µg/L) For Groundwater Samples Collected in 11/91, 1/92, 3/92, 7/92, and 10-11/96 (Continued)

CONTAMINANT	MW-2 (On-Property) STAGE 1 (11/91)	MW-2 (On-Property) STAGE 2 (1/92)	MW-2 (On-Property) ROUND 1 (3/92)	MW-2 (On-Property) ROUND 2 (7/92)	MW-2 (On-Property) ROUND 3 (10-11/96)
CADMIUM	5 U	NS	388	609 / 502 J (F)	336
CHROMIUM	5.2 J	NS	58.7	61.2 / 19 J (F)	32
TRICHLOROETHYLENE (TCE)	1,400 D	NS	980	1,100 J	250
TETRACHLOROETHYLENE (PCE)	13	NS	8 J	12 J	2.7 J
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	1,800 D	NS	840	900 J	1.8 J (TRANS 1,2-DCE) (See Note 8.)

CONTAMINANT	USGS 62 (Off-Property) STAGE 1 (11/91)	USGS 62 (Off-Property) STAGE 2 (1/92)	USGS 62 (Off-Property) ROUND 1 (3/92)	USGS 62 (Off-Property) ROUND 2 (7/92)	USGS 62 (Off-Property) ROUND 3 (10-11/96)
CADMIUM	27	NS	NS	NS	NS
CHROMIUM	1 USJ	NS	NS	NS	NS
TRICHLOROETHYLENE (TCE)	10 U	NS	NS	NS	NS
TETRACHLOROETHYLENE (PCE)	10 U	NS	NS	NS	NS
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	10 U	NS	NS	NS	NS

CONTAMINANT	USGS 50 (Off-Property) STAGE 1 (11/91)	USGS 50 (Off-Property) STAGE 2 (1/92)	USGS 50 (Off-Property) ROUND 1 (3/92)	USGS 50 (Off-Property) ROUND 2 (7/92)	USGS 50 (Off-Property) ROUND 3 (10-11/96)
CADMIUM	5 U	NS	NS	NS	NS
CHROMIUM	3.5 J	NS	NS	NS	NS
TRICHLOROETHYLENE (TCE)	10 U	NS	NS	NS	NS
TETRACHLOROETHYLENE (PCE)	10 U	NS	NS	NS	NS
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	10 U	NS	NS	NS	NS

Table A-1

Liberty Industrial Finishing Superfund Site, Farmingdale, New York Analytical Results (in µg/L) For Groundwater Samples Collected in 11/91, 1/92, 3/92, 7/92, and 10-11/96 (Continued)

CONTAMINANT	USGS 58 (Off-Property) STAGE 1 (11/91)	USGS 58 (Off-Property) STAGE 2 (1/92)	USGS 58 (Off-Property) ROUND 1 (3/92)	USGS 58 (Off-Property) ROUND 2 (7/92)	USGS 58 (Off-Property) ROUND 3 (10-11/96)
CADMIUM	5 U	NS	NS	NS	NS
CHROMIUM	1 UJ	NS	NS	NS	NS
TRICHLOROETHYLENE (TCE)	10 U	NS	NS	NS	NS
TETRACHLOROETHYLENE (PCE)	10 U	NS	NS	NS	NS
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	10 U	NS	NS	NS	NS

CONTAMINANT	MW-4 (On-Property) STAGE 1 (11/91)	MW-4 (On-Property) STAGE 2 (1/92)	MW-4 (On-Property) ROUND 1 (3/92)	MW-4 (On-Property) ROUND 2 (7/92)	MW-4 (On-Property) ROUND 3 (10-11/96)
CADMIUM	NS	4 UJ*	1.3 B	NS	NS (See Note 5)
CHROMIUM	NS	10 UJ*	2.8 B	NS	NS (See Note 5)
TRICHLOROETHYLENE (TCE)	NS	10 U	10 U	NS	NS (See Note 5)
TETRACHLOROETHYLENE (PCE)	NS	10 U	10 U	NS	NS (See Note 5)
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	NS	10 U	10 UJ	NS	NS (See Note 5)

CONTAMINANT	MW-5 (On-Property) STAGE 1 (11/91)	MW-5 (On-Property) STAGE 2 (1/92)	MW-5 (On-Property) ROUND 1 (3/92)	MW-5 (On-Property) ROUND 2 (7/92)	MW-5 (On-Property ROUND 3 (10-11/96)
CADMIUM	NS	13.5 j*	14.7	21.4 / 20.1 J (F)	18
CHROMIUM	NS	18 J*	14.2	17.3 / 19.4 J (F)	26
TRICHLOROETHYLENE (TCE)	NS	10 UJ	10 U	10 UJ	1.5 J
TETRACHLOROETHYLENE (PCE)	NS	10 UJ	10 U	10 UJ	0.6 J
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	NS	10 UJ	10 UJ	10 UJ	10 U (TRANS 1,2-DCE) (See Note 8.)

Table A-1

Liberty Industrial Finishing Superfund Site, Farmingdale, New York Analytical Results (in µg/L) For Groundwater Samples Collected in 11/91, 1/92, 3/92, 7/92, and 10-11/96 (Continued)

CONTAMINANT	MW-6 (On-Property) STAGE 1 (11/91)	MW-6 (On-Property) STAGE 2 (1/92)	MW-6 (On-Property) ROUND 1 (3/92)	MW-6 (On-Property) ROUND 2 (7/92)	MW-6 (On-Property) ROUND 3 (10-11/96)
CADMIUM	NS	171 J*	276	314 J / 300 J (F) 302 J(D) / 291 R(D)(F)	241
CHROMIUM	NS	22.6 J*	235 / 249 (DUP)	314 J / 5.2 BJ (F) 392 J(D) / 5.6 BJ(D)(F)	20
TRICHLOROETHYLENE (TCE)	NS	120 J	220	160 / 170 (DUP)	110
TETRACHLOROETHYLENE (PCE)	NS	8 J	20	21 J / 24 J (DUP)	5.6 J
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	NS	41 J	110	120	10 U (TRANS 1,2-DCE) (See Note 8.)

CONTAMINANT	MW-6B (On-Property) STAGE 1 (11/91)	MW-6B (On-Property) STAGE 2 (1/92)	MW-6B (On-Property) ROUND 1 (3/92)	MW-6B (On-Property) ROUND 2 (7/92)	MW-6B (On-Property) ROUND 3 (10-11/96)
CADMIUM	NS	12.2 J*	28.7	24.2 R / 23.9 J (F)	22
CHROMIUM	NS	19.4 R	21.4	12 J / 3.7 UJ (F)	17
TRICHLOROETHYLENE (TCE)	NS	10 UJ	10 U	10 UJ	10 U
TETRACHLOROETHYLENE (PCE)	NS	10 UJ	10 U	10 UJ	10 U
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	NS	10 UJ	10 U	10 UJ	10 U (TRANS 1,2-DCE) (See Note 8.)

CONTAMINANT	MW-7 (On-Property) STAGE 1 (11/91)	MW-7 (On-Property) STAGE 2 (1/92)	MW-7 (On-Property) ROUND 1 (3/92)	MW-7 (On-Property) ROUND 2 (7/92)	MW-7 (On-Property) ROUND 3 (10-11/96)
CADMIUM	NS	25.4 J*	23.6	40.6 J / 41 J (F)	24
CHROMIUM	NS	100 J*	74.6	112 J / 128 J (F)	109
TRICHLOROETHYLENE (TCE)	NS	67	100 J	1,700 J	740
TETRACHLOROETHYLENE (PCE)	NS	10 U	2 J	100 UJ	2.4 J
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	NS	10 U	4 J	62 J	10 U (TRANS 1,2-DCE) (See Note 8.)

Table A-1

Liberty Industrial Finishing Superfund Site, Farmingdale, New York Analytical Results (in µg/L) For Groundwater Samples Collected in 11/91, 1/92, 3/92, 7/92, and 10-11/96 (Continued)

CONTAMINANT	MW-7B (On-Property) STAGE 1 (11/91)	MW-7B (On-Property) STAGE 2 (1/92)	MW-7B (On-Property) ROUND 1 (3/92)	MW-7B (On-Property) ROUND 2 (7/92)	MW-7B (On-Property) ROUND 3 (10-11/96)
CADMIUM	NS	4 UJ*	4.3 B	6.5 J / 5.4 J (F)	5 U
CHROMIUM	NS	19.4 J*	54.1	8.8 BJ / 3.7 UJ (F)	10 U
TRICHLOROETHYLENE (TCE)	NS	10 U	10 U	10 UJ	10 U
TETRACHLOROETHYLENE (PCE)	NS	10 U	10 U	10 UJ	10 U
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	NS	10 U	10 U	10 UJ	10 U (TRANS 1.2-DCE) (See Note 8.)

CONTAMINANT	MW-8 (On-Property) STAGE 1 (11/91)	MW-8 (On-Property) STAGE 2 (1/92)	MW-8 (On-Property) ROUND 1 (3/92)	MW-8 (On-Property) ROUND 2 (7/92)	MW-8 (On-Property) ROUND 3 (10-11/96)
CADMIUM	NS	4 UJ*	1 U	3 U / 1.4 UJ (F)	NS(See Note 6.)
CHROMIUM	NS	10 U*	2.8 B	8 U / 3.7 UJ (F)	NS(See Note 6.)
TRICHLOROETHYLENE (TCE)	NS	10 UJ	10 U	10 UJ	NS(See Note 6.)
TETRACHLOROETHYLENE (PCE)	NS	10 U	10 U	10 UJ	NS(See Note 6.)
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	NS	10 U	10 U	10 UJ	NS(See Note 6.)

CONTAMINANT	MW-9 (Off-Property) STAGE 1 (11/91)	MW-9 (Off-Property) STAGE 2 (1/92)	MW-9 (Off-Property) ROUND 1 (3/92)	MW-9 (Off-Property) ROUND 2 (7/92)	MW-9 (Off-Property) ROUND 3 (10-11/96)
CADMIUM	NS	26.7 J*	79 / 80.3 (DUP)	89.1 / 67.3 B (F) 88.8 (D) / 74.3 J(D)(F)	NS(See Note 3.)
CHROMIUM	NS	89.1 *	316 / 345 (DUP)	400 J / 136 J (F) 382 (D) / 188 J(D)(F)	NS(See Note 3.)
TRICHLOROETHYLENE (TCE)	NS	10 U	2 J	2 J / 3 J (DUP)	NS(See Note 3.)
TETRACHLOROETHYLENE (PCE)	NS	10 U	10 U	2 J	NS(See Note 3.)
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	NS	10 U	10 U	10 UJ	NS(See Note 3.)

Table A-1

Liberty Industrial Finishing Superfund Site, Farmingdale, New York Analytical Results (in µg/L) For Groundwater Samples Collected in 11/91, 1/92, 3/92, 7/92, and 10-11/96 (Continued)

CONTAMINANT	MW-10 (Off-Property) STAGE 1 (11/91)	MW-10 (Off-Property) STAGE 2 (1/92)	MW-10 (Off-Property) ROUND 1 (3/92)	MW-10 (Off-Property) ROUND 2 (7/92)	MW-10 (Off-Property) ROUND 3 (10-11/96)
CADMIUM	NS	4 UJ*	1 U	3 U / 1.4 UJ (F)	5 U
CHROMIUM	NS	18.3 *	7.3 B	8 U / 3.7 UJ (F)	10 U
TRICHLOROETHYLENE (TCE)	NS	10 U	10 U	10 UJ	10 U
TETRACHLOROETHYLENE (PCE)	NS	10 U	10 U	10 UJ	10 U
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	NS	10 U	10 UJ	10 UJ	10 U (TRANS 1,2-DCE) (See Note 8.)

CONTAMINANT	MW-11 (Off-Property) STAGE 1 (11/91)	MW-11 (Off-Property) STAGE 2 (1/92)	MW-11 (Off-Property) ROUND 1 (3/92)	MW-11 (Off-Property) ROUND 2 (7/92)	MW-11 (Off-Property) ROUND 3 (10-11/96)
CADMIUM	NS	4 UJ*	2 B	1.5 UJ / 2.6 BJ (F) 3.4 BJ(D)/ 2.6 BJ(D)(F)	90
CHROMIUM	NS	10 U*	26.4 J	4.9 UJ / 3.7 UJ (F) 7 BJ(D) / 3.7 UJ(D)(F)	22
TRICHLOROETHYLENE (TCE)	NS	6 J	10	25 UJ / 1 J (DUP)	10 J
TETRACHLOROETHYLENE (PCE)	NS	10 U	1 J	25 UJ	2.9 J
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	NS	10 U	10 U	25 UJ	10 U (TRANS 1,2-DCE) (See Note 8.)

CONTAMINANT	MW-11B (Off-Property) STAGE 1 (11/91)	MW-11B (Off-Property) STAGE 2 (1/92)	MW-11B (Off-Property) ROUND 1 (3/92)	MW-11B (Off-Property) ROUND 2 (7/92)	MW-11B (Off-Property) ROUND 3 (10-11/96)
CADMIUM	NS	5.5 J*	55.6	73.9 J / 77 J (F)	5 U
CHROMIUM	NS	10 U*	47.6	30.9 J / 24 J (F)	50
TRICHLOROETHYLENE (TCE)	NS	13	41	22 J	0.5 J
TETRACHLOROETHYLENE (PCE)	NS	10 U	8 J	5 J	10 U
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	NS	10 U	8 J	13 J	10 U (TRANS 1,2-DCE) (See Note 8.)

Table A-1

Liberty Industrial Finishing Superfund Site, Farmingdale, New York Analytical Results (in µg/L) For Groundwater Samples Collected in 11/91, 1/92, 3/92, 7/92, and 10-11/96 (Continued)

CONTAMINANT	MW-12 (Off-Property) STAGE 1 (11/91)	MW-12 (Off-Property) STAGE 2 (1/92)	MW-12 (Off-Property) ROUND 1 (3/92)	MW-12 (Off-Property) ROUND 2 (7/92)	MW-12 (Off-Property) ROUND 3 (10-11/96)
CADMIUM	NS	4 UJ*	3 B	1.5 UJ / 1.4 UJ (F)	NS(See Note 3)
CHROMIUM	NS	10 U*	5 B	4.9 UJ / 3.7 UJ (F)	NS(See Note 3)
TRICHLOROETHYLENE (TCE)	NS	10 U	10 U	10 UJ	NS(See Note 3)
TETRACHLOROETHYLENE (PCE)	NS	10 U	10 U	10 UJ	NS(See Note 3)
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	NS	10 U	10 U	10 UJ	NS(See Note 3)

CONTAMINANT	MW-13 (Off-Property) STAGE 1 (11/91)	MW-13 (Off-Property) STAGE 2 (1/92)	MW-13 (Off-Property) ROUND 1 (3/92)	MW-13 (Off-Property) ROUND 2 (7/92)	MW-13 (Off-Property) ROUND 3 (10-11/96)
CADMIUM	NS	4 UJ*	4 U	1.5 UJ / 1.4 UJ (F)	5 U
CHROMIUM	NS	10 U*	7 U	12.2 J / 3.7 UJ (F)	24
TRICHLOROETHYLENE (TCE)	NS	10 U	10 U	10 UJ	10 U
TETRACHLOROETHYLENE (PCE)	NS	10 U	10 U / 1 J (DUP)	10 UJ	10 U
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	NS	10 U	10 U / 1 J (DUP)	10 UJ	10 U (TRANS 1,2-DCE) (See Note 8.)

CONTAMINANT	MW-9B (Off-Property) STAGE 1 (11/91)	MW-9B (Off-Property) STAGE 2 (1/92)	MW-9B (Off-Property) ROUND 1 (3/92)	MW-9B (Off-Property) ROUND 2 (7/92)	MW-9B (Off-Property) ROUND 3 (10-11/96)
CADMIUM	NS	NS	40.7	64.2 / 55.5 J (F)	NS(See Note 3)
CHROMIUM	NS	NS	437	518 / 461 J (F)	NS(See Note 3)
TRICHLOROETHYLENE (TCE)	NS	NS	14	7 J	NS(See Note 3)
TETRACHLOROETHYLENE (PCE)	NS	NS	5 J	3 J	NS(See Note 3)
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	NS	NS	1 J	10 UJ	NS(See Note 3)

Table A-1

Liberty Industrial Finishing Superfund Site, Farmingdale, New York Analytical Results (in µg/L) For Groundwater Samples Collected in 11/91, 1/92, 3/92, 7/92, and 10-11/96 (Continued)

CONTAMINANT	MW-10B (Off-Property) STAGE 1 (11/91)	MW-10B (Off-Property) STAGE 2 (1/92)	MW-10B (Off-Property) ROUND 1 (3/92)	MW-10B (Off-Property) ROUND 2 (7/92)	MW-10B (Off-Property) ROUND 3 (10-11/96)
CADMIUM	NS	NS	1.6 B	3 U / 1.4 UJ (F)	5 U
CHROMIUM	NS	NS	5.2 B	8 U / 3.7 UJ (F)	10 U
TRICHLOROETHYLENE (TCE)	NS	NS	10 U	2 J	10 U
TETRACHLOROETHYLENE (PCE)	NS	NS	2 J	4 J	10 U
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	NS	NS	10 U	10 UJ	10 U (TRANS 1,2-DCE) (See Note 8.)

CONTAMINANT	MW-11C (Off-Property) STAGE 1 (11/91)	MW-11C (Off-Property) STAGE 2 (1/92)	MW-11C (Off-Property) ROUND 1 (3/92)	MW-11C (Off-Property) ROUND 2 (7/92)	MW-11C (Off-Property) ROUND 3 (10-11/96)
CADMIUM	NS	NS	1 U	1.5 UJ / 1.4 UJ (F)	5 U
CHROMIUM	NS	NS	4 UJ	4.9 UJ / 3.7 UJ (F)	36
TRICHLOROETHYLENE (TCE)	NS	NS	760 D	1,300 J	51
TETRACHLOROETHYLENE (PCE)	NS	NS	10 U	71 UJ	10 U
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	NS	NS	69	120 J	4.9 J (See Note 8.)
XYLENES (TOTAL)					6 J

CONTAMINANT	MW-14 (Off-Property) STAGE 1 (11/91)	MW-14 (Off-Property) STAGE 2 (1/92)	MW-14 (Off-Property) ROUND 1 (3/92)	MW-14 (Off-Property) ROUND 2 (7/92)	MW-14 (Off-Property) ROUND 3 (10-11/96)
CADMIUM	NS	NS	1 U	1.5 UJ / 1.4 UJ (F)	5 U
CHROMIUM	NS	NS	7.2 B	4.9 UJ / 3.7 UJ (F)	10 U
TRICHLOROETHYLENE (TCE)	NS	NS	5 J	10 UJ	10 U
TETRACHLOROETHYLENE (PCE)	NS	NS	10 U	10 UJ	10 U
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	NS	NS	2 J	10 UJ	10 U (TRANS 1,2-DCE) (See Note 8.)

Table A-1

Liberty Industrial Finishing Superfund Site, Farmingdale, New York Analytical Results (in µg/L) For Groundwater Samples Collected in 11/91, 1/92, 3/92, 7/92, and 10-11/96 (Continued)

CONTAMINANT	MW-15 (Off-Property) STAGE 1 (11/91)	MW-15 (Off-Property) STAGE 2 (1/92)	MW-15 (Off-Property) ROUND 1 (3/92)	MW-15 (Off-Property) ROUND 2 (7/92)	MW-15 (Off-Property) ROUND 3 (10-11/96)
CADMIUM	NS	NS	1 U	1.5 UJ / 1.4 UJ (F)	5 U
CHROMIUM	NS	NS	4 UJ	4.9 UJ / 3.7 UJ (F)	10 U
TRICHLOROETHYLENE (TCE)	NS	NS	10 U	10 UJ	10 U
TETRACHLOROETHYLENE (PCE)	NS	NS	10 U	10 UJ	10 U
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	NS	NS	10 U	10 UJ	10 U (TRANS 1.2-DCE) (See Note 8.)
BENZENE					55 (See Note 9.)
TOLUENE					37 (See Note 9.)
XYLENES (TOTAL)					380 (See Note 9.)

CONTAMINANT	MW-16 (Off-Property) STAGE 1 (11/91)	MW-16 (Off Property) STAGE 2 (1/92)	MW-16 (Off-Property) ROUND 1 (3/92)	MW-16 (Off-Property) ROUND 2 (7/92)	MW-16 (Off-Property ROUND 3 (10-11/96)
CADMIUM	NS	NS	4 U	1.5 UJ / 1.4 UJ (F)	5 U
CHROMIUM	NS	NS	7 U	4.9 UJ / 3.7 UJ (F)	10 U
TRICHLOROETHYLENE (TCE)	NS	NS	10 U	10 UJ	10 U
TETRACHLOROETHYLENE (PCE)	NS	NS	10 U	10 UJ	10 U
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	NS	NS	10 U	10 UJ	10 U (TRANS 1.2-DCE) (See Note 8.)

Table A-1

Liberty Industrial Finishing Superfund Site, Farmingdale, New York Analytical Results (in µg/L) For Groundwater Samples Collected in 11/91, 1/92, 3/92, 7/92, and 10-11/96 (Continued)

CONTAMINANT	MW-17 (Off-Property) STAGE 1 (11/91)	MW-17 (Off-Property) STAGE 2 (1/92)	MW-17 (Off-Property) ROUND 1 (3/92)	MW-17 (Off-Property) ROUND 2 (7/92)	MW-17 (Off-Property) ROUND 3 (10-11/96)
CADMIUM	NS	NS	6.6	7.2 J / 4.6 BJ (F)	7
CHROMIUM	NS	NS	42.3	34.7 J / 32.3 J (F)	46
TRICHLOROETHYLENE (TCE)	NS	NS	10 U	10 UJ	10 U
TETRACHLOROETHYLENE (PCE)	NS	NS	10 U	10 UJ	10 U
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	NS	NS	10 U	10 UJ	10 U (TRANS 1,2-DCE) (See Note 8.)

CONTAMINANT	MW-17B (Off-Property) STAGE 1 (11/91)	MW-17B (Off-Property) STAGE 2 (1/92)	MW-17B (Off-Property) ROUND 1 (3/92)	MW-17B (Off-Property) ROUND 2 (7/92)	MW-17B (Off-Property) ROUND 3 (10-11/96)
CADMIUM	NS	NS	109	143 J / 146 J (F)	147
CHROMIUM	NS	NS	62.6	50.4 J / 42.4 J (F)	45
TRICHLOROETHYLENE (TCE)	NS	NS	3 J	3 J	10 U
TETRACHLOROETHYLENE (PCE)	NS	NS	10 U	10 UJ	10 U
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	NS	NS	10 U	10 UJ	10 U (TRANS 1,2-DCE) (See Note 8.)

CONTAMINANT	MW-18 (On-Property) STAGE 1 (11/91)	MW-18 (On-Property) STAGE 2 (1/92)	MW-18 (On-Property) ROUND 1 (3/92)	MW-18 (On-Property) ROUND 2 (7/92)	MW-18 (On-Property) ROUND 3 (10-11/96)
CADMIUM	NS	NS	79.8	58.6 / 43.4 J (F)	24
CHROMIUM	NS	NS	609	888 / 107 J (F)	143
TRICHLOROETHYLENE (TCE)	NS	NS	150	110 J	41
TETRACHLOROETHYLENE (PCE)	NS	NS	14	13 J	1.2 J
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	NS	NS	19	13 J	10 U (TRANS 1,2-DCE) (See Note 8.)

Table A-1

Liberty Industrial Finishing Superfund Site, Farmingdale, New York Analytical Results (in µg/L) For Groundwater Samples Collected in 11/91, 1/92, 3/92, 7/92, and 10-11/96 (Continued)

CONTAMINANT	MW-19 (Off-Property) STAGE 1 (11/91)	MW-19 (Off-Property) STAGE 2 (1/92)	MW-19 (Off-Property) ROUND 1 (3/92)	MW-19 (Off-Property) ROUND 2 (7/92)	MW-19 (Off-Property) ROUND 3 (10-11/96)
CADMIUM	NS	NS	1.2 B	4.6 BJ / 1.4 UJ (F)	5 U
CHROMIUM	NS	NS	2 U	7.6 BJ / 3.7 UJ (F)	10 U
TRICHLOROETHYLENE (TCE)	NS	NS	10 U	10 UJ	10 U
TETRACHLOROETHYLENE (PCE)	NS	NS	10 U	10 UJ	10 U
1,2-DICHLOROETHYLENE-TOTAL (1,2-DCE-total)	NS	NS	10 U	10 UJ	10 U (TRANS 1,2-DCE) (See Note 8.)

NOTES: (1) All MWs are Off-Property except where designated as On-Property.
All samples are unfiltered except where noted as "(F)".
NS - Not Sampled.
B - Reported Value is Between the Instrument Detection Limit and the Contract Required Detection Limit.
U - Reporting Limit or Analyte Was Not Detected at the Instrument Detection Limit Given.
DUP - Duplicate Sample.
D - Determined After Sample Dilution.
J - Estimated Value.
S - Determined by Method of Standard Addition (MSA).
R - Rejected During Data Validation.
* - Duplicate Analysis Not Within Control Limits.
Boldfaced/redlined analytical results indicate ARAR exceedances.

(2) Stage 1 MWs - Monitoring wells MW-1, MW-2 and MW-3 are on-property wells whereas N-9430, N-9441, USGS 29, USGS 77, USGS 62, USGS 50, and USGS 58 are off-property wells.

Stage 2 MWs - Monitoring wells MW-4, MW-5, MW-6, MW-6B, MW-7, MW-7B, and MW-8 are on-property wells whereas MW-9, MW-10, MW-11, MW-11B, MW-12 and MW-13 off-property wells.

Rounds 1, 2, and 3 MWs - 11 on-property monitoring wells (MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, MW-6B, MW-7, MW-7B, MW-8 and MW-18) and 15 off-property monitoring wells (MW-9, MW-9B, MW-10, MW-10B, MW-11, MW-11B, MW-11C, MW-12, MW-13, MW-14, MW-15, MW-16, MW-17, MW-17B and MW-19) were monitored with the following exceptions: (1) MW-4 was not monitored during Round 2 and (2) MW3, MW-4, MW-8, MW-9, MW-9B, and MW-12 were not monitored during Round 3.

(3) EPA Edison could not locate and, therefore, sample MW-9, MW-9B, and MW-12. These three MWs were either covered with leaves or wetland bushes. However, Michael Mercado of EPA Edison informed Lorenzo Thantu, RPM, on 12/18/96 that he may be able to go back in the field January of 1997 to try to locate and sample these three missing MWs.

(4) EPA Edison could not sample MW3 as it could not take its cap off.

(5) EPA Edison could not sample MW-4 because it was found to be plugged up with trash such that it could not be penetrated with a probe (Michael Mercado of EPA Edison believes MW-4 is probably destroyed or at minimum would need to be redeveloped or replaced with another MW).

(6) EPA Edison could not sample MW-8 because it had been knocked down and does not exist. Michael Mercado of EPA Edison reports that he and his crew searched the entire parking lot and did not find any MW.

Table A 1

Liberty Industrial Finishing Superfund Site, Farmingdale, New York Analytical Results (in µg/L) For Groundwater Samples Collected in 11/91, 1/92, 3/92, 7/92, and 10-11/96 (Continued)

(7) 11/91 samples (10 MWs) - collected by Roy F. Weston, Inc.
1/92 samples (13 MWs) - collected by Roy F. Weston, Inc.
3/92 samples (26 MWs) - collected by Roy F. Weston, Inc.
7/92 samples (25 MWs) - collected by Roy F. Weston, Inc.
10-11/96 samples (20 MWs) - collected by EPA Edison Lab.
10-11/96 samples - collected by EPA Edison Lab (low-flow pump sampling was employed on all monitoring wells).

(8) In analyzing 1,2-DCEs as part of its VOAs analysis of groundwater samples collected from the 10-11/96 round, EPA Edison analyzed only for trans-1,2-DCE. Therefore, EPA Edison did not analyze for either cis-1,2-DCE or total-1,2-DCE. Given the fact that total-1,2-DCE is one of the three major VOC indicator chemicals for the Liberty site, along with TCE and PCE, and that EPA Edison analyzed only for trans-1,2-DCE in its VOA analysis, the 1,2-DCE data cannot be considered conclusive in determining the current nature and extent of total-1,2-DCE contamination in groundwater.

(9) MW-15 is located on some unnamed gas station, not currently in operation but being advertised for lease, just to the southwest of the Liberty site on Roberts Street. On 10/31/96, EPA Edison attempted to probe this off-property MW to measure the groundwater elevation. When Michael Mercado of EPA Edison pulled out the probe, he found the probe covered with thick tar-soaked sludge materials. He also observed sheen of what appeared to be petroleum oil.

(10) Groundwater aquifers underlying the Liberty Industrial Finishing Site are classified as Class GA pursuant to 6 New York Codes, Rules and Regulations Parts 700-705 (6 NYCRR Parts 700-705, effective September 1991). The Class GA standards, promulgated thereunder, apply to any groundwater, surface water body, aquifer or water course from which water is regularly taken for drink or which has been classified for present or future public beneficial use or source for domestic purposes. The Class GA standard for chromium is 50 µg/L; therefore, even though the Federal MCL for chromium is 100 µg/L, the State's Class GA standard of 50 µg/L would supersede 100 µg/L Federal MCL for chromium as the more stringent ARAR. In addition, the State's Class GA standards for both toluene and xylenes (each isomer) are 5 µg/L.

APPENDIX B

IDENTIFICATION OF POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

WESTON

APPENDIX B

IDENTIFICATION OF POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

TABLE OF CONTENTS

LIST OF TABLES

WESTON

APPENDIX B

IDENTIFICATION OF POTENTIALLY APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

U.S. EPA policy, as reflected in CERCLA (or Superfund) as amended by SARA and in the NCP, provides that the development and evaluation of remedial actions under CERCLA must include alternative site responses able to meet applicable or relevant and appropriate federal and state environmental and public health requirements (ARARs).

ARARs are defined as:

- Applicable Requirements - those cleanup standards, standards of control, and other substantive environmental protection requirements promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstance at a CERCLA site.

- Relevant and Appropriate Requirements - those cleanup standards, standards of control, and other substantive environmental protection requirements promulgated under federal or state law that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at a CERCLA site.

- To Be Considered (TBC) - TBC information refers to other federal and state criteria, advisories, guidance, and proposed standards and local ordinances that are not legally binding but may provide useful information or recommended procedures.

Identification of ARARs is performed on a site-specific basis. Neither CERCLA and its amendments nor the NCP provide across-the-board standards for determining whether a particular remedy will produce an adequate cleanup at a particular site. Rather, the process recognizes that each site will have unique characteristics that must be evaluated and compared to those requirements that apply under the given circumstances. Under CERCLA, permits for compliance with the RCRA, National Pollutant Discharge Elimination System (NPDES), and Clean Air Act (CAA) regulations are not required for on-site remedial actions. CERCLA, however, does require that the selected remedial alternative meet relevant and appropriate regulations wherever possible. The remedial action selected must meet all enforceable and applicable requirements unless a waiver from specific requirements has been granted. A waiver from compliance with a specific APAR can be granted for an alternative under the following circumstances:

- The alternative is an interim measure and will become part of a total remedial action that will meet ARARs.

- Compliance with the ARAR is technically impractical from an engineering perspective.

- Compliance with the ARAR will result in a greater risk to human health and the environment than other alternatives.

- The alternative will attain a standard of performance that is equivalent to that required under the otherwise applicable standard, requirement, or limitation through use of another method or approach.

- With respect to a state ARAR, the state has not consistently applied, or demonstrated the intention to consistently apply, the promulgated requirement in similar circumstances at other remedial actions within the state.

- For Superfund-financed response actions, an alternative that attains the ARAR will not provide a balance between the need for protection of human health and the environment at the site and the availability of Superfund monies to respond to other sites that may present a threat to human health and the environment.

A summary of possible ARARs and TBCs for the Liberty Industrial Finishing Site is included in Table B-1.

ARARs are divided into the following three categories:

- Chemical-Specific Requirements - health or risk-based concentration limits or ranges in various environmental media for specific hazardous substances, pollutants, or contaminants. These limits may take the form of cleanup levels or discharge levels.

- Local-Specific Requirements - restrictions on activities that are based on the characteristics of a site or its immediate environment.

- Action-Specific Requirements - controls or restrictions on particular types of activities in related areas such as hazardous waste management or wastewater treatment.

The chemical-specific, location-specific, and action-specific ARARs developed for the Liberty Industrial Finishing site are summarized in Sections B-1, B-2, and B-3, respectively.

B.1 CHEMICAL-SPECIFIC ARARs FOR THE LIBERTY SITE

"Chemical-specific requirements set health or risk-based concentration limits or discharge limitations in various environmental media for specific hazardous substances, pollutants, or contaminants" (52 FR 32496). These requirements generally set protective cleanup levels for the chemicals of concern in the designated media or indicate a safe level of discharge that may be incorporated in a remedial activity. The chemical specific ARARs for the Liberty Industrial Finishing Site may include the following:

1. Waste Materials

   6 NYCRR Part 371, Identification and Listing of Hazardous Wastes (amended October 23, 1994) [NY Division of Hazardous Substances Regulation].

   6 NYCRR Part 376 - Land Disposal Restrictions (amended November 30, 1994 [NY Division of Hazardous Substances Regulation].

   40 CFR Part 172 - Hazardous Materials Tables, Hazardous Materials Communications Requirements, and Emergency Response Information Requirements (amended July 22, 1997) [US Department of Transportation].

2. Surface Water

   6 NYCRR Part 701 - Classification of Surface Waters and Groundwaters, and 703 - Surface Water and Groundwater Quality Standards: (Part 701 amended September 22, 1993, Part 703 amended December 29, 1993). Applicable Regulation; the purpose of this regulation is to present classifications for surface water bodies and standards to maintain best usage based upon human health, protection of aquatic life, aesthetics, chemical correlation, bioaccumulation, etc. Data from the Liberty Industrial Site were compared to the standards and guidance values established for classification C-T. The NYSDEC has classified Massapequa Creek from its source south to Merrick Road as Class C-T, Fresh Surface Waters. This classification states that the best usage of such water is fishing. These waters shall be "suitable for fish propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes." Reportedly, this creek is stocked with trout for fishing [NY Division of Water Resources].

   6 NYCRR Part 754 - Provisions of SPDES Permits (amended July 22, 1987) (including application of standards, limits and other requirements; effluent limits, schedules, & compliance, etc.) [NY Division of Water Resources].

   State Sanitary Code Part 5 - Drinking Water Supplies (statutory authority, Public Health Law, section 225); Subpart 5.1 - Public Water Systems; Subpart 5.2 - Water Well Construction (amended December 16, 1992) [NYS Department of Health].

6 NYCRR Part 702.8: Procedures for Deriving Standards and Guidance Values for Protection of Human Health from Consumption of Fish: (amended August 2, 1991) [NY Division of Water Resources].

4. Surficial Soil

40 CFR Part 264 Subparts Corrective Action for Solid Waste Management Units: Allows for land treatment of wastes during a corrective action without constituting "land disposal" of hazardous wastes (amended June 13, 1997).

5. Air

6 NYCRR Part 257 - Air Quality Standards (standards for emission of SO_2 particulates, CO, photochemical oxidants, hydrocarbons (non-methane), NO_2, fluorides beryllium, H_2S) (February 16, 1997) [NY Division of Air Resources].

a. Ambient Air

6 NYCRR Part 212 - General Process Emission Sources: Under this regulation, when an application is made for a permit to operate a process emission source, the Commissioner will issue an environmental rating for each air contaminant from each emission point. The degree of cleaning required is based on the ratings designed (amended September 7, 1994) [NY Division of Air Resources].

b. Vent Air

6 NYCRR Part 212 - General Process Emission Sources: Under this regulation, when an application is made for a permit to operate a process emission source, the Commissioner will issue an environmental rating for each air contaminant from each emission point. The degree of cleaning required is based on the ratings designed (amended September 7, 1994) [NY Division of Air].

6. Groundwater

6 NYCRR Part 703 - Surface Water and Groundwater Quality Standards and Groundwater Effluent Standards: (amended December 29, 1993) Applicable Regulation; the purpose of this regulation is to present classifications, quality standards and effluent standards or limitations to prevent pollution of groundwater and to protect groundwater for use as potable water. Groundwater underlying the Liberty Industrial Finishing Site is classified as GA. These standards are applicable.

10 NYCRR Part 170 - Sources of Water Supply (Stat. Auth., Pub. Health Law Sec. 1100): Applicable Regulation; this regulation applies to Class GA sources of water in NY. These standards apply as they have been incorporated into the NYSDEC Water

Quality Standards for Surface and Groundwaters (6 NYCRR Parts 700-705 effective September 1991). They appear as Class GA standards. It applies to any ground water, surface water body, aquifer or water course from which water is regularly taken for drink...or which has been classified for present or future public beneficial use or source for domestic purposes. (August 16, 1971) [NYS Department of Health].

State Sanitary Code - Part 5 - Drinking Water Supply: (statutory authority, Public Health Law, section 225); Subpart 5.1 - Public Water supplies. Applicable Regulation; this regulation was promulgated to protect present or future sources of water supply. These standards apply as incorporated into 6 NYCRR Parts 700-705 effective September 1991. They appear in the class GA column of Ground water Standards. It applies to all existing and proposed sources and addresses planning, siting, treatment and approval as well as MCLs, monitoring and quality control. (amended December 16, 1992) [NYS Department of Health].

B.2 LOCATION-SPECIFIC ARARs FOR THE LIBERTY SITE

Location-specific requirements set restrictions on activities depending on the characteristics of a site or its immediate environs (52 FR 32496). In determining the use of these location-specific ARARS for selection of remedial actions at CERCLA sites, one must investigate the jurisdictional prerequisites of each of the regulations. Basic definitions, exemptions, etc., should be analyzed on a site-specific basis to confirm the correct application of the requirements. The location-specific ARARs for the Liberty Industrial Finishing Site may include the following:

1. Wetlands

6 NYCRR Part 608 - Use and Protection of Waters (permit is required for various activities relating to impoundments, structures and dredge and fill. Section 608.7 conforms with Section 401(a)(i) of the Federal Clean Water Act (amended December 7, 1994) [NY Division of Fish and Wildlife].

Executive Order 11990 - Protection of Wetlands - Activities performed in a wetland area are required to take actions to minimize the destruction, loss, or degradation of the wetland. There is a protected wetland located adjacent to the site toward the east.

Executive Order 11988 - Floodplain Management - Controls construction and other development activities in areas subject to flooding and fringe areas.

NYSECL Article 24 New York Freshwater Wetlands Act

2. Flora/Fauna

6 NYCRR Part 182 - Endangered and Threatened Species of Fish and Wildlife: Species of Special Concern (amended June 3, 1987) [NY Division of Fish and Wildlife].

6 NYCRR Part 608 - Use and Protection of Waters (permit is required for various activities relating to impoundments, structures and dredge and fill). Section 608.7 conforms with Section 401(a)(i) of the Federal Clean Water Act (amended December 7, 1994) [NY Division of Fish and Wildlife].

3. Fishing Areas

6 NYCRR Parts 701, 702, and 703 - Classifications Surface Waters and Groundwaters; Derivation and Use of Standards and Guidance Values; and Surface Water and Groundwater Quality Standards and Groundwater Effluent Standards: (Part 701 amended September 22, 1993; Part 702 amended August 2, 1991; Part 703 amended December 29, 1993) Applicable Regulation; the purpose of this regulation is to present classifications for surface water bodies and standards to maintain best usage based upon human health, protection of aquatic life, aesthetics, chemical correlation, bioaccumulation, etc.

6 NYCRR Part 182 - Endangered and Threatened Species of Fish and Wildlife: Species of Special Concern (amended June 3, 1987) [NY Division of Fish and Wildlife].

4. Soils

6 NYCRR Part 372 - Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities (amended November 30, 1994) [NY Division of Hazardous Substances Regulation].

6 NYCRR Part 373-1 Hazardous Waste Treatment, Storage and Disposal Facility Permitting Requirements (amended October 23, 1996) [NY Division of Hazardous Substances Regulation].

6 NYCRR Part 375 - Inactive Hazardous Waste Disposal Sites: (April 20, 1992) [NY Division of Hazardous Substances Regulation].

5. Air Quality

NYSDEC Air Guide - 1: Guidelines for the Control of Toxic Ambient Air Contaminants (NYSDEC, Division of Air Resources): Appendix B (Ambient Air Quality Impact Screening Analysis); Appendix C (Toxic Classification and Guideline Development Methodology) [NY Division of Air Resources].

6 NYCRR Part 287 - Air Quality Classifications - Nassau County (April 28, 1972) [NY Division of Air Resources].

6. Present/Future Drinking Water Supply at Liberty Industrial Finishing Site

6 NYCRR Part 602 - Applications for Long Island Wells: Applicable for wells capable of withdrawing 45 gallons per minute or greater (January 15, 1985) [NY Division of Water Resources].

6 NYCRR Part 703 - Surface Water and Groundwater Quality Standards and Groundwater Effluent Standards: (amended December 29, 1993) The purpose of this regulation is to present classifications, quality standards and effluent standards or limitations to prevent pollution of groundwater and to protect groundwater for use as potable water. NYSDEC has designated all groundwater as Class GA with best usage as source of potable water.

10 NYCRR Part 170 - Sources of Water Supply (Stat. Auth., Pub. Health Law Sec 1100: This regulation applies to Class GA sources of water in NY. It applies to any groundwater, surface water body, aquifer or water course from which water is regularly taken for drink...or which has been classified for present or future public beneficial use or source for domestic purposes. (August 16, 1971) [NYS Department of Health].

State Sanitary Code - Part 5 - Drinking Water Supply (statutory authority, Public Health Law, section 225); Subpart 5.1 - Public Water supplies. This regulation was promulgated to protect present or future sources of water supply. It applies to all existing and proposed sources and addresses planning, siting, treatment and approval as well as MCLs, monitoring and quality control. (amended December 16, 1992) [NYS Department of Health].

B.3 ACTION-SPECIFIC ARARs FOR THE LIBERTY SITE

Action-specific ARARs are usually technology- or activity-based requirements or limitations on actions taken with respect to site remediation. These requirements are triggered by the particular activities that are selected to accomplish the cleanup. Since there are usually several alternative actions for any remedial site, very different potential requirements can come into play. These action-specific requirements do not in themselves determine which remedial alternative is selected; rather, they indicate how a selected alternative must be implemented.

1. Groundwater Pump and Treat with Discharge to Surface Water

6 NYCRR Part 200 - General Provisions (amended May 7, 1997) [NY Division of Air Resources].

6 NYCRR Part 201 - Permits and Registrations (to construct or operate an air contamination source) (amended October 2, 1996) [NY Division of Air Resources].

6 NYCRR Part 211 - General Prohibitions (amended July 12, 1983) [NY Division of Air Resources].

6 NYCRR Part 212 - General Process for Emission Sources: Under this regulation, when an application is made for a permit to operate a process emission source, the Commissioner will issue an environmental rating for each air contaminant from each emission point. The degree of cleaning required is based on the designed ratings (amended September 7, 1994) [NY Division of Air].

6 NYCRR Part 256 - Air Quality Classification System, and Part 257 - Air Quality Standards (standards for emission of SO_2, particulates, CO, photochemical oxidants, hydrocarbons (non-methane), NO_2, fluorides, beryllium, H_2S) (Part 256 - April 28, 1972; Part 257 February 16, 1977) [NY Division of Air Resources].

NYSDEC Air Guide - 1: Guidelines for the Control of Toxic Ambient Air Contaminants (NYSDEC, Division of Air Resources); Appendix B (Ambient Air Quality Impact Screening Analysis); Appendix C (Toxicity Classification and Guideline Development Methodology) [NY Division of Air Resources].

6 NYCRR Part 617 and 618 - State Environmental Quality Review and Implementation of State Environmental Quality Review Act (permit application procedures) (Part 617 amended November 8, 1995, Part 618 amended February 12, 1988) [NY Division of Regulatory Affairs].

6 NYCRR Part 621 - Uniform Procedures (applicability - permit application procedures) (amended June 26, 1996) [NY Division of Regulatory Affairs].

6 NYCRR Part 650 - Qualifications of Operators of Wastewater Treatment Plants (amended September 17, 1974) [NY Division of Water Resources].

6 NYCRR Part 372 - Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities (amended November 30, 1994) [NY Division of Hazardous Substances Regulation].

6 NYCRR Subpart 373-1 - Hazardous Waste Treatment, Storage and Disposal Facility Permitting Requirements (amended October 23, 1996) [NY Division of Hazardous Substances Regulation].

6 NYCRR Subpart 373-2 - Final Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities (amended October 23, 1996) [NY Division of Hazardous Substances Regulation].

6 NYCRR Subpart 373-3 - Interim Status Standards for Owners and Operators of Hazardous Waste Facilities (amended October 23, 1996) [NY Division of Hazardous Substances Regulation].

6 NYCRR Part 375 - Inactive Hazardous Waste Disposal Sites (April 20, 1992) [NY Division of Hazardous Substances Regulation].

6 NYCRR Part 702 - Derivation and Use of Standards and Guidance Values Allows NYSDEC to require evaluation of short-term and long-term effects of discharge (amended August 2, 1991) [NY Division of Water Resources].

6 NYCRR Part 750 - State Pollutant Discharge Elimination System - General (pursuant to ECL Art. 17, title 8) (amended April 25, 1985) [NY Division of Water Resources].

6 NYCRR Part 751 - Required Permits (explains that permit is required for any discharge (point source) and presents exceptions). Liberty Industrial Finishing Site would not meet any of these exceptions, and future activities at the site any require compliance with this section (amended April 25, 1985) [NY Division of Water Resources].

6 NYCRR part 752 - Applications; Data (amended April 25, 1985) [NY Division of Water Resources].

6 NYCRR Part 753 - Notice and Public Participation (re: application) (amended April 25, 1985) [NY Division of Water Resources].

6 NYCRR Part 754 - Provisions of SPDES Permits (including application of standards, limits and other requirements; effluent limits, schedules & compliance, etc.) (amended July 22, 1987) [NY Division of Water Resources].

6 NYCRR part 756 - Monitoring, Recording & Reporting (of discharges authorized by SPDES permit, recording of monitoring activities, reporting results) (amended April 25, 1985) [NY Division of Water Resources].

6 NYCRR Part 885 - Classes and Standards of Quality and Priority Assigned to Fresh Surface and Tidal Salt Waters - Nassau County Waters: (amended June 20, 1988) [NY Division of Water Resources].

40 CFR Part 136 - Guidelines Establishing Text Procedure for the Analysis of Pollutants - Appendix B: Describes required analytical methods (method detection limit [MDL]) for SPDES discharges, monitoring and sampling. Dischargers must submit supporting data that has been generated in accordance with the MDL procedure (amended June 5, 1997.

6 NYCRR Part 182 - Endangered and Threatened Species of Fish and Wildlife: Species of Special Concern (amended June 3, 1987) [NY Division of Fish and Wildlife].

6 NYCRR Part 608, Use and Protection of Waters (permit is required for various activities relating to impoundments, structures and dredge and fill. Section 608.7 conforms with Section 401(a)(i) of the Federal Clean Water Act (amended December 7, 1994) [NY Division of Fish and Wildlife].

40 CFR Part 136.4; 136.5: Allows for alternative analytical methods.

6 NYCRR Part 624 - Permit Hearing Procedures (applicable to permit applications for SPDES, Wetlands activity, air emission permits, waste transport, etc.) (amended January 9, 1994) [NY Division of Regulatory Affairs].

2. Groundwater Pump and Treat with Discharge to Groundwater

6 NYCRR Part 200 - General Provisions (amended May 7, 1997) [NY Division of Air Resources].

6 NYCRR Part 201 - Permits and Registrations (to construct or operate an air contamination source) (amended October 2, 1996) [NY Division of Air Resources].

6 NYCRR Part 211 - General Prohibitions (amended July 12, 1983) [NY Division of Air Resources].

6 NYCRR Part 212 - General Process Emission Sources: Under this regulation, when an application is made for a permit to operate a process emission source, the Commissioner will issue an environmental rating for each air contaminant from each emission point. The degree of cleaning required is based on the designed ratings (amended September 7, 1994) [NY Division of Air].

6 NYCRR Part 257 - Air Quality Standards (standards for emission of SO_2, particulates, CO, photochemical oxidants, hydrocarbons (non-methane), NO_2, Fluorides, Beryllium, H_2S) (February 16, 1977) [NY Division of Air Resources].

6 NYCRR Part 617 and 618 - State Environmental Quality Review and Implementation of State Environmental Quality Review (permit application procedures) (Part 617 amended November 8, 1997), Part 618 amended February 2, 1988) [NY Division of Regulatory Affairs).

6 NYCRR Part 621 - Uniform Procedures (applicability - permit application procedures) (amended September 17, 1974) [NY Division of Regulatory Affairs].

6 NYCRR Part 650 - Qualifications of Operators of Wastewater Treatment Plants [NY Division of Water Resources].

6 NYCRR Part 372 - Hazardous Waste Manifest System and Related Standards for Generators, Transporters, and Facilities (amended November 30, 1994) [NY Division of Hazardous Substances Regulation].

6 NYCRR Subpart 373-1 - Hazardous Waste Treatment, Storage, and Disposal Facility Permitting Requirements (amended October 23, 1996) [NY Division of Hazardous Substances Regulation].

6 NYCRR Subpart 373-2 - Final Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities (amended October 23, 1996) [NY Division of Hazardous Substances Regulation].

6 NYCRR Subpart 373-3 - Interim Status Standards for Owners and Operators of Hazardous Waste Facilities (amended October 23, 1996) [NY Division of Hazardous Substances Regulations].

6 NYCRR Part 375 - Inactive Hazardous Waste Disposal Sites (amended April 20, 1992) [NY Division of Hazardous Substances Regulation].

6 NYCRR Part 702 - Derivation and Use of Standards and Guidance Values (amended August 2, 1991) Allows NYSDEC to require evaluation of short-term and long-term effects of discharge [NY Division of Water Resources].

6 NYCRR Part 703.6 - Groundwater Effluent Standards and Limitations for Discharges to Class GA Waters (amended December 29, 1993) [NY Division of Water Resources].

6 NYCRR Part 750 - State Pollutant Discharge Elimination System - General (pursuant to ECL Art. 17, title 8) (amended April 25, 1985) [NY Division of Water Resources].

6 NYCRR Part 751 - Required Permits (explains that permit is required for any discharge (point source) and presents exceptions). Liberty Industrial Finishing Site would not meet any of the exceptions, and future activities at the site may require compliance with this section (amended April 25, 1985) [NY Division of Water Resources].

6 NYCRR Part 752 - Application; Data: (amended April 25, 1985) [NY Division of Water Resources].

6 NYCRR Part 753 - Notice of Public Participation: (re: application) (amended April 25, 1985) [NY Division of Water Resources].

6 NYCRR Part 754 - Provisions of SPDES Permits: (including application of standards, limits and other requirements; effluent limits, schedules & compliance, etc.) (amended July 22, 1987) [NY Division of Water Resources].

6 NYCRR Part 756 - Monitoring, Recording & Reporting (of discharges authorized by SPDES permit, recording of monitoring activities, reporting results) (amended April 25, 1985) [NY Division of Water Resources].

40 CFR Part 136 - Guidelines Establishing Test Procedures for the Analyses of Pollutants - Appendix B: Describes required analytical methods (method detection limit [MDL]) for SPDES discharges, monitoring and sampling. Dischargers must submit supporting data that has been generated in accordance with MDL procedure (amended June 5, 1997).

40 CFR Part 136.4: 136.5: Allows for alternative analytical methods (amended June 5, 1997).

40 CFR Part 144 - Underground Injection Control Program (amended June 29, 1995).

40 CFR Part 146 - State Underground Injection Control Program: Criteria and Standards (amended June 29, 1995).

40 CFR Part 147 - State Underground Injection Control Programs: Subpart HH specifies that New York's program is administered by USEPA (amended January 14, 1997).

40 CFR Part 148 - Hazardous Waste Injection Restrictions (amended May 12, 1997).

6 NYCRR Part 624 - Permit Hearing Procedures (applicable to permit applications for SPDES, Wetlands activity, air emissions permits, waste transport, etc.) (amended January 9, 1997) [NY Division of Regulatory Affairs].

3. Transportation Routes To/From/Around Liberty Industrial Finishing Site

6 NYCRR Part 621 - Uniform Procedures (applicability - permit application procedures) (amended June 26, 1996) [NY Division of Regulatory Affairs].

6 NYCRR Part 624 Permit Hearing Procedures (applicable to permit applications for SPDES, Wetlands activity, air emissions permits, waste transport, etc.) (amended January 9, 1994) [NY Division of Regulatory Affairs].

6 NYCRR Part 372 - Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities (amended November 30, 1994) [NY Division of Hazardous Substances Regulation].

6 NYCRR Part 375 - Inactive Hazardous Waste Disposal Sites (amended April 20, 1992) [NY Division of Hazardous Substances Regulation].

40 CFR Part 107 - Hazardous Materials Program Procedures; Part 171 - General Information Regulations, and Definitions; and Part 172 - Hazardous Materials Tables, Hazardous Materials Communications Requirements, and Emergency Response Information Requirements [US Department of Transportation].

4. Site Construction

Occupational Safety and Health Act (OSHA)

6 NYCRR Part 182 - Endangered and Threatened Species of Fish and Wildlife: Species of Special Concern (amended June 3, 1987) [NY Division of Fish and Wildlife].

6 NCYRR Part 608 - Use and Protection of Waters (permit is required for various activities relating to impoundments, structures and dredge and fill. Section 608.7 conforms with Section 401(a)(i) of the Federal Clean Water Act (amended December 7, 1994) [NY Division of Fish and Wildlife].

6 NYCRR Part 360 - Solid Waste Management Facilities (amended October 16, 1996) [NY Division of Solid Waste]

6 NYCRR Part 372 - Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities (amended November 30, 1994) [NY Division of Hazardous Substances Regulation].

6 NYCRR Subpart 373-1 - Hazardous Waste Treatment, Storage and Disposal Facility Permitting Requirements (amended October 23, 1996) [NY Division of Hazardous Substances Regulation].

6 NYCRR Part 375 - Inactive Hazardous Waste Disposal Sites (April 20, 1992) [NY Division of Hazardous Substances Regulation].

State Sanitary Code Part 5 - Drinking Water Supplies: Subpart 5-2 Water Well Construction (amended December 16, 1992) [NY Division of Water].

5. Soil Gas Collection/Air Stripping Emissions

6 NYCRR Part 200 - General Provisions (amended May 7, 1997) [NY Division of Air Resources].

6 NYCRR Part 200.1 - Definitions (amended May 7, 1997) [NY Division of Air Resources].

6 NYCRR Part 201 - Permits and Registrations (to construct or operate an air contamination source) (amended October 2, 1996) [NY Division of Air Resources].

6 NYCRR Part 211 - General Prohibitions (amended July 12, 1983) [NY Division of Air Resources].

6 NYCRR Part 212 - General Process Emission Sources Under this regulation, when an application is made for a permit to operate a process emission source, the Commissioner will issue an environmental rating for each air contaminant from each emission point. The degree of cleaning required is based on the designated ratings (amended September 7, 1994) [NY Division of Air].

6 NYCRR Part 257 - Air Quality Standards (standards for emission of SO_2, particulates, CO, photochemical oxidants, hydrocarbons (non-methane), NO_2, Fluorides, Beryllium, H_2S) (February 16, 1977) [NY Division of Air Resources].

6 NYCRR Part 621 - Uniform Procedures (applicability - permit application procedures) (amended June 26, 1996) [NY Division of Regulatory Affairs].

6. Wetlands

6 NYCRR Part 182 - Endangered and Threatened Species of Fish and Wildlife: Species of Special Concern (amended June 3, 1987) [NY Division of Fish and Wildlife].

Executive Order 11990 - Protection of Wetlands

Executive Order 11988 - Floodplain Management

NYSECL Article 24 New York Freshwater Wetlands Act

6 NYCRR Part 608 - Use and Protection of Waters (Permit is required for various activities relating to impoundments, structures and dredge and fill. Section 608.7 conforms with Section 401(a)(i) of the Federal Clean Water Act (amended December 7, 1994) [NY Division of Fish and Wildlife].

6 NYCRR Part 621 - Uniform Procedures (applicability - permit application procedures) (amended June 26, 1996) [NY Division of Regulatory Affairs].

6 NYCRR Part 624 - Permit Hearing Procedures (applicable to permit applications for SPDES, Wetlands activity, air emissions permits, waste transport, etc.) (amended January 9, 1994) [NY Division of Regulatory Affairs].

7. Air Quality

6 NYCRR Part 212 - General Process Sources: Under this regulation, when an application is made for a permit to operate a process emission source, the Commissioner will issue an environmental rating for each air contaminant from each emission point. The degree of cleaning required is based on the designated ratings. [This regulation is applicable during the permitting process.] (amended September 7, 1994) [NY Division of Air].

6 NYCRR Part 621 - Uniform Procedures (applicability - permit application procedures) (amended June 26, 1996) [NY Division of Regulatory Affairs].

6 NYCRR Part 624 - Permit Hearing Procedures (applicable to permit applications for SPDES, Wetlands activity, air emissions permits, waste permits, waste transport, etc.) (amended January 9, 1994) [NY Division of Regulatory Affairs].

B.4 TO-BE-CONSIDERED (TBC) CRITERIA FOR THE LIBERTY SITE

In addition to legally binding laws and regulations, federal and state environmental and public health programs issue non-promulgated, unenforceable advisories, criteria, policies, proposed standards, or guidance that are not legally binding. These criteria to-be-considered, or TBCs should be evaluated along with ARARs. TBCs can include health advisories, reference doses and potency factors, proposed rules, guidance materials, or policy documents. When evaluating TBCs, professional judgment is required based upon the latest available information. These TBCs fall into the following three types:

1. Health effects information, e.g., reference doses;
2. Technical information on how to perform or evaluate site conditions; and
3. Policy directives or guidance documents, e.g., U.S. EPA's Groundwater Protection Strategy.

A. Chemical-specific TBCs for the Liberty Site

1. Surface Water

Technical & Operations Guidance Series (TOGS)

a. 1.1.1 Ambient Water Quality Standards and Guidance Values (amended October 1993)

b. 1.3.2 Toxicity Testing in the SPDES Permit Program (this document describes procedures to be followed when the decision has been made to include toxicity testing in a SPDES permit; this could become applicable in the future with regard to the site) (amended December 1996)

c. 1.3.4 BPJ Methodologies (applies to the preparation of SPDES permits for direct discharges to surface water from non-POTW point sources). The document outlines procedures to determine effluent limits to satisfy technical requirements of the Clean Water Act and 1.3.4 A BPJ Methodologies/Amendments.

d. Criteria for the Development of Health Advisories for Sport Fish Consumption NYS Department of Health].

2. Sediment

Technical Guidance for Screening Contaminated Sediments: July 1994 [NYSDEC Division of Fish and Wildlife and Division of Marine Resources].

3. Air

Air Cleanup Criteria (prepared by: Division of Air Resources, May 31, 1990) [NY Division of Air Resources].

a. Ambient Air

NYSDEC Air Guide 1 - Guidelines for the Control of Toxic Ambient Air Contaminants: Applicable guidance document; this document presents a screening mechanism to assist the NYSDEC in determining whether and under what conditions a permit should be issued for emission sources. It reviews control requirements under 6 NYCRR Part 212 [NYSDEC Division of Air Resources; Appendix B: Ambient Air Quality Impact screening Analysis, and Appendix C: Toxicity Classification and Guideline Development Methodology [NY Division of Air Resources].

B. Location-specific TBCs for the Liberty Site

1. Flora/Fauna

Division Technical and Administrative Guidance Memorandum: Habitat Based Assessment, Guidance Document for Conducting Environmental Risk Assessments at Hazardous Waste Sites. (December 28, 1990) [NY Division of Fish and Wildlife].

Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites (October 1994) [NY Division of Fish and Wildlife].

2. Fishing Area

Criteria for the Development of Health Advisories for Sport Fish Consumption [NYS Department of Health].

3. Air Quality

Air Cleanup Criteria (prepared by: Division of Air Resources, May 31, 1990) [NY Division of Air Resources].

C. Action-Specific ARARs for the Liberty Site

1. Groundwater Pump and Treat with Discharge to Surface Water

Quality Assurance Manual for Special Ambient Air Studies (need to determine which sections are applicable, depending on the air sampling programs used) [NY Division of Air Resources].

Air Cleanup Criteria (prepared by: Division of Air Resources, May 31, 1990) [NY Division of Air Resources].

Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites (October 1994) [NY Division of Fish and Wildlife].

Division of Technical and Administrative Guidance Memorandum: Habitat Based Assessment, Guidance Document for Conducting Environmental Risk Assessments at Hazardous Waste Sites. (December 28, 1990) [Division of Fish and Wildlife].

Technical & Operations Guidance Series ("TOGS")

a. 1.3.2 Toxicity Testing in the SPDES Permit Program (this document describes procedures to be followed when the decision has been made to include toxicity testing in a SPDES permit; this could become applicable in the future with regard to this site).

b. 1.3.4 BPJ Methodologies (applies to the preparation of SPDES permits for direct discharges to surface water from non-POTW point sources). This document outlines procedures to determine effluent limits to satisfy technical requirements of the Clean Water Act and 1.3.4A BPJ Methodologies/Amendments.

2. Groundwater Pump and Treat with Discharge to Groundwater

NYSDEC Air Guide - 1: Guidelines for the Control of Toxic Ambient Air Contaminants (NYSDEC, Division of Air Resources); Appendix B, Ambient Air Quality Impact Screening Analysis: Appendix C (Toxicity Classification and Guideline Development Methodology) [NY Division of Air Resources].

Quality Assurance Manual For Special Ambient Air Studies (need to determine which sections are applicable depending on the air sampling programs used) [NY Division of Air Resources].

Air Cleanup Criteria: (prepared by: Division of Air Resources, May 31, 1990) [NY Division of Air Resources].

Technical & Operations Guidance Series ("TOGS"): 1.3.2 Toxicity Testing in SPDES Permit Program.

3. Soil Gas Collection/Air Stripping Emissions

NYSDEC Air Guide - 1, Guidelines for the Control of Toxic Ambient Air Contaminants (NYSDEC, Division of Air Resources); Appendix B (Ambient Air Quality Impact Screening Analysis); Appendix C (Toxicity Classification and Guideline Development Methodology) [NY Division of Air Resources].

4. Wetlands

Technical & Operations Guidance Series ("TOGS")

a. 1.3.2 Toxicity Testing in the SPDES Permit Program (this document describes procedures to be followed when the decision has been made to include toxicity testing in a SPDES permit; this could become applicable in the future with regard to this site).

b. 1.3.4 BPJ Methodologies (applies to the preparation of SPDES permits for direct discharges to surface water from non-POTW point sources). The document outlines procedures to determine effluent limits to satisfy technical requirements of the Clean Water Act and 1.3.4A BPJ Methodologies/Amendments.

5. Air Quality

Air Cleanup Criteria: This document concerns evaluation of air impacts from contaminated sites. It describes the requirements and procedures for addressing emissions and impacts associated with pre-remediation, remediation and post-remediation activities.

B.5 SUMMARY

The New York State Groundwater and Surface Water Standards are generally more stringent than the Federal regulations. They also have provisions for the principal organic contaminants and the unspecified organic contaminants which sets an MCL for any contaminants not otherwise specified, making the New York State Standards the most comprehensive, as well. Therefore, the New York State Groundwater and Surface Water Standards will generally be considered the ARARs for the Liberty Industrial Finishing Site. However, if a federal regulation lists more stringent limits for a particular compound, then that value will apply.

The primary ARARs to be adhered to are summarized in the tables that follow.

- The Federal Safe Drinking Water Act Maximum Concentration Limits (MCL's) are presented in Table B-2.

- RCRA Maximum Constituent Concentrations for Groundwater Protection are presented in Table B-3.

- New York State Department of Health Part 5 Regulations are summarized in Table B-4.

- New York State Water Quality Regulations for Class GA Groundwaters and Class C-T Fresh Water Surface Waters are presented in Table B-5.

TABLE B-1
FEDERAL, STATE, AND LOCAL ARARS AND TBCS

FEDERAL
Resource Conservation and Recovery Act (RCRA) Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Superfund Amendments and Reauthorization Act (SARA) Clean Water Act (CWA) Safe Drinking Water Act (SDWA) Occupational Safety and Health Act (OSHA) Hazardous Materials Transportation Act (HMTA) Underground Injection Control Program (40 CFR 144-148) Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) Guidelines Establishing Test Procedures for the Analysis of Pollutants (40 CFR 136 Appendix B) Toxic Substances Control Act (TSCA) Fish and Wildlife Coordination Act (16 USC 661) Endangered Species Act (ESA) (16 USC 1531) Coastal Zone Management Act Resource Conservation and Recovery Act (RCRA) - Solid Waste Disposal Act Rivers and Harbors Act of 1899 Wilderness Act National Wildlife Refuge System Act National Environmental Policy Act; Chapter 55 (NEPA) Clean Water Act - Water Pollution Prevention and Control Act (33 USC 1251) Quality Criteria for Water Ambient Air Quality Standards (40 CFR 50) Protection of Wetlands (Exec. Order 11990) Floodplains Management (Exec. Order 11988) Corrective Action for Solid Waste Management Units (40 CFR 264 Subpart S) Guidelines for Specification of Disposal Sites for Dredged or Fill Material (40 CFR 230) DOT Rules for Hazardous Materials Transport (49 CFR 107, 171.1-172.604)
STATE
6 NYCRR Part 182 - Endangered Threatened Species of Fish and Wildlife: Species of Special Concern 6 NYCRR Part 200 - General Provisions 6 NYCRR Part 201 - Permits and Registrations 6 NYCRR Part 211 - General Prohibitions [NY Division of Air Resources] 6 NYCRR Part 212 - General Process Emission Sources 6 NYCRR Part 256 & 257 - Air Quality Standards 6 NYCRR Part 287 - Air Quality Classifications - Nassau County

WESTON

TABLE B-1 (CONTINUED)
FEDERAL, STATE AND LOCAL ARARS AND TBCS

STATE (CONTINUED)
6 NYCRR Part 360 - Solid Waste Management Facilities
6 NYCRR Part 370 - Hazardous Waste Management Systems: General
6 NYCRR Part 371 - Identification and Listing of Hazardous Wastes
6 NYCRR Part 372 - Hazardous Waste Manifest System and Related Standards for Generators, Transporters, and Facilities
6 NYCRR Part 373-1 - Hazardous Waste Treatment, Storage, and Disposal Facility Permitting Requirements
6 NYCRR Subpart 373-2 - Final Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities (revised December 25, 1988) [NY Division of Hazardous Substances Regulation)
6 NYCRR Subpart 373-3 - Interim Status Standards for Owners and Operators of Hazardous Waste Facilities
6 NYCRR Part 375 - Inactive Hazardous Waste Disposal Sites
6 NYCRR Part 376 - Land Disposal Restrictions
6 NYCRR Part 602 - Applications for Long Island Wells
6 NYCRR Part 608 - Use and Protection of Waters
6 NYCRR Parts 617 and 618 - State Environmental Quality Review
6 NYCRR Part 621 - Uniform Procedures
6 NYCRR Part 624 - Permit Hearing Procedures
6 NYCRR Part 650 - Qualifications of Operators of Wastewater Treatment Plants
6 NYCRR Part 701 and 702- Surface Water Quality Standards
6 NYCRR Part 703 - Surface Water and Groundwater Quality Standards and Groundwater Effluent Standards
6 NYCRR Part 750 - State Pollutant Discharge Elimination System (SPDES) - General
6 NYCRR Part 751 - Required Permits
6 NYCRR Part 752 - Applications; Data
6 NYCRR Part 753 - Notice and Public Participation
6 NYCRR Part 754 - Provisions of SPDES Permits
6 NYCRR Part 756 - Monitoring, Recording and Reporting
6 NYCRR Part 885 - Classes and Standards of Quality and Purity Assigned to Fresh Surface and Tidal Salt Waters - Nassau County Waters
10 NYCRR Part 5 - Drinking Water Supplies
10 NYCRR Part 170 - Sources of Water Supply (Stat. Auth., Pub Health Law Sec. 1100)
Technicals' Operations Guidance Series (TOGS) a. 1.1.1 Ambient Water Quality Standards and Guidance Values b. 1.3.2 Toxicity Testing in the SPDES Permit Program c. 1.3.4 BPJ Methodologies

WESTON

TABLE B-1 (CONTINUED)
FEDERAL, STATE AND LOCAL ARARS AND TBCS

STATE (CONTINUED)
d. 1.3.4A BPJ Methodologies/Amendments
State Sanitary Code Part 5 - Drinking Water Supplies
Criteria for the Development of Health Advisories for Sport Fish Consumption
NYSECL Title 5, Article 15 - Protection of Waters
NYSECL Title 24 - Freshwater Wetlands Act
Technical Guidance for Screening Contaminated Sediments: July 1994, Guidance by Bureau of Environmental Protection [NYSDEC Division of Fish and Wildlife, and Division of Marine Resources]
Air Cleanup Criteria (prepared by: Division of Air Resources, January 8, 1990)
NYSDEC Air Guide 1 - Guidelines for the Control of Toxic Ambient Air Contaminants
Division Technical and Administrative Guidance Memorandum: Habitat Based Assessment, Guidance Document for Conducting Environmental Risk Assessments at Hazardous Waste Sites
Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites
Division Technical and Administrative Guidance Memorandum: Determination of Soil Cleanup Objectives and Cleanup Levels
Quality Assurance Manual for Special Ambient Air Studies
LOCAL
Nassau County Public Health Ordinance Toxic & Hazardous Materials, Storage, Handling, & Control (Article XI)

TABLE B-2
FEDERAL SAFE DRINKING WATER ACT
MAXIMUM CONCENTRATION LIMITS

PARAMETER	SDWA MCL (mg/L)	MCLG (mg/L)
Antimony	.006	0.006
Arsenic	0.05	
Barium	2	2
Beryllium	0.004	0.004
Cadmium	0.005	0.005
Chromium	0.1	0.1
Cyanide	0.2	
Lead	0.15*	0
Mercury	0.002	0.002
Nickel	0.1	0.1
Selenium	0.05	0.05
Thallium	0.002	0.0005
Fluoride	4	4.0
Nitrate (as N)	10	10
Nitrite (as N)	1.0	1.0
Benzene	0.005	0
Carbon Tetrachloride	0.005	0
p-Dichlorobenzene	0.075	0.075
1,2-Dichloroethane	0.005	0
1,1-Dichloroethylene	0.007	0.007
1,1,1-Trichloroethane	0.2	0.2
Trichloroethylene	0.005	0
Trihalomethanes (Total)	0.1	
Vinyl Chloride	0.002	0
Dichloromethane	0.005	0
1,2,4-Trichlorobenzene	0.07	0.07
1,1,2-Trichloroethane	0.005	0.003
cis-1,2-Dichloroethylene	0.07	0.07
1,2-Dichloropropane	0.005	0
Ethylbenzene	0.7	0.7
Monochlorobenzene	0.1	0.1
o-Dichlorobenzene	0.6	0.6
Styrene	0.1	0.1
Tetrachloroethylene	0.005	0
Toluene	1.0	1.0
trans-1,2-Dichloroethylene	0.1	0.1
Xylenes (total)	10	10
Dalapon	0.2	0.2
Dinoseb	0.007	0.007
Diquat	0.02	0.02
Endothall	0.1	0.1
Endrin	0.002	0.002
Glyphosphate	0.7	0.7

WESTON

TABLE B-2 (CONTINUED)
FEDERAL SAFE DRINKING WATER ACT
MAXIMUM CONCENTRATION LIMITS

PARAMETER	SDWA MCL (mg/L)	MCLG (mg/L)
Oxamyl (Vydate)	0.2	0.2
Picloram	0.5	0.5
Simazine	0.004	0.004
Benzo(a)pyrene	0.0002	0
Dis(2-ethylhexyl)adipate	0.4	0.4
Dis(2-ethylhexyl)phthalate	0.006	0
Hexachlorobenzene	0.001	0
Hexachloropentadiene	0.05	0.05
2,3,7,8-TCDD (Dioxin)	3E-8	0
Alachlor	0.002	0
Aldicarb	0.003	0.001
Aldicarb Sulfoxide	0.004	0.001
Aldicarb Sulfone	0.002	0.001
Atrazine	0.003	0.003
Carbofuran	0.04	0.04
Chlordane	0.002	0
Dibromochloropropane	0.0002	0
2,4-D	0.07	0.07
Ethylene dibromide	0.00005	0
Heptachlor	0.0004	0
Heptachlor epoxide	0.0002	0
Lindane	0.0002	0.0002
Methoxychlor	0.04	0.04
Polychlorinated biphenyls	0.0005	
Pentachlorophenol	0.001	0
Toxaphene	0.003	0
2,4,5-TP	0.05	0.05
Acrylamide		0
Epichlorohydrin		0

* action level

SOURCES: 40 CFR 141.11-16: 40 CFR 141.32, 50, 51, 52, 60, 61, 62, 80

WESTON

TABLE B-3
RCRA MAXIMUM CONSTITUENT CONCENTRATIONS
FOR GROUNDWATER PROTECTION

PARAMETER	CONCENTRATION (mg/L)
Arsenic	0.05
Barium	1
Cadmium	0.01
Chromium	0.05
Lead	0.05
Mercury	0.002
Selenium	0.01
Silver	0.05
Nitrate (as N)	10
Molybdenum	0.1
Combined radium-226 and radium-228	5 pCi/liter
Combined uranium-234 and uranium-238	30 pCi/liter
Gross alpha-particle activity (excluding Rn and U)	15 pCi/liter
Endrin	0.0002
Lindane	0.004
Methoxychlor	0.1
Toxaphene	0.005
Chlorophenoxy Herbicides:	
2,4-D	0.1
2,4,5-TP Silvex	0.01

SOURCE: 40 CFR 264.94.

WESTON

TABLE B-4
NEW YORK STATE DEPARTMENT OF HEALTH
PART 5 REGULATIONS (10 NYCRR TITLE 5)

PARAMETER	MCL (mg/L)
INORGANIC CHEMICALS	
Arsenic (As)	0.05
Barium (Ba)	2
Cadmium (Cd)	0.005
Chloride (Cl)	250
Chromium (Cr)	0.10
Copper (Cu)	1.3
Fluoride (F)	2.2
Iron (Fe)	0.015
Lead (Pb)	0.05
Manganese (Mn)	0.3
Mercury (Hg)	0.002
Nitrate (as N)	10
Selenium (Se)	0.01
Silver (Ag)	0.05
Sulfate (SO_4)	250
Zinc (Zn)	5
ORGANIC CHEMICALS	
Endrin	0.0002
Lindane	0.0002
Methoxychlor	0.04
Toxaphene	0.003
2,4-Dichlorophenoxyacetic Acid	0.05
2,4-5-TP Silvex	0.01
Total Trihalomethanes	0.10
Principal Organic Contaminant (POC)	0.005
Unspecified Organic Contaminant (UOC)	0.05
Total POC plus UOC	0.10
PHYSICAL CHARACTERISTICS	
Color	15 units
Corrosivity	Non-corrosive
Odor	3 units
Turbidity	5 units

WESTON

TABLE B-5
NYSDEC WATER QUALITY REGULATIONS

PARAMETERS	SURFACE WATER CONC. (mg/L)	GROUNDWATER CONC. (mg/L)	BASIS
Alachlor		0.35	F
Aldicarb & Methomyl		0.00035	F
Aldrin		ND	F
Aldrin & Dieldrin	0.000001		K
Alkyldimethyl benzyl ammonium chloride	0.001		N
Aluminum (ionic)	0.1	0	N
Ametryn		0.05	J
Aminocresols	0.005	0.001	R/F
Ammonia & Ammonium (as N)	*	2	N/H
Arsenic	0.19	0.025	N/F
Atrazine		0.0075	F
Azinphosmethyl	0.000005	0.0044	N/F
Barium		1	F
Benefin		0.035	F
Benzene		0.0007	A
Benzidine	0.0001		N
Benzo(a)pyrene		ND	F
Beryllium	**		N
Bis(2 chloro-ethyl)ether		0.001	F
Bis(2-ethylhexyl)phthalate	0.0006	0.05	N/J
Boron	10	1	N/H
Bromacil		0.0044	F
Butachlor		0.0035	F
Butylate		0.05	J
Cadmium	***	0.01	N/F
Captan		0.018	F
Carbaryl		0.029	F

(CONTINUED)

* Varying pH and temperature will affect value. Table of Standard Values is located in Part 703.5.
** 11 ug/L when hardness ≤ 75 ppm
100 ug/L when hardness > 75 ppm
*** exp (0.7852[In(ppm hardness)] - 3.490)

<u>BASIS</u>
- A Oncogenic (702.4) Health (Water Source)
- B Nononcogenic, chronic (702.5) Health (Water Source)
- F Former Groundwater Regulations (6 NYCRR 703.5(a)(3)) Health (Water Source)
- G Specific MCL (702.3)(a)) Health (Water Source)
- H Former use of or reference to 10 NYCRR Part 170 Health (Water Source)
- J Former Groundwater reference to 10 NYCRR Subpart 5-1 General Standards Health (Water Source)
- K Bioaccumulation (702.8) Health (Bioaccumulation)
- N Propagation (702.10) Health (Aquatic)
- Q Survival (702.11) Aquatic
- R Tainting (702.12) Aquatic
- S Bioaccumulation (702.13) Wildlife Protection - Aquatic
- T Chemical Correlation (702.14) Aquatic

TABLE B-5 (CONTINUED)
NYSDEC WATER QUALITY REGULATIONS

PARAMETERS	SURFACE WATER CONC. (mg/L)	GROUNDWATER CONC. (mg/L)	BASIS
Carbofuran	0.001		N
Carbon Tetrachloride		0.005	F
Carboxin		0.05	J
Chloramben		0.05	J
Chlordane		0.0001	F
Chloride		250	H
Chlorine (Total Residual)	0.005		N
Chlorobenzene	0.005		N
Chloroform		0.007	A
Chromium	**	0.05	G
Chromium VI	0.011	0.05	N/F
Cobalt	0.005		N
Copper	***	0.2	N/H
Cyanide	0.0052	0.1	N/H
Dalapon		0.05	J
DDT, DDD, & DDE	0.000001	ND	S/F
Demeton	0.0001		N
Diazinon	0.00008	0.0007	N/F
Di-N-butyl-phthalate		0.05	J
Dicamba		0.00044	F
Dichlorobenzenes	0.005	0.0047	N, T/F
1,2-Dichorobenzene and 1,4-dichlorobenzene		0.0047	F
2,4-Dichlorophenol	0.001	0.001	R/F
2,4-Dichlorophenoxyacetic Acid		0.0044	F
Dieldrin *(see Aldrin & Dieldrin)	*	ND	F
Dimethyl tetrachloroterephthalate		0.05	J
Diphenamid		0.05	J
Diphenylhydrazines		ND	F
Endosulfan	0.000009		N
Endrin	0.000002	ND	K/F
Ethylenethiourea		ND	F

(CONTINUED)

** exp (0.819[In(ppm hardness)] + 1.561)
*** exp (0.8545[In(ppm hardness)] - 1.465)

<u>BASIS</u>
- A Oncogenic (702.4) Health (Water Source)
- B Nononcogenic, chronic (702.5) Health (Water Source)
- F Former Groundwater Regulations (6 NYCRR 703.5(a)(3)) Health (Water Source)
- G Specific MCL (702.3)(a)) Health (Water Source)
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- J Former Groundwater reference to 10 NYCRR Subpart 5-1 General Standards Health (Water Source)
- K Bioaccumulation (702.8) Health (Bioaccumulation)
- N Propagation (702.10) Health (Aquatic)
- Q Survival (702.11) Aquatic
- R Tainting (702.12) Aquatic
- S Bioaccumulation (702.13) Wildlife Protection - Aquatic
- T Chemical Correlation (702.14) Aquatic

WESTON

TABLE B-5 (CONTINUED)
NYSDEC WATER QUALITY REGULATIONS

PARAMETERS	SURFACE WATER CONC. (mg/L)	GROUNDWATER CONC. (mg/L)	BASIS
Ferbam		0.0042	F
Fluometuron	*	0.05	J
Fluoride		1.5	N/F
Foaming Agents		0.5	F
Folpet		0.05	J
Gross Alpha Radiation		15 pc/L	G
Gross Beta Radiation		1000 pc/L	H
Heptachlor & Heptachlor Epoxide	0.000001	ND	S/F
Herbicides		0.1	H
Hexachlorobenzene		0.00035	F
Hexachlorobutadiene	0.001		N
Hexachlorocyclohexanes	0.00001	ND	N/F
Hexachlorocyclopentadiene	0.00045		Q
Hexazinone		0.05	J
Hydrazine	**		N
Hydrogen Sulfide (undissociated)	0.002		N
Hydroquinone	0.0022		N
Iron	0.3	0.3	N/F
Iron & Manganese		0.5	F
Isodecyl diphenyl phosphate	0.0017		N
Isothiazolenes, Total	0.001		N
Kepone		ND	F
Lead	***	0.25	N/F
Linear Alkyl benzene sulfonates	0.04		N
Malathion	0.0001	0.007	N/F
Mancozeb		0.0018	F
Maneb		0.0018	F
Manganese		0.3	F

(CONTINUED)

* (0.02) exp (0.907[In(ppm hardness)] + 7.394)
** 5 ug/L when hardness < 50 ppm. 10 ug/L when hardness ≥ 50 ppm.
*** exp (1.266[In(ppm hardness)] - 4.661)

BASIS
- A Oncogenic (702.4) Health (Water Source)
- B Nononcogenic, chronic (702.5) Health (Water Source)
- F Former Groundwater Regulations (6 NYCRR 703.5(a)(3)) Health (Water Source)
- G Specific MCL (702.3)(a)) Health (Water Source)
- H Former use of or reference to 10 NYCRR Part 170 Health (Water Source)
- J Former Groundwater reference to 10 NYCRR Subpart 5-1 General Standards Health (Water Source)
- K Bioaccumulation (702.8) Health (Bioaccumulation)
- N Propagation (702.10) Health (Aquatic)
- Q Survival (702.11) Aquatic
- R Tainting (702.12) Aquatic
- S Bioaccumulation (702.13) Wildlife Protection - Aquatic
- T Chemical Correlation (702.14) Aquatic

WESTON

TABLE B-5 (CONTINUED)
NYSDEC WATER QUALITY REGULATIONS

PARAMETERS	SURFACE WATER CONC. (mg/L)	GROUNDWATER CONC. (mg/L)	BASIS
Mercury		0.002	F
Methoxychlor	0.00003	0.035	N/F
2-Methyl-4-Chloro-phenoxyacetic acid		0.00044	F
Methylene bisthiocyanate	0.0001		N
Methylmethacrylate		0.05	J
Metribuzin		0.05	J
Mirex	0.000001		N
Nabam		0.0018	F
Nickel	*		N
Nitralin		0.035	F
Nitrate & Nitrite (as N)		10	H
Nitrotriacetic acid	5	0.003	N/A
Nitrite	.02		N
Oxamyl		0.05	J
Oxygen Consumed		2	H
Parquat		0.003	F
Parathion & Methyl Parathion	0.000008	0.0015	N, T/F
Pentachloronitrobenzene		ND	F
Pentachlorophenol	0.0004	0.001	N/F
Phenol	0.005	0.001	R/F
Phenolic Compounds (total Phenols)		0.001	F
Phenols, total Chlorinated	0.001	0.001	R/F
Phenols, total Unchlorinated	0.005		R
Phorate & Disulfoton		ND	F
Picloram		0.05	J
Polychlorinated biphenyls	0.000001	0.0001	S/F
Principal Organic Contaminants		0.005	J
Prometon		0.05	J
Propachlor		0.035	F
Propanil		0.007	F

(CONTINUED)

* exp (0.76[ln(ppm hardness)] + 1.06)

BASIS
- A Oncogenic (702.4) Health (Water Source)
- B Nononcogenic, chronic (702.5) Health (Water Source)
- F Former Groundwater Regulations (6 NYCRR 703.5(a)(3)) Health (Water Source)
- G Specific MCL (702.3)(a)) Health (Water Source)
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- N Propagation (702.10) Health (Aquatic)
- Q Survival (702.11) Aquatic
- R Tainting (702.12) Aquatic
- S Bioaccumulation (702.13) Wildlife Protection - Aquatic
- T Chemical Correlation (702.14) Aquatic

TABLE B-5 (CONTINUED)
NYSDEC WATER QUALITY REGULATIONS

PARAMETERS	SURFACE WATER CONC. (mg/L)	GROUNDWATER CONC. (mg/L)	BASIS
Propazine		0.016	F
Propham		0.05	J
Quaternary ammonium compounds	0.01		N
Radium 226		3 pc/L	H
Radium 226 & Radium 228		5 pc/L	G
Selenium	0.001	0.01	N/G
Silver	0.0001	0.05	N/F
Simazine		0.05	J
Sodium		20	H
Styrene		0.005	J
Sulfate		250	F
Sulfite	.2		N
Tebuthiuron		0.05	J
Terbacil		0.05	J
2,3,7,8-Tetrachlorodibenzo-p-dioxin	0.000000001	0.000000035	K/F
Tetrachloroephthalic acid		0.05	J
Thallium	0.008		N
Thiram		0.0018	F
Toxaphene	0.000005	ND	N/F
Trichlorobenzenes	0.005		N/T
2,4,5-Trichlorophenoxyacetic acid		0.35	F
2,4,5 Trichlorophenoxypropionic acid		0.00026	F
Trifluralin		0.035	F
Trihalomethanes (total)		0.1	J
Triphenyl-phosphate	0.004		N
Unspecific Organic Contaminant		0.05	J
Uranyl ion		5	H

(CONTINUED)

BASIS

- A Oncogenic (702.4) Health (Water Source)
- B Nononcogenic, chronic (702.5) Health (Water Source)
- F Former Groundwater Regulations (6 NYCRR 703.5(a)(3)) Health (Water Source)
- G Specific MCL (702.3)(a)) Health (Water Source)
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- N Propagation (702.10) Health (Aquatic)
- Q Survival (702.11) Aquatic
- R Tainting (702.12) Aquatic
- S Bioaccumulation (702.13) Wildlife Protection - Aquatic
- T Chemical Correlation (702.14) Aquatic

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TABLE B-5 (CONTINUED)
NYSDEC WATER QUALITY REGULATIONS

PARAMETERS	SURFACE WATER CONC. (mg/L)	GROUNDWATER CONC. (mg/L)	BASIS
Vanadium	0.14		N
Vinyl Chloride		0.002	G
Zinc	*	0.3	N/H
Zineb		0.0018	F
Ziram		0.0042	F

* exp (0.85[In(ppm hardness)] + .50)

BASIS
- A Oncogenic (702.4) Health (Water Source)
- B Nononcogenic, chronic (702.5) Health (Water Source)
- F Former Groundwater Regulations (6 NYCRR 703.5(a)(3)) Health (Water Source)
- G Specific MCL (702.3)(a)) Health (Water Source)
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- J Former Groundwater reference to 10 NYCRR Subpart 5-1 General Standards Health (Water Source)
- K Bioaccumulation (702.8) Health (Bioaccumulation)
- N Propagation (702.10) Health (Aquatic)
- Q Survival (702.11) Aquatic
- R Tainting (702.12) Aquatic
- S Bioaccumulation (702.13) Wildlife Protection - Aquatic
- T Chemical Correlation (702.14) Aquatic

**Principal Organic Contaminant: (Excepted from 10 NYCRR Subpart 5-1)

Principal organic contaminant (POC) means any organic chemical compound belonging to the following classes, except for trichloromethane (chloroform), dibromochloromethane, bromodichloromethane, tribromomethane (bromoform) and any other organic contaminant with a specific MCL listed in 10 NYCRR Section 5.1-52, Table 3:

1. Halogenated alkane: Compound containing carbon (C), hydrogen (H) and halogen (X) where X - fluorine (F), chlorine (Cl), bromine (Br) and/or iodine (I), having the general formula $C\_H_yX_2$, where y + z = 2n + 2; n, y and z are integer variables; n and z are equal to or greater than one and y is equal to or greater than zero.

2. Halogenated ether: Compound containing carbon (C), hydrogen (H), oxygen (O) and halogen (X) (where X = F, Cl, Br and/or I) having the general formula $C\_H_yX_2O$, where y + z = 2n + 2; the oxygen is bounded to two carbons; n, y and z are integer variables; n is equal to or greater than two, y is equal to or greater than zero and z is equal to or greater than one.

3. Halobenzenes and substituted halobenzenes: Derivatives of benzene which have at least one halogen atom attached to the ring and which may or may not have straight or branches chain hydrocarbons, nitrogen or oxygen substituents.

4. Benzene and alkyl- or nitrogen-substituted benzenes: Benzene or a derivative of benzene which has either an alkyl- and/or a nitrogen-substituent.

5. Substituted, unsaturated hydrocarbons: A straight or branched chain unsaturated hydrocarbon compound containing one of the following: halogen, aldehyde, nitrile, amide.

6. Halogenated non-aromatic cyclic hydrocarbons: A non-aromatic cyclic compound containing a halogen.

WESTON

APPENDIX C

DESIGN BASIS FOR GROUNDWATER TREATMENT SYSTEM

GENERAL

This groundwater pump and treat alternative for the Liberty Industrial Finishing Site addresses the scenario in which contaminated groundwater is intercepted at the southern site boundary for treatment and discharge using a pump and treat approach. In addition, this approach is limited to aboveground treatment of groundwater; in-situ treatment alternatives are screened and evaluated separately. The portion of the contaminant plume(s) that is already off-site will be addressed under separate actions (by others).

This process has been developed at the conceptual level for purposes of cost analysis and cost estimating (rather than the feasibility level).

GROUNDWATER CAPTURE

WESTON conducted supplemental groundwater modeling and calculations to estimate the configuration and flow rates required to capture the on-site plume component at the southern site boundary (Appendix D). These evaluations indicate that one (or two) withdrawal wells would be used to capture groundwater at the fence line using a total flow rate of approximately 200 gallons per minute (gpm).

INFLUENT GROUNDWATER CHARACTERISTICS

Chemical characteristics of the extracted groundwater flowing to the treatment system were estimated from groundwater data presented in the FFS. The average concentration for groundwater parameters was calculated for those existing wells that would lie in the presumed capture zone for the remediation well. These included MW-1, MW-2, MW-3, MW-6, MW-6B, and MW-18. In the absence of more specific modeling data, the final concentration was assumed to be the arithmetic average of values from the wells.

PROCESS DESCRIPTION

The proposed groundwater treatment process is illustrated by the process flow diagram shown in Figure C-1. The first treatment step is for the removal of hexavalent chromium. This form of chromium exists as an anion that will be removed very effectively by ion exchange. Acid is fed to maintain a pH of approximately 5 to enhance this process as well as to solubilize iron and aluminum so they will not clog the resin as suspended solids. Sulfuric acid is injected by a chemical metering pump, and a static mixer disperses the acid uniformly into the flow of groundwater. A pH monitor following the static mixer allows the metering pump to be manually adjusted to give the desired pH level. The exact pH is not critical; a range of 4 to 6 will suffice. The ion exchange resin will be purchased in the chloride form. Initially, all anions in the water will be exchanged for chloride, but in a short period of time only the chromic ion will be removed and will occupy all the exchange sites on the resin. This is a result of the resin having a much stronger affinity for chromate than the other anions found in the groundwater. The projected time required to exhaust the resin is in excess of 1 year, based on a capacity for chromate of 3.5 lbs/ft^3 (usable capacity will be as high as 7 lbs/ft^3). The resin will then be removed, disposed of and replaced with fresh resin. The ion exchange unit is sized to contain 100 ft^3 of resin.

From the ion exchanger the water flows to an equalization tank, T-1, having a capacity of 12,000 gallons. This tank allows a more uniform quality of water to be fed to subsequent treatment units and capacity to hold return flows from the treatment system. Water is pumped from T-1 to a lamella clarifier via separate flash mix and flocculation tanks. Caustic is fed to the flash mix unit along with ferric chloride to precipitate and coagulate heavy metals at an alkaline pH range. Polymer is fed to the flocculator to form larger particles that will settle well in the clarifier. A pH meter controller at the flocculator will automatically adjust the rate of caustic feed to give the desired pH level.

Overflow from the clarifier will collect in the neutralization tank, T-2, having a volume of 2,000 gallons. Sulfuric acid will be fed to this tank at a rate determined by a pH meter/controller to bring the water to neutral pH. T-2 will also serve as a reservoir for pump P-2 that feeds the greensand filters and air stripper.

Two greensand filter units, each 6 ft in diameter, will operate in parallel. These units serve a dual function, removing suspended solids carryover from the clarifier and removing residual iron and manganese. Potassium permanganate is fed to the influent flow to the filters for the purpose of oxidizing dissolved iron and manganese in the groundwater. Upon oxidation the metals precipitate from solution, such that both are removed by the anthracite filter media. Supporting the anthracite is a layer of manganese-based greensand, a natural ion exchange medium. It will remove excess permanganate fed to the filter, or if insufficient permanganate is fed, it will oxidize and remove dissolved iron and manganese.

After filtration the water enters the top of the air stripper and flows down through the packing. Air is drawn up through the packing by a blower, with VOCs being removed from the water and carried out by the air. The blower compresses the air, raising the temperature approximately 25° F, thus reducing the relative humidity to less than 50% such that the VOCs can be removed efficiently by gas phase activated carbon in unit GAC-1. The bottom of the air stripper serves as a sump for pump P-3 that transfers the water through liquid phase carbon in unit GAC-2 to remove any residual VOCs and any pesticides found in the groundwater.

Effluent from GAC-2 collects in effluent tank T-3, which has a capacity of 12,000 gallons. Depending on site conditions and the ultimate point of discharge, a gravity overflow from this tank may be feasible. Otherwise, Pump P-4 will discharge the effluent through a force main. Pump P-4 and Tank T-3 will also supply water to backwash the filters. The backwashing procedure will require shutting off the well pumps and emptying Tank T-1, at which point Pump

P-1 will be turned off and forward flow will stop. Pump P-4 will then supply water at 340 gpm for 15 min to each filter to remove accumulated solids. After exiting the filter, the water containing solids removed from the filter will be returned to T-1. After completing the backwashing of both filters, P-1 will be activated and the well pumps restarted when the operating level in T-1 is reached.

Sludge will accumulate at the bottom of the clarifier. A timer will operate pump P-7 periodically to transfer sludge to holding tank T-4. At 3,500 gallons, this tank has sufficient capacity to store sludge over the weekend without the dewatering press operating. It has several taps to decant excess water from the sludge. T-5 is a 1,200-gallon sludge conditioning tank. At the maximum expected rate of sludge production, this tank will be filled five times per week. Lime will be added at 20 lbs per batch (or an equivalent amount of sludge conditioning polymer) to aid the dewatering process. A 6-ft^3 filter press will dewater the sludge, with 10 cycles of the press per week being required to handle the estimated sludge load. Filtrate from the press and supernatant from the holding tank will drain to a sump for return to T-1.

PROCESS CONTROL

The discharge line from each well will be equipped with a flow meter and control valve. This will allow the operator to adjust the withdrawal rate to a selected value. This rate will be determined through an analysis of monitoring well water levels to achieve capture of the contaminant plume. The next point of control is the rate of acid feed just before the static mixer and ion exchange column. A pH instrument will monitor pH to permit the operator to manually adjust the acid feed pump to achieve the desired pH range.

Tank T-1 will be equipped with a level sensor and controller. It will modulate a control valve on the discharge of Pump P-1 such that the level in T-1 remains fixed at the selected set point. The rate of caustic feed to the flash mix tank will be controlled by a pH control loop. The rate of ferric chloride feed will be manually selected by the operator based on system performance. The rate of polymer feed will also be adjusted manually by the operator based on performance. Initially, a series of jar tests will be conducted to establish the optimum pH and chemical feed rates for best performance of the clarifier.

The rate of acid feed to Tank T-2 will be controlled by a pH control loop. T-2 will also be equipped with a level sensor and controller to maintain a constant tank level. The controller will modulate a control valve on the discharge from Pump P-2. The feed rate for potassium permanganate will be set by the operator. A bench test will establish the approximate dosage. A slight excess is used to keep the greensand regenerated. A pink color in the filter effluent indicates an overdose of permanganate.

The filters will require backwashing at least once a day when pressure loss across the bed reaches 10 psi. T-1 must be nearly empty and T-3 full before backwashing is initiated. A flow controller on the backwash line will maintain the required 340 gpm. The sump at the base of the air stripper is also equipped with a level sensor and controller to maintain a fixed water level. The controller modulates a valve on the discharge of Pump P-3. T-3 is also equipped with a level sensor and controller. It will start and stop Pump P-4 between two set points when operating in the discharge mode.

Pump P-7 will be operated by a timer to transfer sludge from the clarifier to T-4. The operator will adjust the timer to keep the sludge level within the proper range. Pump P-5 will be operated manually to transfer sludge to T-5. P-5 is also connected to the filter press control panel. It operates when a press cycle is started and is turned off when the cycle is complete based on reaching maximum pressure. The press is operated manually. First the plates are closed by a hydraulic ram, and then the feed pump is started. After approximately 2 hours, the feed cycle will be completed, and the operator can retract the closing ram. The plates are then manually retracted one at a time, and the sludge drops into the sludge box. Pump P-6 is operated by level switches in the sump to return decant and filtrate to T-1.

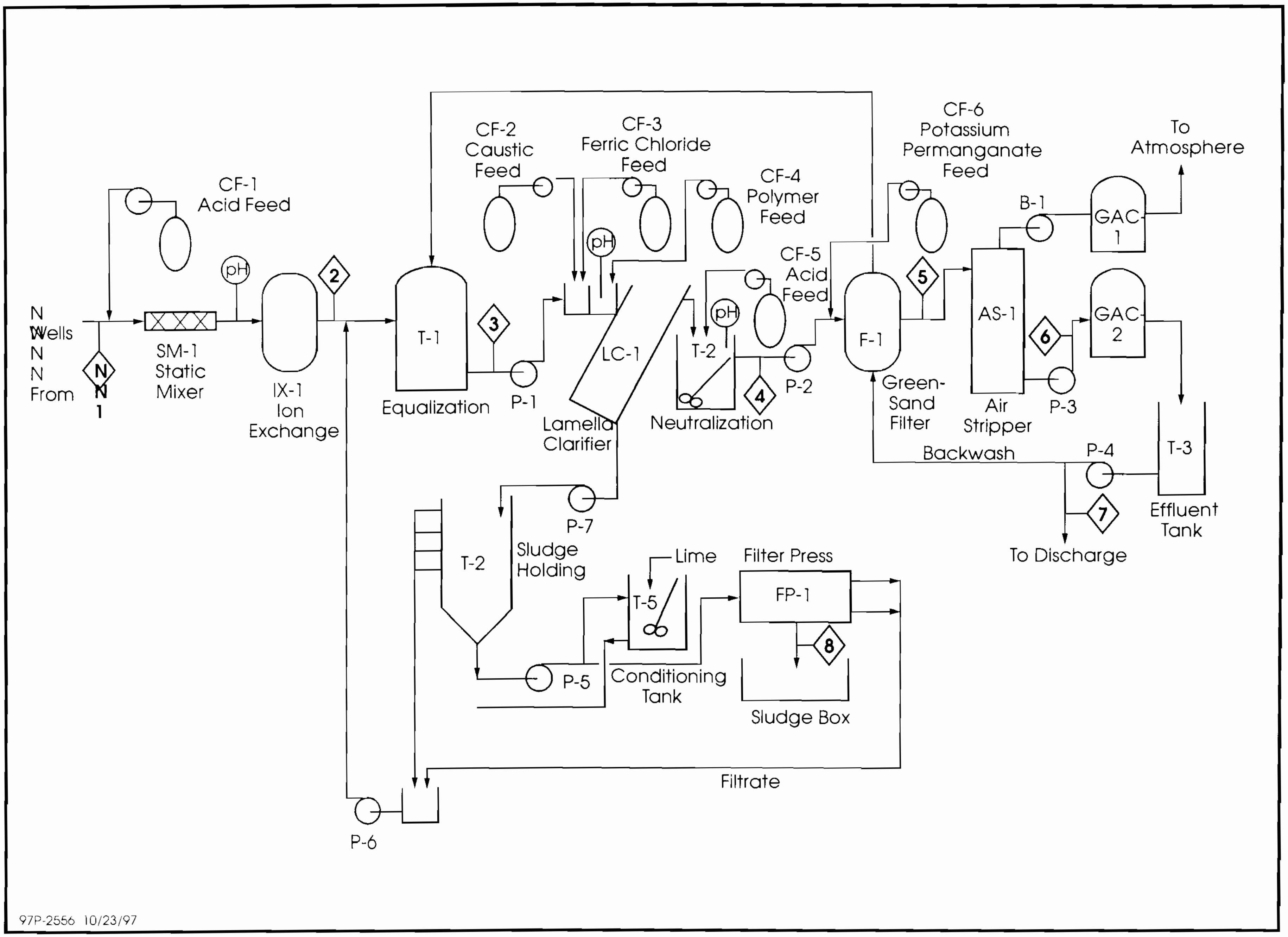


FIGURE 1 PROCESS FLOW DIAGRAM FOR GROUNDWATER TREATMENT SYSTEM
LIBERTY INUSTRIAL FINISING SITE
FARMINGDALE, NEW YORK

APPENDIX D

CAPTURE ZONE ANALYSIS FOR HYDRAULIC CONTAINMENT OF CONTAMINATED GROUNDWATER

WESTON

APPENDIX D

CAPTURE ZONE ANALYSIS FOR HYDRAULIC CONTAINMENT OF CONTAMINATED GROUNDWATER

An analytical steady-state groundwater flow model (QUICKFLOW) was used to evaluate the location and pumping rates required to provide hydraulic containment of contaminated groundwater in the Upper Glacial aquifer. The model selected was QUICKFLOW (Geraghty & Miller, 1991), an analytical model that simulates two-dimensional steady-state and transient groundwater flow in a horizontal plane using analytical functions developed by Strack (1989). The transient module uses equations developed by Theis (1935) and by Hantush and Jacob (1955) for confined and leaky aquifers, respectively. Each module uses the principle of superposition to evaluate the effects from multiple analytical functions (wells, etc.) in a uniform regional flow field. In other words, the total effect resulting from several analytic functions is equal to the sum of the individual effect caused by each analytic function acting separately. The steady-state module simulates the effects of the following analytic elements in two-dimensional flow: uniform recharge, circulate recharge/discharge areas, and line sources and sinks. The model depicts the flow field using streamlines, particle traces, and contours of hydraulic head. Both confined and unconfined aquifers are simulated with the steady-state module.

The recovery wells were located such that the respective capture zones would encompass the portions of the aquifer delineated as containing the highest concentrations of inorganics and organics during the remedial investigation (RI). These locations primarily include areas directly downgradient of the site and at the downgradient detailed plume locations. The modeling was conducted for the Upper Glacial unit, and the input data were taken from the RI Report. The following parameters were entered into the model:

Hydraulic conductivity:	215 ft/day
Effective porosity:	0.30
Hydraulic gradient:	0.0022
Groundwater flow direction:	South 10 degrees west
Bottom elevation:	-35 feet MSL
Top elevation:	70 feet MSL

The model assumptions for this effort include the following:

- Groundwater flow is horizontal, and the horizontal extent of the aquifer is infinite.
- The aquifer is homogeneous and isotropic.
- The base of the aquifer is horizontal and fixed at a given elevation.

- All well pumping rates are constant through time, fully efficient, and fully penetrate the aquifer.

Model simulations were conducted under three different conditions: no pumping, pumping one well at 200 gpm, and pumping two wells at 100 gpm each. The results of these model runs are shown in Figures D-1 through D-3. Figure D-1 shows that the non-pumping model output matches the measured groundwater contour map shown in the report. Figures D-2 and D-3 show that both scenarios (one well at 200 gpm and 2 wells at 100 gpm) provide adequate capture to contain the plumes.

MANAGERS DESIGNERS/CONSULTANTS

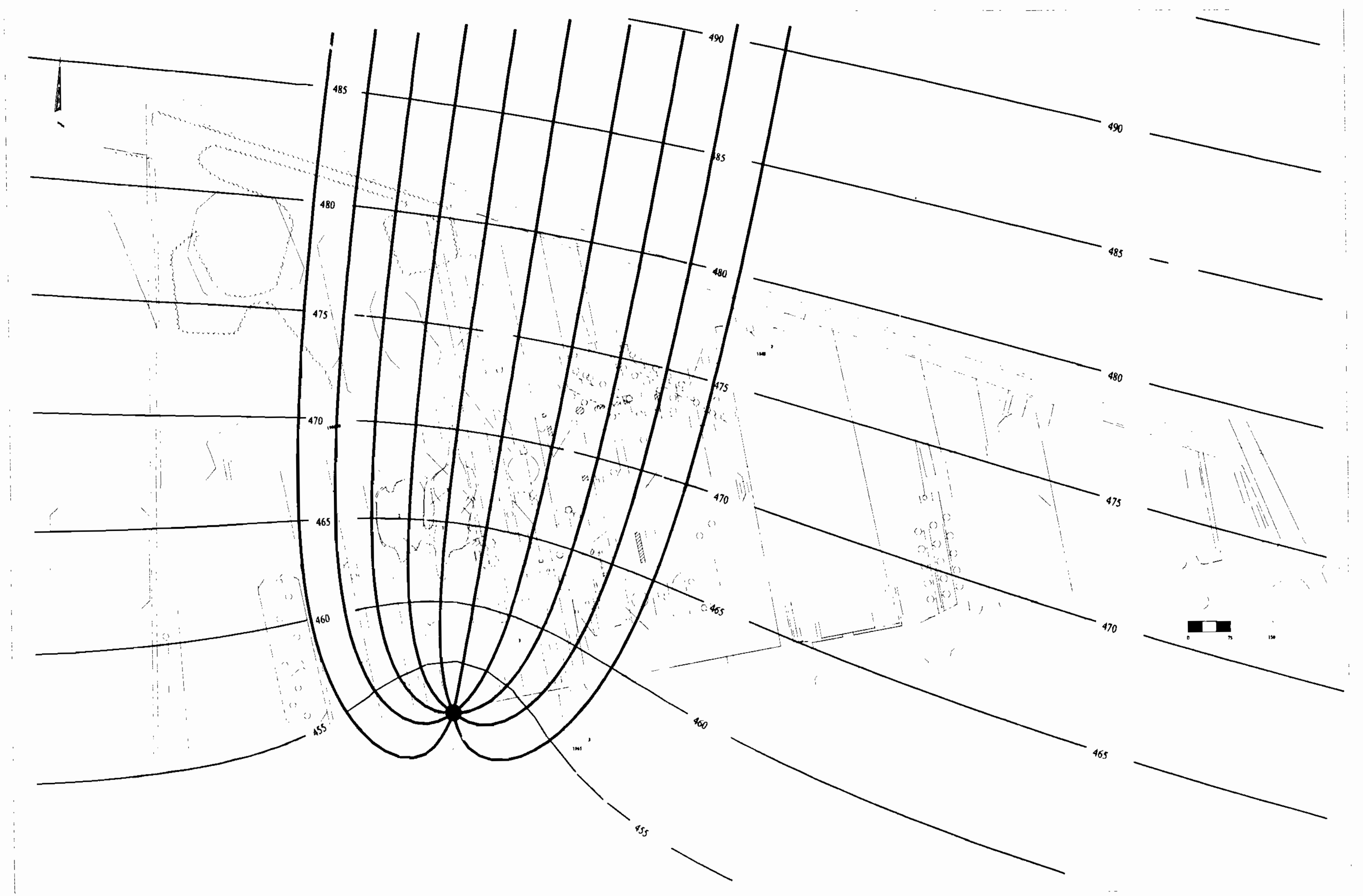
PROJECT NAME:
LIBERTY INDUSTRIAL FINISHING SITE
FOCUSED GROUNDWATER
FEASIBILITY STUDY
FARMINGDALE NEW YORK

CLIENT NAME:
UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY

GROUNDWATER ELEVATION
CONTOUR MAP
NON-PUMPING CONDITIONS

DATE: NOVEMBER 1997

FIGURE #: D-1



MANAGERS DESIGNERS/CONSULTANTS

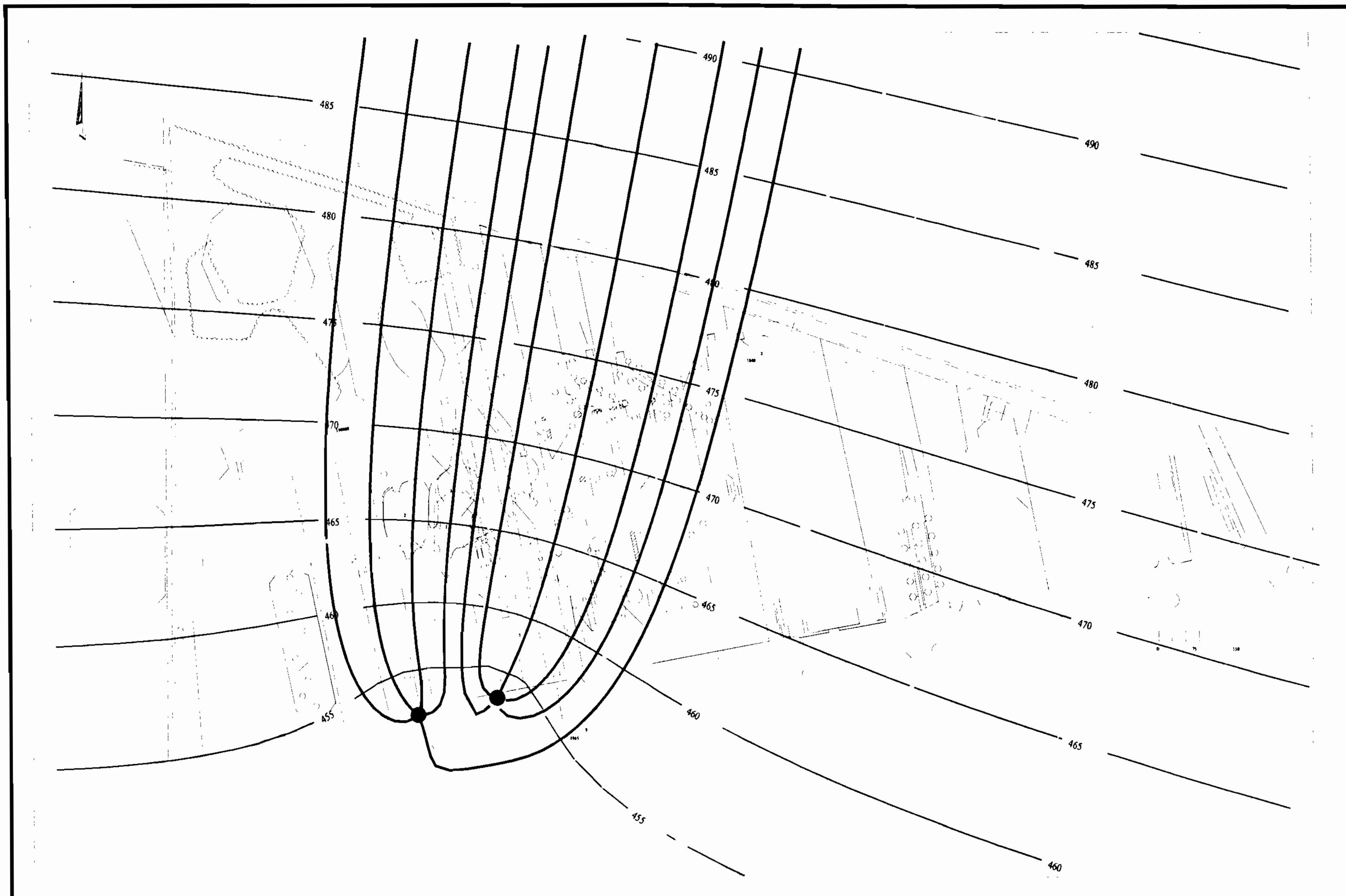
PROJECT NAME:
LIBERTY INDUSTRIAL FINISHING SITE
FOCUSED GROUNDWATER
FEASIBILITY STUDY
FARMINGDALE NEW YORK

CLIENT NAME:
UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY

GROUNDWATER ELEVATION
CONTOUR MAP
ONE PUMPING WELL - 200 GPM

DATE: NOVEMBER 1997

FIGURE #: D-2



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MANAGERS DESIGNERS/CONSULTANTS

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GROUNDWATER ELEVATION
CONTOUR MAP
TWO PUMPING WELLS - 100 GPM EACH

DATE: NOVEMBER 1997

FIGURE #: D-3