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NEW YORK STATE
DEPARTMENT OF
ENVIRONMENTAL CONSERVATION
SUPERFUND STANDBY CONTRACT

SERVALL LAUNDRY SITE
Bay Shore, New York
WORK ASSIGNMENT NO. D002472-2.1



REMEDIAL INVESTIGATION/
FEASIBILITY STUDY REPORT
VOLUME I - TEXT AND APPENDIX A

JANUARY 1992

**NYSDEC SUPERFUND STANDBY CONTRACT
WORK ASSIGNMENT NO. D002472-2.1**

**DRAFT FINAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY REPORT
VOLUME I - TEXT AND APPENDIX A**

**SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK**

Submitted to:

New York State Department of Environmental Conservation
Albany, New York

Submitted by:

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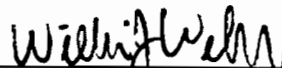
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1.0 INTRODUCTION

This Remedial Investigation/Feasibility Study (RI/FS) Report for the ServAll Laundry site (ServAll) was prepared by E.C. Jordan Co. (Jordan) as a component of Work Assignment No. D002472-2.1 for the New York State Department of Environmental Conservation (NYSDEC). The ServAll site, shown in Figure 1-1, is located in the unincorporated hamlet of Bay Shore, which is located in the town of Islip in the southwest corner of Suffolk County on Great South Bay, Long Island, New York. ServAll is classified as a Type 2 inactive hazardous waste site, and is listed by ID No. 152-077 in the Registry of Inactive Hazardous Waste Disposal Sites in New York State (NYSDEC, 1990).

This report presents the results of the RI field investigation conducted at ServAll by Jordan from December 10, 1990, through March 8, 1991 and the combined Phase I, II, and III FS. The background information used for this report was summarized from existing documents, including the Final Draft Site Inspection Report, ServAll Laundry (NUS, 1989), which includes the Phase 1 Investigation for ServAll Laundry Site (EA Science and Technology [EA], 1987), and the Suffolk County Department of Health Services (SCDHS) Preliminary Report and Interim Report #2, Vinyl Chloride Contamination of Groundwater, North Bay Shore, New York, (Harris [SCDHS], 1983).

1.1 REPORT ORGANIZATION

Sections 1.0 through 8.0 of this RI/FS report present the findings of the RI program field activities conducted by Jordan and subcontractor personnel during the winter 1990 - 1991. Sections 9.0 through 13.0 present the FS including development of remedial response objectives and target clean up levels; identification and screening of remedial technologies, development and screening of remedial alternatives, detailed analysis of alternatives, and comparative analysis of alternatives. Section 14.0 presents the selection of a preferred remedial action and the conceptual design.

To select sound and protective remedial measures, the RI is structured in general accordance with the NYSDEC Technical and Administrative Guidance Memorandum (TAGM) HWR-89-4025 (NYSDEC, 1989) and the U.S. Environmental Protection Agency (USEPA) Office of Solid Waste and Emergency Response (OSWER) Directive 9355.3-01 (USEPA, 1988).

E.C. Jordan Co.



SOURCE: U.S.G.S. QUADRANGLE, BAY SHORE EAST, N.Y., 1967, BAY SHORE WEST, N.Y., 1969, CENTRAL ISLIP, N.Y., 1967, GREENLAWN, N.Y., 1967. ALL PHOTOREVISED 1969. 7.5-MINUTE SERIES.



FIGURE 1-1
SITE LOCATION MAP
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

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The purpose and scope of work are presented with a brief site history in Section 1.0. The general physical setting and characteristics of the area surrounding the site, such as population and land-use characteristics, natural resources, climate, and geology, are described in Section 2.0. In Section 3.0, the technical approach and structure of the field program are discussed, as well as applicable or relevant and appropriate requirements (ARARs), State Criteria and Guidelines (SCGs), aspects of the analytical program, and data validation methods. Section 4.0 describes the regional and site hydrogeology. Section 5.0 summarizes the nature and distribution of contamination encountered, including the identification of site contaminants. An evaluation of fate and transport mechanisms operating at the site is discussed in Section 6.0. Section 7.0 summarizes the findings of the baseline risk assessment. Finally, Section 8.0 presents a summary of the RI findings and conclusions.

Sections 9.0 through 13.0 represent the FS portion of the RI/FS Report. Section 9.0 presents the development of remedial response objectives and target clean-up levels. The identification and screening of technologies and subsequent development of remedial alternatives is presented in Sections 10.0 and 11.0, respectively. Screening of alternatives is outlined in Section 12.0. Section 13.0 presents the detailed evaluation of the remedial alternatives retained after screening along with a comparative analysis of alternatives. Section 14.0 presents the selection of a preferred remedial action and a conceptual design for that action.

Appendix A presents the Field Program Log, Boring Logs, Well Installation Logs, Well Development Logs, and Preliminary Hydraulic Conductivity Test Results. Appendix B presents Gas Chromatograph (GC) Screening Data, tables of raw and validated analytical data for soil and groundwater samples obtained at the site, and Field Data Sheets. Appendix C presents the standard operating procedures for the purge and trap GC screening technique. Appendix D presents the Baseline Human Health Risk Assessment and Appendix E contains the risk estimate spreadsheets. Appendix F presents the calculations and methodology utilized to estimate shower-generated air contaminant concentrations. Appendix G presents the methodology and calculations used to model organic vapor exposure pathways.

Calculations in support of the work conducted in the FS are presented in Appendices H through Q: Calculations of Leaching-based Soil Target Cleanup Levels are presented in Appendix H; Calculation of Volume of Contaminated Soil are presented in Appendix I; Calculation of Volume of Contaminated

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Groundwater are presented in Appendix J. Cost Backup for alternative cost estimates are presented in Appendix K. Vacuum Extraction Treatment Length and Estimate of Contaminant Mass Removal are presented in Appendices L and M. Appendices N and O include Groundwater Extraction Modeling and Groundwater Treatment Durations. Calculations of VOC Emissions from Air Stripping are presented in Appendix P. A summary of Contaminant Mass Removals by Alternatives is outlined in Appendix Q. Calculations of contaminant mixing in Great South Bay are presented in Appendix R.

1.2 PURPOSE

The objectives of the ServAll RI were to:

- provide necessary data to characterize the nature and distribution of contamination in soil and groundwater at the site;
- assess the contaminant transport pathways; and
- provide the technical basis for the Risk Assessment and FS.

The Risk Assessment process identified contaminants of concern and assessed human health and environmental risks associated with the contamination encountered in the study area as a result of past site activities. These were used to develop target clean-up levels for use in the FS.

The objectives of the ServAll FS were to develop and present potential remedial alternatives to allow NYSDEC to select a remedial action for ServAll that meets the following list of criteria:

- protects human health and the environment;
- attains federal and state human health and environmental requirements identified for ServAll;
- uses permanent solutions and alternative treatment technologies to the maximum extent practicable, given feasible and available technologies;
- uses treatment to permanently and significantly reduce the toxicity, mobility, or volume of wastes; and

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- minimizes costs.

1.3 SCOPE OF WORK

The scope of work required to fulfill the purpose and objectives of the RI/FS, as presented in the site Work Plan (E.C. Jordan Co., 1990), consisted of the following 11 major activities:

- (1) A site reconnaissance, and compilation and review of existing site-specific information, including data from previous studies, aerial photographs, and documents relating to the site
- (2) Community relations support to NYSDEC
- (3) A field investigation program consisting of the following sub-activities:
 - performance of a geophysical survey to locate known or suspected underground structures and utilities
 - collection of surface and shallow subsurface soil samples with GC screening for selected chlorinated and aromatic volatile organic compounds (VOCs); and confirmational laboratory analysis for Target Compound List (TCL) parameters
 - soil test borings with GC screening of soil and groundwater samples for selected chlorinated and aromatic VOCs; and collection of confirmational samples for laboratory analysis of TCL parameters, Toxicity Characteristic Leachate Procedure (TCLP), and selected water quality parameters
 - installation of water table piezometers and installation and sampling of monitoring wells
 - estimation of aquifer hydraulic conductivity by performance of slug tests in new monitoring wells and reduction of slug test data
- (4) Preparation and submission of an RI Data Summary Report (E.C. Jordan Co., 1991)

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SECTION 1

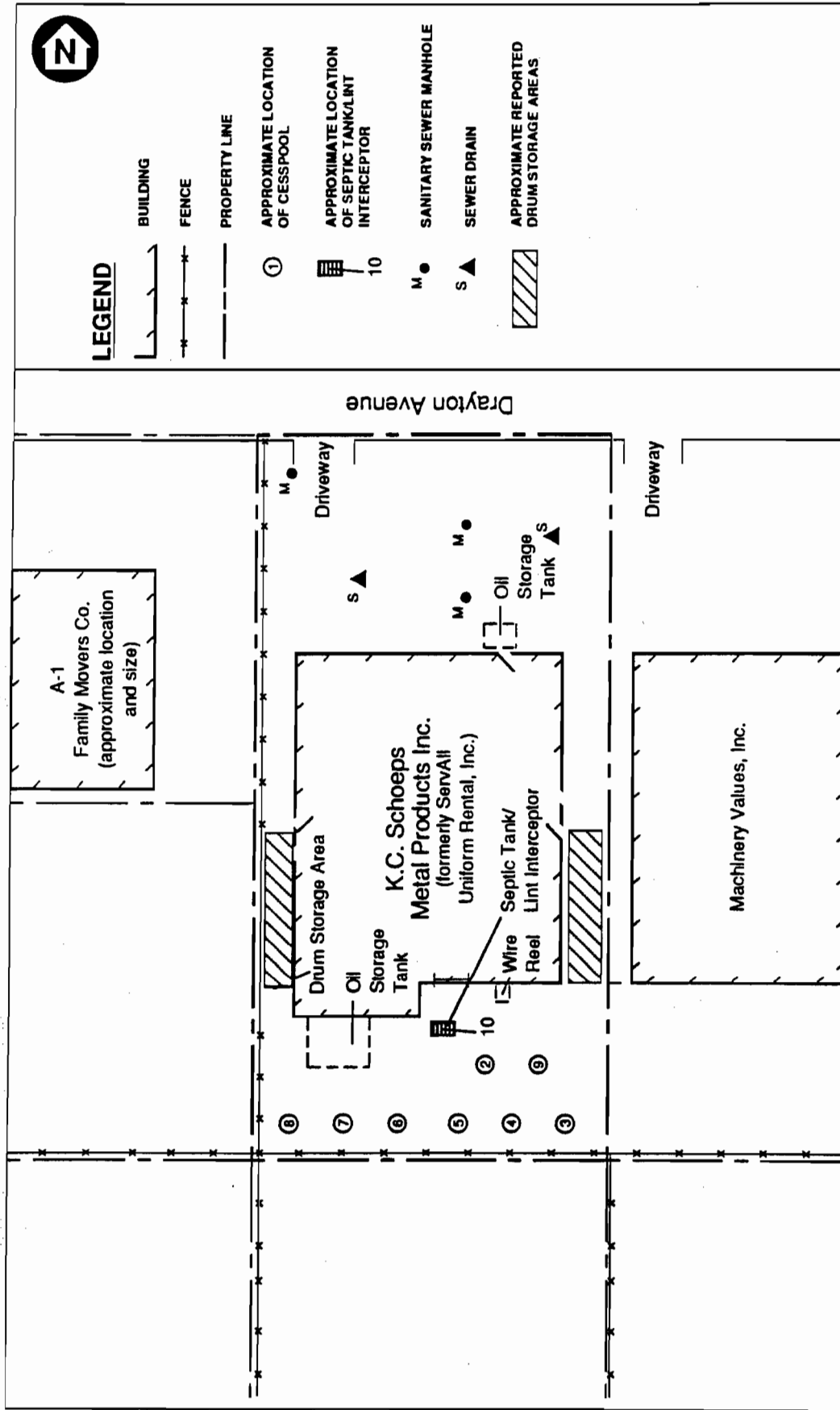
- (5) Data evaluation
- (6) Risk assessment, including identification of contaminants of concern, and human health and environmental receptors
- (7) Development of remedial response objectives and target clean-up levels for the contaminants of concern in each affected media
- (8) Development of a range of remedial alternatives to address contamination in each of the affected media
- (9) Screening of the remedial alternatives to eliminate those that are impractical based on effectiveness and implementability
- (10) A detailed analysis of the remaining alternatives consisting of the following subactivities:
 - A detailed description of each alternative
 - Evaluation of each alternative according to USEPA criteria
 - A comparative analysis of the alternatives
- (11) Selection of a remedy that includes a conceptual plan for implementation

1.4 SITE HISTORY

ServAll Uniform Rental, Inc. (ServAll Uniform), operated as a commercial laundry from 1969 to 1972, and as a commercial dry cleaner/laundry from 1972 to 1984. During this time, unknown quantities of wash water were pumped to, and occasionally overflowed from, three to eleven cesspools located outside and to the rear of the ServAll building. The approximate locations of the ServAll Uniform cesspools and the alleged drum storage areas are shown in Figure 1-2. SCDHS performed several on-location inspections from 1978 to 1983, and cited ServAll Uniform for violations including discharge of industrial waste without a State Pollution Discharge Elimination System (SPDES) permit, improper storage and disposal of drummed waste, and overflowing cesspools (NUS, 1989).

Tetrachloroethene (PCE), trichloroethene (TCE), vinyl chloride, chloroform, methylbenzenes and some TCL metals were detected in some of the samples collected by SCDHS from the cesspools. Until 1983, ServAll Uniform is believed

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SECTION 1

to have continued illegal discharge and storage practices regardless of repeated notices from SCDHS. SCDHS alleged that discharges from ServAll Uniform resulted in groundwater contamination downgradient of the site. Although SCDHS personnel were denied access to the ServAll property for the purpose of installing monitoring wells to confirm the source of groundwater contamination, ServAll Uniform cleaned the on-site storm drains and an unknown number of cesspools, removing sludge and contaminated water in 1981. In 1984, the area behind the building was backfilled and paved over.

Mr. Ralph Colantuoni owned and operated ServAll Uniform at 8 Drayton Avenue, Bay Shore, New York. Although Mr. Colantuoni apparently still owns the property, the site is currently leased by Mr. Kurt Schoeps for the operation of K.C. Schoeps Metal Products, Inc.

1.4.1 1983 Suffolk County Department of Health Services Investigation

In 1983, the SCDHS Office of Water Resources identified a contaminated groundwater plume containing PCE, TCE, cis-1,2-dichloroethene (DCE), and vinyl chloride in the Bay Shore area. Analysis of groundwater data from a series of test wells suggested the source was located at or just downgradient of ServAll, and that a plume of contaminated groundwater extended 0.6 miles southeast of the site, ending just south of the Southern State Parkway. At that time, the downgradient extent of the plume was 0.3 miles upgradient from a Suffolk County Water Authority (SCWA) well field located on Thomas Avenue in Bay Shore.

SCDHS used profile wells to acquire groundwater data. Using this method, a polyvinyl chloride (PVC) well was temporarily installed in a borehole drilled to a depth ranging from 90 to 110 feet. The well was sampled, and then withdrawn (raised) in 10-foot increments and sampled at increasingly shallower intervals until the well screen intersected the water table and an analytical profile of the saturated zone soils was established. This method was repeated at each exploration location. Following the final sampling episode at each location, the PVC test wells were either left in place or completely removed from the boreholes.

The highest contaminant concentrations found in the groundwater samples were 110,000 micrograms per liter ($\mu\text{g/L}$) of PCE and 2,800 $\mu\text{g/L}$ of vinyl chloride. The SCDHS report concluded that the contaminated groundwater plume appeared to be confined within the upper glacial aquifer above a silty clay unit, Gardiners Clay, but suggested that the aquifer below the clay be investigated. In

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the Bay Shore area near the site, Gardiners Clay separates the upper glacial aquifer from the Magothy Formation aquifer. The Magothy Formation aquifer is the water source for the Thomas Avenue SCWA well field, as well as more than 10 other SCWA well fields.

1.4.2 1987 U.S. Geological Survey/Suffolk County Department of Health Services Investigation

In 1987, a second series of temporary profile wells was drilled and sampled by the U.S. Geological Survey (USGS) in association with SCDHS. The 1987 data suggest that the plume had migrated slightly less than 0.3 miles further downgradient in four years. At that time, the distal end of the plume was approximately 100 feet south of the SCWA Thomas Avenue well field. The plume velocity was estimated at approximately 1 foot per day (NUS, 1989).

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2.0 PHYSICAL SETTING

This section describes the location of ServAll in Bay Shore, New York. Population and current land use of the surrounding area are discussed, as well as the natural resources, climate, and geology.

2.1 SITE DESCRIPTION

ServAll is an inactive hazardous waste site located at 8 Drayton Avenue in a mixed-use industrial/residential area in Bay Shore, an unincorporated hamlet in the Township of Islip, New York. Drinking water is supplied to the site by the SCWA. ServAll is not within a sewer district. ServAll, located at 40°45'16" north latitude and 73°15'43" west longitude, and the surrounding area are shown in Figure 1-1.

The two-story former ServAll building, now occupied by a lessee, K.C. Schoeps Metal Products, Inc., occupies approximately 8,000 square feet of a paved 22,000-square-foot lot on the south side of Drayton Avenue. ServAll abutters include a household moving company and a heavy equipment sales company to the west and east, respectively, and a private residence to the south. The ServAll property is bordered by a chain link fence topped with barbed wire on the south and west sides. The north side of the property fronts Drayton Avenue, where the building is separated from the street by a small parking lot. The site slope is from zero to 2 percent to the southeast. Two storm water runoff drywells, two sanitary system cesspools, and one underground fuel tank are located in the front yard parking area between the building and Drayton Avenue. A driveway, shared by the adjacent commercial property to the east, provides access to the backyard of both properties. A second underground fuel tank is located behind the ServAll building in the backyard. The site layout is shown in Figure 1-2.

2.2 POPULATION CHARACTERISTICS/LAND USE

More than 100,000 people live within a 2-mile radius of ServAll. Fourteen public/private schools, four public parks, the South Shore Shopping Mall, and St. Joseph's Academy and Convent are also located within this radius. Several small commercial enterprises and light industries, and two listed inactive hazardous waste sites, the Hubbard-Wilson Landfill site and the Rite-Off site, both of which are listed by NYSDEC as Class 2A inactive hazardous waste sites, are located within 2,000 feet to the west and southwest, respectively, of ServAll. Area residents are served by SCWA for their drinking water supply. Homes and

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businesses located south of the Southern State Parkway are within the Suffolk County Southwest Sewer District No. 3; the area north of the Southern State Parkway is outside the sewer district.

2.3 NATURAL RESOURCES

The natural resources of the Bay Shore area include sand and gravel, which are mined (Hubbard Sand and Gravel Mining Yard), and the Upper Glacial and Magothy aquifers. Groundwater is the sole source of drinking water in this area. Although the Magothy aquifer is the major municipal drinking water source, in accordance with NYSDEC requirements, all groundwater sources in Nassau and Suffolk Counties of Long Island are designated and protected as sole source aquifers. SCWA has 13 well fields within a 3-mile radius of the site (EA, 1986).

No wetlands are located within a 2-mile radius of the site. A large wetland area is located 6 miles east of the site within Connetquot River State Park. The nearest surface water body is Penataquit Creek, which originates approximately 1 mile southeast of the site and discharges to the Great South Bay in Islip.

2.4 CLIMATE

Long Island, New York, is situated in a humid-temperate zone between Long Island Sound and the Atlantic Ocean, and the local climate is strongly influenced and moderated by the proximity of coastal waters. Summers are warm and humid, followed by mild winters. The average temperature for 1990 was 54.9 degrees Fahrenheit (F). Mean annual precipitation for Long Island weather stations ranges from 40 to 50 inches with a definite seasonal variation, precipitation being greatest in the spring and least in the fall. The total precipitation over the central part of the island for 1990 was 55 inches, with approximately 20 percent falling as snow.

During the ServAll RI field program in the winter of 1990-91, temperatures ranged from 20 to 50 degrees F. Prevailing winds were from the west and northwest. Although precipitation was not measured at the site, approximately 50 percent of the days were overcast with precipitation ranging from occasional snow flurries or drizzle to moderate rainfall. No prolonged heavy rainfall occurred during the field program.

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2.5 REGIONAL GEOLOGY

Two Late Wisconsin-age end moraines, each with extensive outwash plains, cover most of the surface of Long Island (Flint, 1971). Most of southwestern Suffolk County located south of the Ronkonkoma end moraine is characterized by glacial outwash deposits of coarsely stratified sand and gravel. The sand and gravel are major components of the Upper Glacial unit. Outside of wetland and forest areas, the surface soil is very sandy with thin, poorly developed topsoil.

The Gardiners Clay unit, a northward-thinning wedge of silty marine clay (Figure 2-1), discontinuously underlies the Upper Glacial unit outwash deposits. Near the site, Gardiners Clay underlies a zone approximately parallel to the south coastline of Long Island and extending inland 1 to 5 miles. It is occasionally absent in deep valleys along the southernmost edge of the outwash plain near the coastline where Late Pleistocene erosional processes cut back deeply into the Upper Glacial unit. In the Bay Shore area near ServAll, the Gardiners Clay unit was encountered from 90 to 110 feet below ground surface (bgs) and is estimated by Soren to be approximately 5 to 10 feet thick (Soren et al., 1987) and by Kimmel and Braid to be 10 to 13 feet thick (Kimmel and Braid, 1980). Stratigraphically, Gardiners Clay overlies the Jameco Gravel and the Mannelto Gravel (these units are commonly included with the upper glacial aquifer where Gardiners Clay is absent), which, in turn, overlie the Cretaceous-age Matawan Group-Magothy Formation, the Lloyd Clay and Sand Members of the Raritan Formation, and Precambrian-age bedrock.

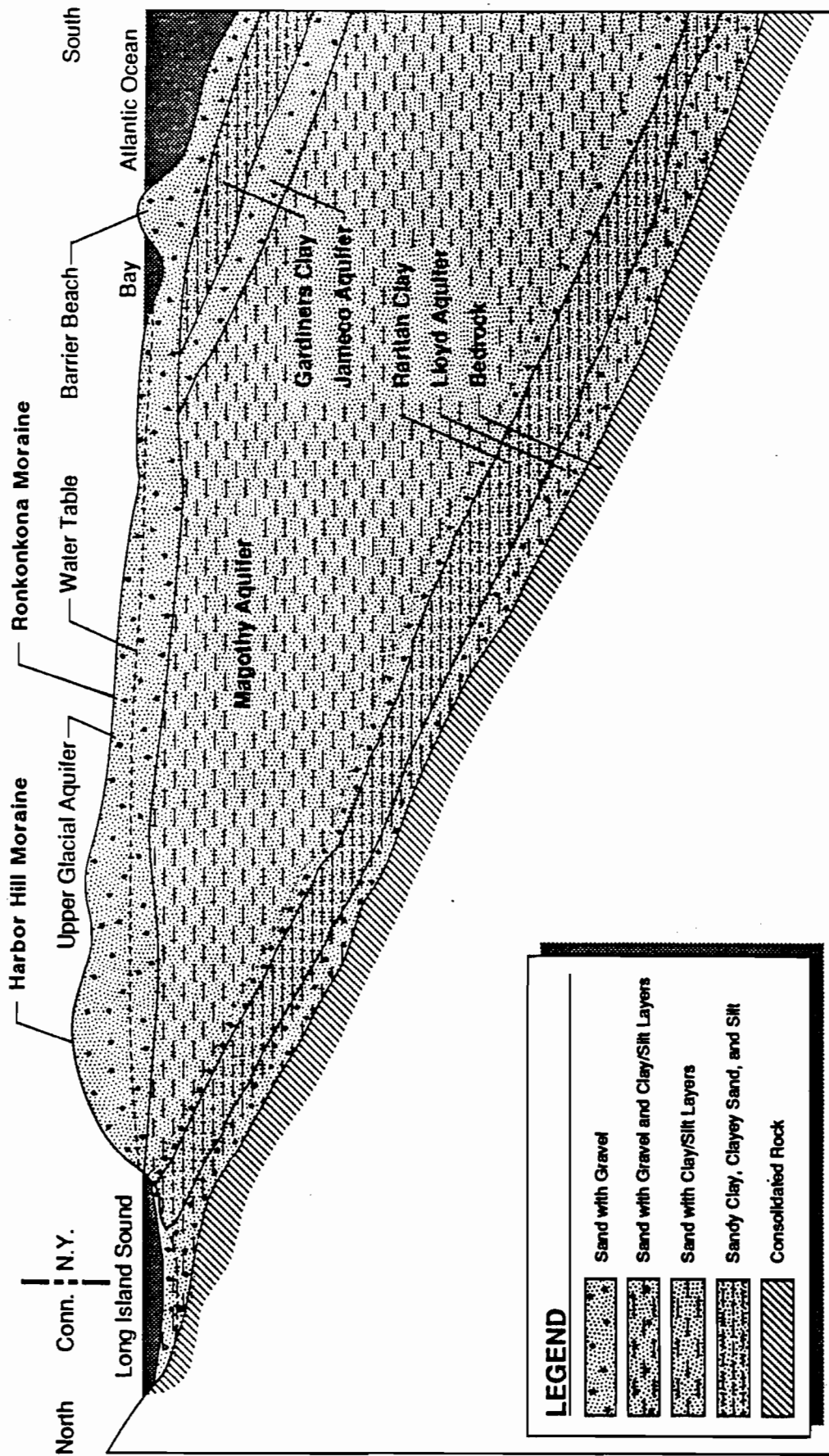
Although the aquifers of Long Island are generally hydraulically interconnected, pumping tests conducted near the site in the Magothy Formation by the USGS indicated poor hydraulic connection between the Magothy and the upper glacial aquifers where Gardiners Clay unit is present (NUS, 1989). Average depth to groundwater is 20 feet and groundwater flow is to the southeast.

2.6 SITE GEOLOGY

ServAll is located on sandy glacial outwash deposits at an elevation of approximately 66 feet above mean sea level (MSL). The site and surrounding terrain are nearly flat (zero to 2 percent slope) and mostly paved. Other than runoff from precipitation during storms, no surface water storage or flow was observed on-site or in the area immediately surrounding the site. The glacial outwash deposits underlying ServAll are composed predominantly of tan, fine-to-medium sand with trace amounts of gravel and occasional cobbles, coarse

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LONG ISLAND



LEGEND

Sand with Gravel

Sand with Gravel and Clay/Silt Layers

Sand with Clay/Silt Layers

Sandy Clay, Clayey Sand, and Silt

Consolidated Rock

(Modified from McClymonds and Franke, 1972)

FIGURE 2-1
REGIONAL GEOLOGY
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

SECTION 2

sand, and silt. The unit ranges from 85 to 115 feet in thickness and is coarsely stratified. A dark greenish-gray clayey-silt unit, interpreted as Gardiners Clay unit, was encountered below the outwash sands at several boring locations during the RI field program. Although RI program explorations were designed not to penetrate the entire clay thickness, this clay unit was encountered at upgradient and downgradient boring locations and is believed to be present beneath ServAll.

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3.0 REMEDIAL INVESTIGATION PROGRAM

Section 3.0 presents the structure of the ServAll RI program. Subsection 3.1 discusses the RI program technical approach and summarizes the on-site field investigation activities. Subsection 3.2 presents the program for chemical analysis of soil and groundwater samples collected during the RI.

3.1 TECHNICAL APPROACH

To meet the RI objectives outlined in Subsection 1.2, the Final RI/FS Work Plan (WP), Quality Assurance Project Plan (QAPP), and Health and Safety Plan (HASP) (E.C. Jordan Co., 1990) were developed and approved by NYSDEC. The First Phase RI field program was conducted by Jordan personnel from December 1990 through March 1991. The field investigation consisted of the following activities:

- performance of a geophysical survey, using ground-penetrating radar (GPR), of the ServAll property
- collection of nine surface and near-surface soil samples using a bucket auger
- collection of 59 subsurface soil samples during advancement of eight soil test borings
- collection of 234 groundwater and 21 soil samples during advancement of 18 monitoring well and three piezometer borings
- on-site GC screening of 89 soil and 234 groundwater samples for PCE, TCE, DCE, vinyl chloride, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene
- laboratory analysis of 34 confirmational soil samples using NYSDEC Analytical Services Protocols (ASP)(1989) for TCL organics and TCL metals
- installation of 18 new groundwater monitoring wells and three water table piezometers
- in situ hydraulic conductivity testing in 18 new monitoring wells

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- two rounds of groundwater sampling for ASP laboratory analysis of TCL organics and metals and other water quality parameters from the new monitoring wells with the collection of a total of 40 samples
- an exploration location survey of the new explorations

3.1.1 Geophysical Program

Jordan personnel conducted GPR surveys at the former ServAll property on June 26 and November 13 of 1990. The surveys were conducted outside, in the area surrounding the ServAll building. GPR was used to map known or suspected underground features such as water and gas supply lines, underground storage tanks, storm drains, cesspools, and buried pipes, and to optimize the placement of subsurface explorations.

The GPR surveys were performed using a GSSI subsurface interface radar (SIR) System III with a 500 Megahertz (Mhz) antenna. The traverse grid was spaced at 5-foot intervals and oriented parallel to the site boundaries. A total of 4,700 feet of profiling was completed. The extent of coverage and the underground features and anomalies mapped during the surveys are shown in Figure 3-1. The largest subsurface anomalies shown are two underground storage tanks that were delineated using GPR and confirmed by the site lessee. One is located adjacent to the northeast corner of the building and the other is near the southwest corner of the building.

Three buried pipes were mapped: the water supply pipe from the street (oriented north-south), a cesspool pipe (oriented north-south), and an unidentified pipe (oriented east-west) about 35 feet south of the building's south wall. The latter may have originally connected some of the ServAll Uniform cesspools. Several other discontinuous features were also mapped, varying in depth from a few inches to more than 6 feet. Some of these anomalies appear to be buried cables, while others may be pipes. Discarded pieces of scrap metal or even boulders and cobbles may account for some of these features.

3.1.2 Bucket Auger Explorations

To investigate potential residual sources of on-site contamination in areas where drill rigs could not be maneuvered, six shallow explorations were advanced manually to a maximum depth of 7 feet using a bucket auger.

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LEGEND

BUILDING

FENCE

GPR TRAVERSE

GPR ANOMALY & DEPTH (FT)

MANHOLE

SEWER DRAIN

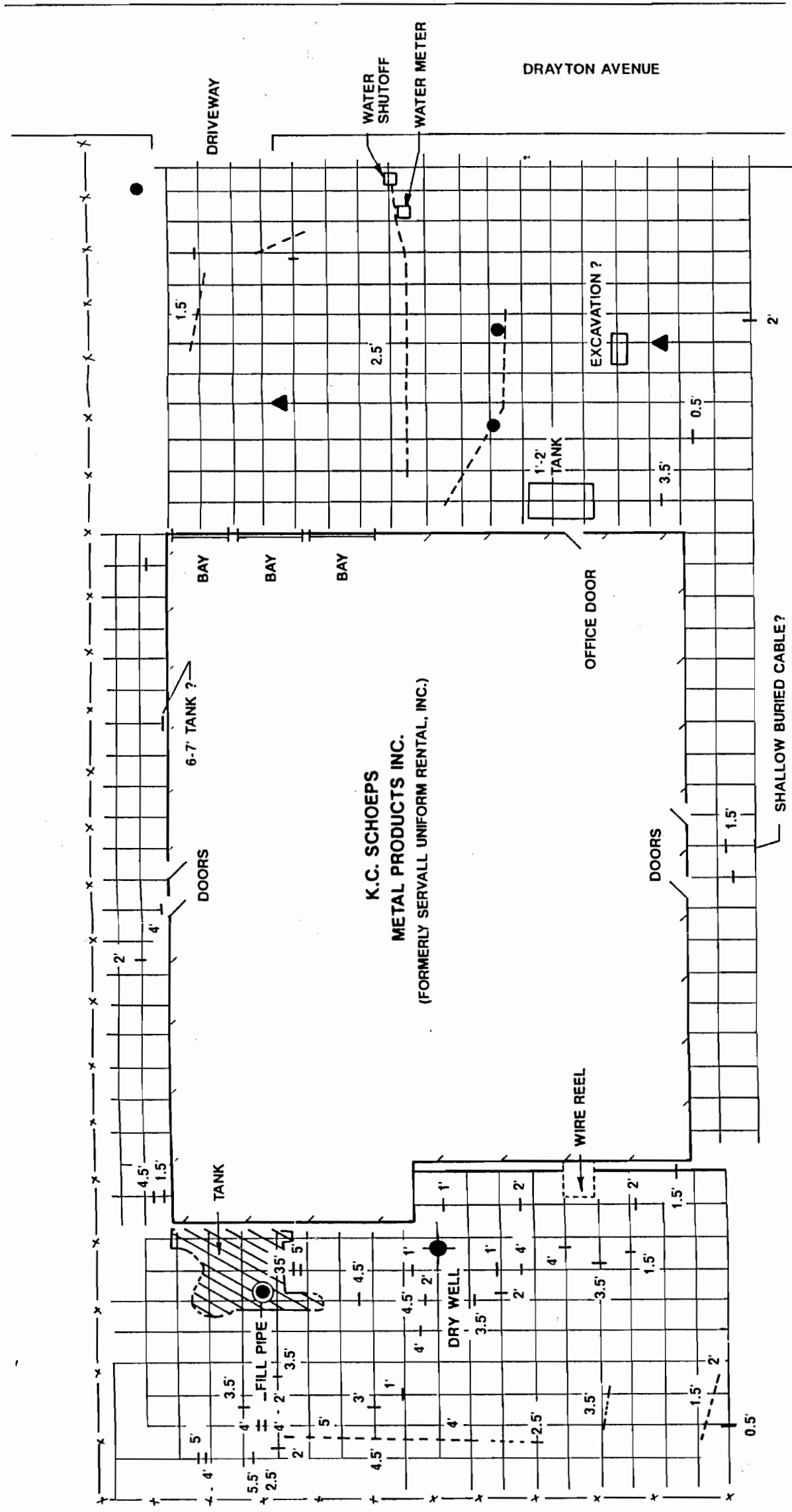


FIGURE 3-1
GPR ANOMALY MAP
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK
ECJORDANCO

Six shallow augered borings were completed near the southwest corner of the ServAll building. Explorations SS-1, SS-2, SS-3, and SS-6 are located near the building in an area reportedly used by ServAll Uniform as a drum storage area. Explorations SS-4 and SS-5 are along the southern boundary of the site where wash water overflow from the cesspools may have pooled during ServAll Uniform operations. The bucket auger sample locations are shown in plan view in Figure 3-2 and in profile in Figure 3-3.

Surface and near-surface composited samples were collected with a bucket auger from a range of 1 to 7 feet bgs and submitted to the GC operator for screening. Each collected sample was also analyzed using NYSDEC ASP (1989) for TCL VOCs and TCL metals; two samples were analyzed for TCL semivolatile organic compounds (SVOCs). In accordance with QAPP (E.C. Jordan Co., 1990) procedures, one duplicate sample and one rinsate sampler blank were also obtained. The GC screening results are presented in Appendix B-1; laboratory analytical results are summarized in Section 5.0.

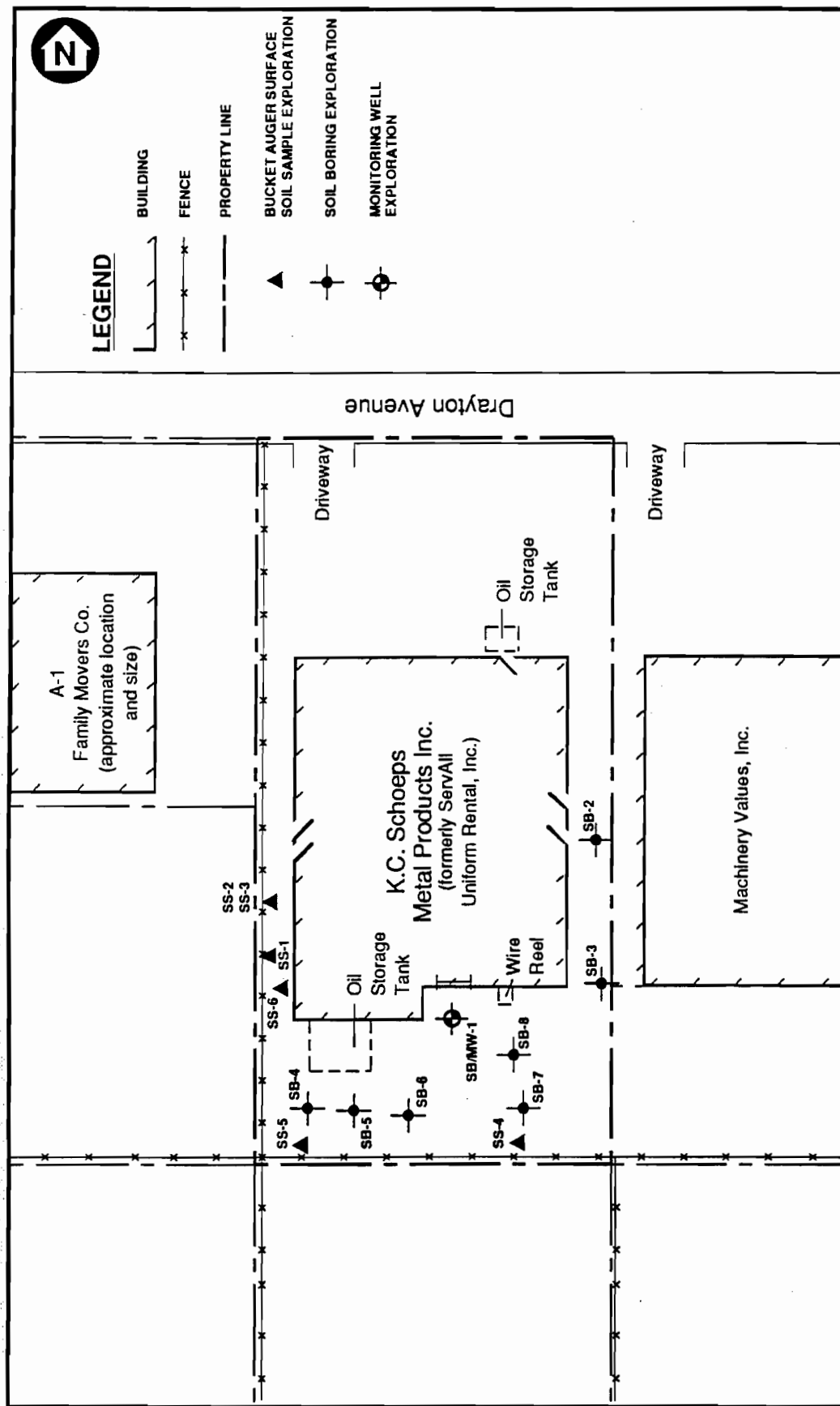
3.1.3 Soil Boring Explorations

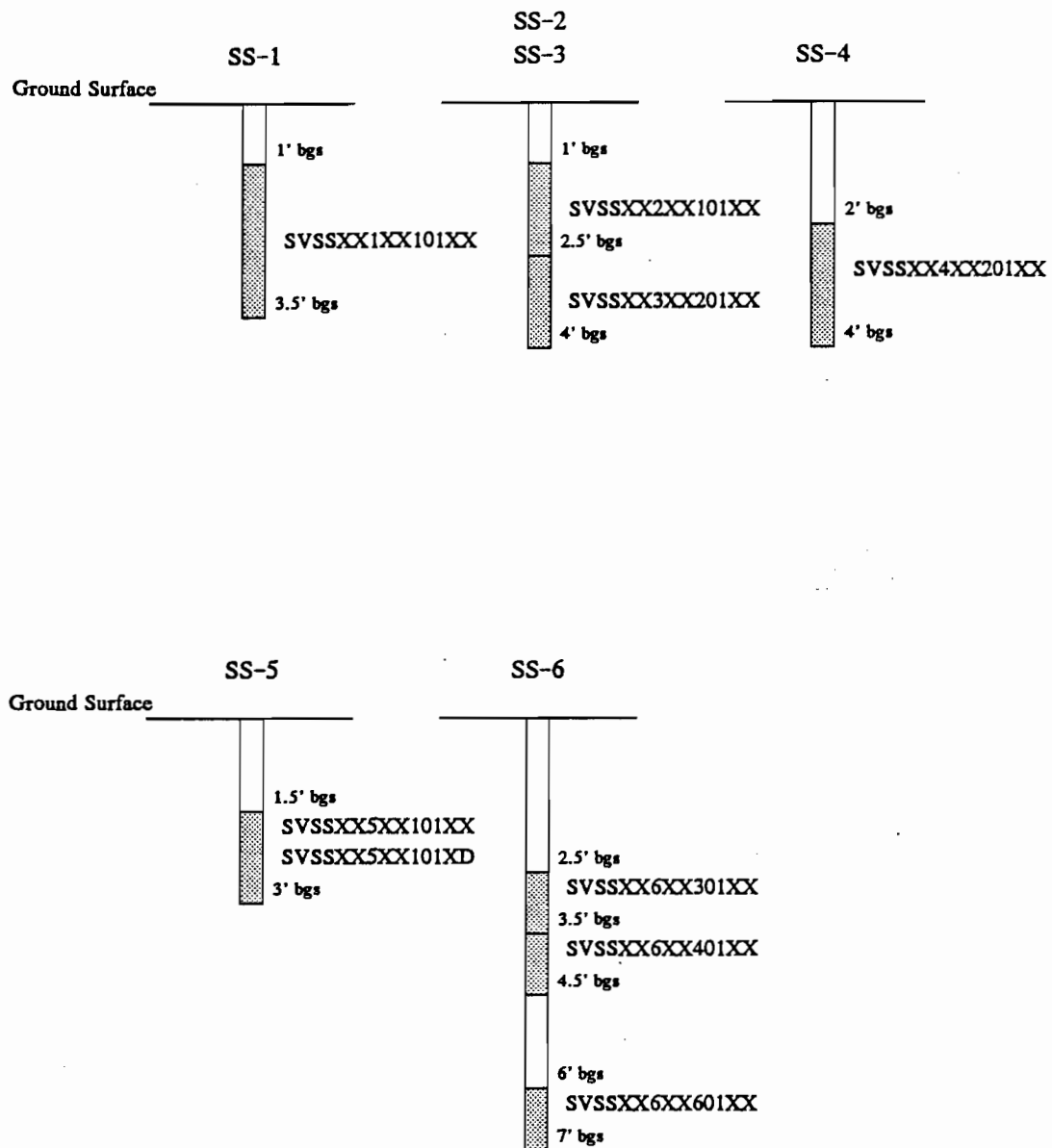
To investigate and quantify residual contamination in the former cesspool area behind the ServAll building, eight soil borings were advanced and sampled continuously within the vadose zone. The locations of the soil borings are shown in Figure 3-2.

Six borings, numbered SB-2 through SB-4 and SB-6 through SB-8, were sampled at continuous intervals from the ground surface to the water table at 22 feet bgs, then completed by backfilling with drill cuttings and sealing with cement grout at the ground surface. The SB-1 exploration was drilled from the ground surface to 104 feet bgs. It was sampled continuously from zero to 22 feet and 73 to 104 feet bgs; and sampled at 5-foot intervals from 22 to 73 feet bgs. Instead of being backfilled, SB-1 was completed with the installation of a monitoring well, MW-1. SB-5 was drilled to 47 feet bgs and sampled continuously to 22 feet bgs and at 5-foot intervals from 22 to 47 feet bgs prior to being backfilled with drill cuttings and being sealed with grout at the surface. Detailed drilling logs are presented as Soil Boring Logs in Appendix A-2.

A total of 59 soil samples from the soil borings were screened for PCE, TCE, DCE, vinyl chloride, 1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene with the on-site GC. Thirty-four samples were shipped for laboratory analysis. The analytical parameters and methods are presented in Subsection 3.2.2 and

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LEGEND:

bgs - Below ground surface

SVSSXX1XX101XX - Sample interval and number

The bucket auger boring locations are shown on Figure 3-2

**FIGURE 3-3
BUCKET AUGER BORING PROFILES
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK**

SECTION 3

discussed further in Subsection 5.0. Analytical data tables showing all the soil boring sample results are presented in Appendix B. A summary of validated analytical results above the method detection limits is presented in Section 5.0.

3.1.4. Piezometers and Monitoring Wells

Eighteen monitoring wells and three water table piezometers were installed in the vicinity of and downgradient from ServAll. The purpose of the monitoring wells was to further characterize a known plume of groundwater contamination in the upper glacial aquifer downgradient of the site. The piezometers were installed to intersect the water table surface and evaluate groundwater flow direction and gradients. All piezometer and monitoring well locations are shown in Figure 3-4. Figure 3-4 also shows the locations of five geologic profiles, discussed in subsections 3.1.4.2 through 3.1.4.4.

The new monitoring wells and piezometers, except MW-1, are constructed with 2-inch inside diameter (ID) Schedule 5 stainless steel riser pipe and wire-wrapped well screen. MW-1 is constructed with 4-inch ID Schedule 80 PVC pipe and machine-slotted well screen. All well screens are 10 feet long with a slot size opening of 0.010-inch.

All well screens are placed above Gardiners Clay unit in the upper glacial aquifer. A summary of the well installation details, including exploration elevations and well screen depths, is presented in Table 3-1. Boring Logs and Well Installation Logs are presented as Appendices A-2 and A-3, respectively.

To provide vertical profiles of the contaminant plume and "real time" analytical data to optimize well screen placement, groundwater from all monitoring well borings except MW-1 was sampled at 5-foot intervals during boring advancement using the screened-auger method described in the WP (E.C. Jordan Co., 1990). To provide data to characterize the geology beneath the site, soils from the MW-1 boring were sampled. A total of 234 screened-auger groundwater samples were analyzed with the on-site GC.

A summary of water level measurements is presented in Table 3-2. Analytical data tables showing all groundwater sample results are in Appendix B. A summary of validated analytical results above the method detection limits is presented in Section 5.0.

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TABLE 3-1
SUBSURFACE EXPLORATION SUMMARY
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

TYPE OF BORING	SAMPLE MEDIA	BORING NUMBER	BORING LOCATION (NY State Plane Coordinate System)	GROUND SURFACE ELEVATION (FT. above MSL)	DEPTH OF BORING (FT)	NUMBER OF SCREENING SAMPLES OBTAINED	NUMBER OF ANALYTICAL SAMPLES OBTAINED	WELLSCREEN DEPTH (FT)
<u>SOIL TEST BORINGS</u>	SOIL	SB-1	N 193973.4341 E 2204502.9497	65.47	104	15	4	n/a
	SOIL	SB-2	N 194025.2282 E 2204544.2792	64.79	22	5	3	n/a
	SOIL	SB-3	N 193984.4285 E 2204542.2534	64.71	22	5	3	n/a
	SOIL	SB-4	N 193954.3298 E 2204457.5059	65.55	22	5	4	n/a
	SOIL	SB-5	N 193950.6825 E 2204473.4064	65.54	47	11	5	n/a
	SOIL	SB-6	N 193947.8988 E 2204491.3892	65.47	22	6	4	n/a
	SOIL	SB-7	N 193945.9033 E 2204520.5328	65.15	22	5	4	n/a
	SOIL	SB-8	N 193961.9865 E 2204521.3049	65.08	22	6	4	n/a
<u>PIEZOMETERS</u>	SOIL/WATER	PZ-2	N 194181.7260 E 2204500.4306	64.81	27	0	1, 2	17.0 - 27.0
	WATER	PZ-4	N 193713.5666 E 2204682.8535	63.69	27	0	2	17.0 - 27.0
	WATER	PZ-5	N 193734.3203 E 2204458.3960	64.33	27	0	2	17.0 - 27.0
<u>MONITORING WELLS</u>	SOIL/WATER	MW-1	N 193973.4341 E 2204502.9497	65.47	104	15	2	76.5 - 86.5
	WATER	MW-2	N 194178.6281 E 2204535.2080	65.05	85	13	2	71.8 - 81.8
	WATER	MW-3A	N 194188.7695 E 2204423.4013	64.91	123	8	2	110.0 - 120.0
	WATER	MW-3B	N 194189.8042 E 2204411.5094	65.02	90	14	2	78.0 - 88.0
	WATER	MW-4	N 193713.5535 E 2204672.0885	63.69	86	13	2	74.0 - 84.0
	WATER	MW-5	N 193738.1218 E 2204418.0873	64.44	85	13	2	74.0 - 84.0
	WATER	MW-6A	N 193723.6226 E 2204573.7112	64.24	93	14	2	53.0 - 63.0
	WATER	MW-6B	N 193722.7726 E 2204566.2947	64.31	117	12	2	25.0 - 35.0
	WATER	MW-7	N 193247.0018 E 2204841.6184	61.28	113	18	2	102.0 - 112.0
	WATER	MW-8	N 192291.4486 E 2205304.2660	54.94	113	19	2	94.0 - 104.0
	WATER	MW-9	N 189214.0748 E 2206683.2379	41.28	90	14	2	78.0 - 88.0
	WATER	MW-10	N 188924.3510 E 2207905.9470	40.54	90	14	2	78.7 - 88.7
	WATER	MW-11	N 188889.8186 E 2207272.7580	37.29	90	14	2	80.0 - 90.0
	WATER	MW-12	N 191051.7020 E 2205475.3358	50.90	90	14	2	78.8 - 88.8
	WATER	MW-13	N 190990.0558 E 2205989.1140	50.77	98	17	2	88.0 - 98.0
	WATER	MW-14	N 191009.2646 E 2206506.4563	50.33	95	16	2	83.3 - 93.3
	WATER	MW-15	N 190264.2463 E 2206372.0460	49.00	98	16	2	87.0 - 97.0
	WATER	MW-16	N 188111.4355 E 2207779.2852	36.80	95	16	2	84.0 - 94.0

NOTES:

a SB-1 and MW-1 are the same exploration.

b Subsurface soil samples screened with the site GC.

c Groundwater (screened auger) samples screened with the site GC.

d Subsurface soil samples submitted for CLP laboratory analysis.

e Two rounds of groundwater samples submitted for CLP laboratory analysis.

TABLE 3-2
WATER LEVEL OBSERVATIONS

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

WELL ID NUMBER	GROUND SURFACE ELEVATION (FT above MSL)	ELEVATION OF RISER (FT above MSL)	WATER LEVEL ELEVATION		
			<u>2/5/91-2/7/91</u>	<u>2/12/91</u>	<u>3/5/91-3/6/91</u>
			(FT above MSL)		
MW-1	65.47	64.79	44.98	44.84	44.79
MW-2	65.05	64.47	45.27	45.20	45.05
MW-3A	64.91	64.37	43.24	43.18	43.22
MW-3B	65.02	64.54	45.34	45.18	45.16
MW-4	63.69	63.11	44.45	44.34	44.12
MW-5	64.44	64.06	44.59	44.60	44.39
MW-6A	64.24	63.87	44.53	44.31	44.33
MW-6B	64.31	63.83	44.45	44.34	44.26
MW-7	61.28	60.79	43.28	43.29	43.04
MW-8	54.94	54.60	39.34	39.44	39.37
MW-9	41.28	40.91	29.61	29.46	29.74
MW-10	40.54	40.22	26.96	26.87	27.14
MW-11	37.29	37.07	28.70	28.44	28.60
MW-12	50.90	50.61	37.53	37.46	37.34
MW-13	50.77	50.33	36.78	36.56	36.36
MW-14	50.33	49.98	35.83	35.63	35.64
MW-15	49.00	48.79	34.23	34.01	33.98
MW-16	36.80	36.50	24.97	24.82	25.05
PZ-2	64.81	64.18	--	45.27	--
PZ-4	63.69	63.30	--	48.34	--
PZ-5	64.33	63.97	--	44.32	--

NOTES:

-- : Not measured.

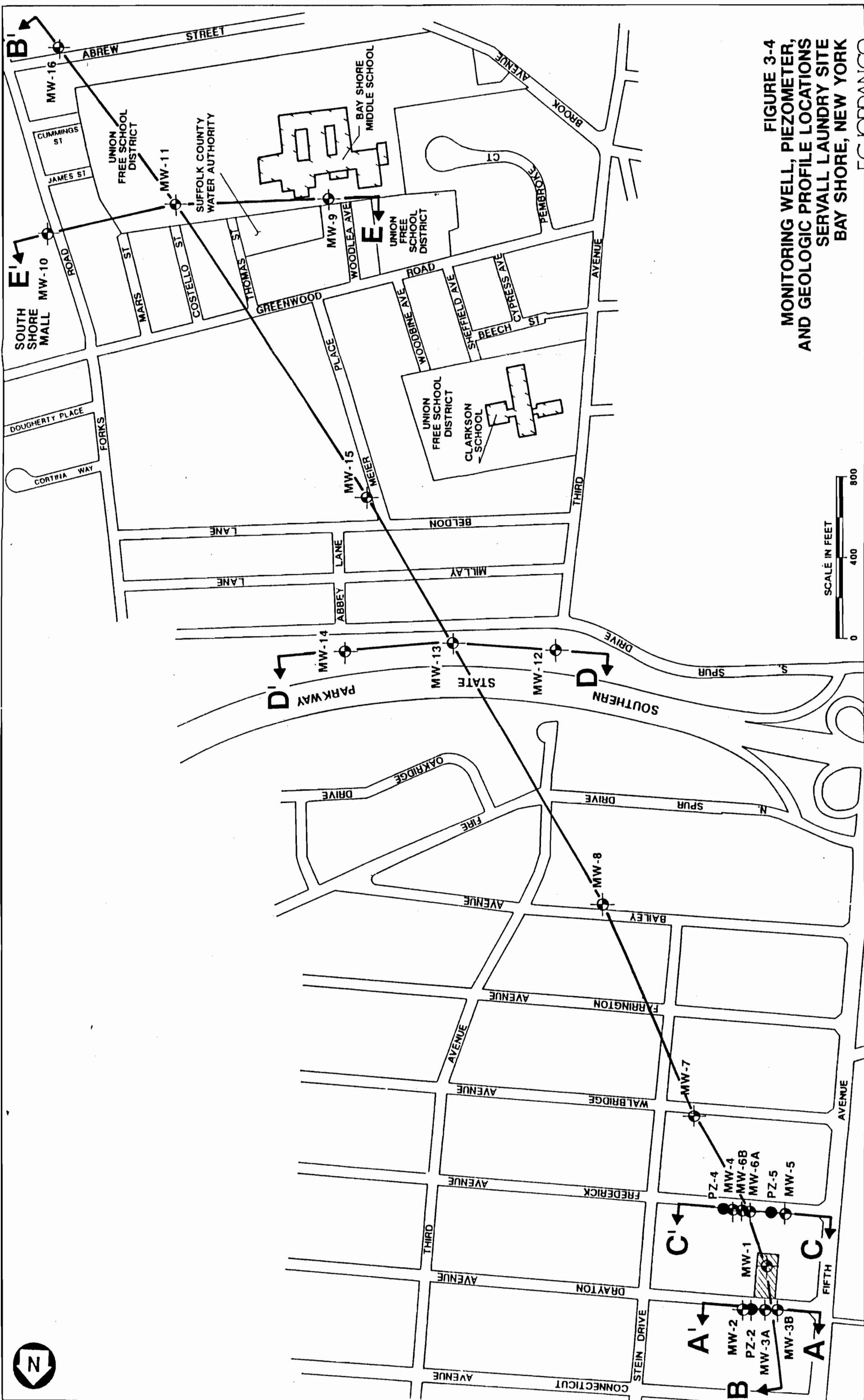


FIGURE 3-4
MONITORING WELL, PIEZOMETER,
AND GEOLOGIC PROFILE LOCATIONS
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

ECJORDANCO

SECTION 3

3.1.4.1 Piezometers. Three water table piezometers, PZ-2 (located upgradient of the site), and PZ-4 and PZ-5 (located downgradient of the site), were installed to evaluate the direction of groundwater flow and measure the vertical gradient at the site.

All piezometer borings were drilled to a final depth of 27 feet bgs. The 10-foot-long piezometer well screens were placed from 17 to 27 feet bgs to intersect the water table with allowance for seasonal variations.

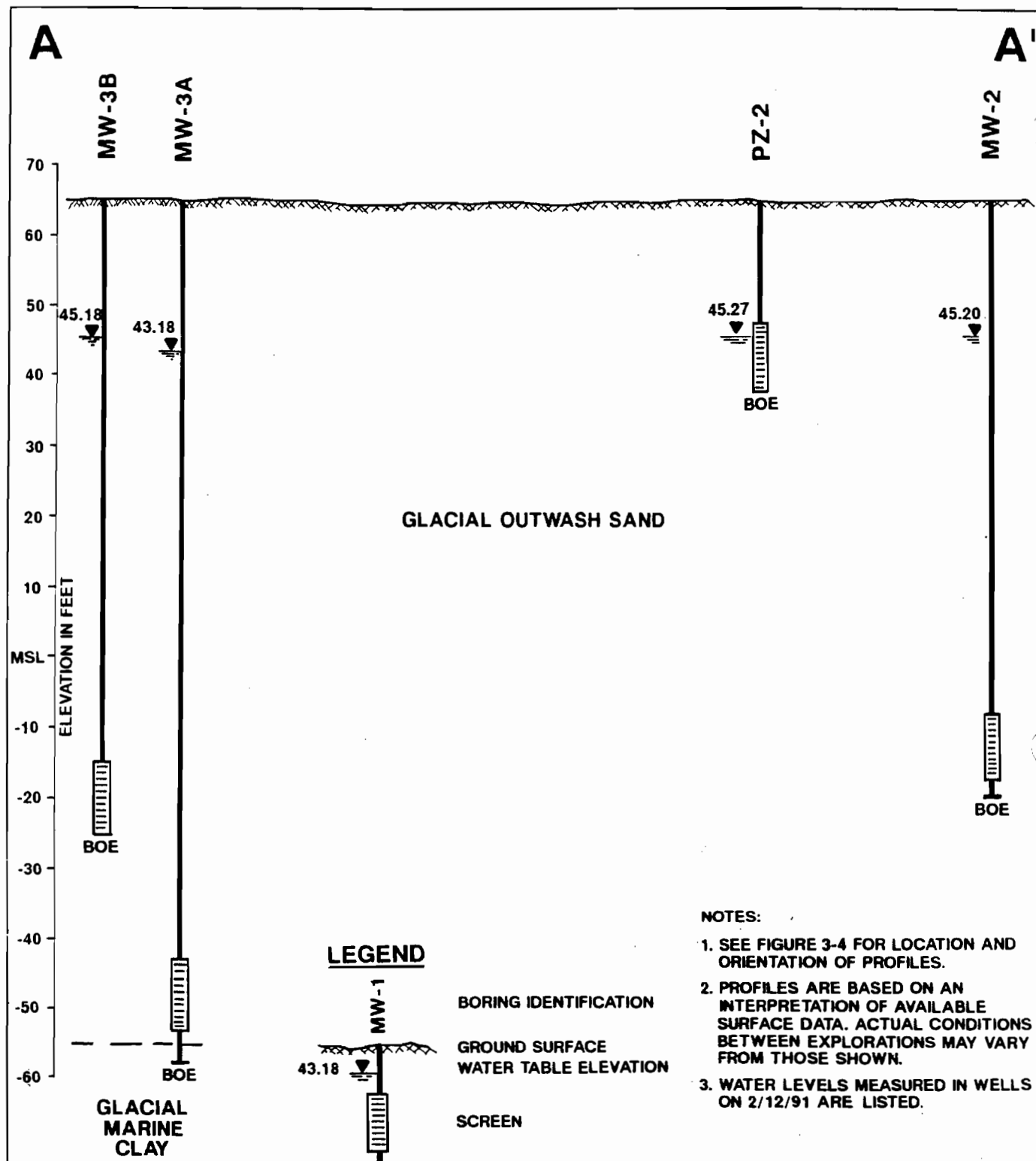
3.1.4.2 Upgradient Monitoring Wells. Monitoring wells MW-2, MW-3A, and MW-3B were installed upgradient of the ServAll property, on the north side of Drayton Avenue. The well screen depths ranged from 85 to 120 feet bgs and are shown in profile along with PZ-2 in Figure 3-5, Geologic Profile A - A'.

3.1.4.3 Source Area Monitoring Well. Monitoring well MW-1 is located on-site, behind the ServAll building within the source area. This well was installed in soil boring SB-1. It is a 4-inch ID PVC well with the screen placed at 76.5 to 86.5 feet bgs. MW-1 is shown in profile in Figure 3-6, Geologic Profile B - B'.

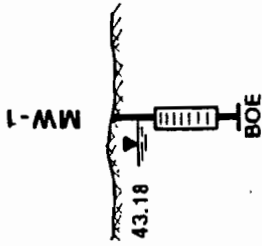
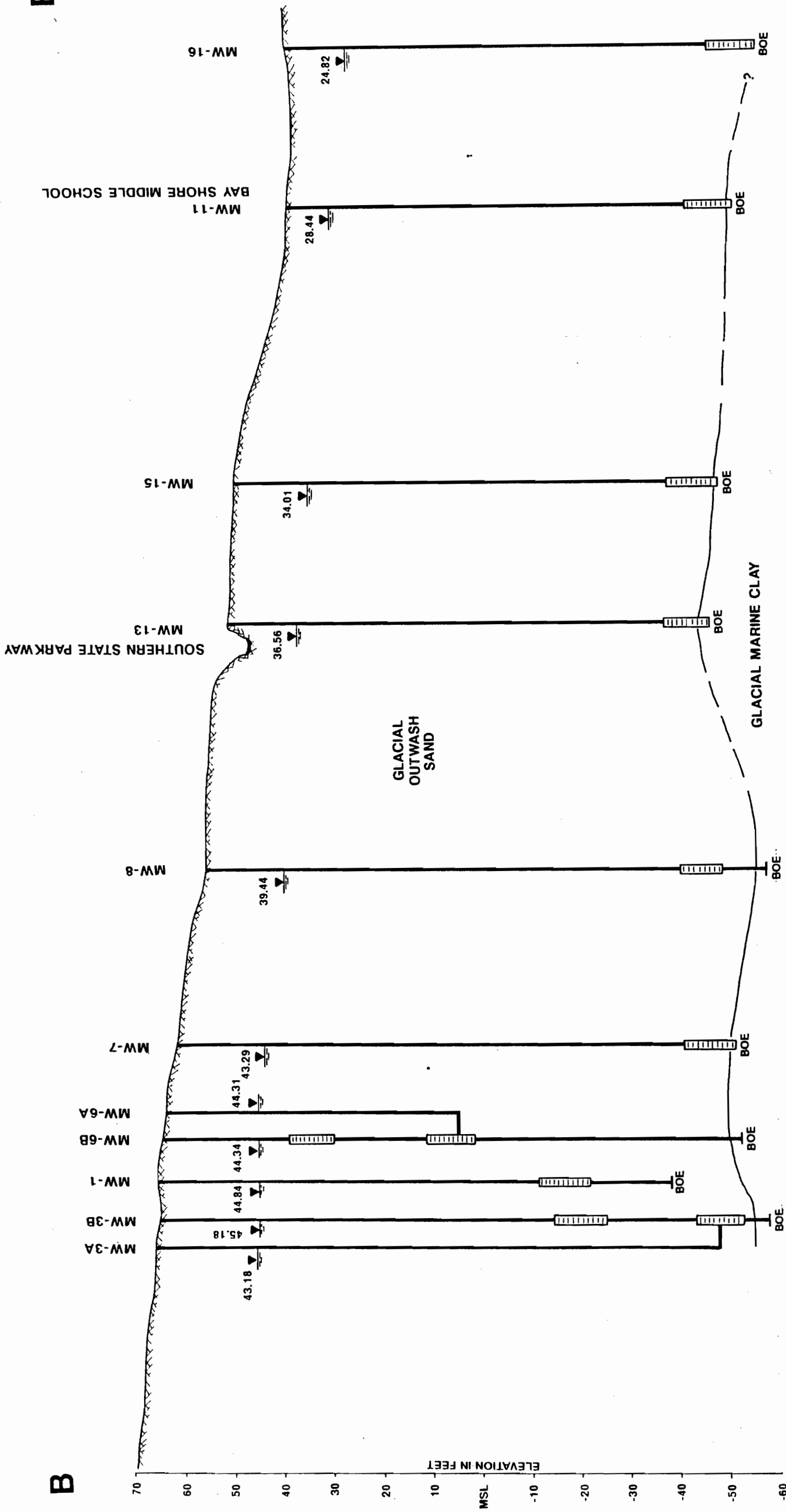
3.1.4.4 Downgradient Monitoring Wells. Fourteen monitoring wells were installed downgradient of the ServAll property. Eight wells, MW-6A, MW-6B, MW-7, MW-8, MW-11, MW-13, MW-15, and MW-16, are located on the estimated axis of the known groundwater plume. The well farthest downgradient of the site is MW-16, located on Abrew Street. MW-16 is screened above the Gardiners Clay unit at the distal end of the plume, and was installed there to evaluate the extent of plume migration to date. The relative screen depths of the axial wells are listed in Table 3-1 and shown in profile in Figure 3-6, Geologic Profile B - B'.

To delineate the lateral extent of the plume to the east and west of the plume axis, three sets of "fence" wells were placed so that a line connecting the wells in a fence is approximately perpendicular to the plume axis.

Nearest to the site, MW-4, PZ-4, MW-5, PZ-5, MW-6A, and MW-6B form a fence just downgradient of the site on Frederick Avenue. The screen depths of the monitoring wells and piezometers in this fence range from 17 to 85 feet bgs. The relative screen depths are shown in profile in Figure 3-7, Geologic Profile C -



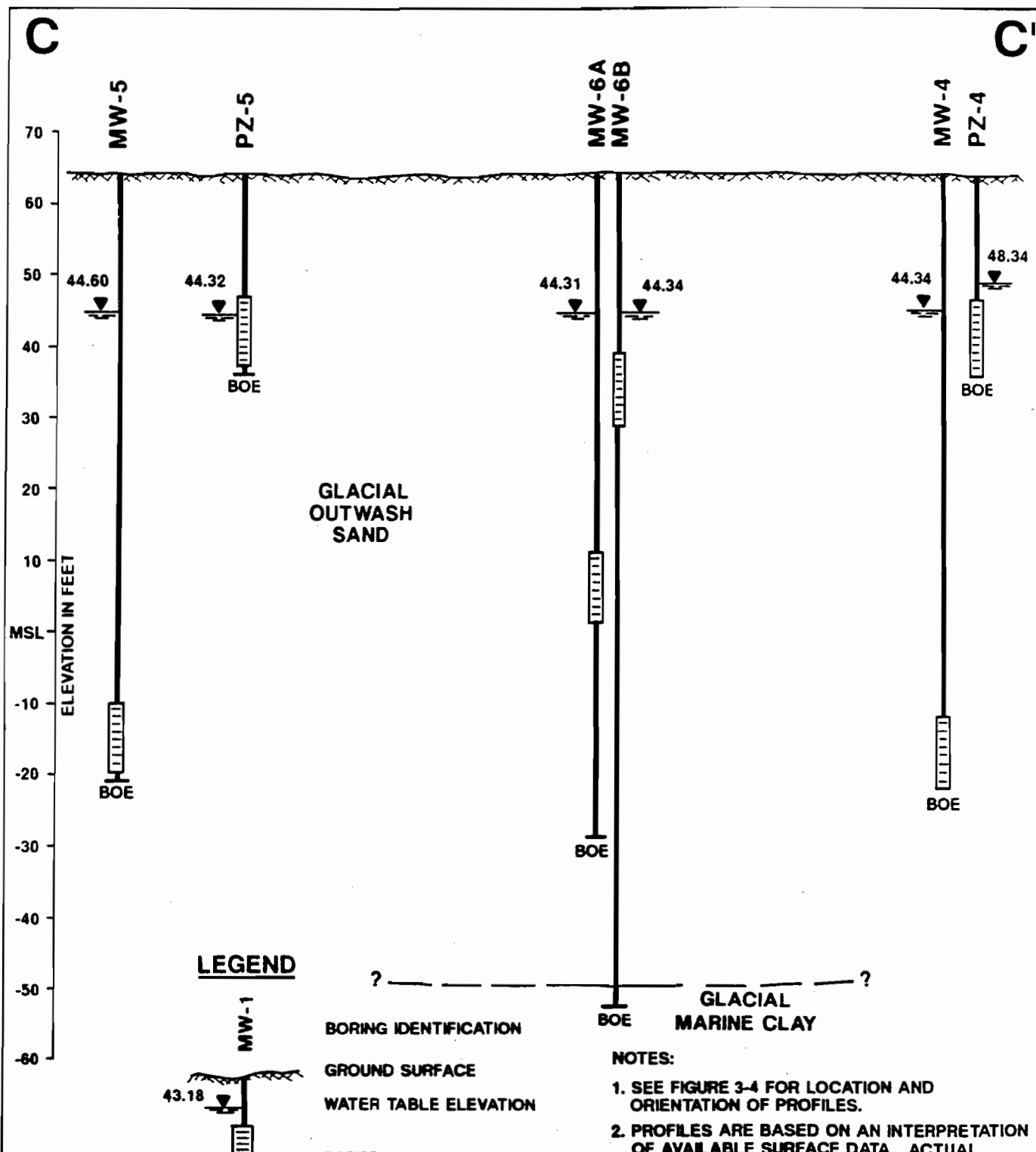
B'



- NOTES:
1. SEE FIGURE 3-3 FOR LOCATION AND ORIENTATION OF PROFILES.
 2. PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE DATA. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.
 3. WATER LEVELS MEASURED IN WELLS ON 2/12/91 ARE LISTED.
 4. WELLS 3A, 3B, 6A, AND 6B WERE INSTALLED IN SEPARATE BORINGS.

FIGURE 3-6
GEOLOGIC PROFILE B-B'
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

ECJORDANCO



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The middle fence, made up of MW-12, MW-13, and MW-14, is located near the trees on the southern edge of the Southern State Parkway right-of-way. The screen depths range from 83 to 97 feet bgs. The relative screen depths are shown in profile in Figure 3-8, Geologic Profile D - D'.

The distal fence is made up of MW-9, MW-10, and MW-11. Monitoring wells MW-9 and MW-11 are located on the northern edge of the Bay Shore Middle School playing fields, and MW-10 is located on East Forks Road near the northwest entrance to the South Shore Mall. The well screen depths range from 78 to 90 feet bgs and are shown in profile in Figure 3-9, Geologic Profile E - E'.

3.1.5 Preliminary Hydraulic Conductivity Testing

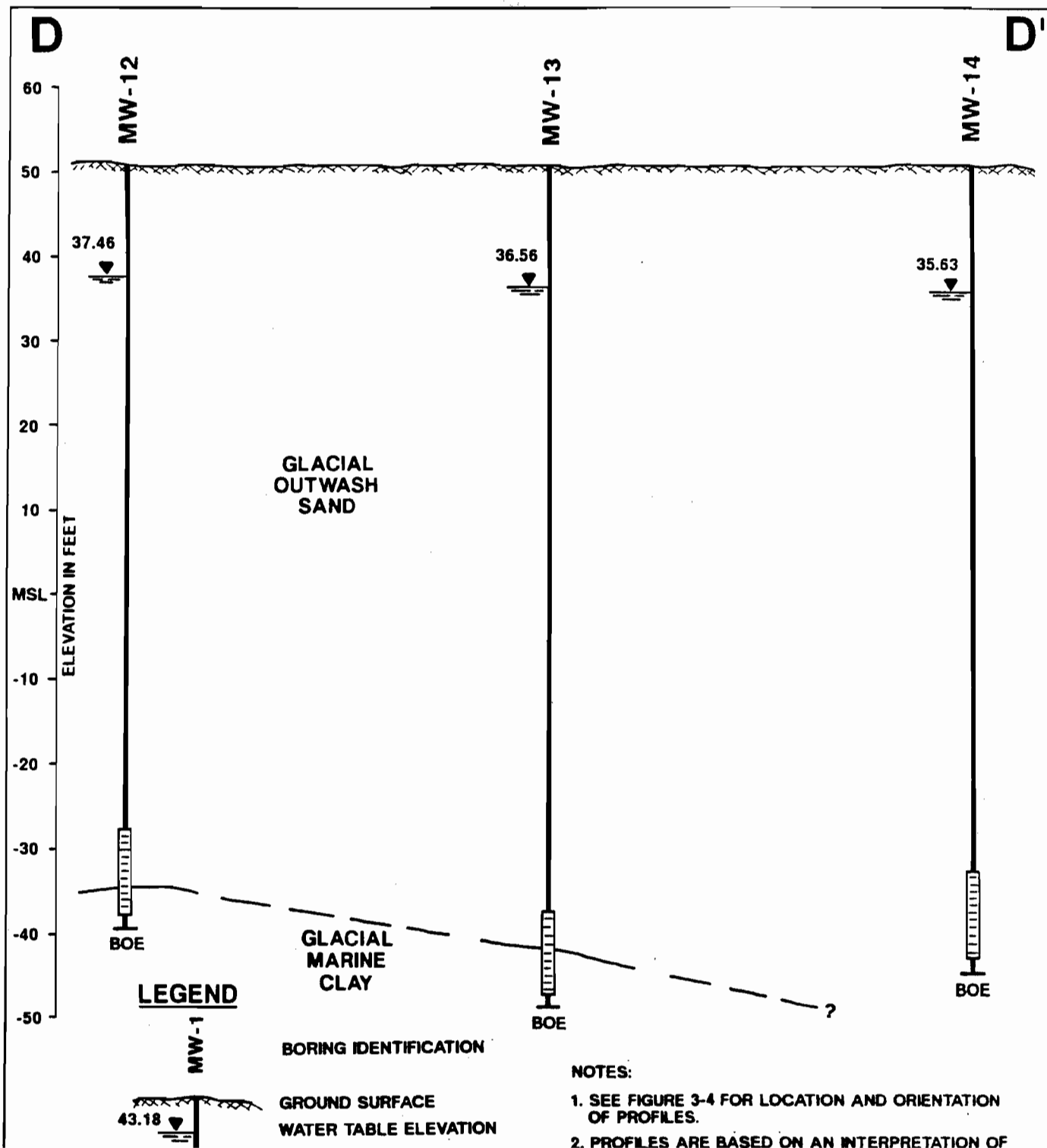
Hydraulic conductivity tests were performed in all of the new monitoring wells during the week of February 4th, 1991. A 7-foot-long, 1-inch outside diameter (OD) PVC slug was used to displace the water level in each well. The rate of recovery of the aquifer to equilibrium conditions was measured with a 20 pounds per square inch (psi) pressure transducer. Data from falling-and rising-head tests were recorded at each location with a Hermit Data Logger Model 1000, and downloaded periodically to computer files at the site operations trailer. The results of the testing are discussed in Subsection 4.2.

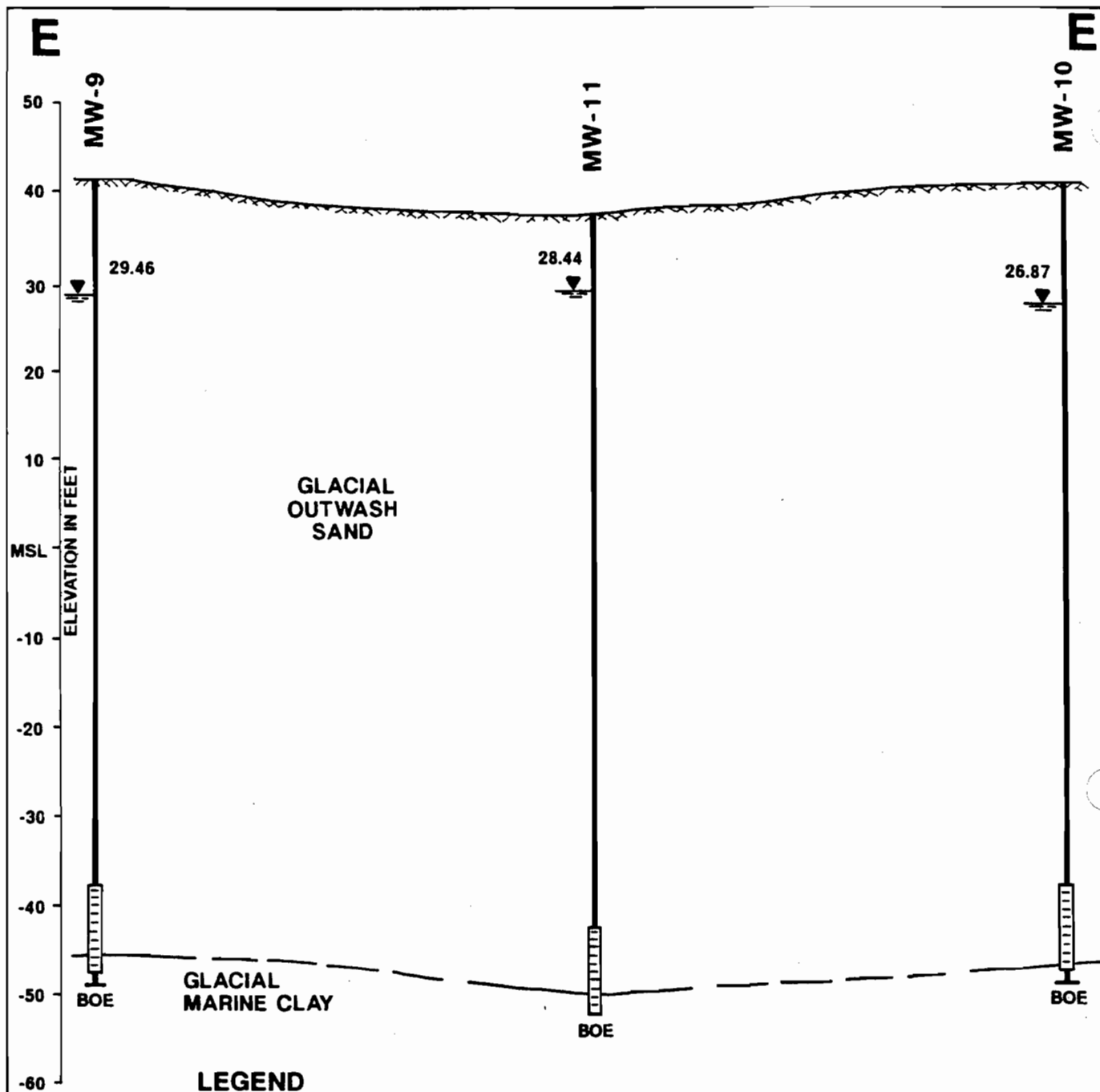
3.1.6 Exploration Location Survey

VEP Associates Inc., as a subcontractor to Jordan, conducted an exploration location survey during the week of February 12, 1991. The scope of work included location of the soil borings, piezometers, and monitoring wells as follows:

- Horizontal positions were established to the nearest 1 foot and the vertical position at the natural ground surface to the nearest 0.1 foot for soil borings, piezometers, and monitoring wells.
- Two additional vertical positions, (1) the top of the uncapped well risers and (2) the rims of the protective casings, were established to the nearest 0.01 foot for the monitoring wells and piezometers.

The horizontal positions of the ServAll RI explorations were tied into the New





NOTES:

1. SEE FIGURE 3-4 FOR LOCATION AND ORIENTATION OF PROFILES.
2. PROFILES ARE BASED ON AN INTERPRETATION

3.2 ANALYTICAL PROGRAM

The analytical parameters and methods described in this Subsection were selected to evaluate the nature of chemicals in soil and groundwater and to delineate, to the extent possible, the contaminated groundwater plume in the aquifer underlying and downgradient of the site. Subsection 3.2.1 discusses the Data Quality Objectives (DQOs). Subsections 3.2.2 and 3.2.3 present the specific chemical analytical parameters and methods selected to meet these objectives. Subsection 3.2.4 presents laboratory data evaluation procedures, including data reduction, validation, and reporting formats. ARARs and SCGs are identified in Subsection 3.2.5. The standards used to evaluate potential site contaminants are presented in Subsection 3.2.6. Subsection 3.2.7 presents selected physical parameters that were measured to further evaluate overall groundwater quality.

The quality assurance requirements and data quality objectives developed for this RI are outlined in further detail in the QAPP (E.C. Jordan Co., 1990). The analytical procedures and methods used for field GC screening are defined in "Purge and Trap Analysis of Volatile Compounds by Field Gas Chromatography" (E.C. Jordan Co. SOP FGCPT-001-01, 1991), which is presented in Appendix C. The analytical procedures used for the laboratory analyses follow the NYSDEC ASP (1989).

3.2.1 Data Quality Objectives

DQOs are based on the premise that different data uses require different levels of data quality. Data quality refers to the degree of uncertainty of analytical data with respect to precision, accuracy, representativeness, completeness, and comparability (PARCC). These objectives are established based on site conditions, the purpose of the field program, and the knowledge of the measurement systems used for the generation of analytical data. The data obtained during the ServAll field program will be used for site characterization and other uses consistent with an RI.

No major quality control problems were observed during the data validation process that would affect the usability of sample results. A discussion of laboratory data quality as it relates to the PARCC objectives is presented in the following subsections. The laboratory data were subjected to data validation, and

SECTION 3

3.2.1.1 Precision and Accuracy. Precision refers to the reproducibility of a measurement under certain specified conditions, and accuracy measures the bias associated with the sampling and analysis process. Precision and accuracy are affected by both field and laboratory conditions. Precision was monitored through the analysis of field and laboratory duplicate samples; accuracy was measured through the analysis of field and laboratory blanks, matrix spikes, and surrogate spikes. The ASP protocols used for the analysis of samples collected for the ServAll field program define the criteria for acceptable precision and accuracy, and these criteria are presented in Table 3-3.

3.2.1.2 Representativeness. Measurements are made so that the results obtained are representative of the sampling population, the medium (e.g., soil and groundwater), and the site conditions. Sampling protocols were developed to ensure that samples were representative of the media, that sampling locations were properly selected, and that a sufficient number of samples were collected. Sample handling protocols (chain-of-custody, storage, and transportation) were adequate to preserve the sample integrity. Proper documentation established that the correct protocols had been followed.

3.2.1.3 Completeness. The characteristic of completeness is defined as the percentage of valid data obtained compared to what would be expected under normal conditions. The USEPA has found that Contract Laboratory Program (CLP) protocols typically generate data that is 80 percent complete. Because sampling activities are often influenced by field conditions, the ServAll RI WP provided estimates of the number of samples to be collected during the field program. There were no significant deviations from the field program proposed.

3.2.1.4 Comparability. The characteristic of comparability reflects both the internal consistency of measurements and the expression of results in units consistent with other organizations reporting similar data. Each value reported for a given measurement should be similar to other values within the same data set and with other related data sets. Comparability was assured through the use of standardized sampling procedures and ASP analytical methods.

3.2.2 Field Gas Chromatography Screening

The field GC screening method used purge-and-trap techniques to provide real-time evaluation of selected VOCs in water and soil samples. Groundwater and

TABLE 3-3
PRECISION AND ACCURACY ACCEPTANCE CRITERIA
USEPA CLP ORGANICS SOW 2/88
MATRIX SPIKE RECOVERY LIMITS & RELATIVE PERCENT DIFFERENCE

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

FRACTION	MATRIX SPIKE COMPOUND	PERCENT RECOVERY		RELATIVE PERCENT DIFFERENCE	
		WATER	SOIL/SEDIMENT	WATER	SOIL/SEDIMENT
VOA	1,1-Dichloroethene	81-145	59-172	14	22
VOA	Trichloroethene	71-120	82-137	14	24
VOA	Chlorobenzene	75-130	60-133	13	21
VOA	Toluene	76-125	59-139	13	21
VOA	Benzene	76-127	66-142	11	21
BN	1,2,4-Trichlorobenzene	39-98	38-107	28	23
BN	Acenaphthene	46-118	31-137	31	19
BN	2,4-Dinitrotoluene	24-96	28-89	38	47
BN	Pyrene	26-127	35-142	31	36
BN	N-nitroso-di-n-propylamine	41-116	41-126	38	38
BN	1,4-Dichlorobenzene	36-97	28-104	28	27
ACID	Pentachlorophenol	9-103	17-109	50	47
ACID	Phenol	12-89	26-90	42	35
ACID	2-Chlorophenol	27-123	25-102	40	50
ACID	4-Chloro-3-methylphenol	23-97	26-103	42	33
ACID	4-Nitrophenol	10-80	11-114	50	50
PESTICIDES/PCBs	gamma-BHC (Lindane)	56-123	46-127	15	50
PESTICIDES/PCBs	Heptachlor	40-131	35-130	20	31
PESTICIDES/PCBs	Aldrin	40-120	34-132	22	43
PESTICIDES/PCBs	Dieldrin	52-126	31-134	18	38
PESTICIDES/PCBs	Endrin	56-121	42-139	21	45
PESTICIDES/PCBs	4,4'-DDT	38-127	23-134	27	50

FIELD DUPLICATE PRECISION RELATIVE PERCENT DIFFERENCE CRITERIA

	WATER	SOIL
For sample results > 5 x CRQL	30	50
For sample results < 5 x CRQL	2 x CRQL	4 x CRQL

SPIKE RECOVERY LIMITS

	WATER	SOIL/SEDIMENT
All analytes	75-125	75-125

LABORATORY DUPLICATE PRECISION CRITERIA

SECTION 3

contamination profiles within the saturated zone and to aid in screen placement for the monitoring wells. The target analytes were:

- PCE
- TCE
- trans-1,2-DCE
- vinyl chloride
- chloroform
- 1,2,4-trimethylbenzene
- 1,3,5-trimethylbenzene

A Hewlett Packard Model 5890 GC equipped with an electrolytic conductivity detector (ELCD) and a photoionization detector (PID) was used to analyze chlorinated and aromatic compounds, respectively. Compound separation was achieved using a J & W Scientific DB-624 column in conjunction with the following temperature program:

- Initial temperature = 50°C (Celsius)
- Rate = 8°C/minute
- Final temperature = 135°C
- Final time = 4 minutes

Compound identifications were made based on standard elution times and a retention time window of ± 3.0 percent.

The GC screening results for each exploration are presented in Appendix B-1.

3.2.3 Laboratory Analysis

Nytest Environmental, Inc., as a subcontractor to Jordan, provided USEPA CLP analytical services for the ServAll RI field program. The laboratory procedures that Nytest followed to complete the analytical program are specified in the NYSDEC ASP (1989). These analytical protocols and the required laboratory deliverables were developed to provide legally defensible data.

The analytical parameters are as follows:

- Total Suspended Solids (TSS)
- Total Dissolved Solids (TDS)
- Total Organic Carbon (TOC)
- Total alkalinity

3.2.4 Data Evaluation

The purpose of data evaluation is to ensure that laboratory analytical data are comparable, adequate in quality, and sufficient in quantity to meet project objectives. There are three steps to the data evaluation process:

- data reduction
- data validation
- data reporting

Data reduction is the process of converting measurement system outputs to an expression of the parameter which is consistent with the comparability objective. Data validation is a systematic process of reviewing a body of data to provide assurance that the data are adequate for their intended use. Data reporting presents the body of analytical results in formats suitable for review.

3.2.4.1 Data Reduction. Upon receipt from Nytest Environmental, Inc., analytical data packages in the format specified by the ASP were manually entered into a computerized data base by Jordan personnel. The original hard copy data packages were stored in a secure and retrievable fashion.

3.2.4.2 Data Validation. Validation of laboratory data was performed in accordance with "Laboratory Data Validation, Functional Guidelines for Evaluating Organics Analyses" (USEPA, 1988) and "Laboratory Data Validation, Functional Guidelines for Evaluating Inorganics Analyses" (USEPA, 1988), as well as appropriate USEPA Region II revisions to these protocols. In addition, the validation protocols were modified to include laboratory requirements in the NYSDEC ASP. Data validation activities are presented in detail in the QAPP (E.C. Jordan Co., 1990).

3.2.4.3 Data Reporting. Three presentations of the analytical data were prepared

SECTION 3

2. The annotated data resulting from the validation process, tabulated in the same format (Table 2)
3. The summary data, presenting only those data above Contract-Required Quantitation Limits (CRQLs) that survive the validation process and are considered suitable for site contaminant interpretation (Table 3)

The data tables are presented in Appendix B-2.

3.2.5 Identification of Applicable or Relevant and Appropriate Requirements and State Criteria and Guidelines

ARARs and SCGs are federal and state human health and environmental requirements used to (1) evaluate the appropriate extent of site cleanup, (2) define and formulate remedial action alternatives, and (3) govern implementation and operation of the selected action.

3.2.5.1 Definition of ARARs and SCGs. To properly consider ARARs and SCGs and to clarify the function of these requirements in the RI/FS and remedial response processes, the National Contingency Plan (NCP) defines two ARAR components: (1) applicable requirements, and (2) relevant and appropriate requirements. These definitions are discussed in the following paragraphs.

Applicable requirements are those federal and state requirements that would be legally applicable, either directly or as incorporated by a federally authorized state program. Requirements that specifically address, and have jurisdiction over, a given situation are considered "applicable requirements." An example of an applicable requirement is the use of Maximum Contaminant Levels (MCLs) for a site where groundwater contamination enters a public water supply.

Relevant and appropriate requirements are those federal and state requirements that, while not legally "applicable," can be applied if the decision-maker's best professional judgment determines that site circumstances are sufficiently similar to those situations that are covered and use of the requirement makes good sense. Relevant and appropriate requirements are intended to have the same weight and consideration as applicable requirements.

appropriate, be included as an ARAR for the site. For example, MCLs would be relevant and appropriate requirements at a site where groundwater contamination could affect a potential (rather than actual) drinking water source.

Other requirements to be considered (TBCs) are federal and state nonpromulgated advisories or guidelines that are not legally binding and do not have the status of potential ARARs and SCGs. However, if there are no specific ARARs and SCGs for a chemical or site condition, or if existing ARARs and SCGs are not deemed sufficiently protective, then guidance or advisory criteria should be identified and used to ensure human health and environmental protection.

3.2.5.2 Identification of ARARs and SCGs. Under the description of ARARs set forth in the NCP, state and federal environmental requirements must be considered. These requirements include ARARs that are:

- location-specific (i.e., pertain to existing site features),
- chemical-specific (i.e., govern the level or extent of site remediation), and
- action-specific (i.e., pertain to proposed site remedies and govern implementation of the selected site remedy).

Action-specific ARARs are usually technology- or activity-based limitation controlling action at hazardous waste sites. Action-specific ARARs are identified and discussed in Section 13.0.

Chemical-Specific ARARs and SCGs. Chemical-specific ARARs and SCGs are usually health- or risk-based standards limiting the concentration of a chemical found in or discharged to the environment. They govern the extent of site remediation by providing either actual clean-up levels, or the basis for calculating such levels. For example, groundwater standards may provide necessary clean-up goals for sites with contaminated groundwater. Chemical-specific ARARs and SCGs for the site may also be used to indicate acceptable levels of discharge in determining treatment and disposal requirements, and to assess the effectiveness

TABLE 3-4
CHEMICAL-SPECIFIC APPLICABLE, RELEVANT AND APPROPRIATE REQUIREMENTS
AND STATE PROMULGATED STANDARDS AND GUIDANCE DOCUMENTS

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE RI/FS
1/A-Maximum Residual Levels MCLs) (40 CFR 141.11 - 116)	Relevant and Appropriate	MCLs have been promulgated for several common organic and inorganic contaminants. These levels regulate the concentration of contaminants in public drinking water supplies, but may also be considered relevant and appropriate for groundwater aquifers used for drinking water.	To assess the potential risks to human health due to consumption of groundwater, contaminant concentrations were compared to their MCLs.
1/A-Maximum Residual Level Goals MCLGs) (40 CFR 141.50 115)	Relevant and Appropriate	MCLGs are health-based criteria to be considered for drinking water sources as a result of SARA. MCLGs are available for several organic and inorganic contaminants.	The 1990 National Contingency Plan states that non-zero MCLGs are to be used as goals. Contaminant concentrations in groundwater were compared to their MCLGs.
1/A - Subpart F Groundwater Protection Standards, Alternative Concentration Limits (CFR 264.94)	Relevant and Appropriate	This requirement outlines standards, in addition to background concentrations and MCLs, to be used in establishing clean-up levels for remediating groundwater contamination.	These requirements may be relevant and appropriate if certain conditions relating to transport and exposure are met.
1/A Risk Reference Doses (RfDs)	To Be Considered	RfDs are considered the levels unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure for a lifetime.	USEPA RfDs are used to characterize risks due to noncarcinogens in various media.
1/A Carcinogen Assessment Group Carcinogenic Potency Factors (CPFAs)	To Be Considered	Carcinogenic effects present the most up-to-date information on cancer risk potency derived from USEPA's Carcinogen Assessment Group.	USEPA CPFAs are used to compute the individual incremental cancer risk resulting from exposure to certain compounds.

TABLE 3-4 (continued)
CHEMICAL-SPECIFIC APPLICABLE, RELEVANT AND APPROPRIATE REQUIREMENTS
AND STATE PROMULGATED STANDARDS AND GUIDANCE DOCUMENTS

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE RI/FS
Particulate Water Concentrations (6 to 701 - 703)	Applicable	New York State has established classifications for groundwater based on use. The regulation also sets forth concentration limits for 83 compounds, that are to be exceeded in groundwater except due to natural conditions.	This standards will be reviewed and evaluated when determining target clean-up levels or potential discharge limits. State standards apply when they are more stringent than federal standards.
State Drinking Water (10 part 5-1)	Relevant and Appropriate	This requirement outlines MCLs that are not to be exceeded in public water supplies. Where MCLs have been exceeded, action is to be taken to comply with regulatory standard which can include remedial and feasibility studies and subsequent installation of a suitable treatment process.	These standards will be reviewed and evaluated when determining target clean-up levels or potential discharge limits. State standards apply when they are more stringent than federal standards.
State of Health PWS 69 - Chemical Action Drinking Water	To Be Considered	This technical document outlines concentrations of certain organic chemicals that are to be used in evaluating appropriate response for chemicals without MCLs.	Action levels provide a decision-making mechanism as to whether steps are required to protect public health if organic chemicals contaminate a drinking water supply.
State - National Primary and Ambient Air Standards	Applicable	Primary ambient air quality standards define levels of air quality to protect public health. Secondary ambient air quality standards protect public welfare from known or anticipated adverse effects from pollutants.	Particulate standard for matter less than 10 microns is 150 $\mu\text{g}/\text{m}^3$, 24-hour average concentration.

TABLE 3-4 (continued)
CHEMICAL-SPECIFIC APPLICABLE, RELEVANT AND APPROPRIATE REQUIREMENTS
AND STATE PROMULGATED STANDARDS AND GUIDANCE DOCUMENTS

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE RI/FS
Work Air Pollution Regulations - Provisions 0.6)	Applicable	An air contamination source may not emit air contaminants in quantities that would exceed ambient air quality standards.	Activities conducted at the ServAll site should not result in the release of regulated contaminants in concentrations that exceed ambient air quality standards.
Work Air Pollution Regulations - Prohibitions 1.2)	Applicable	Air contaminants are not to be emitted to the outdoor atmosphere in quantity, characteristic, or duration which is injurious to public health or the environment.	Activities that include the release of air contaminants should not result in emissions at concentrations that exceed risk - or public health-based standards.
Work Air Quality Standards (Part 257)	Applicable	Air quality standards are designed to provide protection from adverse health effects from air contaminants.	Particulate standards for matter less than 10 microns is 250 $\mu\text{g}/\text{m}^3$, 24-hour average concentration.
Work State Air Quality Guidelines for Control of Toxic Air Contaminants	To Be Considered	This guide outlines Ambient Guideline Concentrations (AGCs). AGCs are numerical values to be used as a screening mechanism for permit applications and determining the needs for additional air quality controls.	AGCs can be used in determining potential impacts of emissions of toxic contaminants and evaluating the needs for air quality controls.

Concentration
Regulations
or
inant Level
inant Level Goals
Rules and Regulations
Department of Health
tion and Recovery Act

RfD - Reference dose
SARA - Superfund Amendments and Reauthorization Act
SDWA - Safe Drinking Water Act
 $\mu\text{g}/\text{m}^3$ - microgram per cubic meter
USEPA - U.S. Environmental Protection Agency

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Drinking water standards, promulgated under the Safe Drinking Water Act (40 CFR 141.11 - 141.16), New York Groundwater Quality Standards (6 NYCRR Part 703), New York State Ambient Water Quality Standards and Guidance Values (NYSDEC, 1991), and New York Public Water Supplies (10 NYCRR Subpart 5-1), will be used during the RI/FS to compare to the concentration of contaminants detected in the groundwater. Groundwater is used as a drinking water source in Suffolk County; therefore, these standards are applicable to ServAll.

Location-Specific ARARs and SCGs. Location-specific ARARs and SCGs govern natural site feature (e.g., wetlands, floodplains, and sensitive ecosystems) and man made features (e.g., existing landfills, disposal areas, and places of historical or archeological significance). These ARARs and SCGs generally restrict the concentration of hazardous substances or the conduct of activities solely based on a site's particular characteristics or location. Table 3-5 provides a list and synopses of potential location-specific standards that apply to the site.

Because of the relatively small size of the ServAll site and its location in a developed, suburban area, many location-specific ARARs and SCGs pertaining to natural resources do not apply to this site. The site is located in Suffolk County, which has been designated as a sole source aquifer area. Under the Safe Drinking Water Act, USEPA may make the designation of sole source aquifer if an area has an aquifer that has is the sole or principal source of drinking water which, if contaminated, would create a significant hazard to human health.

3.2.6 Assessment of Potential Site Contaminants

To evaluate which compounds are potential site contaminants, the validated analytical results will be compared to background concentrations and/or standards established by NYSDEC or USEPA. A site contaminant is a chemical detected in environmental samples from the site at concentrations exceeding appropriate background levels. The specific methods used to evaluate the laboratory results are described in the following paragraphs.

For soil samples, organics detected at concentrations above the detection limit will be considered potential site contaminants unless they can be attributed to

TABLE 3-5
LOCATION-SPECIFIC APPLICABLE, RELEVANT AND APPROPRIATE REQUIREMENTS
AND STATE PROMULGATED STANDARDS AND GUIDANCE DOCUMENTS

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	CONSIDERATION IN THE RI/FS
Drinking Water Protection 1424(e) Source Aquifer Protection	Applicable	This section of the Safe Drinking Water Act allows USEPA to designate sole source aquifers in areas where the aquifer is the sole or principal source of drinking water.	Nassau and Suffolk Counties were designated as Sole Source Aquifers (43 FR 120) June 21, 1978.
Groundwater Protection and Guidance (2.1.3) Primary Principal Aquifer Protection	To Be Considered	This document provides guidance for determining whether an aquifer is considered a Primary Water Supply Aquifer or Principal Aquifer.	The Division of Water is responsible for making Primary Water Supply and Principal aquifer determinations. Factors for determination include groundwater productivity, natural water quality, aquifer vulnerability and geologic and hydrogeologic characteristics.
Underground Storage Tanks (40 CFR 26.100)	Relevant and Appropriate	These regulations outline the design, construction, operation, and closure requirements for USTs greater than 110 gallons containing petroleum or hazardous substances. Additional requirements pertain to release reporting, investigation and corrective action.	Standards set forth in this regulation are potentially relevant and appropriate if the tanks have leaked or require closure.

Regulations
on & Recovery Act
Protection Agency
tank

TABLE 3-6
BACKGROUND SOIL CONCENTRATION RANGES

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

COMPOUND	NEW YORK REGION ¹ (mg/kg)	EASTERN UNITED STATES (mg/kg) ²
Aluminum	1,000 - 25,000	700 - >10,000
Arsenic	3 - 12	<0.1 - 73
Barium	15 - 600	10 - 1,500
Beryllium	0 - 1.75	<1 - 7
Cadmium	0.01 - 2	NA
Calcium	130 - 35,000	100 - 28,000
Chromium	1.5 - 40	1 - 1,000
Cobalt	2.5 - 60	<0.3 - 70
Copper	1 - 15	<1 - 700
Iron	17,500 - 25,000	10 - >10,000
Lead	10 - 37	<10 - 300
Magnesium	1,700 - 6,000	50 - 5,000
Manganese	50 - 5,000	<2 - 7,000
Mercury	0.042 - 0.066	0.01 - 0.34
Nickel	0.5 - 25	<5 - 700
Potassium	8,500 - 43,000	5 - 3,700
Selenium	<0.1 - 0.125	<0.1 - 3.9
Silver	NA	NA
Sodium	6,000 - 8,000	50 - 5,000
Vanadium	25 - 60	<7 - 300
Zinc	37 - 60	<20 - 2,000

NOTE:

¹ Concentrations obtained from "Background Concentrations of 20 Elements in Soils with Special Regard for New York State". (no date) Paper prepared by E. Carol McGovern, NYSDEC Wildlife Resources Center.

² Shacklette, M.T. and J.G. Boerngen, 1984. Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States"; USGS Professional Paper 1270.

NA - Not Available

SECTION 3

background concentrations were established by using soil data compiled by NYSDEC Wildlife Resources Center (McGovern, n.d.). The New York Region concentration ranges in the table are for soils from uncontaminated and undisturbed areas of New York far from any sources of pollution. These values may not be representative of background levels in highly industrialized regions, such as ServAll; therefore, background concentration data for the Eastern United States has also been included. An inorganic compound will be considered a potential site contaminant if the concentration of that compound exceeds either of these ranges and/or those of site background samples.

For groundwater, concentrations of both organic and inorganic compounds will be compared to both New York State and federal standards (See Table 3-7) as well as background concentrations detected in upgradient wells. The primary standards for comparison are New York State Class GA groundwater standards. If a compound has no associated Class GA standard, concentrations will be compared to New York State Drinking Water Standards or federal MCLs. If the concentration of a compound exceeds the appropriate standard, it will be compared to background concentrations to evaluate whether the contaminant is site-related. If the concentration of a compound is less than the appropriate standard, but greater than background concentrations, it will still be considered a potential site contaminant. If no standards exist for a compound, its concentration will be compared to background concentrations to evaluate whether it is a potential site contaminant.

3.2.7 Field Parameters

During the groundwater sample collection rounds, selected water quality parameters were measured to ensure that representative samples were collected, and to provide data to assess the quality of groundwater in the aquifer. The following field parameters were measured by Jordan personnel during the groundwater collection phase of the field program:

- pH
- specific conductance
- temperature
- dissolved oxygen

During the purging step prior to the collection of each groundwater sample, a YSI

TABLE 3-7
GROUNDWATER STANDARDS AND GUIDANCE

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

Compound Type	NY STATE Groundwater Quality Class GA (ug/l)	NY STATE Drinking Water Supplies (ug/l)	FEDERAL MCL (ug/l)	FEDERAL MCLG (ug/l)	FEDERAL WQC Drink (ug/l)
<u>VOLATILE ORGANIC COMPOUNDS</u>					
1,1-Dichloroethene	5	5	7	7	0(33 ng/l)
1,1-Dichloroethane	5	5			
1,1,1-Trichloroethane	5	5	200	200	19000
1,1,2-Trichloroethane	5	5	(5)	(3)	0(0.6)
1,1,2,2-Tetrachloroethane	5	5			0(0.17)
1,2-Dichloroethene (total)	5	5	*	*	IND
1,2-Dichloroethane	5	5	5	0	0(0.94)
1,2-Dichloropropane	5	5	(5)	(0)	IND
2-Hexanone	50 G	50			
2-Butanone		50			
2-Chloroethylvinylether		5			
4-Methyl-2-Pentanone		50			
Acetone		50			
Benzene	ND	5	5	0	0(0.67)
Bromodichloromethane	50 GT	100 T	100 T		
Bromoform	50 GT	100 T	100 T		
Bromomethane		5			0(0.19)
Carbon Disulfide		50			
Carbon Tetrachloride	5	5	5	0	0(0.42 ng/l)
Chlorobenzene	5	5	(100)	(100)	488
Chloroethane		5			IND
Chloroform	100 T	100 T	100 T		0(0.19)
Chloromethane		5			0(0.19)
Cis-1,3-Dichloropropene	5	5			87
Dibromochloromethane	50 GT	100 T	100 T		0(0.19)
Ethylbenzene	5	5	(700)	(700)	2400
Methylene Chloride	5	5	(5)	(0)	0(0.19)
Styrene	5 S	50	(100)	(100)	
Tetrachloroethene	5	5	(5)	(0)	0(0.88)
Toluene	5	5	(1000)	(1000)	15000
Trans-1,3-Dichloropropene	5	5			87
Trichloroethene	5	5	5	0	0(2.8)
Vinyl Acetate		50			
Vinyl Chloride	2	2	2	0	0(2.0)
Xylenes (Total)	5	5	(10000)	(10000)	

TABLE 3-7
(continued)
GROUNDWATER STANDARDS AND GUIDANCE

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

Compound Type	NY STATE Groundwater Quality Class GA (ug/l)	NY STATE Drinking Water Supplies (ug/l)	FEDERAL MCL (ug/l)	FEDERAL MCLG (ug/l)	FEDERAL WQC Drink (ug/l)
<u>SEMI-VOLATILE ORGANIC COMPOUNDS (CONT.)</u>					
2-Methylphenol	+	50			
2,4-Dimethylphenol	+	50			400(ol)
2,4-Dinitrophenol	+	50			70
2,4-Dichlorophenol	+	50			3090
2,4-Dinitrotoluene		5			0(0.11)
2,4,5-Trichlorophenol	+	50			2600
2,4,6-Trichlorophenol	+	50			0(1.8)
2,6-Dinitrotoluene	5	5			
3-Nitroaniline		5			
3,3'-Dichlorobenzidine		50			470
4-Chlorophenyl-phenylether		5			
4-Bromophenyl-phenylether		5			
4-Nitrophenol	+	50			
4-Nitroaniline		5			
4-Methylphenol	+	50			
4-Chloro-3-Methylphenol	+	50			3000
4-Chloroaniline		5			
4,6-Dinitro-2-methylphenol	+	50			
Acenaphthene	20 G	50			0(3.1 ng/l)
Anthracene	50 G	50			0(3.1 ng/l)
Benzo(a)Anthracene	0.002 G	50			0(3.1 ng/l)
Benzo(a)Pyrene	ND	50	(0.2)	(0)	0(3.1 ng/l)
Benzo(b)Fluoranthene	0.002 G	50			0(3.1 ng/l)
Benzo(g,h,i,)perylene		50			0(3.1 ng/l)
Benzo(k)Fluoranthene	0.002 G	50			0(3.1 ng/l)
Benzoic acid		50			
Benzyl alcohol		50			
bis(2-Chloroethoxy)methane		50			
bis(2-Ethylhexyl)phthalate	50 S	50			
bis(2-Chloroisopropyl)ether		5			34.7
bis(2-Chloroethyl)ether	1	5			0(30 ng/l)
Butylbenzylphthalate	50 G	50			
Chrysene	0.002 G	50			0(3.1 ng/l)
Di-n-butylphthalate	50 S	50			44000

TABLE 3-7
(continued)
GROUNDWATER STANDARDS AND GUIDANCE

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

Compound Type	NY STATE Groundwater Quality Class GA (ug/l)	NY STATE Drinking Water Supplies (ug/l)	FEDERAL MCL (ug/l)	FEDERAL MCLG (ug/l)	FEDERAL WQC Drink (ug/l)
<u>SEMI-VOLATILE ORGANIC COMPOUNDS (CONT.)</u>					
Isophorone	50 G	50			5200
N-Nitroso-di-n-propylamine		50			
N-Nitrosodiphenylamine	50 G	50			0(7.0)
Naphthalene	10 G	50			IND
Nitrobenzene	5	5			19800
Pentachlorophenol	+	50	(1)	(0)	200
Phenanthrene	50 G	50			0(3.1 ng/l)
Phenol	+	50			3500
Pyrene	50 G	50			0(3.1 ng/l)
<u>PESTICIDE/PCB COMPOUNDS</u>					
4,4'-DDE	ND				
4,4'-DDD	ND				
4,4'-DDT	ND				0(1.2 ng/l)
Aldrin ***	ND				
alpha-Chlordane	0.1		(2)	(0)	0(22 ng/l)
alpha-BHC	ND				0(73 ng/l)
Aroclor-1248	0.1				0(> 12.6 ng/l)
Aroclor-1254	0.1				0(> 12.6 ng/l)
Aroclor-1242	0.1				0(> 12.6 ng/l)
Aroclor-1221	0.1				0(> 12.6 ng/l)
Aroclor-1016	0.1				0(> 12.6 ng/l)
Aroclor-1232	0.1				0(> 12.6 ng/l)
Aroclor-1260	0.1				0(> 12.6 ng/l)
beta-BHC	ND				0(23.3 ng/l)
delta-BHC	ND				IND
Dieldrin ***	ND				0(1.1 ng/l)
Endosulfan I					138
Endosulfan II					
Endosulfan sulfate					
Endrin Aldehyde					
Endrin ketone					

TABLE 3-7
(continued)
GROUNDWATER STANDARDS AND GUIDANCE

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

Compound Type	NY STATE Groundwater Quality Class GA (ug/l)	NY STATE Drinking Water Supplies (ug/l)	FEDERAL MCL (ug/l)	FEDERAL MCLG (ug/l)	FEDERAL WQC Drink (ug/l)
<u>INORGANIC COMPOUNDS (CONT.)</u>					
Barium	1000	1000	1000	(5000)	
Beryllium	3 G		(1)	(0)	
Cadmium	10	10	5	5	10
Calcium					
Chromium III					179000
Chromium VI	50				50
Chromium	50	50	100	100	
Cobalt					
Copper	200	1000		(1300)	1000(ol)
Cyanide	100		(200)	(200)	
Iron	300	300			
Lead	25	50	50	(0)	50
Magnesium	35000 G				
Manganese	300	300			
Mercury	2	2	2	(2)	10
Nickel			(100)	(100)	15.4
Potassium					
Selenium	10	10	50	50	10
Silver	50	50	50		50
Sodium	20000				
Thallium	4 G		(2/1)	(0.5)	17.8
Vanadium					
Zinc	300	5000			5000(ol)

NOTES:

Federal MCLs and MCLGs from 40 CFR 141.

Federal MCLs and MCLGs in parentheses are proposed (from 54FR22062, 55FR30370, and 56FR3521)

Federal WQCs taken from EPA's Superfund Public Health Evaluation Manual, October 1987, Table 4-7 and Exhibits C-4 and C-6.

New York State Groundwater Quality standards taken from 6NYCRR 703 (March 31, 1986) and Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water Quality Standards and Guidance Values (September 25, 1990). New York State Public Water Supply MCLs taken from 10 NYCRR 5-1 (January 19, 1990).

MCL Maximum Contaminant Level
MCLG Maximum Contaminant Level Goal
WQC Water Quality Criteria (for the protection of human health)

SECTION 3

was calibrated daily with appropriate standards in accordance with the procedures presented in the QAPP (E.C. Jordan Co., 1990).

Dissolved oxygen was measured during the second groundwater sampling round by performing an iodometric method titration on an aliquot from each sample. This method is the standard procedure for measuring dissolved oxygen in water (Franson, 1989).

In the analysis, Mn^{2+} (manganous ion) from manganese sulfate added to the sample aliquot reacts with the dissolved oxygen present in the solution to form a Mn^{4+} oxide hydroxide floc. Alkaline iodide is added to suppress interference from any nitrate present which would react with the iodide. The solution is then acidified with sulfuric acid, whereby the manganese floc is reduced by iodide to produce Mn^{2+} and a quantity of free iodine in proportion to the oxygen present. This process gives the supernate a brown color. A standard sodium thiosulfate solution and a starch indicator, giving a blue color in the presence of free iodine, are then used to titrate the iodine to a clear end point. The dissolved oxygen in the sample is calculated from the quantity of titrant used. The results are summarized in Table 3-8.

TABLE 3-8
GROUNDWATER - FIELD PARAMETERS

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

SAMPLING LOCATION	TEMPERATURE (deg C)		pH		SPECIFIC CONDUCTANCE ($\mu\text{mhos/cm}$)		DISSOLVED OXYGEN
	ROUND 1	ROUND 2	ROUND 1	ROUND 2	ROUND 1	ROUND 2	ROUND 2 *
MW-1	14.5	14.4	5.5	5.4	192	196	1.0
MW-2	15.3	14.8	5.6	5.5	278	263	1.0
MW-3A	13.7	14.1	5.7	6.3	313	238	2.7
MW-3B	14.6	14.2	5.6	5.0	152	152	1.1
MW-4	14.1	14.2	4.7	5.3	331	286	2.4
MW-5	14.0	14.0	6.0	6.2 **	107	38	8.3
MW-6A	14.2	14.5	5.7	5.3	420	427	1.0
MW-6B	14.4	14.5	6.0 **	6.0	280	269	2.4
MW-7	12.9	13.0	5.6	6.2	956	687	1.4
MW-8	12.4	12.7	4.5	5.9	483	404	1.0
MW-9	12.2	12.3	5.7	6.1 **	311	42	2.2
MW-10	11.7	11.8	6.0	7.2 **	178	174	1.7
MW-11	12.3	12.0	4.3	6.3	464	420	0.9
MW-12	12.5	12.7	5.1	5.7 **	490	444	0.9
MW-13	12.3	12.4	6.4	6.4	844	890	2.0
MW-14	12.1	12.3	5.6	6.2 **	118	120	2.7
MW-15	12.4	12.1	5.3	6.7	961	660	2.2
MW-16	11.9	12.0	4.3 **	6.4	310	281	3.1

NOTES

- * Dissolved oxygen was measured only during Round 2.
- ** Initial reading was 1 unit higher than reported; the pH meter was recalibrated or checked with pH paper and pH value adjusted.

4.0 HYDROGEOLOGY

The descriptions of regional and site hydrogeology presented in this report are derived from a review of available scientific literature on the site area and the results of explorations at the site. The regional groundwater discussion is primarily based on information contained in USGS Professional Paper 627-E, Water-Transmitting Properties of Aquifers on Long Island, New York (McClymonds and Franke, 1972). Other scientific articles used in the report are cited as appropriate and listed in the references for this document. The explorations conducted at the site are summarized in Section 3.0.

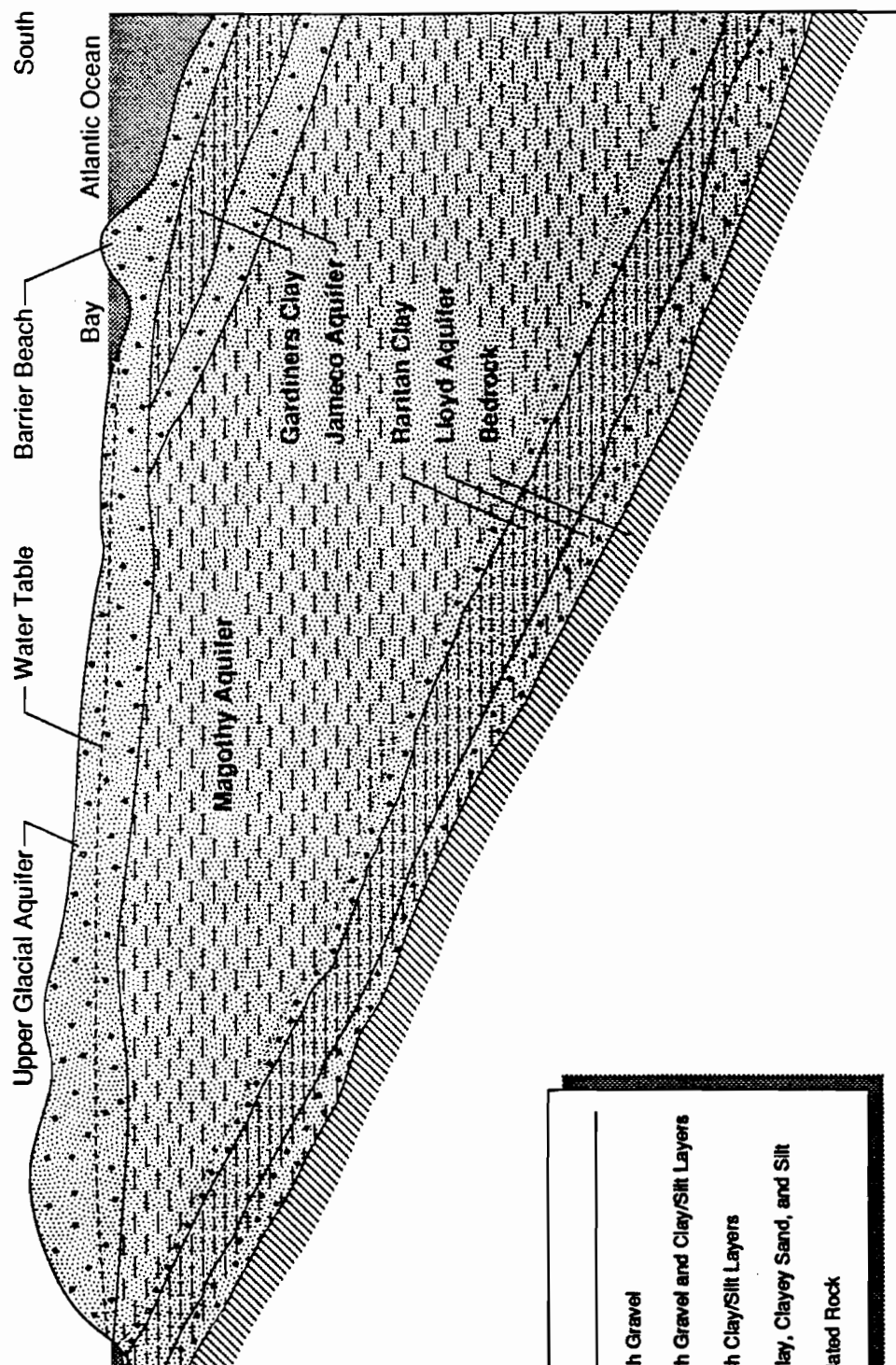
4.1 REGIONAL HYDROGEOLOGY

Southwestern Suffolk County near ServAll is underlain by Late Wisconsin-age glacial outwash deposits of coarsely stratified sand and gravel called the Upper Glacial unit. The Upper Glacial unit outwash deposits rest unconformably on Gardiners Clay, as shown in Figure 4-1. Near the site, Gardiners Clay underlies a zone that is approximately parallel to the south coast of Long Island and extends inland 1 to 5 miles. Gardiners Clay overlies the Jameco Gravel and the Mannetto Gravel, which, in turn, overlie the Cretaceous-age Matawan Group - Magothy Formation, the Raritan Clay and Lloyd Sand Members of the Raritan Formation, and Precambrian-age bedrock.

The major aquifers on Long Island are the upper glacial aquifer, the Magothy aquifer, and the Lloyd aquifer. The upper glacial aquifer is present as a water table aquifer under most of Long Island. It is in hydraulic connection with the Magothy aquifer in areas where Gardiners Clay is absent. Confined conditions predominate in most other parts of the groundwater reservoir on Long Island. The most significant confining layers are Gardiners Clay (where present), discontinuous layers of silt and clay in the Magothy aquifer, and the Raritan Clay.

Groundwater is the sole source of water for public water supplies, agriculture, and industry in Suffolk County. Within 3 miles of the site, the Upper Glacial and Magothy aquifers are used by 13 SCWA well fields, two Brentwood Water District well fields, and the St. Joseph's Convent University well (NUS, 1989). The SCWA system is completely interconnected in this area and serves more than 500,000 people in Bay Shore (NUS, 1989). The Thomas Avenue wells are the

LONG ISLAND



(Frank, 1972)

FIGURE 4-1
REGIONAL STRATIGRAPHY
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

Recharge to the aquifers occurs primarily through precipitation to the water table (Mack and Maus, 1986). The approximate annual rainfall is 46 inches per year (Pluhowski and Kantrowitz, 1964). An estimated 21 inches per year are lost to evapo-transpiration and 1 inch per year to runoff (low, due to the coarse nature of the surface materials); the estimated annual recharge to groundwater is 24 inches per year (Pluhowski and Kantrowitz, 1964). The bulk of the recharge is expected to occur in late fall, winter, and early spring when the rate of evapotranspiration is low.

Most recharge to the groundwater reservoir occurs at the water table divide formed by the Ronkonkoma end moraine that lies east-west along the center of the island (Mack and Maus, 1986). Generally, north of the moraine, groundwater discharges to Long Island Sound; south of the moraine, groundwater discharges to the Atlantic Ocean. ServAll is located approximately 5 miles south of the water table divide.

Hydraulic conductivity values for the Upper Glacial unit range from 2×10^{-2} centimeters per second (cm/sec) in medium-to-fine sands with silt and clay layers to 1.4×10^{-1} cm/sec in gravels to coarse sands (McClymonds and Franke, 1972). The average hydraulic conductivity for 69 wells in southwestern Suffolk County (the area of ServAll) is 9.0×10^{-2} cm/sec (McClymonds and Franke, 1972). The upper glacial aquifer is anisotropic; estimates of the ratio of horizontal to vertical hydraulic conductivity (K_h/K_v) range from 2:1 to 7:1 (Lindner and Riley, 1983; Getzen, 1977).

4.2 SITE HYDROGEOLOGY

Information about the local hydrogeology was collected from the 18 monitoring wells and three piezometers installed at ServAll. The data collected included stratigraphic information, water level measurements, and in situ hydraulic conductivity measurements.

ServAll is located on sandy glacial outwash deposits of the Upper Glacial unit. The site and surrounding terrain is nearly flat, sloping zero to 2 percent to the south, with an approximate elevation of 66 feet above MSL at the site. The site vicinity is largely covered with buildings, pavement, and roads. Other than runoff

SECTION 4

The upper glacial aquifer, as encountered in borings at the site, consists of coarsely stratified, tan, fine-to-medium sand with trace amounts of gravel and occasional cobbles, coarse sand, and silt. The unit ranges in thickness from 86 feet in MW-12, 7,800 feet south of the site, to 120 feet in MW-3A, located across the street from the northern site boundary. A dark greenish-gray clayey silt unit, interpreted as Gardiners Clay, was encountered below the outwash sands at several boring locations during the investigation. The upper surface of the clay unit was encountered in borings upgradient and downgradient of the site and is believed to be present beneath ServAll. Although the unit was not penetrated in the RI borings, Gardiners Clay is reported to be approximately 5 to 13 feet thick in the site area (see Subsection 2.5).

Groundwater was encountered in the overburden in the borings completed during the RI field program. In general, the depth to groundwater decreased from north to south in the site area, from 21.7 feet bgs at MW-3A to 8.8 feet bgs 7,000 feet south-southeast at MW-11 (water levels measured February 12, 1991). As indicated in Figure 4-2, groundwater flow in the water table aquifer is predominantly south-southeast in the site vicinity. The horizontal hydraulic gradient is 0.003 feet per foot.

Water level measurements from nested well pairs screened at different depths can be used to assess vertical hydraulic gradients. Well pairs located upgradient of the site along Drayton Avenue exhibit downward vertical gradients of approximately 0.0013 feet per foot in MW-2 and PZ-2 and 0.067 feet per foot in MW-3A and 3B. Downgradient of the site along Frederick Avenue, downward gradients were observed in MW-4 and PZ-4 (0.07 feet per foot), varying upward and downward gradients in MW-6A and 6B, and generally upward gradients in MW-5 and PZ-5 (0.005 feet per foot).

In situ hydraulic conductivity testing was conducted in all new monitoring wells at the site (E.C. Jordan Co., 1991). Results of this testing are provided in Appendix A-5. Most of the tests exhibited harmonic oscillations indicative of inertial effects caused by rapid acceleration of water into the well with little damping capacity provided by the aquifer. This is a common problem in aquifers with relatively high hydraulic conductivities. The most commonly used type curves for unconfined aquifers, (i.e., Hvorslev [1951] and Bouwer and Rice [1976]), cannot be applied to this data (Pandit, et al., 1986), and there are no type curves for this



LEGEND

- MW-3B MONITORING WELL WITH WATER TABLE ELEVATION
- 45.2
- INTERPRETIVE WATER TABLE CONTOUR
- INTERPRETIVE GROUNDWATER FLOW DIRECTION

NOTES:

1. WATER LEVEL MEASUREMENTS WERE COLLECTED 2/12/91.
2. ALL ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.
3. WATER LEVEL FROM PZ-4 APPEARS ANOMALOUS AND WAS NOT USED IN THIS INTERPRETATION.

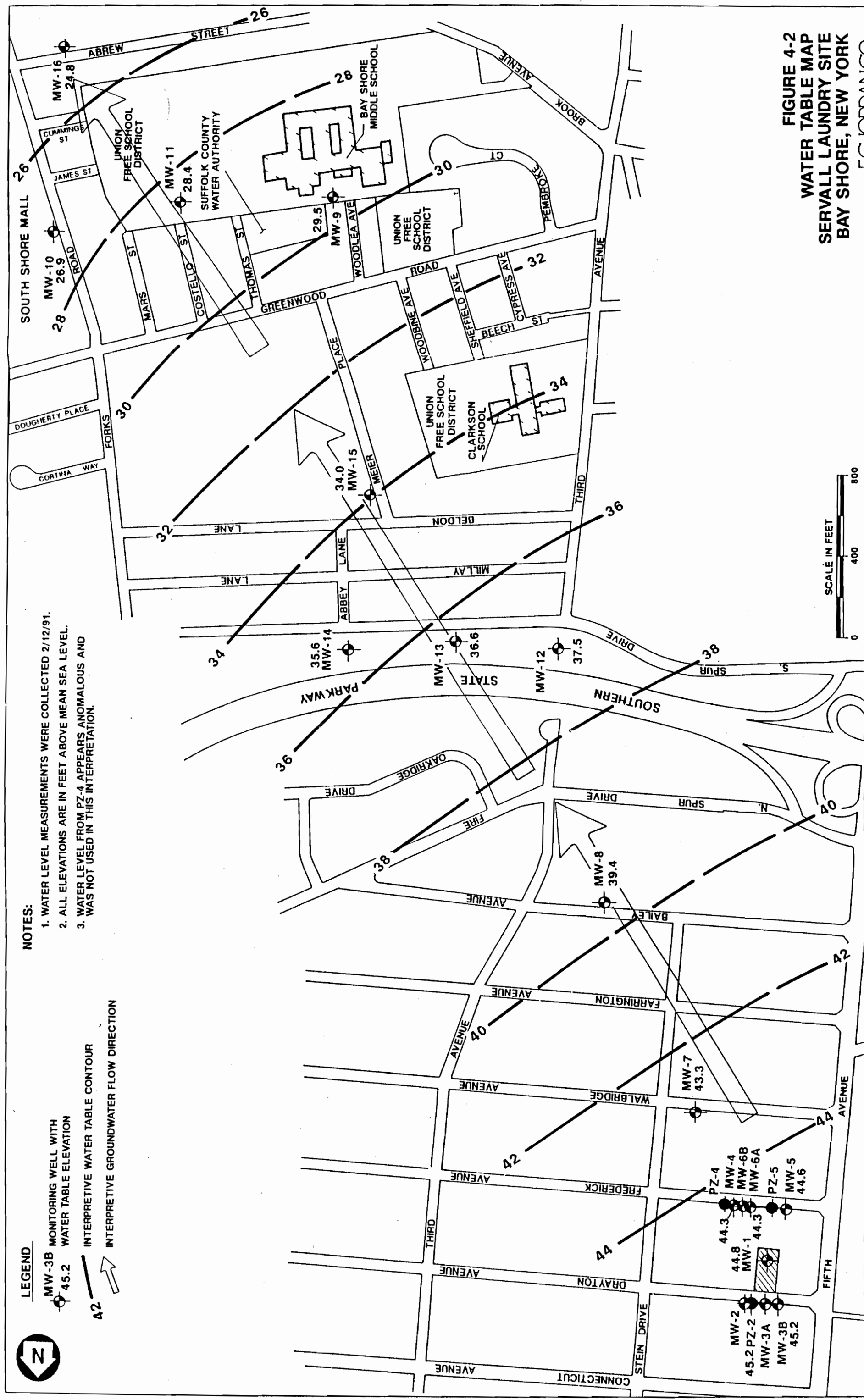


FIGURE 4-2
WATER TABLE MAP
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK
ECJORDANCO

Tests from four wells yielded satisfactory data utilizing standard analysis techniques. Hydraulic conductivity values ranged from 6.6×10^{-3} cm/sec in MW-3A to 1.7×10^{-1} cm/sec in MW-6B. The average hydraulic conductivity value from the usable data is 2.2×10^{-2} cm/sec. This value is most likely characteristic of the low end of the spectrum of hydraulic conductivity values for the upper aquifer because wells in areas of lower hydraulic conductivity are more likely to yield usable data. Calculations requiring hydraulic conductivity use the value of 9.0×10^{-2} cm/sec, a regional average for southwestern Suffolk County (McClymonds and Franke, 1972).

Flow rates for groundwater through the overburden can be calculated from the hydraulic gradient, hydraulic conductivity, and porosity. The porosity (n) of the upper glacial aquifer was calculated at 0.33 by Veatch, et al. (1906), with an effective porosity ranging from 0.25 to 0.30 (Kimmel and Braids, 1980; and Gureghian, et al., 1981). The average groundwater flow rate is estimated using the following equation:

$$\text{flow rate} = \frac{K (\text{hydraulic gradient})}{n}$$

where K is the hydraulic conductivity and n is porosity. For the ServAll site, hydraulic conductivity was estimated from published data at 9.0×10^{-2} cm/sec (or 255 feet per day), the hydraulic gradient is 0.003 feet per foot, and effective porosity is conservatively estimated at 0.30. Using these data, the estimated flow rate is 2.5 feet per day or 910 feet per year. This is higher than the flow rate of 1.1 feet per day or 410 feet per year estimated by Wexler (1988) for groundwater flow in the upper glacial aquifer at the Brookhaven Landfill where lower hydraulic gradients were observed.



5.0 NATURE AND DISTRIBUTION OF CONTAMINATION

This section describes field GC screening and laboratory analytical results for all samples collected during the 1990-91 ServAll Phase I RI field program, and identifies the site contaminants. Identification of site contaminants has been accomplished by evaluating the concentration range of each contaminant detected above the CRQL or method detection limit (MDL) in each sample medium on the basis of:

- actual background concentrations, where available
- published background concentrations
- analytical results of associated quality assurance/quality control (QA/QC) samples (i.e., field, trip, and laboratory blanks)

The analytical results of the QA/QC blanks are considered to screen out matrix interferences, detect contamination introduced to the samples during and after collection, and detect contamination of laboratory equipment.

The analytes and analytical methods chosen for field GC screening and laboratory analysis are shown in Table 5-1. Field GC screening was performed on-site as described in Subsection 3.2.2.

The analytical results for each sample medium are presented in separate subsections. Surface soils are discussed in Subsection 5.1, followed by subsurface soils in Subsection 5.2 and groundwater in Subsection 5.3. Within the subsection for each sample medium, where applicable, analytical results are discussed in the following order: (1) upgradient (background) samples, (2) on-site (source) samples, and (3) downgradient samples.

5.1 SURFACE SOIL

Surface soil samples were collected from shallow soils at on-site locations suspected to be former drum storage areas and in areas where ServAll Uniform cesspool overflow may have occurred. As shown in plan view in Figure 3-2 and in profile in Figure 3-3, nine surface and near-surface composited samples were obtained at depths ranging from 1 to 7 feet bgs from five on-site locations.

E.C. Jordan Co.

TABLE 5-1
SUMMARY OF LABORATORY ANALYTICAL PROGRAM

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

MEDIUM	METHOD	ANALYSIS	RATIONALE
Soil	Purge and Trap	Field screen for VOCs	Limit laboratory analytical costs, evaluate distribution and quantity of contaminated soils.
Soil	NYSDEC 89-1	TCL VOCs	Provide a Level IV data base for contaminated soils.
Soil	NYSDEC 89-2	TCL SVOCs	Evaluate presence and distribution of contaminated soils.
Soil	Inductively Coupled Plasma Atomic Emission Spectromic Mercury 245.5 CLP-M Arsenic 206.2 CLP-M Lead 239.2 CLP-M Selenium 270.2 CLP-M Thallium 279.2 CLP-M	TCL Metals	Evaluate presence and distribution of contaminated soils.
Soil	TCLP VOCs 8240 TCLP SVOCs 8270 TCLP Metal 6000/7000	TCLP VOCs, SVOCs, and Metals	Preliminary consideration of remedial alternatives for soil.
Groundwater	Purge and Trap	Field screen for VOCs	Limit laboratory analytical costs, evaluate distribution of contaminated groundwater for placement of monitoring well screens.
Groundwater	NYSDEC 89-1: 524.2 VOCs NYSDEC 89-2 SVOCs Inductively Coupled Plasma Metals Atomic Emission Spectrometer Metals Mercury 245.1 CLP-M Arsenic 206.2 CLP-M Lead 239.2 CLP-M Selenium 270.2 CLP-M Thallium 279.2 CLP-M	TCL VOCs, SVOCs, and Metals	Provide a Level IV data base for site-related groundwater.
Groundwater	TDS 160.2 TSS160.1 TOC 415.1 Total Alkalinity 310.1	TDS, TSS, TOC, and Total Alkalinity	Treatability.

NOTES:

NYSDEC: New York State Department of Environment Conservation
SVOC: semivolatile organic compounds
TDS: total dissolved solids
TCL: Target Compound List
TCLP: Toxicity Characteristic Leaching Procedure
TOC: total organic carbon
TSS: total suspended solids
VOCs: volatile organic compounds

5.1.1 Surface Soil Field Screening

Five surface soil samples were screened with the field GC. PCE was detected above the detection limit (DL) in four samples, ranging from 8 to 1400 micrograms per kilogram ($\mu\text{g}/\text{kg}$); TCE was detected in only one sample at 8 $\mu\text{g}/\text{kg}$. The other target analytes, vinyl chloride, trans-1,2-DCE, chloroform, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene, were not detected above the DL in the GC samples. The analytical results for the GC soil samples are presented in Appendix B-1.

5.1.2 Surface Soil Laboratory Results

Nine surface soil samples were analyzed for TCL VOCs and TCL metals. Two of these samples were also analyzed for TCL SVOCs. PCE was detected above the CRQL in five samples, ranging from 17 to 310,000 $\mu\text{g}/\text{kg}$. TCE was detected in one sample at 76 $\mu\text{g}/\text{kg}$. No other TCL VOCs were detected. The laboratory analytical results for all surface soil samples are summarized in Table 5-2 and Figure 5-1. Complete laboratory analytical results are presented in Appendix B-2.

One of the two samples analyzed for TCL SVOCs contained polycyclic aromatic hydrocarbons (PAHs), commonly associated with petroleum products. Phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, and benzo(a)pyrene were detected in one sample, SS-1, at a total concentration of 7,730 $\mu\text{g}/\text{kg}$ (see Table 5-2 and Figure 5-1). No SVOCs were detected in the other surface soil sample analyzed.

Eleven inorganic analytes were detected above the CRQL in nine surface soil samples analyzed for TCL metals, as shown on the following table:

E.C. Jordan Co.

TABLE 5-2
SUMMARY OF LABORATORY ANALYTICAL RESULTS
SURFACE SOIL SAMPLES

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

ANALYTE	SAMPLE # DEPTH	SS-1 1.0 - 3.5	SS-2 1.0 - 2.5	SS-3 2.5 - 4.0	SS-4 2.0 - 4.0	SS-5 1.5 - 3.0	SS-5D 1.5 - 3.0	SS-6 2.5 - 3.5	SS-6 3.5 - 4.5	SS-6 6.0 - 7.0
VOLATILE ORGANICS	UNIT									
TETRACHLOROETHENE	µg/kg	--	17	5200	--	--	--	31000 DEF	15000 D	27000 D
TRICHLOROETHENE	µg/kg	--	--	--	--	--	--	76	--	--
SEMIVOLATILE ORGANICS										
PHENANTHRENE	µg/kg	1400	n/a	n/a	--	n/a	n/a	n/a	n/a	n/a
ANTHRACENE	µg/kg	420	n/a	n/a	--	n/a	n/a	n/a	n/a	n/a
FLUORANTHENE	µg/kg	1600	n/a	n/a	--	n/a	n/a	n/a	n/a	n/a
PYRENE	µg/kg	1700 J	n/a	n/a	--	n/a	n/a	n/a	n/a	n/a
BENZO(A)ANTHRACENE	µg/kg	690	n/a	n/a	--	n/a	n/a	n/a	n/a	n/a
CHRYSENE	µg/kg	790	n/a	n/a	--	n/a	n/a	n/a	n/a	n/a
BENZO(B)FLUORANTHENE	µg/kg	680	n/a	n/a	--	n/a	n/a	n/a	n/a	n/a
BENZO(A)PYRENE	µg/kg	450	n/a	n/a	--	n/a	n/a	n/a	n/a	n/a
METALS										
ALUMINUM	mg/kg	15600	15300	8630	7590	14800	13100	1760 J	1860 J	1700 J
ARSENIC	mg/kg	3.0	2.6	2.5	2.6	3.3	3.3	--	--	--
CALCIUM	mg/kg	--	1230	2190	--	--	--	--	3190	--
CHROMIUM	mg/kg	18.9 J	19.3 J	11.8 J	10.2 J	17.5 J	14.2 J	29.9 J	10.8 J	44.2 J
COPPER	mg/kg	9.9	21.3	13.5	6.6	10.0	7.6	6.2	15.7	13.9
IRON	mg/kg	15500	16700	9900	10500	16000	14000	3390 J	3110 J	4020 J
LEAD	mg/kg	7.6 J	12.4 J	13.1 J	9.7 J	7.2 J	8.4 J	6.6 J	6.9 J	5.7 J
MAGNESIUM	mg/kg	1910	2180	2160	1140	2050	1760	--	1950	--
MANGANESE	mg/kg	104	128	108	110	174	160	65.2 J	62.7 J	61.2 J
NICKEL	mg/kg	9.8	12	12	--	14.3	13.2	16.8 J	--	19.6 J
SILVER	mg/kg	--	--	--	--	5.8 J	--	--	--	--
VANADIUM	mg/kg	27.7 J	23.5 J	15.8 J	14.3 J	27.7 J	23.1 J	--	--	--
ZINC	mg/kg	33.3	484	128	15.6	29.7	21.9	21.6 J	69.2 J	57 J

NOTES:

-- : not detected

J : estimated concentration

n/a : not analyzed

D : sample dilution performed prior to analysis

E : estimated results exceeded the calibration curve



SS-5(1.5-3)		SS-5D
VOCs	ND	ND
SVOCs	NA	NA
Al	14800	13100
As	3.3	3.3
Cr	17.5J	14.2J
Cu	10	7.6
Fe	16000	14000
Pb	7.2J	8.4J
Mg	2050	1760
Mn	174	160
Ni	14.3	13.2
Ag	5.8J	ND
V	27.7J	23.1J
Zn	29.7	21.9

SS-1(1.0-3.5)	
VOCs	ND
PAHs	7730
Al	15600
As	3.0
Cr	18.9J
Cu	9.9
Fe	15500
Pb	7.6J
Mg	1910
Mn	104
Ni	9.8
V	27.7J
Zn	33.3

SS-2(1-2.5)		SS-3(2.5-4)
PCE	17	5200
SVOCs	NA	NA
Al	15300	8630
As	2.6	2.5
Ca	1230	2190
Cr	19.3J	11.8J
Cu	21.3	13.5
Fe	16700	9900
Pb	12.4J	13.1J
Mg	2180	2160
Mn	128	108
Ni	12	12
V	23.5J	15.8J
Zn	484	128

SS-6		2.5-3.5	3.5-4.5	6.0-7.0
PCE	310000DEJ	76	15000D	27000D
TCE	NA	NA	ND	ND
SVOCs	1760J	1860J	NA	NA
Al	ND	3190	ND	1700J
Ca	29.9J	10.8J	44.2J	ND
Cr	6.2	15.7	13.9	ND
Cu	3390J	3110J	4020J	ND
Fe	6.6J	6.9J	5.7J	ND
Pb	ND	1950	ND	ND
Mg	65.2J	62.7J	61.2J	ND
Mn	16.8J	ND	19.6J	ND
Ni	21.6J	69.2J	57J	ND
Zn				

LEGEND

- BUILDING
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- SOIL BORING EXPLORATION
- MONITORING WELL EXPLORATION
- SITE PROPERTY BOUNDARY

SS-4(2-4)	
Al	7590
As	2.6
Cr	10.2J
Cu	6.6
Fe	10500
Pb	9.7J
Mg	1140
Mn	110
V	14.3J
Zn	15.6

CONCENTRATIONS ARE REPORTED IN ug/kg FOR ORGANICS AND IN mg/kg FOR METALS.



FIGURE 5-1
SURFACE SOIL LABORATORY
ANALYTICAL RESULTS
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

TCL Metal	Range of Concentration Above the CRQL (mg/kg)*	Number of Samples Exceeding the CRQL
Aluminum	1700 J - 15600	9
Arsenic	2.5 - 3.3	6
Calcium	1230 - 3190	3
Chromium	10.2 J - 44.2 J	9
Copper	6.2 - 21.3	9
Iron	3110 J - 16700	9
Lead	5.7 J - 13.1 J	9
Magnesium	1140 - 2180	7
Nickel	9.8 - 19.6 J	7
Silver	5.8 J	1
Vanadium	14.3 J - 27.7 J	6
Zinc	15.6 - 484	9

* milligrams per kilogram (mg/kg)

J = Estimated Concentration

5.1.3 Surface Soil Site Contaminant Assessment

According to the criteria for selecting the potential site contaminants in Section 3.0, the potential surface soil organic site contaminants are PCE, TCE, and the PAHs phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, and benzo(a)pyrene. None of the TCL metals were detected in concentrations exceeding the NYSDEC Wildlife Resources Center or Eastern U.S. background data. However, the references do not list a background concentration for silver which was detected at 5.8 mg/kg (see Table 3-6).

Final site soil contaminants are determined by evaluating the potential site contaminants against four criteria:

- history of use at the site
- presence in more than one media at the site
- presence at concentrations greater than trace levels
- comparison to background concentrations

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SECTION 5

Potential site contaminants satisfying one or more of these criteria are considered site contaminants.

PCE is related to the documented history of disposal of dry cleaning fluids during site operations of ServAll Uniform. PCE and TCE (a degradation product of PCE) have widespread distribution in the study area, are detected in other media, and are present at concentrations greater than trace levels. PCE and TCE are considered site contaminants for surface soils.

PAHs were detected in one surface soil sample from the site. These compounds suggest the presence of fuel products and may result from unrecorded spills or disposal of fuels at the site, contaminated fill used at the site, accumulation of tar compounds from the building's built-up roof, or general background conditions in an industrial area. For those reasons, the detected PAHs are not considered site contaminants.

Neither the NYSDEC Wildlife Resources Center or the Eastern U.S. background data provides a range for silver concentrations in soil. Silver was detected above the detection limit in one sample, SS-5, away from the area of other elevated metal concentrations, at a concentration of 5.8 mg/kg. This concentration is within the normal range for silver in soil reported by Bowen (1982) of 0.01 to 8 mg/kg; therefore, silver is not considered a site contaminant.

PCE and TCE are considered site-related contaminants in surface and near-surface soils at ServAll. The fate and transport potential of the site contaminants is discussed in Section 6.0, and Section 7.0 contains an assessment of the associated risk.

5.2 SUBSURFACE SOIL

Subsurface soil samples were collected from one upgradient boring (PZ-2), eight on-site soil borings (SB-1 through SB-8) drilled in the former cesspool area behind and east of the ServAll building, and one downgradient boring (MW-6B). All subsurface soil samples were collected with a split-spoon sampler. The boring logs presented in Appendix A-2 show the sample locations in profile; Figures 3-2 and 3-4 show the sample locations in plan view. Field GC screening data for all subsurface soil samples are presented in Appendix B-1; laboratory analytical results are summarized in Table 5-3 and Figure 5-2. Complete laboratory analytical results are presented in Appendix B-2.

E.C. Jordan Co.

TABLE 5-3
SUMMARY OF LABORATORY ANALYTICAL RESULTS
SUBSURFACE SOIL SAMPLES

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

ANALYTE	BORING # DEPTH (ft)	SB-1				SB-2				SB-3				SB-4				SB-5				
		8-10	12-14	20-22	95-98	4-6	8-10	18-20	6-8	12-14	18-20	18-20D	14-16	16-18	18-20	4-6	10-12	14-16	20-22	40-42		
VOLATILE ORGANICS		UNITS																				
Tetrachloroethene	μg/kg	NA																				
Trichloroethene	μg/kg	13																				
1,2-Dichloroethene	μg/kg	—																				
Toluene	μg/kg	—																				
SEMIVOLATILE ORGANICS		μg/kg																				
bis(2-Ethylhexyl)phthalate		NA																				
METALS		NA																				
Aluminum	mg/kg	624 J	719 J	683 J	1440 J	599 J	946 J	989 J	531 J	815 J	579 J	303 J	1670 J	292 J	7000 J	364 J	NA				637 J	424 J
Cadmium	mg/kg	—	—	—	—	—	—	—	—	—	—	—	—	—	1.6	—	—				—	—
Calcium	mg/kg	—	—	—	—	—	—	—	—	—	—	—	1620 J	—	2480 J	—	—				—	—
Chromium	mg/kg	2.7 J	10.4 J	7.9 J	5.1 J	4.1 J	8.1 J	2.9 J	2.9 J	8.8 J	4.0 J	2.5 J	2.9 J	—	22.7 J	7.8 J	4.3 J				—	—
Copper	mg/kg	—	—	—	—	—	—	—	—	—	—	8.0 J	11.2 J	—	54.4 J	—	—				—	—
Iron	mg/kg	1420 J	1080 J	2220 J	3270 J	1330 J	4040 J	2030 J	2050 J	3030 J	1400 J	782 J	2910 J	769 J	7590 J	511 J	1220 J				875 J	—
Lead	mg/kg	1.2 J	1.0 J	—	1.5 J	0.62 J	0.84 J	1.6 J	0.74 J	1.7 J	0.88 J	11.4 J	9.1 J	3.9 J	18 J	25.9 J	2.5 J				2.2 J	—
Magnesium	mg/kg	—	—	—	—	—	—	—	—	—	—	—	—	—	1450	—	—				—	—
Manganese	mg/kg	22.9 J	15.1 J	30.1 J	58.8 J	17.1 J	37.3 J	46.2 J	31.2 J	45.3 J	15.3 J	5.6 J	24.9 J	5.4 J	174 J	4.4 J	14.8 J				10.6 J	—
Nickel	mg/kg	—	—	—	—	—	—	—	—	—	—	—	—	—	32.2	—	—				—	—
Potassium	mg/kg	—	—	—	—	—	—	—	—	—	—	—	—	—	1360	—	—				—	—
Vanadium	mg/kg	—	—	—	—	—	—	—	—	—	—	—	—	—	12.5	—	—				—	—
Zinc	mg/kg	5.2 J	7.9 J	33.9 J	6.5 J	—	6.7 J	4.9 J	4.3 J	4.9 J	7.4 J	15.9 J	29.7 J	8.2 J	91.4 J	12.4 J	9.4 J				7.6 J	—
TCLP ORGANICS		μg/kg																				
Tetrachloroethene	μg/kg	848																				
TCLP METALS		μg/kg																				
Cadmium	μg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	—	NA	NA	NA	NA	860				NA	NA

NOTES:
 -- : Not detected.
 NA : Not analyzed.
 J : Estimated concentration
 D : sample dilution performed prior to analysis.

TABLE 5-3 (page 2 of 2)
SUMMARY OF LABORATORY ANALYTICAL RESULTS
SUBSURFACE SOIL SAMPLES

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

ANALYTE	BORING # DEPTH (ft)	SB-6					SB-7				SB-8					PZ-2
		4-6	4-6D	6-8	12-14	20-22	6-8	8-10	18-20	20-22	4-6	4-6D	10-12	14-16	20-22	20-22
<u>VOLATILE ORGANICS</u>				NA			NA				NA					
Tetrachloroethene	µg/kg	3400	7000	DI	6200	1400	25	3100	—	—	—	—	—	—	—	
Trichloroethene	µg/kg	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
1,2-Dichloroethene	µg/kg	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Toluene	µg/kg	—	—	—	—	—	—	6700	7300	—	—	—	—	—	—	
<u>SEMIVOLATILE ORGANICS</u>				NA			NA				NA					
bis(2-Ethylhexyl)phthalate	µg/kg	—	—	—	—	1600 J	—	—	1900	—	—	—	—	—	—	
<u>METALS</u>				NA			NA				NA					
Aluminum	mg/kg	4690 J	2530 J	—	—	296 J	4960 J	4350 J	473 J	—	903 J	2850 J	319 J	387 J	408 J	
Cadmium	mg/kg	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Calcium	mg/kg	6270 J	—	—	—	—	1410	1390	—	—	—	1490	—	—	—	
Chromium	mg/kg	8.6 J	—	—	—	—	10.8 J	7.2 J	8.4 J	—	3.0 J	4.9 J	2.6 J	—	—	
Copper	mg/kg	29.4 J	10.2 J	—	—	—	13.5 J	12.8 J	—	—	—	12.0 J	—	—	—	
Iron	mg/kg	6910 J	3720 J	36.7 J	752 J	—	5700 J	5360 J	806 J	—	1730 J	5530 J	864 J	1070 J	904 J	
Lead	mg/kg	19.9 J	25.8 J	10.5 J	4.5 J	—	9.6 J	8.9 J	1.5 J	—	1.3 J	3.9 J	2.6 J	3.1 J	—	
Magnesium	mg/kg	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Manganese	mg/kg	70.0 J	46.6 J	—	8.5 J	—	63.4 J	51.9 J	7.5 J	—	34.4 J	85.0 J	8.5 J	8.9 J	16.9 J	
Nickel	mg/kg	11.6	—	—	—	—	—	—	—	—	—	—	—	—	—	
Potassium	mg/kg	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Vanadium	mg/kg	—	—	—	—	—	14.1	13.5	—	—	—	13.8	—	—	—	
Zinc	mg/kg	49.2 J	40.3 J	—	8.2 J	—	135 J	18.4 J	22.2 J	—	12.5 J	27.1 J	17.5 J	16.6 J	—	
<u>TCLP ORGANICS</u>				NA			NA				NA		NA		NA	
Tetrachloroethene	µg/kg	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
<u>TCLP METALS</u>				NA			NA				NA		NA		NA	
Cadmium	µg/kg	—	—	—	—	—	—	—	—	—	—	—	—	—	—	

NOTES:
-- : Not detected.
NA : Not analyzed.
J : Estimated concentration
D : sample dilution performed prior to analysis.



LEGEND

- BUILDING
- FENCE
- BUCKET AUGER SURFACE SOIL SAMPLE EXPLORATION
- SOIL BORING EXPLORATION
- MONITORING WELL EXPLORATION
- SITE PROPERTY BOUNDARY

SB-4	14-16	16-18	18-20
PCE	1100	30000J	18000J
TOLUENE	ND	9700J	ND
SVOCs	ND	ND	ND
Al	303J	1670J	292J
Ca	ND	1620J	ND
Cr	2.5J	2.9J	ND
Cu	8.0J	11.2J	ND
Fe	782J	2910J	769J
Pb	11.4J	9.1J	3.9J
Mn	5.6J	24.9J	5.4J
Zn	15.9J	29.7J	8.2J

SB-5	4-6	10-12	14-16	20-22	40-42
PCE	4000	84000	NA	4500	27000J
TCE	ND	ND	NA	ND	53
TOLUENE	14000	10000	NA	ND	ND
SVOCs	ND	ND	NA	ND	ND
Al	7000J	364J	NA	637J	424J
Cd	1.6	ND	NA	ND	ND
Ca	2480J	7.8J	NA	4.3J	ND
Cr	22.7J	ND	NA	ND	ND
Cu	54.4J	ND	NA	ND	ND
Fe	7590J	511J	NA	1220J	875J
Pb	18J	25.9J	NA	2.5J	2.2J
Mg	1450	ND	NA	ND	ND
Mn	174J	4.4J	NA	14.8J	10.6J
Ni	32.2	ND	NA	ND	ND
K	1360	ND	NA	ND	ND
V	12.5	ND	NA	ND	ND
Zn	91.4J	12.4J	NA	9.4J	7.6J
TCLP PCE	NA	NA	860	NA	NA
TCLP METALS	NA	NA	ND	NA	NA

SB-1	8-10	12-14	20-22	95-98
PCE	NA	ND	13	ND
SVOCs	NA	ND	ND	ND
Al	NA	624J	719J	683J
Cr	NA	2.7J	10.4J	7.9J
Fe	NA	1420J	1080J	2220J
Pb	NA	1.2J	1.0J	ND
Mn	NA	22.9J	15.1J	30.1J
Zn	NA	5.2J	7.9J	33.9J
TCLP PCE	848	NA	NA	NA
TCLP Cd	212	NA	NA	NA

SB-6	4-6/D	12-14	20-22
PCE	3400J/7000J	6200	1400
SVOCs	ND/ND	ND	1600J
Al	4690J/2530J	NA	296J
Ca	6270J/ND	NA	ND
Cr	8.6J/ND	NA	ND
Cu	28.4J/10.2J	NA	ND
Fe	6910J/3720J	NA	752J
Pb	19.9J/25.8J	NA	10.5J
Mn	70.0J/46.6J	NA	8.5J
Ni	11.6ND	NA	ND
Zn	49.2J/40.3J	NA	8.2J
TCLP ORGANICS	NA/NA	NA	NA
TCLP METALS	NA/NA	NA	NA

SB-7	6-8	18-20	20-22
PCE	25	3100	NA
TOLUENE	ND	6700	7300
BIS(2-ETHYLHEXYL) PHTHALATE	ND	NA	1900
Al	4960J	NA	473J
Ca	1410	NA	1390
Cr	10.8J	NA	7.2J
Cu	13.5J	NA	12.8J
Fe	5700J	NA	5360J
Pb	9.6J	NA	8.9J
Mn	63.4J	NA	51.9J
V	14.1	NA	13.5
Zn	135J	NA	18.4J
TCLP ORGANICS	NA	ND	NA
TCLP METALS	NA	ND	NA

SB-8	4-6/D	10-12	14-16	20-22
SVOCs	ND/ND	NA	ND	ND
Al	903J/2850J	NA	319J	387J
Ca	ND/1490	NA	ND	ND
Cr	3.0J/4.9J	NA	2.6J	ND
Cu	ND/12.0J	NA	864J	1070J
Fe	1730J/5530J	NA	2.6J	3.1J
Pb	1.3J/3.9J	NA	8.5J	8.9J
Mn	34.4J/85.0J	NA	ND	ND
V	ND/13.8	NA	17.5J	16.6J
Zn	12.5J/27.1J	NA	NA	NA
TCLP ORGANICS	NA/NA	ND	NA	NA
TCLP METALS	NA/NA	ND	NA	NA

SB-3	6-8	12-14	18-20/D
SVOCs	ND	ND	ND/ND
Al	988J	531J	815J/579J
Cr	2.9J	2.9J	8.8J/4.0J
Fe	2030J	2050J	3030J/1400J
Pb	1.6J	0.74J	1.7J/0.88J
Mn	46.2J	31.2J	45.3J/15.3J
Zn	4.9J	4.3J	4.9J/7.4J
TCLP ORGANICS	NA	NA	NA/NA
TCLP METALS	NA	NA	NA/NA

SB-2	4-6	9-10	18-20
SVOCs	ND	ND	ND
Al	1440J	599J	946J
Cr	5.1J	4.1J	8.1J
Fe	3270J	1330J	4040J
Pb	1.5J	0.62J	0.84J
Mn	58.8J	17.1J	37.3J
Zn	6.5J	ND	6.7J



CONCENTRATIONS ARE REPORTED IN ug/kg FOR ORGANICS AND IN mg/kg FOR METALS.

FIGURE 5-2
SUBSURFACE SOIL LABORATORY
ANALYTICAL RESULTS
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK
ECJORDANCO

5.2.1 Upgradient Subsurface Soil

PZ-2, located upgradient of the site on the north side of Drayton Avenue, was sampled at 5-foot intervals from the ground surface to 27 feet bgs. The samples were not screened with the field GC.

One analytical sample was collected from PZ-2 for CLP laboratory analysis of TCL organics and TCL metals. No VOCs or SVOCs were detected above the CRQL. Three TCL metals were detected above the CRQL: aluminum at 408 mg/kg, iron at 904 mg/kg, and manganese at 16.9 mg/kg.

5.2.2 On-site Subsurface Soil

Six of the eight on-site soil borings (i.e., SB-2, SB-3, SB-4, SB-6, SB-7, and SB-8) were sampled continuously from the ground surface to 22 feet bgs, penetrating the water table by a few feet. SB-5 was sampled continuously from the ground surface to 22 feet bgs, then at 5-foot intervals to a final depth of 47 feet bgs. MW-1/SB-1 was sampled continuously from the ground surface to 22 feet bgs and 72 to 104 feet bgs, and at 5-foot intervals from 24 to 72 feet bgs.

5.2.2.1 On-site Subsurface Soil Field Screening. A total of 59 samples from eight borings were screened with the field GC. The results above the DL are shown below:

Target Compound	Range of Concentration Above the CRQL ($\mu\text{g/kg}$)	Number of Samples Exceeding the CRQL
PCE	2 - 2600	38
TCE	5 - 55,000	20
1,3,5-Trimethyl-benzene	2 - 50,000	11
1,2,4-Trimethyl-benzene	3 - 90,000	13

Trans-1,2,-DCE and chloroform were not detected above the DL in any of the GC samples. Vinyl chloride was not detected above the DL in the 53 percent of samples analyzed for this compound. During field analysis, degradation of the nickel reaction tube in the ELCD was observed, which precluded the quantitation of vinyl chloride in the remaining 47 percent of the samples. The cause was

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found to be contaminated carrier gas resulting in contamination of the nickel tube. Once understood, the problem was corrected. However, if vinyl chloride had been present in the samples analyzed while the problem was occurring, it would not have been detected. This problem does not affect the other target compounds, because they are detectable on the PID. All GC screening results are presented in Appendix B-1.

5.2.2.2 On-site Subsurface Soil Laboratory Results. A total of 33 subsurface soil samples (including two duplicate QA/QC samples) from eight on-site soil borings were submitted for laboratory analysis. Of these, 28 were analyzed for full TCL organics and TCL metals, and five for TCLP organics and TCLP metals.

Four TCL VOCs were detected above the CRQL. PCE was reported in 14 samples, ranging from 25 to 84,000 $\mu\text{g/kg}$. TCE was reported in one sample at 53 $\mu\text{g/kg}$; 1,2-DCE (total) was reported in the same sample at 16 $\mu\text{g/kg}$. Toluene was reported in five samples, ranging from 6,700 to 14,000 $\mu\text{g/kg}$.

One SVOC, bis(2-ethylhexyl) phthalate, was detected above the CRQL in two samples, with concentrations of 1,600 and 1,900 $\mu\text{g/kg}$.

In 28 subsurface soil samples, 13 TCL metals were detected above the CRQL, as shown below:

TCL Metal	Range of Concentration Above the CRQL (mg/kg)	Number of Samples Exceeding the CRQL
Aluminum	292 J - 7000 J	27
Cadmium	1.6	1
Calcium	1390 - 6270 J	6
Chromium	2.5 J - 22.7 J	22
Copper	8.0 J - 54.4 J	8
Iron	36.7 J - 7590 J	28
Lead	0.62 J - 25.9 J	27
Magnesium	1450	1
Manganese	4.4 J - 174 J	27
Nickel	11.6 - 32.2	2
Potassium	1360	1
Vanadium	12.5 - 14.1	4
Zinc	4.3 J - 91.4	26

J = Estimated concentration

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In two of the six subsurface soil samples analyzed for TCLP organics, one VOC, PCE, was detected at concentrations of 848 and 860 $\mu\text{g/L}$. No SVOCs were detected. One TCLP metal, cadmium, was detected in one sample at a concentration of 212 $\mu\text{g/L}$.

5.2.3 Downgradient Subsurface Soil

One downgradient boring, MW-6B, was sampled continuously from the ground surface to 22 feet bgs and 105 to 117 feet bgs, and at 5-foot intervals from 25 to 42 feet bgs and 90 to 102 feet bgs.

Fifteen samples were analyzed with the field GC. Vinyl chloride, trans-1,2-DCE, 1,3,5-trimethylbenzene, and 1,2,4-trimethylbenzene were not detected above the DL. Chloroform and TCE were detected in trace amounts in one sample each. PCE was detected above the DL in five samples, ranging from 2 to 1,000 $\mu\text{g/kg}$.

No downgradient soil samples were submitted for laboratory analysis.

5.2.4 Subsurface Soil Site Contaminants

According to the criteria presented in Section 3.0, the potential subsurface soil organic site contaminants are PCE, TCE, 1,2-DCE (total), toluene, and bis(2-ethylhexyl) phthalate. No TCL metals were present in concentrations above the NYSDEC Wildlife Resources Center or Eastern U.S. background ranges (see Table 3-6).

PCE, TCE, and 1,2-DCE (total) are directly related to the documented history of dry cleaning fluids disposal at ServAll. PCE is the dominant compound in dry cleaning fluids; TCE and 1,2-DCE are degradation products of PCE (see Subsection 6.2). PCE was detected in 13 of 29 subsurface soil samples analyzed for VOCs. TCE and 1,2-DCE were both detected in one sample out of 29 samples analyzed. All three compounds are considered site contaminants for subsurface soils.

Toluene was detected in five of 29 samples from three borings at the site. The presence of toluene in more than one sample from the same boring and the frequency of occurrence indicate that toluene is a site-related subsurface soil contaminant. Although there is no record of toluene disposal at the site, the observed concentrations of toluene may be the result of undocumented disposal or unrecorded spills, or of contaminated fill at the site.

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Bis(2-ethylhexyl) phthalate was detected in two samples from two borings retrieved from a depth of 20 to 22 feet bgs. Interpretation of the significance of this compound is difficult because of its limited occurrence and the lack of a distribution pattern. There is no record of disposal of bis(2-ethylhexyl) phthalate at the site and it is not known to be associated with dry cleaning chemicals. It may be the result of an unreported disposal or a spill. The depth of the samples suggests it is most likely not related to contaminated fill. Bis(2-ethylhexyl) phthalate may be a site contaminant; however, due to the lack of sufficient data about the nature and distribution of bis(2-ethylhexyl) phthalate at the site, further evaluation of the potential fate and transport or risk associated with this compound is impossible.

The following compounds are considered site-related contaminants in subsurface soils at ServAll:

- PCE
- TCE
- 1,2-DCE
- toluene
- bis(2-ethylhexyl) phthalate

The fate and transport potential of these contaminants is discussed in Section 6.0. The risk associated with these compounds is addressed in Section 7.0.

5.3 GROUNDWATER

Eighteen new monitoring wells were installed during the 1990-91 RI field program. Three wells are located upgradient of the site, one is located on-site, and 14 are located downgradient of the site. All but two of the monitoring well borings were drilled with 4.25-inch-ID screened-augers. Groundwater samples were obtained at regular 5-foot intervals as the screened auger borings were advanced. The screened auger samples were analyzed with the field GC unit prior to placement of the permanent well screens. The field GC screening results are presented in Appendix B-1.

Two rounds of groundwater samples were obtained from the 18 new wells in February and March of 1990, respectively. Rounds 1 and 2 are both composed of 20 groundwater samples (including two duplicate samples) which were analyzed for TCL organics and/or Method 524.2 organics and TCL metals. Seven of the 20 samples were also analyzed for selected water quality parameters: alkalinity,

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TSS, TDS, and TOC. Groundwater samples from both rounds were submitted to Nytest Environmental for analysis (see Table 5-1 for methods). A summary of the validated analytical laboratory data for both rounds of groundwater sampling is presented in Table 5-4. Complete laboratory analytical results are presented in Appendix B-2.

5.3.1 Upgradient Groundwater

The upgradient monitoring wells MW-2, MW-3A, and MW-3B, are located on the north side of Drayton Avenue across the street from the site. They are shown in plan view in Figure 3-4 and in profile in Figure 5-3. Well construction details are presented in the Well Installation Logs, Appendix A-3. Summaries of the laboratory results are presented in Figures 5-3, 5-4, and 5-5.

In accordance with the protocol set forth in the QAPP (E.C. Jordan Co., 1990) analytical method 524.2 or NYSDEC ASP-89-1 (for analysis of VOCs) was selected on an individual well and round basis. The selection of the analytical method was based on field GC screening or Round 1 laboratory results, as applicable. MW-2 was analyzed by method 524.2 for both sampling rounds, MW-3A was analyzed by NYSDEC method ASP-89-1 for both sampling rounds, and MW-3B was analyzed by NYSDEC method ASP-89-1 for Round 1 and 524.2 for Round two. The term CRQL applies to the ASP-89-1 method; MDL applies to the 524.2 method.

5.3.1.1 Upgradient Groundwater Field Screening. Thirty-five groundwater samples collected from three upgradient screened-auger borings were analyzed with the field GC. PCE was detected above the DL in 18 samples, ranging from 1 to 8 $\mu\text{g/L}$, and at trace levels in five additional samples. TCE was detected above the DL in 10 samples, ranging from 1 to 210 $\mu\text{g/L}$. A trace amount of 1,3,5-trimethylbenzene was detected in one sample. Vinyl chloride, trans-1,2-DCE, chloroform, and 1,2,4-trimethylbenzene were not detected in any samples. However, the GC ELCD detector, as discussed, was operational for the detection of vinyl chloride for only 23 percent of the analyses; therefore, if vinyl chloride were present in the remaining samples, it would not have been detected.

5.3.1.2 Upgradient Groundwater Laboratory Results, Round 1. Four VOCs were detected above the CRQL in the upgradient groundwater samples. PCE and xylene (total) were reported at 6 $\mu\text{g/L}$ and 15 $\mu\text{g/L}$, respectively, in the samples from one well. 1,1,1-Trichloroethane (1,1,1-TCA) was detected in one well at 34 $\mu\text{g/L}$. TCE was detected in two wells, with concentrations of 5 and 6 $\mu\text{g/L}$.

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TABLE 5-4
SUMMARY OF LABORATORY ANALYTICAL RESULTS
GROUNDWATER SAMPLES

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

ANALYTE	BORING #	MW-1		MW-1 D		MW-2		MW-3A		MW-3B		MW-4		MW-5	
		Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2
VOLATILE ORGANICS		UNITS													
BENZENE		µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
CHLOROFORM		µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
CHLOROBENZENE		µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
1,1-DICHLOROETHANE		µg/L	---	---	---	---	---	---	---	---	1.2 J	---	---	---	---
1,2,4-TRIMETHYLBENZENE		µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
1,1-DICHLOROETHENE	5	µg/L	3.3 J	6	4.8 J	---	---	---	---	---	4.6 J	---	---	---	---
1,2-DICHLOROETHENE (TOTAL)	4	µg/L	3.1 J	4	4.0 J	---	---	---	---	---	1.2 J	---	---	---	---
TETRACHLOROETHENE	---	µg/L	1.2 J	---	---	6	1 J	---	---	---	---	---	---	---	---
TOLUENE	---	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
TOTAL XYLENES	---	µg/L	---	---	---	15 J	---	---	---	---	---	---	---	---	---
1,1,1-TRICHLOROETHANE	42	µg/L	53 J	48	30 J	---	---	---	---	---	---	---	---	---	---
TRICHLOROETHENE	12	µg/L	9.9 J	13	9.9 J	5	1.1 J	---	---	8	34	66 J	20	---	---
VINYL CHLORIDE	---	µg/L	---	---	---	---	---	---	---	14	6	8.1 J	18	---	2.8 J
1,2,4-TRICHLOROBENZENE	---	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
1,2,3-TRICHLOROBENZENE	---	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
NAPHTHALENE	---	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
SEMIVOLATILE ORGANICS															
2-METHYLPHENOL		µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
DI-N-BUTYLPHTHALATE	---	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
BUTYLBENZYLPHTHALATE	---	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
METALS															
ALUMINUM	---	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
ARSENIC	---	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
BARIUM	---	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
CALCIUM	10800	µg/L	11100	10600	11100	11900	12700	---	---	---	---	---	---	---	---
CHROMIUM	---	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
IRON	---	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
LEAD	---	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
MAGNESIUM	---	µg/L	---	---	---	7300	7560	---	---	---	---	---	---	---	---
MANGANESE	161	µg/L	134	159	134	323	365	161	75.4	85.2	78	82	73.2	24.2	20.8
MERCURY	---	µg/L	---	---	---	---	---	---	---	---	---	---	---	---	---
POTASSIUM	---	µg/L	---	---	---	---	5310	---	---	---	---	---	---	---	---
SODIUM	14300	µg/L	16500	14100	16600	17400	17000	47300	42900	10400	9430	29000	29900	9500	10400
WATER QUALITY PARAMETERS															
ALKALINITY		mg/L	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	6	4.4	n/a	n/a	n/a
TOTAL DISSOLVED SOLIDS		mg/L	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	99	111	n/a	n/a	n/a
TOTAL SUSPENDED SOLIDS		mg/L	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1	2	n/a	n/a	n/a
TOTAL ORGANIC CARBON		mg/L	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	21.3	20	n/a	n/a	n/a

NOTES:

-- : Not detected.

n/a : Not analyzed.

TABLE 5-4 (page 2 of 3)
SUMMARY OF LABORATORY ANALYTICAL RESULTS
GROUNDWATER SAMPLES

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

ANALYTE	BORING #	MW-6A		MW-6B		MW-7		MW-8		MW-9		MW-10		MW-11	
		Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2
VOLATILE ORGANICS															
BENZENE	UNITS														
	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHLOROFORM	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CHLOROBENZENE	µg/L	--	--	--	2.4 J	--	--	--	--	--	--	--	--	--	--
1,1-DICHLOROETHANE	µg/L	--	--	--	--	--	--	--	--	5 J	4 J	--	--	--	--
1,2,4-TRIMETHYLBENZENE	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	310 J	--
1,1-DICHLOROETHENE	µg/L	--	--	--	4.3 J	--	--	--	--	--	--	--	--	--	--
1,2-DICHLOROETHENE (TOTAL)	µg/L	--	--	2400	2200 DJ	--	--	--	--	2	1.5 J	--	--	--	--
TETRACHLOROETHENE	µg/L	48	100	14000	13000 DJ	4300	7200	28	410	1	7	7.6 J	--	4500	1700
TOLUENE	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	8900	5900
TOTAL XYLENES	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,1-TRICHLOROETHANE	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
TRICHLOROETHENE	µg/L	--	--	--	1100 DJ	--	54	10	--	11	7.1 J	1	--	--	430
VINYL CHLORIDE	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-TRICHLOROBENZENE	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	320	--
1,2,3-TRICHLOROBENZENE	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	550 J	--
NAPHTHALENE	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	480	--
SEMIVOLATILE ORGANICS															
2-METHYLPHENOL	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	10	--
DI-N-BUTYLPHTHALATE	µg/L	--	--	--	--	290	--	210	--	170	--	170	--	--	--
BUTYLBENZYLPHTHALATE	µg/L	--	--	--	--	27	--	50	--	--	--	--	--	--	--
METALS															
ALUMINUM	µg/L	236	287	2200	2870	3890	2780	733	1270	--	--	--	--	--	--
ARSENIC	µg/L	--	--	--	--	1750	--	--	--	--	--	--	--	--	--
BARIUM	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
CALCIUM	µg/L	15200	14900	16000	20100	30400	23700	12600	11800	11100	12200	8930	9650	19300	24600
CHROMIUM	µg/L	28.9 J	--	23.6 J	--	35.2 J	--	15.3 J	--	13 J	--	--	--	--	--
IRON	µg/L	--	--	--	978	3830	2820	822	1450	--	--	--	--	--	--
LEAD	µg/L	--	--	--	--	--	--	9	--	--	--	3.3	--	--	--
MAGNESIUM	µg/L	--	--	--	--	16700	12200	6540	6630	10600	12200	--	--	9580	11800
MANGANESE	µg/L	946	833	523	675	139	166	169	127	80.5	78.7	--	--	--	--
MERCURY	µg/L	--	--	0.49	--	--	--	--	--	--	--	--	--	--	--
POTASSIUM	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
SODIUM	µg/L	43100	39800	20900	19400	86300	73500	48800	43800	19500	22900	11800	13200	24000	27100
WATER QUALITY PARAMETERS															
ALKALINITY	mg/L	10	7.9	n/a	n/a	53	50.9	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
TOTAL DISSOLVED SOLIDS	mg/L	223	226	n/a	n/a	449	376	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
TOTAL SUSPENDED SOLIDS	mg/L	7	5	n/a	n/a	56	54	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
TOTAL ORGANIC CARBON	mg/L	28	35.2	n/a	n/a	6.8	18.2	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

NOTES:

-- : Not detected.

n/a : Not analyzed.

TABLE 5-4 (page 3 of 3)
SUMMARY OF LABORATORY ANALYTICAL RESULTS
GROUNDWATER SAMPLES

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

ANALYTE	BORING #	MW-12		MW-13		MW-14		MW-15		MW-15 D		MW-16	
		Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2	Round 1	Round 2
VOLATILE ORGANICS													
BENZENE		--	--	--	--	--	--	--	10	--	--	--	--
CHLOROFORM		--	--	--	--	1	--	--	--	--	--	--	--
CHLOROBENZENE		--	--	--	--	--	1.2 J	--	--	--	--	--	--
1,1-DICHLOROETHANE		--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-TRIMETHYLBENZENE		--	--	--	--	--	--	--	--	--	--	--	--
1,1-DICHLOROETHENE	1	--	--	--	--	1	--	--	--	--	--	--	--
1,2-DICHLOROETHENE (TOTAL)		--	--	530 EJ	200	--	--	3100 D	410 D	2300 D	390 J	--	120 J
TETRACHLOROETHENE		--	--	5800 D	4600 JD	--	--	13000 D	6300 JD	11000 D	8300 J	260	960 JD
TOLUENE		--	--	--	--	--	--	--	56	--	--	--	--
TOTAL XYLENES		--	--	--	--	--	--	--	--	--	--	--	--
1,1,1-TRICHLOROETHANE	5	--	4.6 J	--	--	4	3.9 J	--	--	--	--	--	--
TRICHLOROETHENE		--	--	320 EJ	160	6	4.6 J	1000 EJ	130	990 EJ	--	--	54 J
VINYL CHLORIDE		--	--	240 EJ	120	--	--	1200 EJ	100	1100 EJ	--	--	--
1,2,4-TRICHLOROETHENE		--	--	--	--	--	--	--	--	--	--	--	--
1,2,3-TRICHLOROETHENE		--	--	--	--	--	--	--	--	--	--	--	--
NAPHTHALENE		--	--	--	--	--	--	--	--	--	--	--	--
SEMIVOLATILE ORGANICS													
2-METHYLPHENOL		--	--	--	--	--	--	--	--	--	--	--	--
DI-N-BUTYLPHTHALATE		--	--	--	--	--	--	--	--	--	--	--	--
BUTYLBENZYLPHTHALATE		--	--	--	--	--	--	--	--	--	--	--	--
METALS													
ALUMINUM		--	--	--	--	--	--	--	--	--	--	--	--
ARSENIC		--	--	--	--	--	--	--	--	--	--	--	--
BARIUM	302	--	300	--	--	--	--	--	--	--	--	--	--
CALCIUM	15400	--	16400	15500	19900	5060	6200	21800	40700	20000	41600	14800	16800
CHROMIUM		--	--	--	--	--	--	11.5 J	--	23.7 J	--	--	--
IRON		--	--	--	110	--	--	--	--	--	--	--	--
LEAD		--	--	--	--	--	--	--	--	--	--	--	--
MAGNESIUM		--	--	6860	8860	--	--	11000	22400	10000	22900	7010	7970
MANGANESE	709	--	740	--	16.5	--	--	72.9	--	66.8	--	64.8	40.2
MERCURY	0.27	--	--	--	--	--	--	--	--	--	--	--	--
POTASSIUM	10100	--	12000	--	--	--	--	--	--	--	--	--	--
SODIUM	45500	--	46900	129000	125000	7970	8800	106000	36200	100000	37000	15300	15900
WATER QUALITY PARAMETERS													
ALKALINITY		n/a	n/a	92	85.6	n/a	n/a	83	49.5	85	49.3	17	14.4
TOTAL DISSOLVED SOLIDS		n/a	n/a	465	374	n/a	n/a	369	372	391	372	212	158
TOTAL SUSPENDED SOLIDS		n/a	n/a	2	6	n/a	n/a	6	3	8	3	2	2
TOTAL ORGANIC CARBON		n/a	n/a	42.4	52.4	n/a	n/a	45.2	24.1	46.7	25.3	14.2	14.5

NOTES:

-- : Not detected.

n/a : Not analyzed.

J : Estimated concentration.

D : Sample dilution performed prior to analysis.



ALL CONCENTRATIONS ARE REPORTED IN ug/L.

* DETECTED BY VOLATILE METHOD 524.2
BUT NOT DETECTED IN SVOC ANALYSIS.
ROUND 2 NOT ANALYZED (NA) BY 524.2.

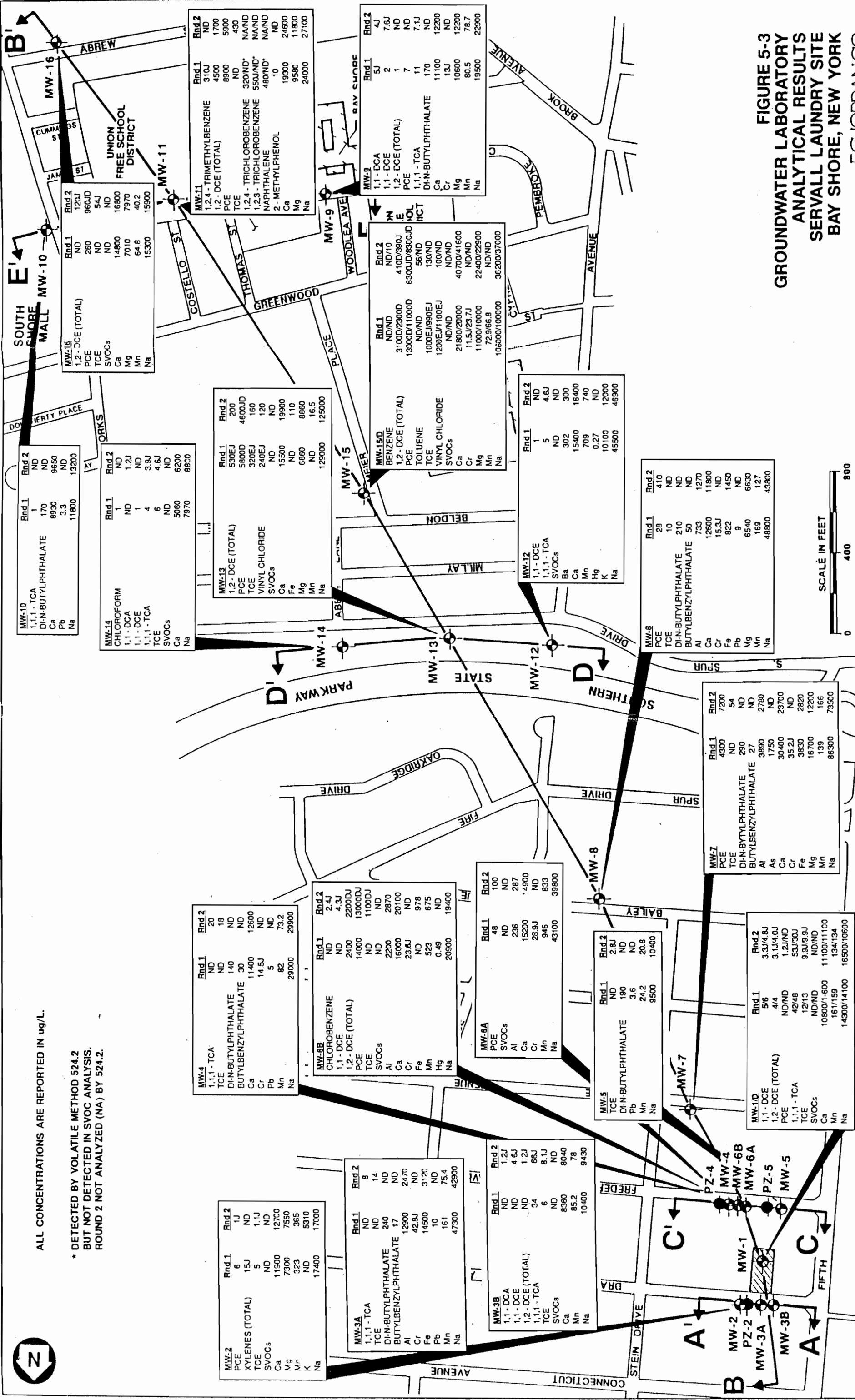
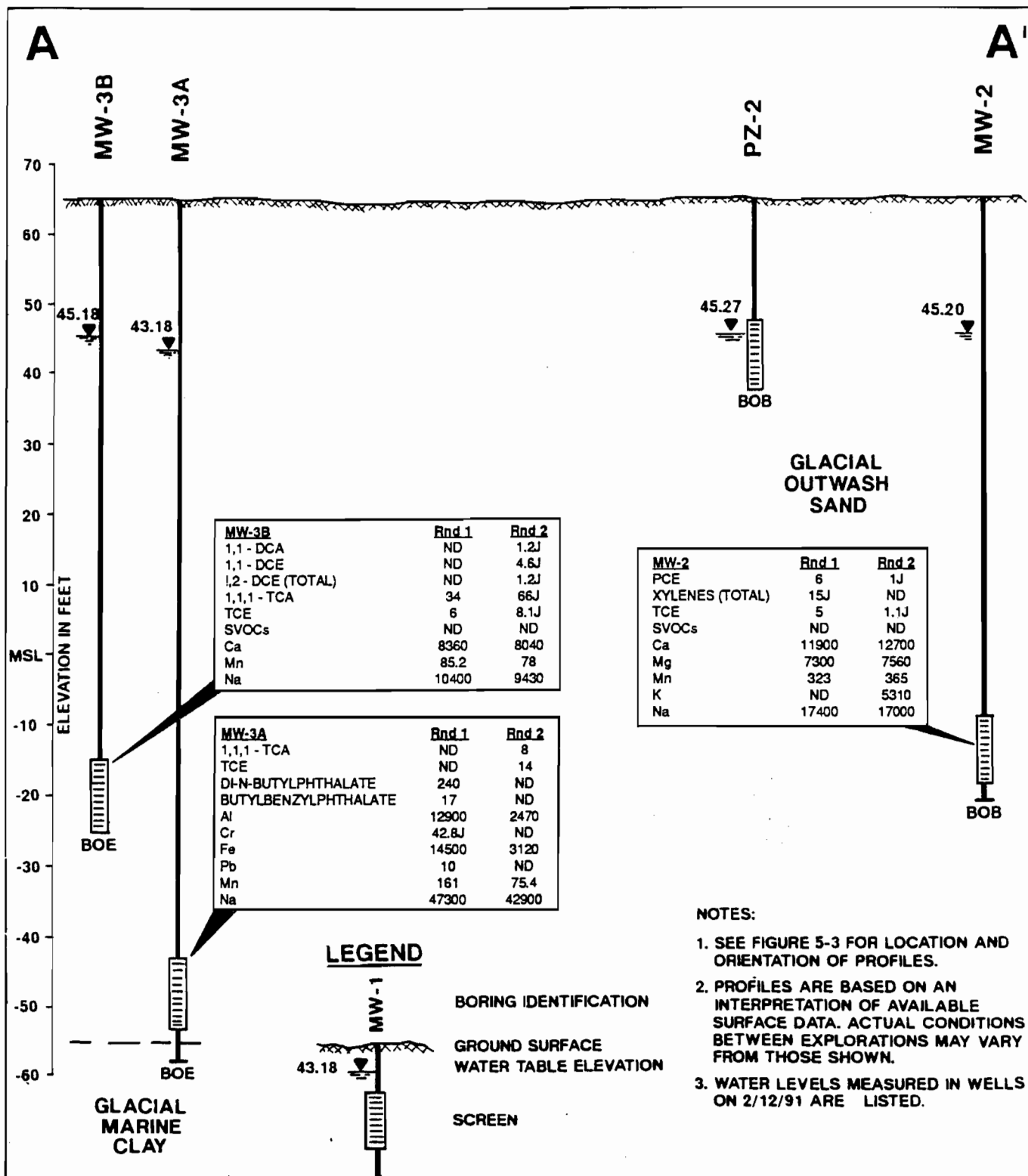


FIGURE 5-3
GROUNDWATER LABORATORY
ANALYTICAL RESULTS
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK





1. SEE FIGURE 5-3 FOR LOCATION AND ORIENTATION OF PROFILES.
2. PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE DATA. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.
3. WATER LEVELS MEASURED IN WELLS ON 2/12/91 ARE LISTED.
4. WELLS 3A, 3B, 6A, AND 6B WERE INSTALLED IN SEPARATE BORINGS.
5. CONCENTRATIONS ARE REPORTED IN $\mu\text{g/L}$.

* DETECTED BY VOLATILE METHOD 524.2 BUT NOT DETECTED IN SVOC ANALYSIS.
ROUND 2 NOT ANALYZED (NA) BY 524.2.

GROUND SURFACE
WATER TABLE ELEVATION
WELL SCREEN
BOTTOM OF EXPLORATION

Age Group	Number of People Not in Labor Force
18-24	100
25-34	200
35-44	300
45-54	400
55-64	500
65-74	600
75+	900

VERTICAL EXAGGERATION 30:1

Two SVOCs, di-n-butylphthalate and butylbenzylphthalate, were detected above the CRQL in one well at 240 and 17 $\mu\text{g/L}$, respectively.

In the three upgradient well samples analyzed for TCL metals, eight inorganic analytes were detected above the CRQL as shown below:

TCL Metal	Range of Concentration Above the CRQL ($\mu\text{g/L}$)	Number of Samples Exceeding the CRQL
Aluminum	12,900	1
Calcium	8,360 - 11,900	2
Chromium	42.8 J	1
Iron	14,500	1
Lead	10	1
Magnesium	7,300	1
Manganese	85.2 - 323	3
Sodium	10,400 - 47,300	3

J = Estimated concentration

One upgradient groundwater sample was analyzed for selected water quality parameters. Alkalinity was reported at 6 mg/L, TSS at 1 milligram per liter (mg/L), TDS at 99 mg/L, and TOC at 21.3 mg/L.

5.3.1.3 Upgradient Groundwater Laboratory Results, Round 2. Six VOCs were detected above the MDL in the upgradient groundwater samples. 1,1-dichloroethane (1,1-DCA), 1,1-DCE, and 1,2-DCE (total), were reported at 1.2 J, 4.6 J, and 1.2 $\mu\text{g/L}$, respectively, in a sample from one well. PCE was detected in one sample at 1 $\mu\text{g/L}$. 1,1,1-TCA was detected in two samples, with concentrations of 8 and 66 $\mu\text{g/L}$. TCE was detected in three samples, ranging from 1.1 to 14 $\mu\text{g/L}$. No SVOCs were detected above the CRQL in Round 2. Three upgradient well samples analyzed for TCL metals, seven inorganic analytes were detected above the CRQL as shown below:

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TCL Metal	Range of Concentration Above the CRQL ($\mu\text{g/L}$)	Number of Samples Exceeding the CRQL
Aluminum	2,470	1
Calcium	8,040 - 12,700	2
Iron	3,120	1
Magnesium	7,560	1
Manganese	75.4 - 365	3
Potassium	5,310	1
Sodium	9,430 - 42,900	3

In round 2, alkalinity was measured at 4.4 mg/L, TSS at 2 mg/L, TDS at 111 mg/L, and TOC at 20 mg/L.

5.3.2 On-site Groundwater

One monitoring well, MW-1, is located on-site behind the ServAll building and is shown in plan view in Figure 3-4 and in profile in Figure 3-6. Well construction details are presented in the Well Installation Logs, Appendix A-3. A summary of the laboratory results is presented in Figures 5-3 and 5-5.

MW-1 was drilled (as MW-1/SB-1) using standard 6.25-inch-ID augers and 6-inch-ID casing rather than with screened augers; soil samples rather than groundwater samples were collected for field GC analysis. The GC and laboratory analytical results for the soil samples collected during the advance of MW-1 are discussed in Subsection 5.2.2.

During each groundwater sampling round, one sample and one duplicate sample were obtained from MW-1. The sample results are discussed in the following subsections.

5.3.2.1 On-site Groundwater Laboratory Results, Round 1. Four VOCs were detected above the CRQL in a groundwater sample and a duplicate sample collected from MW-1. Total 1,2-DCE was detected at a concentration of 4 $\mu\text{g/L}$ in both samples; 1,1-DCE was detected at 5 $\mu\text{g/L}$ in the sample and 6 $\mu\text{g/L}$ in the duplicate sample. TCE was detected at 12 $\mu\text{g/L}$ in the sample and 13 $\mu\text{g/L}$ in the duplicate, and 1,1,1-TCA was detected at 42 $\mu\text{g/L}$ in the sample and 48 $\mu\text{g/L}$ in the duplicate sample.

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No SVOCs were reported above the CRQL in the on-site well samples.

Three TCL metals were detected above the CRQL in the on-site well samples. Calcium was detected at 10,800 $\mu\text{g/L}$ in the sample and 10,600 $\mu\text{g/L}$ in the duplicate sample. Manganese was detected at 161 $\mu\text{g/L}$ in the sample and 134 $\mu\text{g/L}$ in the duplicate. Sodium was detected at 14,300 $\mu\text{g/L}$ in the sample and 14,100 $\mu\text{g/L}$ in the duplicate sample.

The on-site groundwater sample and duplicate sample were not analyzed for the general water quality parameters.

5.3.2.2 On-site Groundwater Laboratory Results, Round 2. Five VOCs were detected above the MDL in the groundwater sample and duplicate sample collected from MW-1. Total 1,2-DCE was detected at a concentration of 3.1 $\mu\text{g/L}$ in the sample and at 4 $\mu\text{g/L}$ in the duplicate; 1,1-DCE was detected at 3.3 $\mu\text{g/L}$ in the sample and 4.8 $\mu\text{g/L}$ in the duplicate sample. PCE was detected at 1.2 $\mu\text{g/L}$ in the sample, but was not detected in the duplicate. TCE was detected at 9.9 $\mu\text{g/L}$ in both the sample and the duplicate sample. 1,1,1-TCA was detected at 53 $\mu\text{g/L}$ in the sample and 30 $\mu\text{g/L}$ in the duplicate sample. No SVOCs were reported above the CRQL in the on-site well samples.

Three TCL metals were detected above the CRQL in the on-site well samples. Calcium was detected at 11,100 $\mu\text{g/L}$ and manganese at 134 $\mu\text{g/L}$ in both the sample and the duplicate sample. Sodium was detected at 16,500 $\mu\text{g/L}$ in the sample and 16,600 $\mu\text{g/L}$ in the duplicate sample.

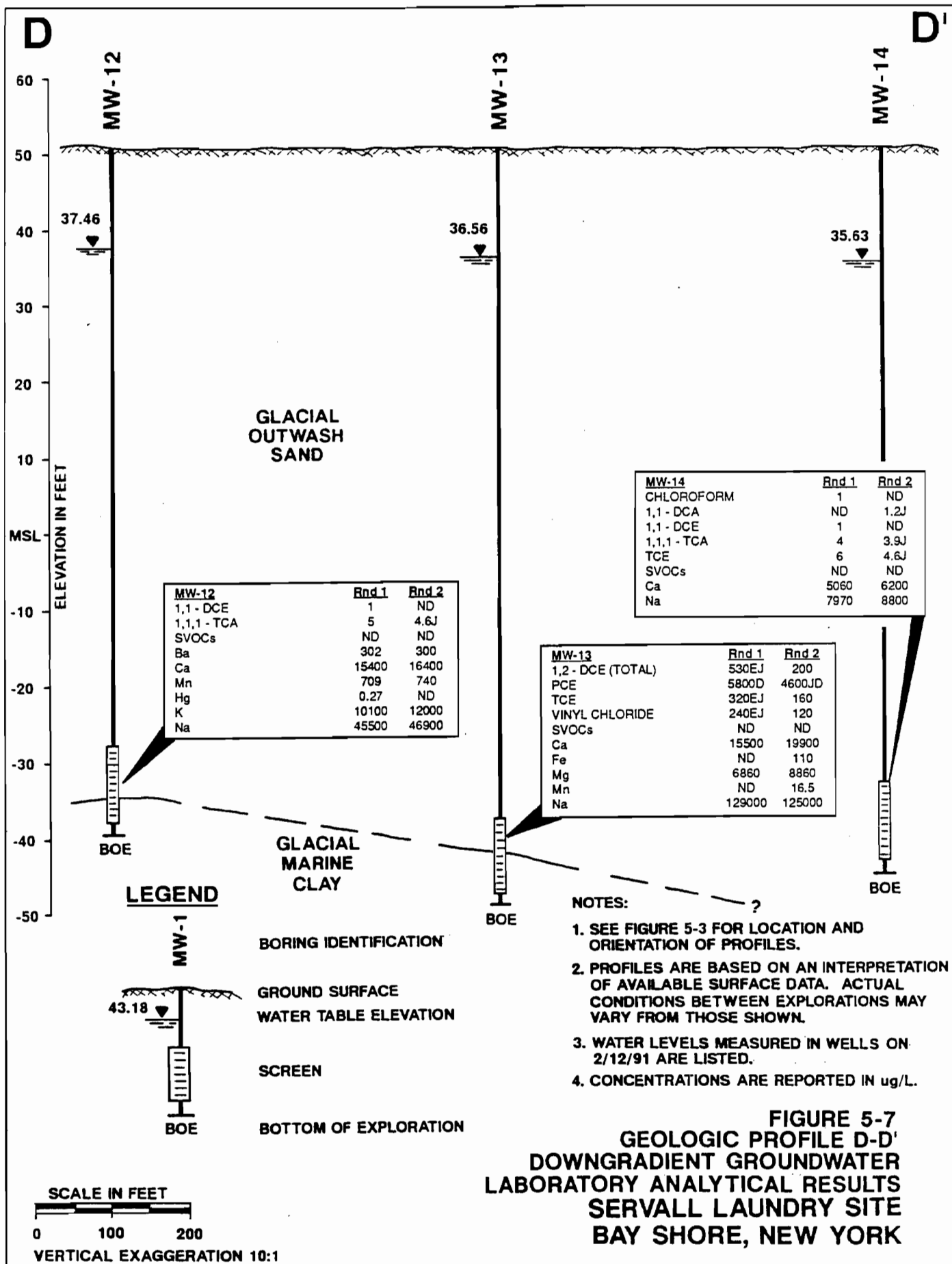
5.3.3 Downgradient Groundwater

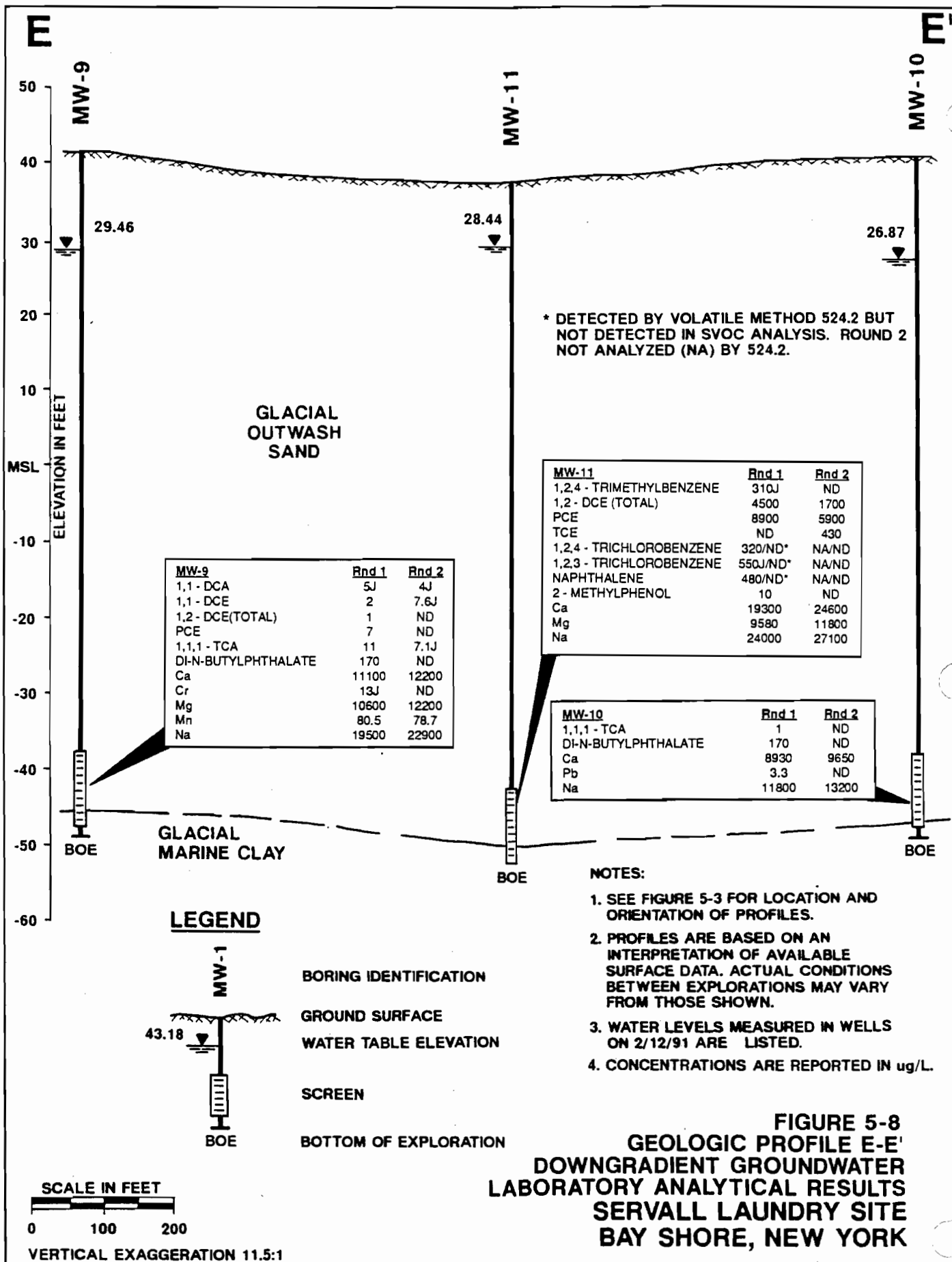
Fourteen monitoring wells, MW-4 through MW-16, are located downgradient of the site. The well locations are shown in plan view in Figure 3-4 and in profile in Figures 3-6 through 3-9. Well construction details are presented in the Well Installation Logs, Appendix A-3. A summary of the laboratory results is presented in Figures 5-3, 5-5, 5-6, 5-7, and 5-8.

The NYSDEC method ASP-89-1 was selected for analysis of VOCs for MW-4, MW-6A, MW-7, MW-8, MW-13, MW-15, MW-15D, and MW-16. Method 524.2



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was selected for MW-5, MW-6B, MW-9, MW-10, MW-12, and MW-14. MW-11 was analyzed by the 524.2 method in Round 1 and by NYSDEC method ASP-89-1 in Round 2.

5.3.3.1 Downgradient Groundwater Field Screening. A total of 214 groundwater samples collected from 14 downgradient screened-auger borings were analyzed with the field GC. PCE was detected above the DL in 109 samples, ranging from 1 to 64,000 $\mu\text{g/L}$, and at trace levels in seven additional samples. TCE was detected above the DL in 53 samples, ranging from 1 to 1,000 $\mu\text{g/L}$, and at trace levels in an additional 20 samples. Vinyl chloride was detected above the DL in eight samples, ranging from 11 to 140 $\mu\text{g/L}$. As discussed, the GC ELCD was not operational for vinyl chloride for 33 (15 percent) of the analyses. 1,2-DCE was detected above the DL in four samples, ranging from 1 to 3 $\mu\text{g/L}$, and at trace levels in two additional samples. Chloroform was detected above the DL in five samples, ranging from 1 to 50 $\mu\text{g/L}$, and at trace levels in five additional samples. 1,3,5-trimethylbenzene and 1,2,4-trimethylbenzene were not detected in any of the samples.

5.3.3.2 Downgradient Groundwater Laboratory Results, Round 1. Twelve VOCs were detected above the MDL and/or CRQL in fifteen samples (including one duplicate sample from MW-15) from the downgradient monitoring wells in Round 1. The summary data are presented in the following table:

Volatile Organic Compound	Range of Concentration Above the CRQL/MDL ($\mu\text{g/L}$)	Number of samples exceeding the CRQL/MDL
PCE	7 - 14,000	10
TCE	6 - 1000 EJ	5
1,2-DCE (total)	1 - 4500	6
1,1-DCE	1 - 2	2
Vinyl Chloride	240 EJ - 1200 EJ	3
1,1-DCA	1 - 5 J	2
1,1,1-TCA	1 - 11	4
1,2,4-Trimethylbenzene	310 J	1
Chloroform	1	1
1,2,4-Trichlorobenzene	320	1
1,2,3-Trichlorobenzene	550 J	1
Naphthalene	480	1

J = Estimated concentration

E = Exceeded calibration range

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Three SVOCs were detected above the CRQL in seven out of 15 downgradient groundwater samples from the downgradient wells. In one sample, 2-methylphenol was detected at 10 µg/L. Di-n-butylphthalate was detected in six samples, ranging from 140 to 290 µg/L. Butylbenzylphthalate was detected in three samples, ranging from 27 to 50 µg/L.

Twelve TCL metals were detected above the CRQL in 15 groundwater samples collected from the downgradient wells. The data are presented in the following table:

TCL Metal	Range of Concentration Above the CRQL (µg/L)	Number of Samples Exceeding the CRQL
Aluminum	236 - 3,890	4
Arsenic	1,750	1
Barium	302	1
Calcium	5,060 - 30,400	14
Chromium	11.5J - 35.2J	8
Iron	822 - 3,830	2
Lead	3.3 - 9	4
Magnesium	6,540 - 16,700	8
Manganese	24.2 - 946	11
Mercury	0.27 - 0.49	2
Potassium	10,100	61
Sodium	9,500 - 129,000	15

J = Estimated Concentration

Six of the downgradient groundwater samples were analyzed for general water quality parameters. Alkalinity was reported ranging from 10 to 92 mg/L, TSS ranging from 2 to 56 mg/L, TDS ranging from 212 to 465 mg/L, and TOC ranging from 6.8 to 46.7 mg/L.

5.3.3.3 Downgradient Groundwater Laboratory Results, Round 2. Ten VOCs were detected above the MDL and/or CRQL in 15 samples (including one duplicate sample from MW-15) from the downgradient monitoring wells in Round 2. Naphthalene, trimethylbenzene, trichlorobenzene, and chloroform, which were present in single samples in Round 1, were absent in Round 2. Chlorobenzene,

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benzene, and toluene were not detected in Round 1 but were detected above the CRQL in single samples in Round 2. The data is presented in the following table:

Volatile Organic Compound	Range of Concentration Above the CRQL/MDL ($\mu\text{g/L}$)	Number of samples exceeding the CRQL/MDL
PCE	100 - 13,000 DJ	9
TCE	2.8 - 1,100 DJ	9
1,2-DCE (total)	120 - 2200 DJ	6
1,1-DCE	4.3 J - 7.6 J	2
Vinyl Chloride	100 - 120	2
1,1-DCA	1.2 J - 4 J	2
1,1,1-TCA	3.9 J - 20	4
Chlorobenzene	2.4 J	1
Benzene	10	1
Toluene	56	1

J = Estimated concentration

D = Dilution prior to analysis

No SVOCs were detected above the CRQL in 15 downgradient groundwater samples from the downgradient wells. Eight TCL metals were detected above the CRQL in 15 groundwater samples collected from the downgradient wells. Arsenic, chromium, lead, and mercury, which were detected in Round one, are absent from the Round 2 sample data. The data are presented in the following table.

TCL Metal	Range of Concentration Above the CRQL ($\mu\text{g/L}$)	Number of Samples Exceeding the CRQL
Aluminum	287 - 2,870	4
Barium	300	1
Calcium	6,200 - 41,600	14
Iron	110 - 2,820	4
Magnesium	6,630 - 22,900	8
Manganese	16.5 - 833	10
Potassium	12,000	1
Sodium	8,800 - 125,000	15

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Six of the downgradient groundwater samples were analyzed for general water quality parameters. Alkalinity was reported ranging from 7.9 to 85.6 mg/L, TSS ranging from 2 to 54 mg/L, TDS ranging from 158 to 374 mg/L, and TOC ranging from 14.5 to 52.4 mg/L.

5.3.4 Groundwater Site Contaminant Assessment

Final site groundwater contaminants are determined by evaluating the potential site contaminants against five criteria:

- history of use at the site
- presence in more than one round from a well
- presence in more than one media at the site
- presence at concentrations greater than trace levels
- not present in upgradient wells

Potential site contaminants satisfying one or more of these criteria are generally considered site contaminants.

In order to ascertain which contaminants may be attributable to the site, statistical analyses of hydraulically downgradient and upgradient (background) data were performed on data collected from groundwater monitoring wells. Because of the limited number of samples per well (two), intra-well comparisons would not yield meaningful results. For this reason, the data were categorized as either upgradient or downgradient in order to test for statistically significant differences between groundwater contaminant levels prior to and after contact with the site. Comparisons of the mean concentration values using the two-sample t-test concluded that differences between upgradient and downgradient mean concentrations were not significant, at the 5 percent level, for aluminum, iron, calcium, sodium, manganese, and 1,1,1-trichloroethane. Therefore, since there is no evidence that concentration levels for these contaminants are significantly greater downgradient than upgradient, they were not considered to be site-related contaminants.

PCE, TCE, 1,2-DCE (total), and vinyl chloride are related compounds made up of the primary dry cleaning solvent (i.e., PCE) and its degradation products. Because of the widespread distribution of these compounds in more than one media at the site at concentrations well above background and the history of PCE disposal at the site, these four compounds are considered site contaminants. 1,1-DCE and 1,1-DCA were detected in low concentrations (less than 10 µg/L) in 10

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and four groundwater samples, respectively. These compounds are common industrial chemicals found in gasoline and other petroleum distillates, degreasers, and metal cleaners. They are also found as impurities in industrial grade PCE. Their presence in groundwater may be related to dry cleaning activities, unrecorded chemicals used at the site, or background conditions in a highly industrialized area. 1,1-DCA was detected in four groundwater samples including both rounds in MW-9 with no distinct distribution pattern to the trace levels detected. 1,1-DCE was detected in both rounds from the on-site well, the onsite well duplicates, and MW-9. Both 1,1, DCA and 1,1-DCE are considered site contaminants.

Toluene was detected in one groundwater sample, the second round sample from MW-15, at 56 $\mu\text{g/L}$. It was not present in either round in the duplicate sample from MW-15. Although toluene is present in five on-site soil samples, there are no reports of toluene use at ServAll. Lack of agreement between sampling rounds and the duplicate nondetect results suggests some uncertainty with the positive toluene result. Although toluene is a site contaminant for subsurface soils, its presence in one groundwater sample more than 4,000 feet from the site is not considered related to on-site soil contamination. Toluene is not considered a site contaminant for groundwater because of the uncertainty about its presence in groundwater and its single isolated occurrence away from the site.

Benzene and 2-methylphenol were each detected in one sample at a relatively low concentration (10 $\mu\text{g/L}$). There is no record of their use at ServAll. The presence of these compounds in groundwater is uncertain due to inconsistent appearance between sampling rounds. Similar to 1,1-DCE and 1,1-DCA, these compounds are common industrial chemicals present in gasoline and degreasers, and may be related to unrecorded site operations or background conditions. Benzene and 2-methylphenol are not considered site contaminants because of the lack of a usage history at the site, their inconsistent appearance between sampling rounds, their occurrence in only one site medium, and the low concentrations detected.

Arsenic was detected in MW-7 during Round 1 at 1,750 $\mu\text{g/L}$ but was not detected in the second round (CRDL = 10 $\mu\text{g/L}$). Disagreement between sampling rounds indicates uncertainty about the arsenic results. There is no record of arsenic use at the site and arsenic was not detected in other media at the site; however, a resampling of MW-7 for arsenic was implemented in December, 1991 due to the relatively high concentration (1750 $\mu\text{g/L}$) compared to New York State Class GA groundwater quality standards (25 $\mu\text{g/L}$). The

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analytical results from the December 1991 samples reported non-detect for arsenic in the MW-7 sample and a duplicate arsenic is not considered a site contaminant.

The following organic compounds have been identified as groundwater site contaminants:

- PCE
- TCE
- 1,2-DCE (total)
- vinyl chloride
- 1,1-DCE
- 1,1-DCA

The fate and transport potential of site contaminants is discussed in Section 6.0; Section 7.0 contains an assessment of the associated risk.

5.4 DATA USABILITY

This subsection summarizes the usability of the analytical results generated during the ServAll site field program. Laboratory analyses were performed in accordance with NYSDEC ASP protocols. The data were validated using the criteria specified by USEPA. A detailed evaluation of the laboratory quality control results is presented in Appendix B-2.

Usability is based on validated sample results; the evaluation has been extended to include blank corrected samples where appropriate. Rejected results ("R" qualifier) represent unusable data because the analyte presence or absence is uncertain. Rejected results should not be used for a quantitative risk assessment (see "Risk Assessment Guidance for Superfund," USEPA 540/1-89/002). In general, sample results with qualifiers other than "R" are considered usable.

The data validation summaries in Appendix B-2 indicate which laboratory results are considered noncompliant when compared to ASP protocols. However, most of these noncompliant results represent minor QC problems and do not affect data usability. The cases where QC problems resulted in the rejection of data are discussed in the following subsections. In most cases, these problems are typical analytical difficulties or are the result of sample matrix problems.

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5.4.1 Volatile Organic Compounds

Most of the VOCs results were acceptable and may be used without qualification. However, in some cases the reported CLP calibration standards did not meet the minimum response criteria for vinyl acetate, and the Method 524.2 calibration standards did not meet the minimum response criteria for dichlorodifluoromethane, 1,2-dibromo-3-chloropropane, bromoform, and bromomethane. The nondetected results for these compounds have been rejected. In addition, positive results for these compounds may be biased high.

5.4.2 Semivolatile Organic Compounds

Most of the SVOC analyses provided acceptable results, and the values presented may be used without qualification. The acid surrogate recoveries for SVBSXX1XX2001XX, SVMWXX1XXX02XD, and SVMWXX9XXX02XX, and the acid and base/neutral surrogate recoveries for SVMWXX8XXX02XX were less than 10 percent. The nondetected results for these samples were rejected for the fractions listed above.

5.4.3 Inorganics

Most of the inorganics analyses are acceptable and may be used without qualification. In one case, selenium results were rejected because of low spike recoveries.

5.4.4 TCLP Analyses

Most of the TCLP results are acceptable and may be used without qualification. The acid surrogate recoveries for SVBSXX1XX801XX and SVBSXX8X1001XX were less than 10 percent. The nondetected results for the acid fraction in these samples were rejected.

5.5 TENTATIVELY IDENTIFIED COMPOUNDS

The ASP analytical procedures for VOCs and SVOCs may also detect the presence of additional tentatively identified compounds (TICs), not included on the TCL. The mass spectra of these non-target compounds (up to 10 VOCs and 20 SVOCs) were compared to library spectra using a computerized search routine, and the best matches were evaluated by the laboratory. If a good library match could not be made the TIC was reported as "unknown." The concentrations were

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estimated by comparing the response of the TIC's to that of the closest internal standard. All TICs from the ServAll analytical program were reported as unknown (see Appendix B-2).

5.6 SUMMARY OF SITE CONTAMINANTS

Potential site contaminants for each media were determined using the procedures presented in Subsection 3.2.4, which identify potential site contaminants as all substances detected above the CRDL that cannot be attributed to laboratory or sampling contamination, or substances with concentrations above background levels and/or New York and federal standards. The final site contaminants were determined based on knowledge of historical site operations, background conditions in a highly industrialized area, and distribution of contaminants in site media. The site contaminants, the range of concentrations at which they were detected at the site, the frequency of detection in site samples, and the relevant background concentrations or standards are summarized in Table 5-5.

Surface and near-surface soil site contaminants are PCE and TCE. The areas of the site open to surface soil sampling were limited to a strip of land less than 12-feet-wide on the western side of the site, and a 3-foot-wide strip along the base of the fence on the south property line (see Figure 5-1). Occurrences of site contaminants were restricted to samples from the western area. This area has been used historically as a drum storage area. PCE and/or TCE contamination in this area are most likely connected with ServAll Uniform solvent storage or disposal practices.

Subsurface soil samples were collected in the southern and eastern areas of the ServAll property (see Figure 5-2). No evidence of contamination was detected in samples from the two explorations completed on the eastern side of the site. The subsurface soil site contaminants are PCE, TCE, 1,2-DCE (total), toluene, and bis(2-ethylhexyl) phthalate.

PCE and/or TCE were detected in subsurface soils from five of six explorations completed in the southern portion of the site. PCE, where detected, appeared to persist with depth; TCE occurrence was more sporadic. The PCE, TCE, and 1,2-DCE (total) in soils are related to dry cleaning solvent disposal practices during site operations as a dry cleaning and laundry facility.

The sources of toluene and bis(2-ethylhexyl) phthalate detected in three and two soil samples, respectively, are not known. Toluene is a common industrial

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TABLE 5-5
FREQUENCY AND OCCURRENCE OF SITE CONTAMINANTS

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

SURFACE SOIL

SITE CONTAMINANT	CONCENTRATION RANGE ($\mu\text{g/kg}$)	FREQUENCY OF DETECTION	BACKGROUND CONCENTRATION ¹
Tetrachloroethene	17 - 310,000 DEJ	5/9	N/A
Trichloroethene	76	1/9	N/A

SUBSURFACE SOIL

SITE CONTAMINANT	CONCENTRATION RANGE ($\mu\text{g/kg}$)	FREQUENCY OF DETECTION	BACKGROUND CONCENTRATION ¹
Tetrachloroethene	13 - 84,000	13/29	N/A
Trichloroethene	53	1/29	N/A
1,2-Dichloroethene (total)	16	1/29	N/A
Toluene	6,700 - 14,000	5/29	N/A
Bis(2-ethylhexyl)phthalate	1600 J - 1,900	2/29	N/A

GROUNDWATER

SITE CONTAMINANT	CONCENTRATION RANGE ($\mu\text{g/L}$)	FREQUENCY OF DETECTION	GROUNDWATER STANDARDS ²
Tetrachloroethene	7 - 14,000	19/30	5/5
Trichloroethene	6 - 1,200 JD	14/30	5/5
1,2-Dichloroethene (total)	1 - 4,500	12/30	5/5
Vinyl chloride	100 - 1,200 EJ	5/30	2/2
1,1-Dichloroethene	1 - 4.8	10/30	5/5
1,1 Dichloroethane	1.2J - 5J	4/30	5/5

NOTES:

¹ Background metal concentration ranges from "Background Concentrations of 20 Elements in Soils with Special Regard for New York State" (no date) E. Carol McGovern, NYSDEC Wildlife Resources Center

² NY State Groundwater Quality Class GA / NY State Drinking Water Supplies
N/A indicates value not available.

SUMTAB.WK1

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compound found in gasoline, solvent recovery operations, paints, and coatings. Toluene may have been used at the site, although there is no record of its use. It may have been a contaminant in the dry cleaning solvents or it may have come to the site via soiled laundry from industries using toluene. Bis(2-ethylhexyl) phthalate is a plasticizer, and there is no known source for the concentrations detected at ServAll.

Groundwater site contaminants are PCE, TCE, 1,2-DCE (total), vinyl chloride, 1,1-DCA, and 1,1-DCE (see Figure 5-3). PCE, TCE, 1,2-DCE (total), and vinyl chloride are the dominant site contaminants. These compounds are related to the disposal of dry cleaning solvents at ServAll, and their distributions in groundwater are discussed in detail in the fate and transport discussion in Section 6.0. Trace level concentrations (less than 10 $\mu\text{g/L}$) of 1,1-DCE and 1,1-DCA were found in 10 and four groundwater samples, respectively. These compounds were not detected in other site media and their source is not known. 1,1-DCE is a common industrial chemical, used as a chlorinated solvent intermediate, gasoline additive, and in degreasing agents.

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6.0 CONTAMINANT FATE AND TRANSPORT

This section evaluates the migration potential of site contaminants and discusses the potential fate of site contaminants. The site contaminants found at ServAll include VOCs (PCE, TCE, 1,2-DCE, 1,1-DCE, 1,1-DCA, toluene, and vinyl chloride), and one SVOC, bis(2-ethylhexyl)phthalate. The observed distribution of these contaminants in soil and groundwater at ServAll is the result of the physico-chemical properties of site contaminants and site conditions. Site conditions governing the fate and transport of chemicals include original chemical distribution, site topography, meteorological conditions, and site hydrogeology. Important physico-chemical properties include specific gravity, solubility, and the organic carbon partition coefficient (K_{oc}).

6.1 CONTAMINANT TRANSPORT

The physico-chemical properties of site contaminants and site conditions determine which contaminant transport mechanisms will predominate. Once the dominant transport mechanisms have been identified, the contaminant distribution can be interpreted in terms of past events, and the future contaminant distribution can be estimated.

Three physico-chemical properties of the site contaminants are presented in Table 6-1. Specific gravity is the ratio of the mass of a given volume of a substance to the mass of an equal volume of water. Liquids with specific gravities greater than 1 are "heavier" than water. When present as a separate phase in the subsurface (i.e., not dissolved in water), these chemicals can sink through the unsaturated and saturated zones and accumulate on low-permeability formations. Such materials are called "dense nonaqueous phase liquids" or DNAPLs.

Solubility and K_{oc} are partition coefficients representing a measure of the tendency of a material to move from one phase to another. Solubility measures partitioning between the pure liquid or solid form of a chemical and the aqueous phase, or the tendency of a material to dissolve in water. Substances with relatively low solubilities are more likely to remain in a separate phase when in contact with water; substances with high solubilities will dissolve and move with groundwater. K_{oc} measures partitioning between the pure liquid phase and adsorption on organic carbon particles within the soil matrix. Chemicals with high K_{oc} values are more likely to remain adsorbed to soil particles than to dissolve in groundwater and surface water, and to be retarded by adsorption onto soil particles as they move through an aquifer.

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TABLE 6-1
PHYSICO-CHEMICAL PROPERTIES OF SITE CONTAMINANTS¹

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

CHEMICAL	SPECIFIC GRAVITY	SOLUBILITY ($\mu\text{g/L}$)	K_{oc} ² (ml/g)
PCE	1.63	1.5×10^5	364
TCE	1.47	1.1×10^6	126
1,2-DCE (cis-/trans-)	1.28/1.26	$3.5 \times 10^6 / 6.3 \times 10^6$	49/59
Vinyl chloride	0.9121	2.7×10^6	57
1,1-DCA	1.176	5.5×10^6	30
1,1-DCE	1.21	2.3×10^6	65
Toluene	0.867	5.35×10^5	300
Bis(2-ethylhexyl) phthalate	0.98	285	5900

NOTES:

¹ From EPA-600/8-90/003, Basics of Pump-and-Treat Ground-water Remediation Technology, prepared by GeoTrans, Inc.

² K_{oc} = Organic Carbon Partition Coefficient

6.1.1 Atmospheric Migration

Atmospheric migration of contaminants occurs primarily by two mechanisms: (1) volatilization of the chemical into the air, and (2) adsorption of the chemical onto airborne particulates. The first mechanism, volatilization, is a major pathway for VOCs from surface soils and water to receptors either on- or off-site. The second method, adsorption, is of more concern for organic compounds with high adsorption coefficients (i.e., high K_{oc} values) and metals in surface soils. The extent to which either mechanism operates is governed, in part, by meteorological conditions and the amount of exposed contaminated surface materials.

Atmospheric migration via migration or adsorption from surface soils is not expected to be a significant exposure pathway because of the small amount of exposed surface soils at ServAll. Less than 18 percent of the site is exposed (i.e., not covered by either buildings or asphalt). Volatilization of the major groundwater contaminants, PCE, TCE, 1,2-DCE, and vinyl chloride, into the atmosphere is a more significant pathway for atmospheric contaminants. There is a potential for these VOCs to volatilize from groundwater into air at the groundwater/air interface (water table), and then migrate into basements of homes in the site vicinity. This exposure scenario is discussed in Section 7.0, the Baseline Risk Assessment Summary. However, over most of the length of the groundwater contaminant plume, contaminated groundwater is confined to the lower portions of the aquifer away from the water table and, therefore, is not available for volatilization into the atmosphere.

6.1.2 Surface Water Migration

Surface water can transport chemicals either as dissolved species or adsorbed onto entrained sediments. Dissolved and adsorbed contaminants move to groundwater via either runoff from contaminated surface soils or discharge from contaminated groundwater. Runoff from contaminated surface soils is not expected to be a significant migration pathway due to the limited amount of surface soil exposed at the site. There is no evidence of contaminated groundwater discharging to surface water; no surface water bodies are currently receiving contaminated groundwater from the site.

6.1.3 Groundwater Migration

Contaminants enter groundwater through the downward seepage of chemicals, either as pure liquids or dissolved in water by the action of rain or surface water

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SECTION 6

percolating through the unsaturated zone. In all cases, concentrations present in groundwater depend on the solubility of the chemical in water. Contaminants may either dissolve in groundwater near the water table and move in the direction of groundwater flow, or sink as DNAPL through the saturated zone due to specific gravities greater than water (i.e., greater than 1).

Contaminants with high specific gravity values continue to dissolve as they move downward through the groundwater. Once dissolved, the contaminants move with groundwater flow. However, during its downward migration through the unsaturated or saturated zones, a DNAPL may reach a residual saturation concentration, or gravity forces may not be great enough to provide for continued downward migration. If this occurs, the DNAPL may become stationary in the soil matrix and continue to act as a residual source of contamination.

Historical records of disposal practices suggest that PCE was the dominant chemical in the wastestream at ServAll Uniform. As indicated by its relatively high specific gravity of 1.63, PCE in its pure liquid form (and also TCE and 1,2-DCE [see Table 6-1]) has the physical potential to move downward through the aquifer under the force of gravity. The downward migration would respond to variations in permeability that might require a minimum entry pressure of the separate phase to build up before the water within the saturated zone pore spaces can be displaced by the PCE.

Vertical Migration of Contaminants. Generally, groundwater concentrations of 10 percent or more of the solubility of a chemical indicate the possible presence of free product, or DNAPL, within the aquifer. Historic concentrations of PCE in groundwater, approaching 70 percent of the solubility of PCE in water, are strong evidence to suggest that PCE was at one time present as free product within the aquifer.

The Gardiners Clay is expected to be a significant obstacle to continued downward migration of separate-phase contaminants. However, PCE is a non-polar compound and may cause shrinking, and possibly cracking, of the clay surface if DNAPL pooled on the clay surface. The extent to which this might affect migration of DNAPL through the clay depends on the clay mineralogy and thickness of the Gardiners Clay beneath the site. True clays, such as montmorillonite, swell when saturated with water and would be expected to shrink when in contact with a non-polar solvent, such as PCE, as the water is removed from its crystalline structure. If the Gardiners Clay unit is a true clay, this effect would be limited to the upper surface of the clay and would not represent a

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significant migration path through it if the unit were more than a few feet in thickness, as is thought to be the case in the ServAll vicinity.

The contaminant plume begins at the water table beneath the ServAll property and extends downward through the aquifer. Figure 6-1 shows the vertical distribution pattern of total VOCs (predominantly PCE based on screening data) in groundwater suggesting downward migration. The high concentrations of PCE and TCE directly beneath the site extending downwards to the bottom of the aquifer indicates that, at some point, solvents moved down through the unsaturated and saturated zones of the highly permeable upper glacial aquifer as a DNAPL, accumulating at the surface of the less permeable Gardiners Clay.

Approximately 3,500 feet south-southeast of the site, groundwater contamination appears to be most significant in a zone within approximately 20 feet of the top of the Gardiners Clay unit. High concentrations of VOCs at 40 and 70 feet bgs at the site most likely represent layers of slightly lower permeability in the upper glacial aquifer where the downward movement of contaminants was slowed and contaminants were detained.

The highest concentrations of PCE in groundwater were detected in deep wells screened at the surface of the clay and in MW-6B. Ten percent of the solubility of PCE is approximately 15,000 $\mu\text{g/L}$. From two 1991 rounds of groundwater sampling and analysis, the highest concentrations of PCE observed in groundwater were 14,000 and 13,000 $\mu\text{g/L}$ in MW-6B and 13,000 and 6,300 $\mu\text{g/L}$ in MW-15. Although the presence of contamination on the clay surface directly below the site and historic concentrations as high as 110,000 $\mu\text{g/L}$ in nearby monitoring wells indicate that at one time PCE could have been present in the aquifer as a DNAPL, present groundwater concentrations near the site suggest that DNAPL is either not currently present in the areas where groundwater samples were collected or that the quantity of residual DNAPL has significantly decreased over time.

Horizontal Migration of Contaminants. Groundwater is the dominant method of contaminant transport from the site source area. Figure 6-2 shows a plan view of the distribution of VOCs in groundwater parallel to the groundwater flow direction. The pattern of contaminant distribution is similar to the distribution detected in previous investigations; however, the plume has advanced to a distance of approximately 7,500 feet from the site.

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B NORTH
B' SOUTH

SOUTHERN STATE PARKWAY

BAY SHORE MIDDLE SCHOOL

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MW-3B
MW-1
MW-6B
MW-6A

MW-7

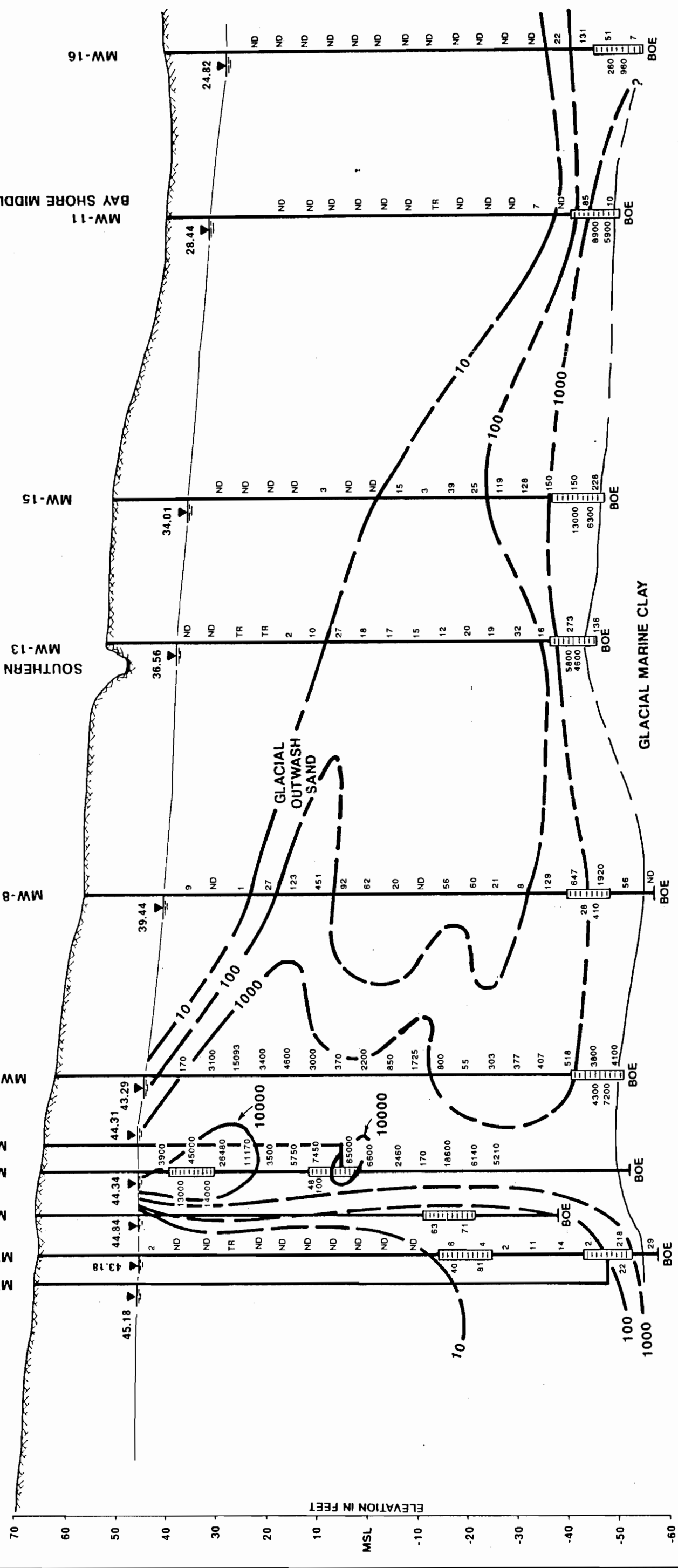
MW-8

MW-13

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MW-11

MW-16



NOTES:

1. SEE FIGURE 5-3 FOR LOCATION AND ORIENTATION OF PROFILES.
2. PROFILES ARE BASED ON AN INTERPRETATION OF AVAILABLE SUBSURFACE DATA. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.
3. WATER LEVELS MEASURED IN WELLS ON 2/12/91 ARE LISTED.
4. WELLS 3A, 3B, 6A, AND 6B WERE INSTALLED IN SEPARATE BORINGS.
5. VALUES ADJACENT TO WELLS ARE TOTAL VOC CONCENTRATIONS IN ppb FROM GC SCREENING OF GROUNDWATER SAMPLES. (PREDOMINANTLY TETRACHLOROETHYLENE)

BORING IDENTIFICATION
GROUND SURFACE
WATER TABLE ELEVATION
WELL SCREEN WITH CONTAMINANT LEVEL
BOTTOM OF EXPLORATION

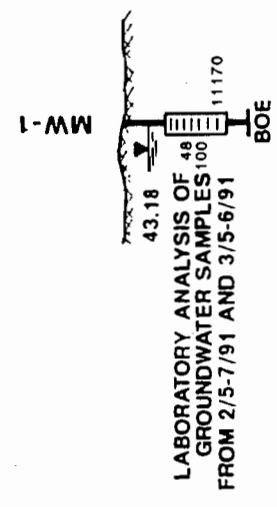
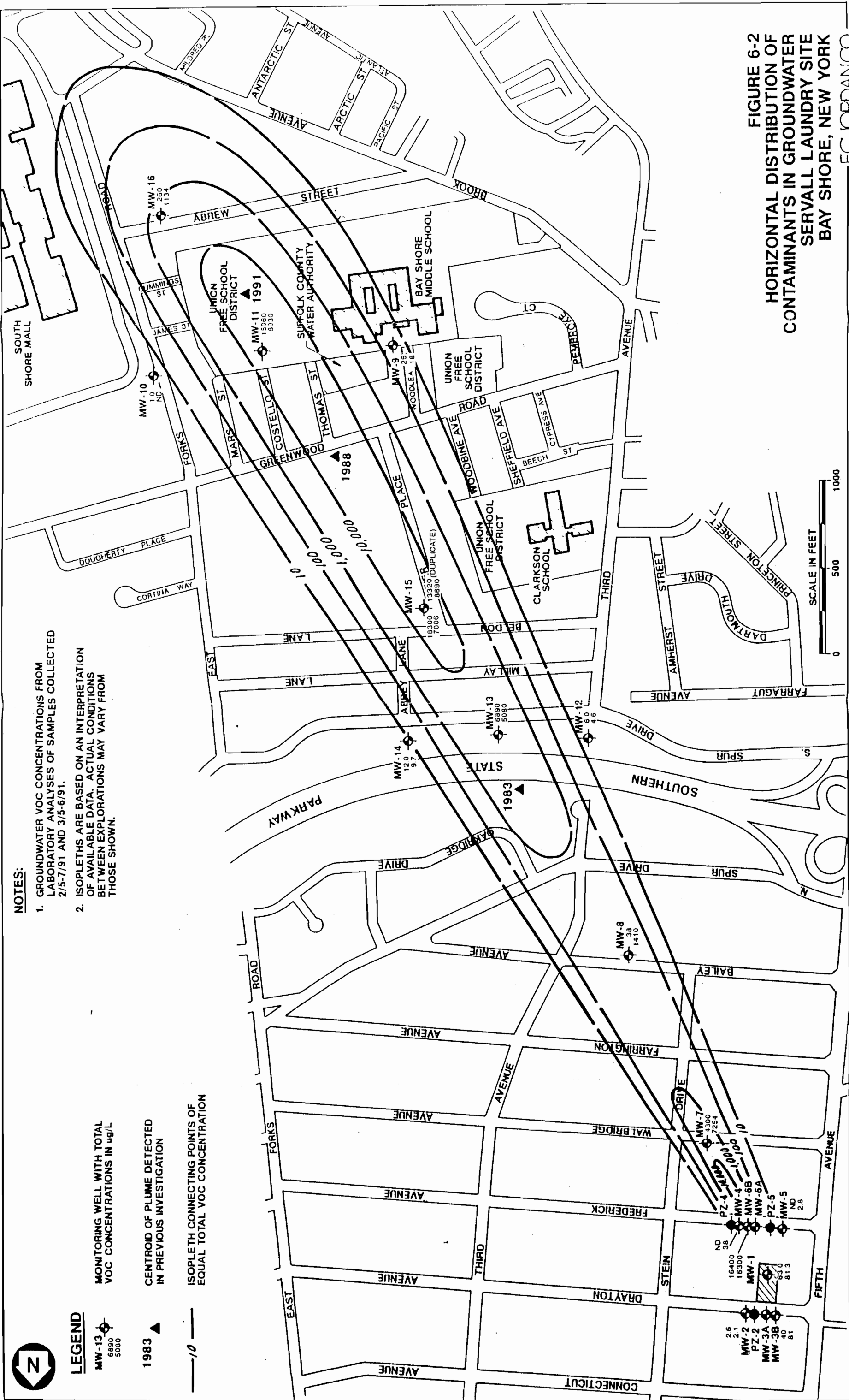


FIGURE 6-1
VERTICAL DISTRIBUTION OF
CONTAMINANTS IN GROUNDWATER
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

ECJORDANCO



NOTES:

- 1. GROUNDWATER VOC CONCENTRATIONS FROM LABORATORY ANALYSES OF SAMPLES COLLECTED 2/5-7/91 AND 3/5-6/91.
- 2. ISOPLETHS ARE BASED ON AN INTERPRETATION OF AVAILABLE DATA. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.

LEGEND

- MW-13 6890 5080
- 1983
- MONITORING WELL WITH TOTAL VOC CONCENTRATIONS IN ug/L
- CENTROID OF PLUME DETECTED IN PREVIOUS INVESTIGATION
- ISOPLETH CONNECTING POINTS OF EQUAL TOTAL VOC CONCENTRATION

FIGURE 6-2
HORIZONTAL DISTRIBUTION OF
CONTAMINANTS IN GROUNDWATER
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

ECJORDANCO

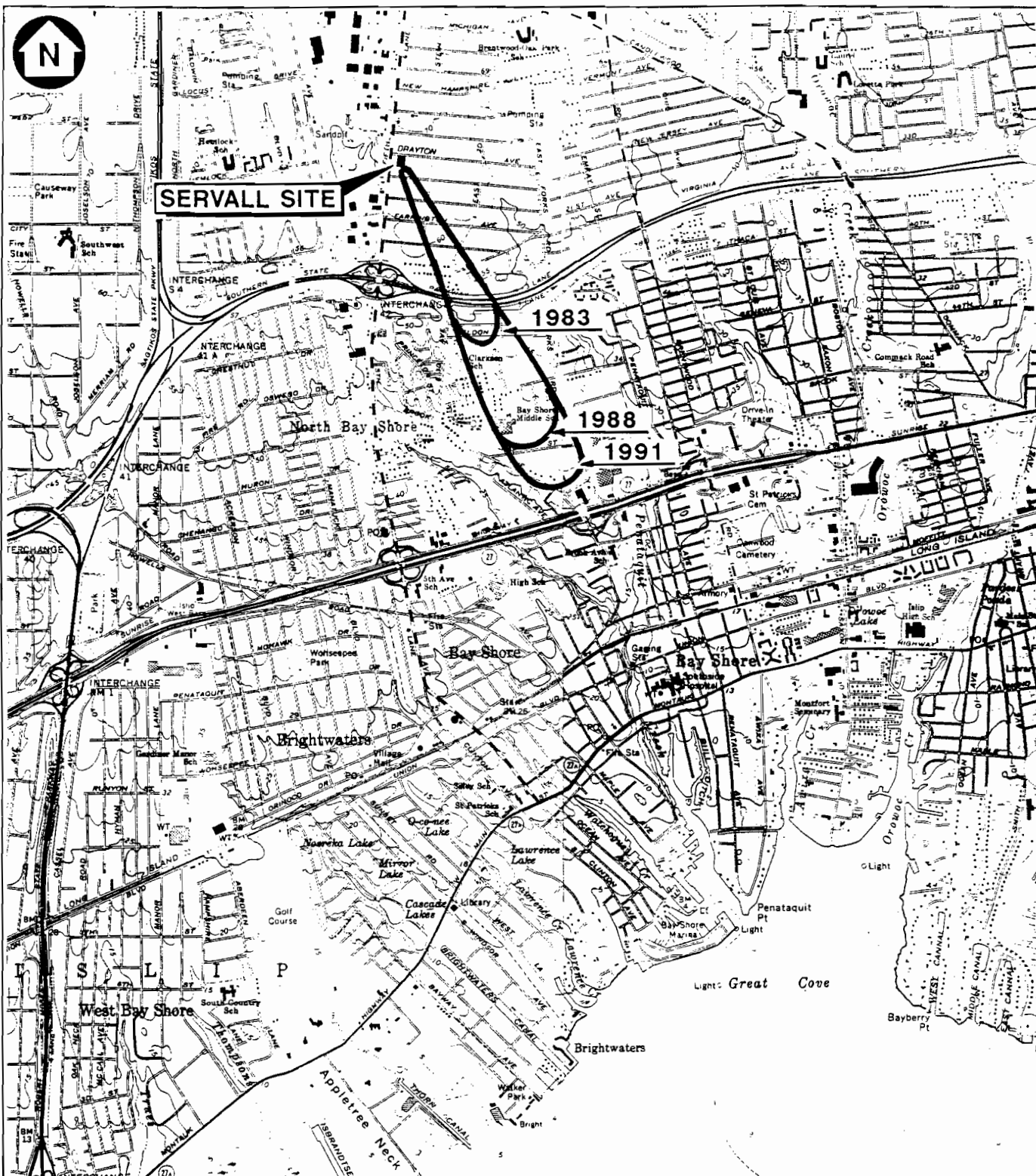
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The chronology of events at the site was used to interpret the present distribution of contaminants. The following list is a chronological summary of the significant historical events related to contaminant transport and migration:

- 1969 ServAll Uniform Rental, Inc. begins operations
- 1972 Dry cleaning equipment is installed at the site. (Disposal of PCE is expected to have begun around this time.)
- 1981 In response to regulatory pressure, eight disposal pools are pumped and cleaned.
- 1983 The first groundwater sampling event, conducted north of the Southern State Parkway, is conducted by SCDHS in September.
- 1984 On-site disposal pools are abandoned and the site is covered with asphalt.
- 1988 From November 1987 to March 1988, a second groundwater sampling event is conducted by SCDHS further downgradient of the site than the 1983 investigation (south of the Southern State Parkway).

Comparisons between the current distribution of groundwater contamination and data from previous investigations were used to calculate estimates of groundwater and contaminant migration rates. The timing of past on-site clean-up efforts is important to evaluate the possible mitigating effects such measures have had on contaminant migration and distribution.

Groundwater and contaminant migration rates were estimated by dividing the distance between the centroids, or centers of the contaminant plume fronts, of the 1983, 1987, and 1991 plumes by the elapsed time between sampling rounds. The locations of the centroids from previous investigations and the current investigation are shown in Figure 6-3. Assuming that sufficient contamination did not accumulate until two years after dry cleaning operations began in 1972, the travel time is nine years for the plume front to move from the site to the centroid of the plume during the 1983 sampling event. The distance between the site and



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time of approximately 4.3 years (52 months) yields a migration rate of 1.3 feet per day (484 feet per year). The distance between the 1988 plume front and the 1991 plume front is approximately 1,065 feet, which, when divided by three years is 0.97 feet per day (355 feet per year). These migration rates are more consistent with the rate of 410 feet per year estimated by Wexler (1988) than the average groundwater flow rate of 910 feet per year derived from published hydraulic conductivity values, porosity for a sandy aquifer, and site-specific hydraulic gradients (see Subsection 4.2).

The contaminant plume migration rate appears to be decreasing when compared to the rate from 1983-1988. This may be in response to slightly lower hydraulic conductivity in the area covered by the plume between 1988 and 1991. This is supported by slightly higher hydraulic gradients calculated from water level measurements in wells in this part of the study area. At the estimated current rate of migration, 0.97 feet per day, and with no remediation, the centroid of the plume would reach the Atlantic Ocean in about 25 years.

The distribution of PCE in groundwater is shown in Figure 6-4. Current groundwater analyses indicate the possibility that two distinct "slugs" of high PCE concentration are moving through the aquifer. This distribution pattern was also observed in the 1988 data. The two isochrons showing distances representing contamination derived from the site in 1981 and 1984 indicate that the first slug may be the result of contamination occurring before clean-up efforts in 1981 and 1984. After 1984, no additional contamination would be expected to enter the groundwater from the ground surface as discharge was discontinued and recharge through precipitation in the area of contamination was cut off by paving of the site. The only potential sources of groundwater contamination after 1984 are subsurface accumulations of site contaminants. The second area of high concentrations, at MW-6B, may represent accumulations of contaminants in shallow layers (40 to 70 feet bgs) of slightly lower permeability within the upper glacial aquifer, which may act as continuing sources of groundwater contamination. Also, soil samples near the water table at the site contain high concentrations of site contaminants, and seasonal fluctuations in the water table could periodically bring groundwater into contact with these contaminated soils beneath the site.

Penataquit Creek is downgradient and slightly east of the present path of the

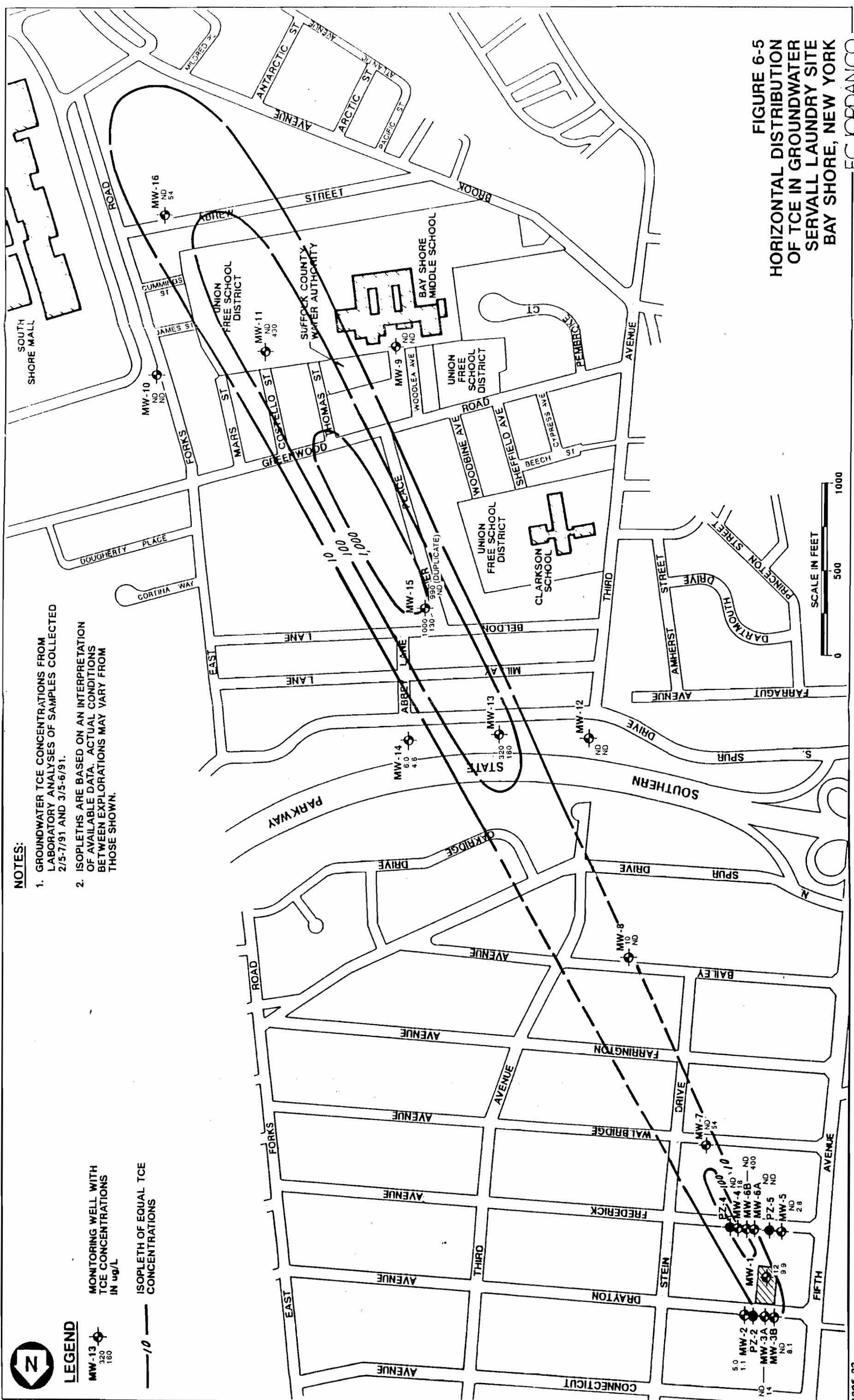
since plume migration has not been affected. The plume is moving southeast toward the ocean, not east toward the creek, as might be expected if the creek had a significant impact. At the point at which the plume is expected to underflow Penataquit Creek, the distance from the bottom of the creek to the top of the plume is over 40 feet. Penataquit Creek is a small, shallow stream. Given the high transmissivity of the upper glacial aquifer, it is unlikely that the influence of Penataquit Creek extends to that depth. The contaminant plume is expected to continue moving south-southeast, ultimately discharging to the ocean.

6.2 CONTAMINANT FATE

PCE is the predominant site contaminant. Three of the other major site-related contaminants are degradation products of PCE: TCE, trans- and cis-1,2-DCE, and vinyl chloride (but may have been present in the original waste streams). The degradation process, called successive dechlorination, is accomplished by anaerobic bacteria which subsist on the energy released as the PCE is transformed from a molecule with four chlorine to three (i.e., TCE) to two (i.e., DCE) to one (i.e., vinyl chloride).

Figures 6-4 through 6-7 show the distribution of PCE, TCE, 1,2-DCE (total), and vinyl chloride in groundwater. The distribution patterns of PCE degradation products generally follow the pattern of PCE distribution. The largest concentrations of PCE, TCE, 1,2-DCE (total), and vinyl chloride are associated with the slug of contamination resulting from disposal during the period from 1972 until the site was covered over and infiltration stopped in 1984. High concentrations of PCE, TCE, and 1,2-DCE (total) are also associated with groundwater close to the site at MW-6B.

Analytical results reported by Burton & Hand (1983) suggest that vinyl chloride was present in the original waste stream from the muck cooker; however, the distribution pattern of vinyl chloride in groundwater (see Figure 6-7) suggests that the bulk of vinyl chloride may have formed during the period of active disposal from 1972 to 1984, perhaps in the area of the cesspools. Vinyl chloride has a higher solubility and lower K_{oc} than PCE and TCE (see Table 6-1), and is expected to be more mobile in groundwater than the other compounds. However, the vinyl chloride plume appears to lag behind the others, suggesting that it formed later. This is likely the result of the large quantities of PCE disposed at



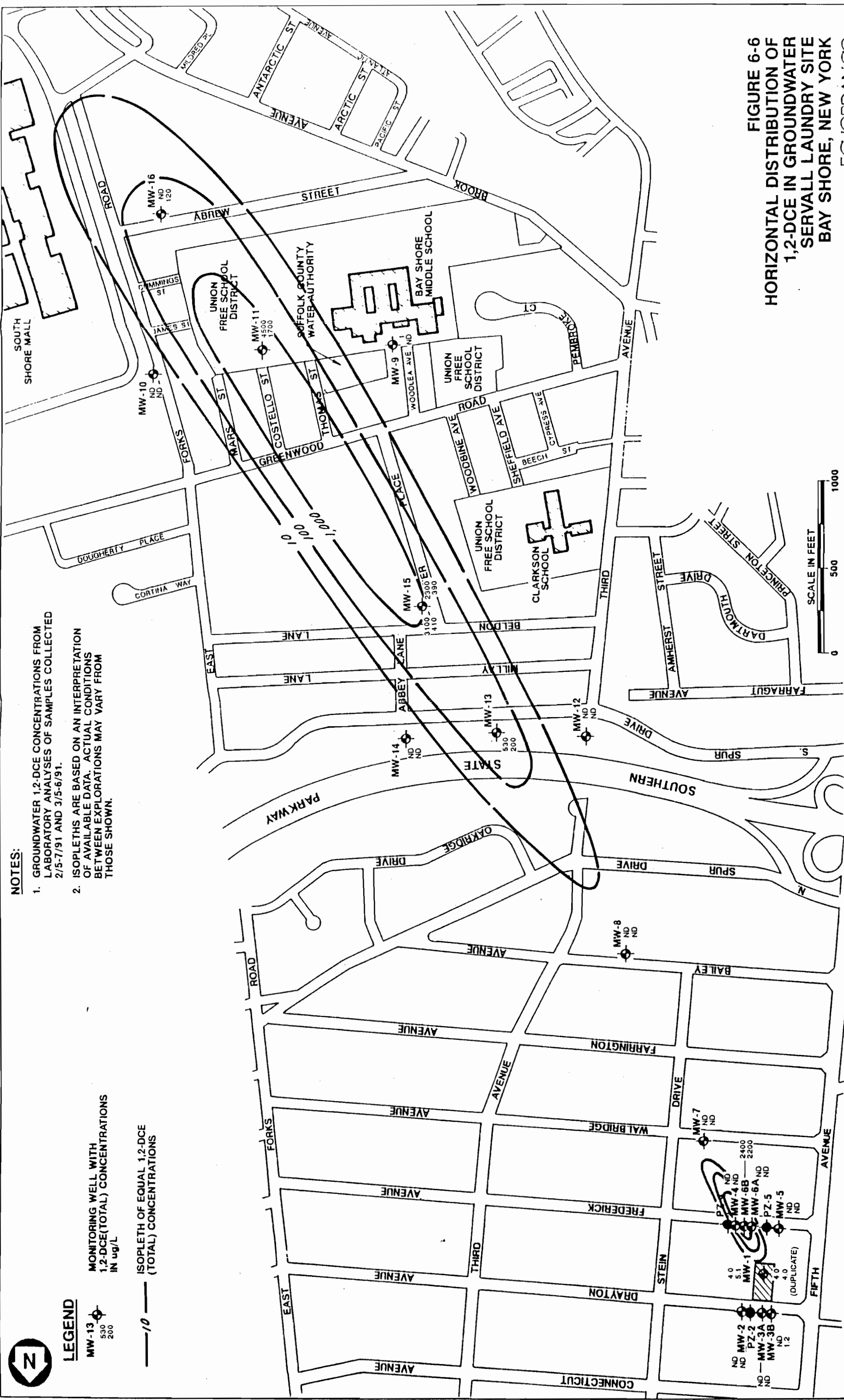


FIGURE 6-6
HORIZONTAL DISTRIBUTION OF
1,2-DCE IN GROUNDWATER
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

EC/JORDANCO

NOTES:

1. GROUNDWATER 1,2-DCE CONCENTRATIONS FROM LABORATORY ANALYSES OF SAMPLES COLLECTED 2/5-7/91 AND 3/5-6/91.
2. ISOPLETHS ARE BASED ON AN INTERPRETATION OF AVAILABLE DATA. ACTUAL CONDITIONS BETWEEN EXPLORATIONS MAY VARY FROM THOSE SHOWN.

LEGEND

- MONITORING WELL WITH 1,2-DCE(TOTAL) CONCENTRATIONS IN ug/L
- MW-13 530 200
- 10— ISOPLETH OF EQUAL 1,2-DCE (TOTAL) CONCENTRATIONS



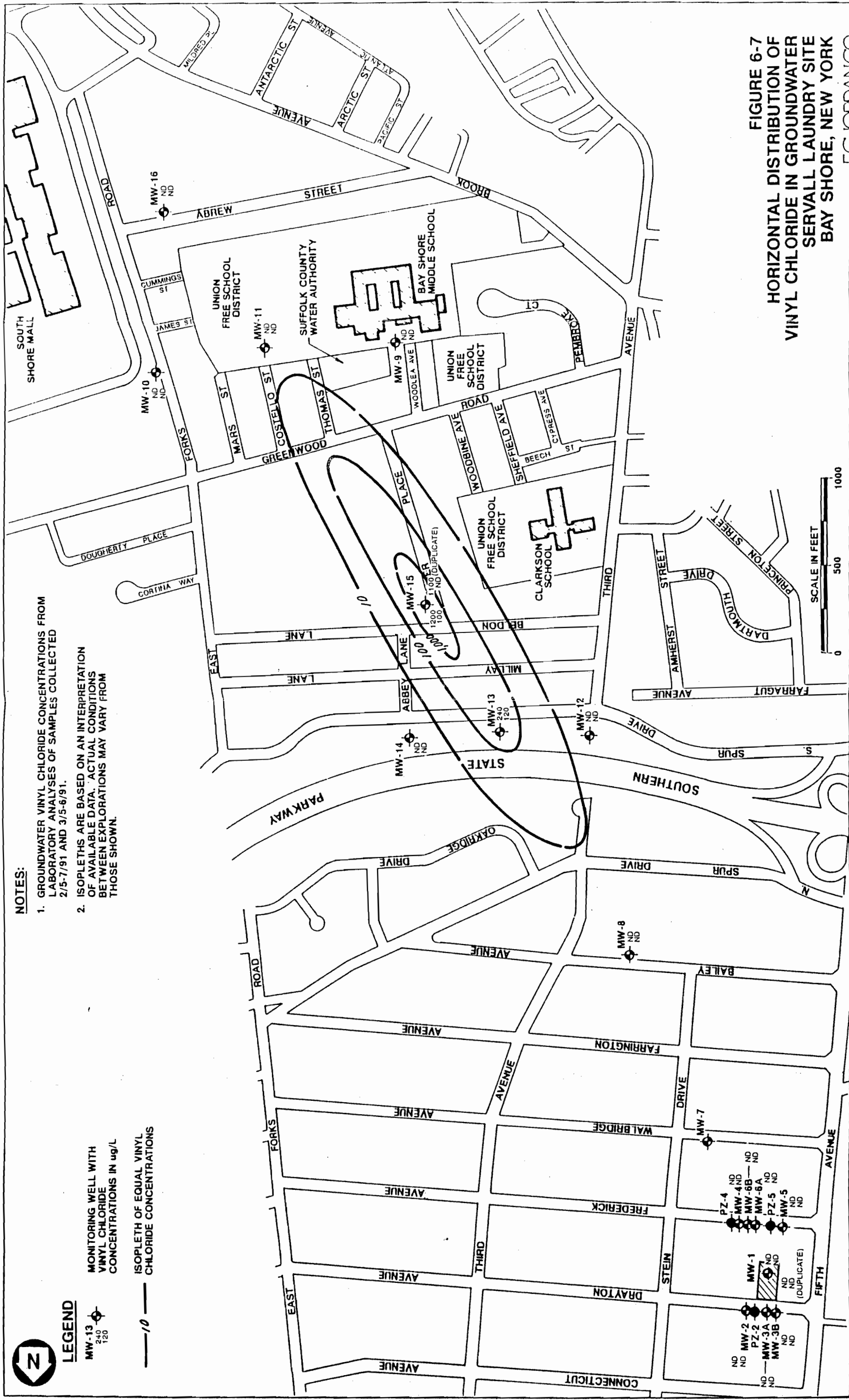


FIGURE 6-7
HORIZONTAL DISTRIBUTION OF
VINYL CHLORIDE IN GROUNDWATER
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

Biodegradation of PCE to TCE, 1,2-DCE (total), and vinyl chloride is an anaerobic reaction mediated by bacteria. It is possible that the concentrations of PCE and its degradation products are sufficiently high within the earliest portion of the plume that an anaerobic environment is maintained as it moves with groundwater flow. Dissolved oxygen concentrations were measured during the second round of groundwater sampling (see Table 3-7), and for wells screened within the plume, MW-6b, MW-7, MW-11, MW-13, MW-15, and MW-16, dissolved oxygen concentrations were low, ranging from 0.9 to 3.1 mg/L [the solubility of oxygen at normal atmospheric partial pressure and 10 degrees Celsius (C) is 11.3 mg/L]. Under these conditions, continued biodegradation of PCE and its degradation products could be occurring along moving reaction fronts within the plume. Concentrations of the degradation products relative to PCE would be expected to increase over time.

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7.0 BASELINE RISK ASSESSMENT SUMMARY

This risk assessment uses information collected in the RI to assess the human health risks posed by the ServAll site in the absence of any remediation. A summary of the risk assessment is presented here. The full text of the risk assessment is in Appendix D. In this summary, the following information is provided:

- a list of the chemicals of potential concern
- descriptions of exposure scenarios developed to model human exposures at the site
- carcinogenic risk estimates and noncarcinogenic hazard indices for the various exposure scenarios
- risk-based target clean-up levels for soil and groundwater

The risk assessment was prepared in accordance with the USEPA "Risk Assessment Guidance for Superfund" (USEPA, 1989b) and NYSDEC TAGM HWR-89-4025: "Guidelines for Remedial Investigations/Feasibility Studies" (NYSDEC, 1989).

7.1 CHEMICALS OF POTENTIAL CONCERN

Table 7-1 lists chemicals of potential concern in surface and subsurface soil and groundwater. These chemicals are evaluated in the risk assessment because of their potential health hazard. Several chemicals detected at the site were not selected as chemicals of potential concern, based either on frequency of detection, comparison to background concentrations, or an evaluation of toxicity or nutritional need. Section 2.0 (Hazard Identification) of Appendix D provides the justification for their exclusion.

7.2 EXPOSURE SCENARIOS

Hypothetical exposure scenarios were developed to model the various ways by

TABLE 7-1
CHEMICALS OF POTENTIAL CONCERN
SOIL AND GROUNDWATER

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

CHEMICAL	LOCATION		GROUNDWATER
	SURFACE SOIL	SUBSURFACE SOIL	
1,1-Dichloroethane			X
1,1-Dichloroethene			X
1,2-Dichloroethene	X		X
Tetrachloroethene	X	X	X
Toluene	X	X	
Trichloroethene	X	X	X
1,2,4-Trimethylbenzene	X	X	
1,3,5-trimethylbenzene	X	X	
Vinyl chloride	X		X

scenarios and exposure assumptions.

A summary of the exposure scenarios under current and future land use is provided in Table 7-2. The current and expected future use of the site itself is industrial/commercial; the area surrounding the site is mixed use (industrial/residential). To evaluate both working and resident populations, the following exposure scenarios were developed:

- Site Worker - A long-term employee working on the site repeatedly comes into contact with chemicals in the surface soil.
- Child Trespasser - A child living near the site trespasses onto the site and repeatedly contacts chemicals in the surface soil.
- Tank Excavation - A temporary worker contacts subsurface soil during excavation activities on the site.
- Domestic Use of Groundwater - An area resident installs a private well and uses contaminated groundwater for a residential lifetime of 30 years.
- VOC Migration into Basements - An area resident inhales VOCs that have migrated into a basement for a residential lifetime of 30 years,

The assumed conditions of exposure shown in Table 7-2 are largely prescribed by USEPA guidance (USEPA, 1989b and USEPA, 1991) and the New York Department of Health (NYDOH). The exposure conditions represent conservative or health-protective assumptions. To estimate the exposure point concentrations to which individuals would be exposed, a repeated exposure to the maximum detected or maximum estimated concentration was assumed. This most likely overestimates the exposure concentrations because continual exposure to maximum concentrations is unlikely. Other assumed conditions of exposure also would be expected to overestimate rather than underestimate human health risks.

This is particularly true for those exposure scenarios involving exposure to contaminants in surface soil: the site worker and child trespasser scenarios

TABLE 7-2
EXPOSURE SCENARIOS

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

REASON FOR SELECTION	EXPOSURE ROUTES	ASSUMED CONDITIONS OF EXPOSURE	EXPOSURE POINT CONCENTRATIONS
Onsite employees could be exposed to chemicals in surface soil during grounds maintenance activities	Direct contact Incidental ingestion Inhalation of VOCs	An employee contacts soil 250 times per year over a 25-year working lifetime	Maximum detected concentrations from samples SS-1 through SS-6
Children living in the area could be exposed to surface soil if they trespass onto the site	Direct contact Incidental ingestion Inhalation of VOCs	A child plays on the site twice a week for six months of the year, for six years	Maximum detected concentrations from samples SS-1 through SS-6
If subsurface excavation occurs (e.g., to service/remove underground tanks), workers could be exposed to chemicals in subsurface soil	Direct contact Incidental ingestion Inhalation of VOCs	A temporary worker contacts soil every day for two weeks	Maximum detected concentrations from samples SB-1 through SS-8 (at depths of 20 feet or less)
Although municipal water is available, a private well could be installed in the future	Ingestion Direct contact during showering Inhalation of VOCs during showering	A resident uses contaminated groundwater for drinking and other domestic uses for a residential lifetime of 30 years	Maximum detected concentrations in downgradient wells
VOCs in groundwater and soil gas could migrate into basements	Inhalation	A resident spends one hour/day in the basement for a residential lifetime of 30 years	(1) Maximum soil concentrations from SB-4, SB-5, and SB-6; and (2) Maximum groundwater concentrations from MW-6

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is unlikely. To adjust for the portion of the site where soil contact is possible, the risk estimates for these scenarios were multiplied by a factor of 0.10 (or 10 percent; the maximum amount of unpaved area on the site).

It is noted that, under existing site conditions, routine direct contact with soil (which might occur during an activity such as landscaping) is also expected to be minimal. Following USEPA and NYDOH guidance, the site worker scenario was developed to model possible future employee exposure at the site that could result from activities involving direct soil contact. It is conceivable that the future use of the site could change such that routine soil contact occurs.

7.3 RISK ESTIMATION

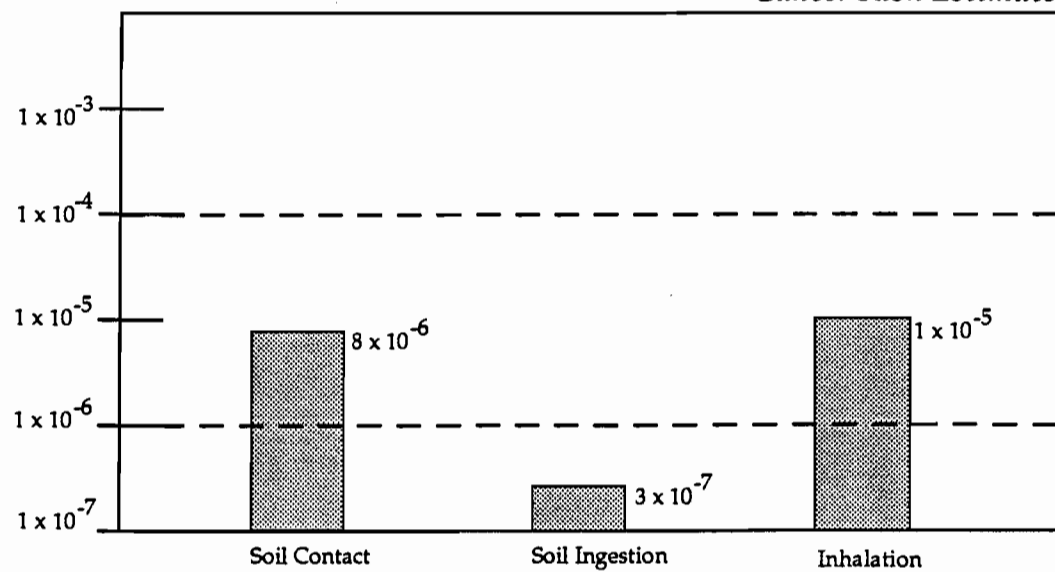
To evaluate the significance of risk estimates made for ServAll, a comparison is made to established target risk levels. The USEPA has adopted target risk levels for the evaluation of both carcinogenic and noncarcinogenic risks at hazardous waste sites. USEPA guidelines state that the total incremental carcinogenic risk for an individual resulting from exposure at a hazardous waste site should not exceed a range of 10^{-6} to 10^{-4} (USEPA, 1989b). Based on USEPA guidelines, the risk characterization in this report refers to the carcinogenic risk estimates as being "below the target range" when risks are less than 10^{-6} ; "within the target range" when risks are between 10^{-6} and 10^{-4} ; and "above the target range" when the risks are greater than 10^{-4} . The NYDOH has also adopted a target risk guideline of 10^{-6} .

Based on USEPA and NYDOH guidance, the target risk level for noncarcinogens is a hazard index of 1.0. If this ratio is less than or equal to 1.0, no adverse health effects are anticipated from the predicted exposure dose level. If the ratio is greater than 1.0, the predicted exposure dose level could potentially cause adverse health effects, although its significance needs to be assessed on a case-by-case basis.

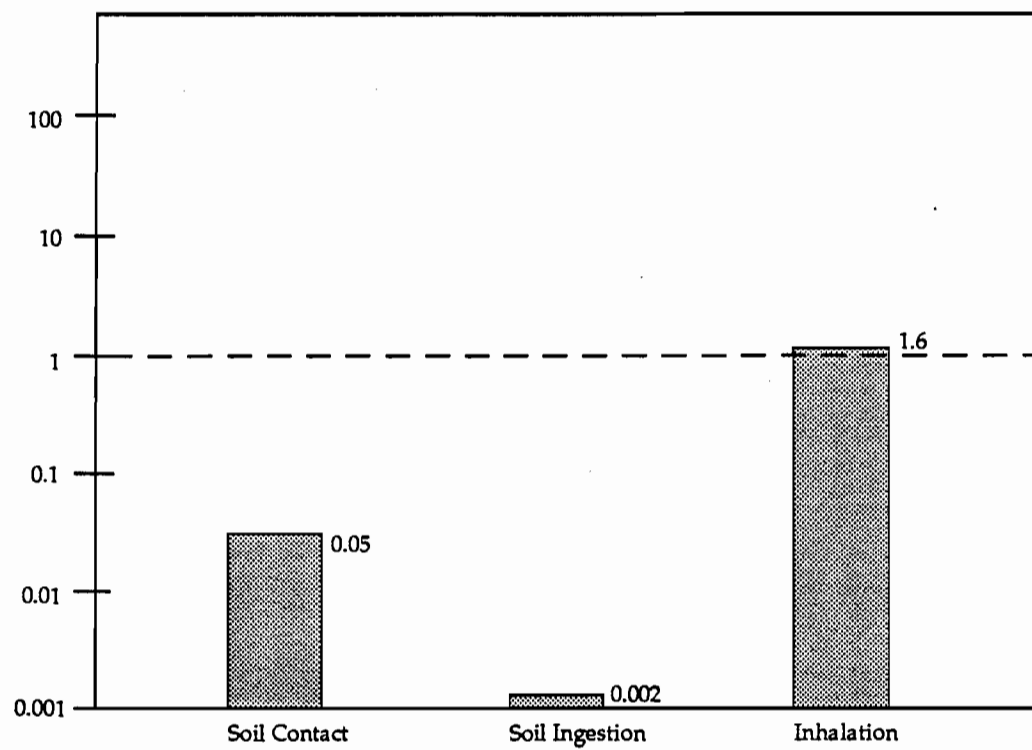
Figures 7-1 through 7-6 present risk estimates for the exposure scenarios discussed above. The spreadsheets used to calculate risk estimates for these scenarios are presented in Appendix E.

The carcinogenic risk estimates and the noncarcinogenic hazard indices closely

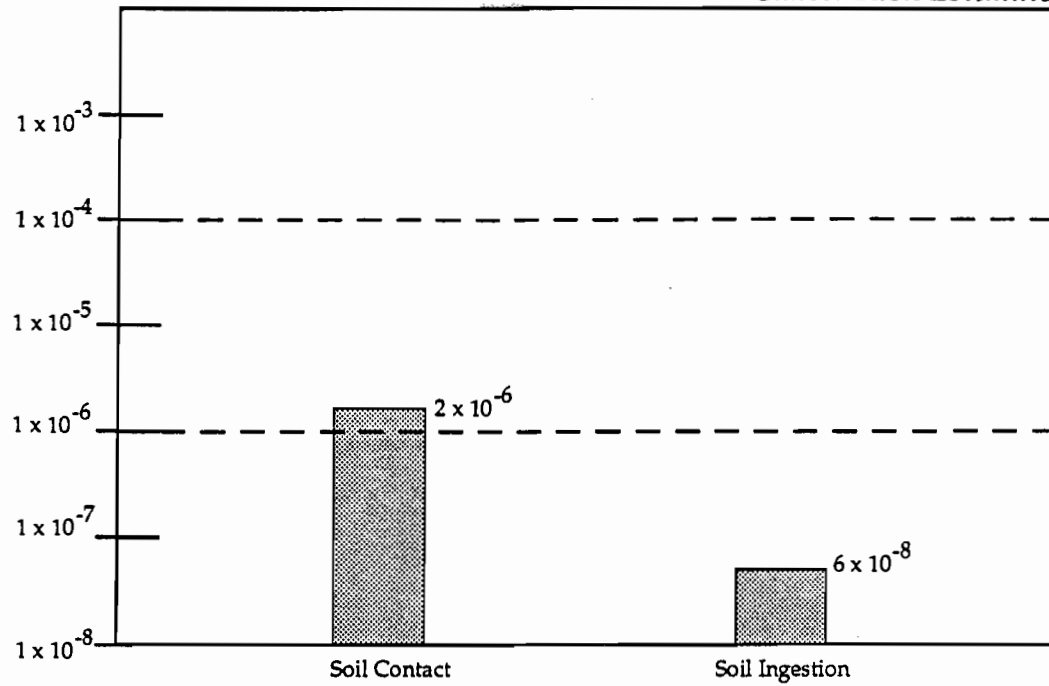
Cancer Risk Estimates



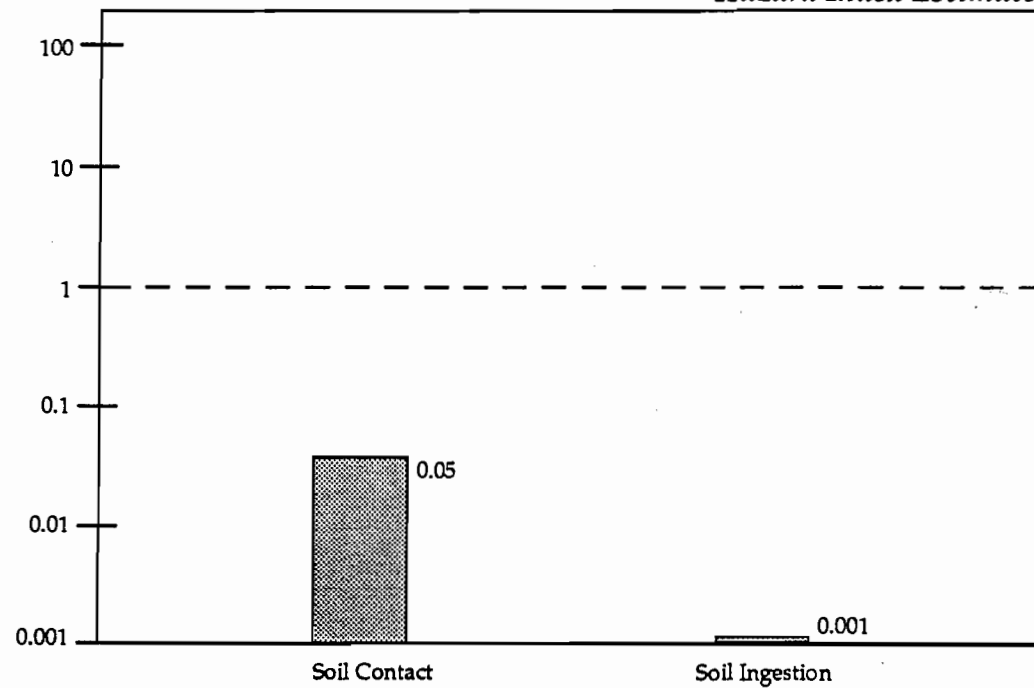
Hazard Index Estimates

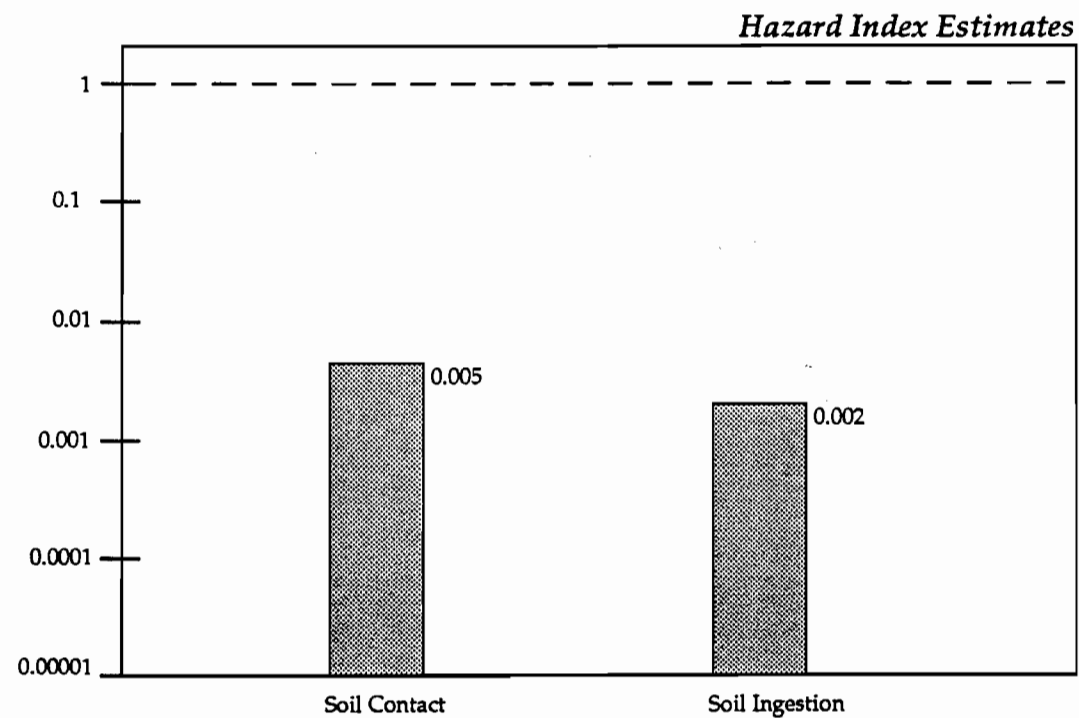
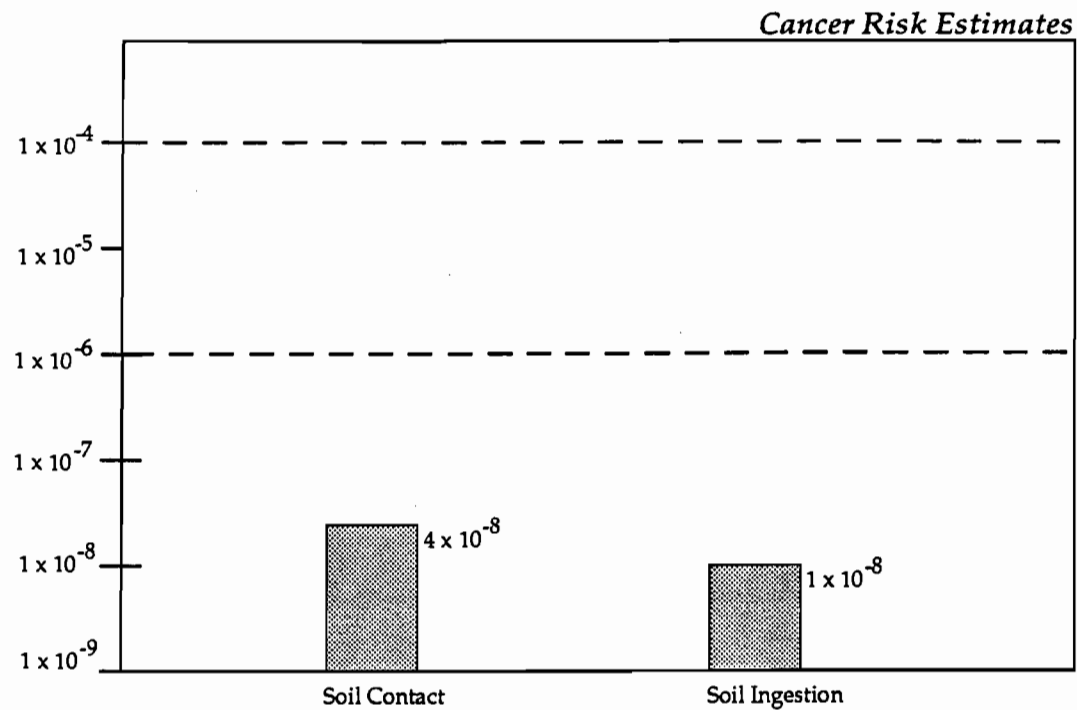


Cancer Risk Estimates

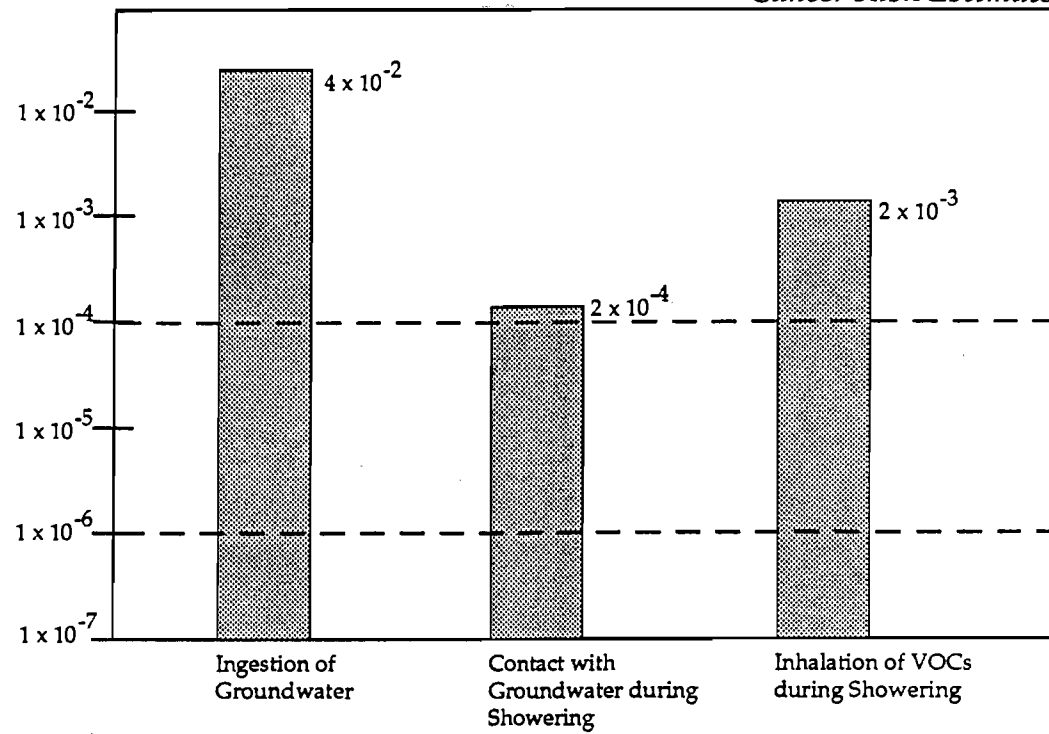


Hazard Index Estimates

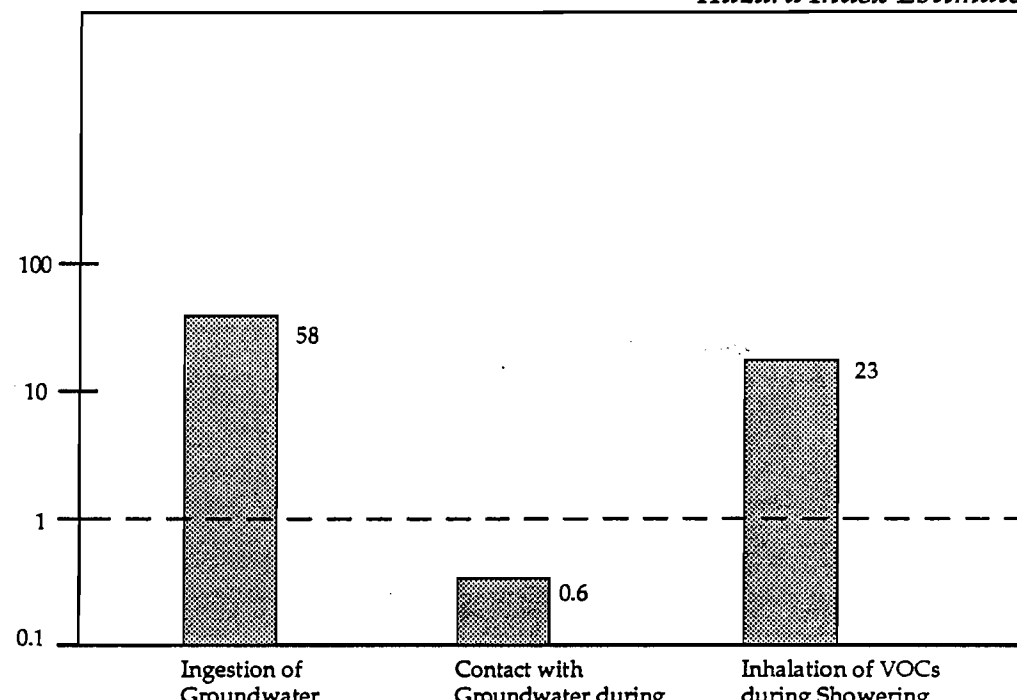


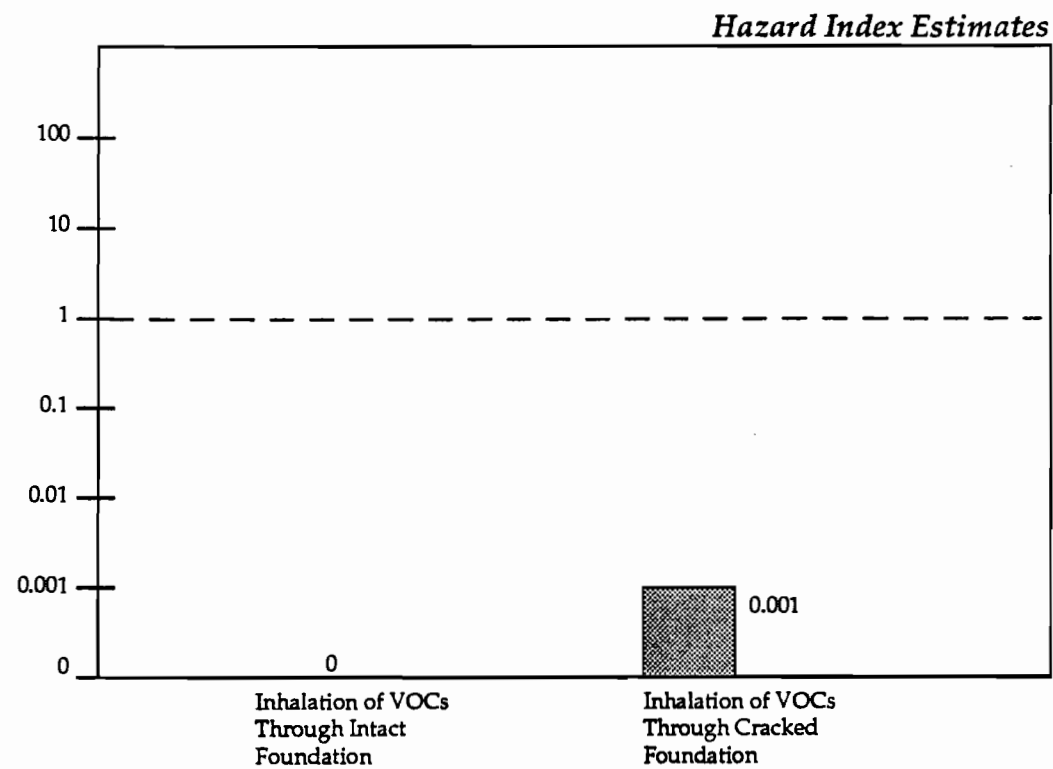
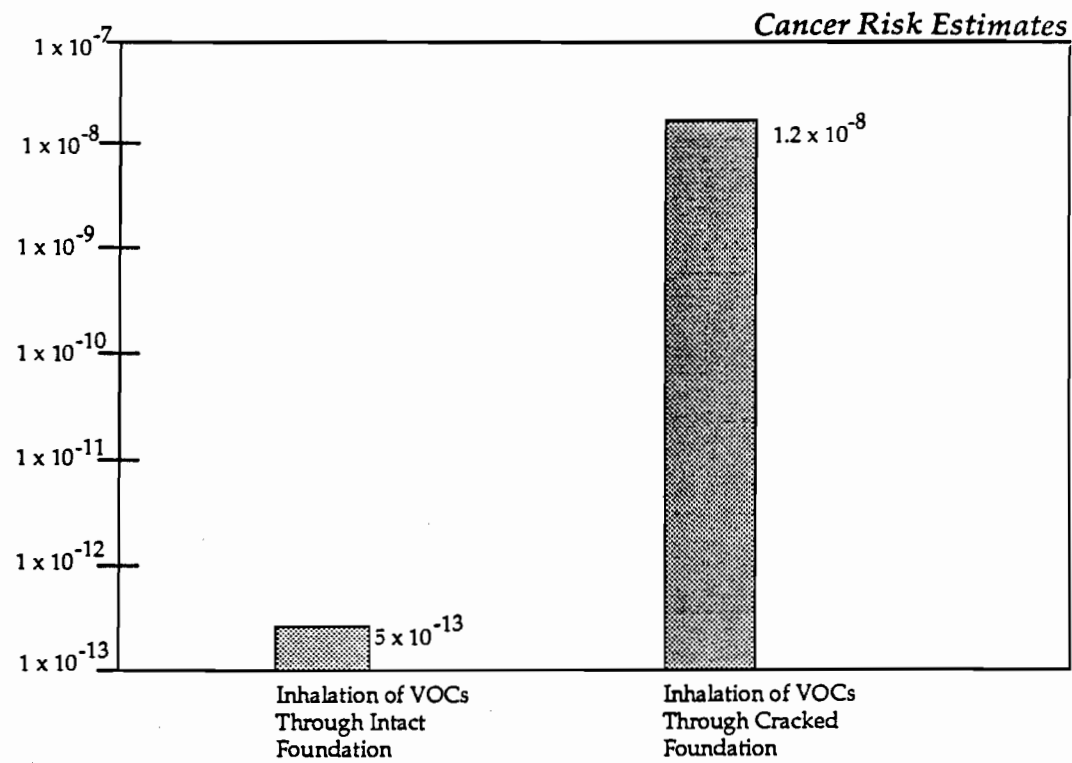


Cancer Risk Estimates

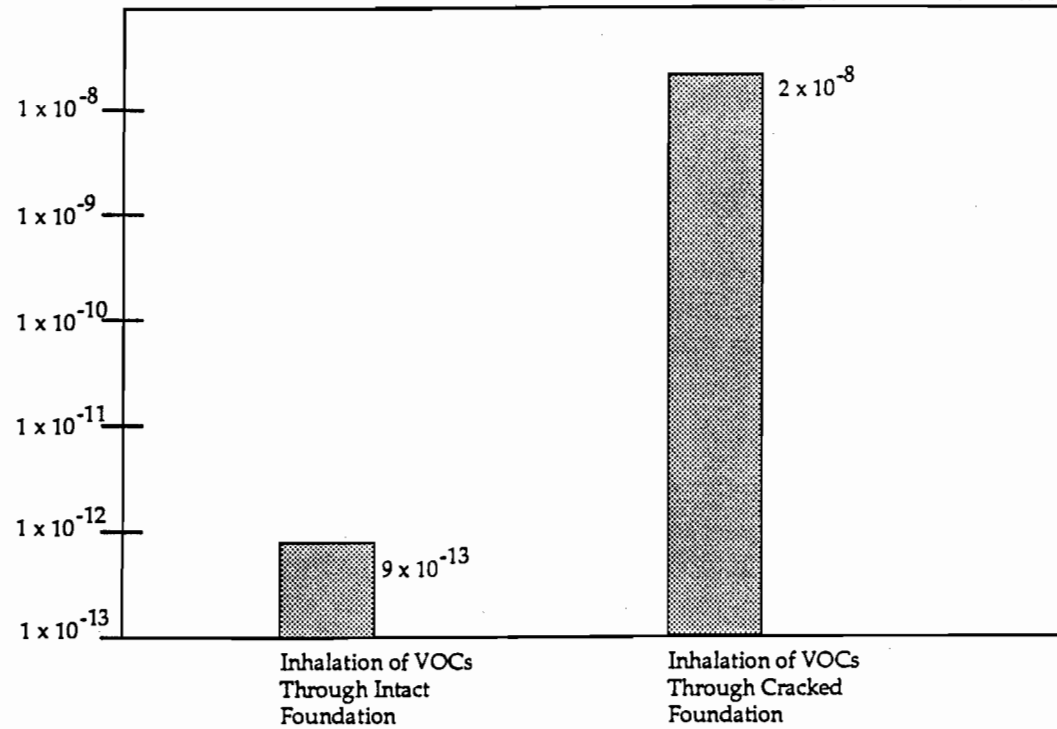


Hazard Index Estimates

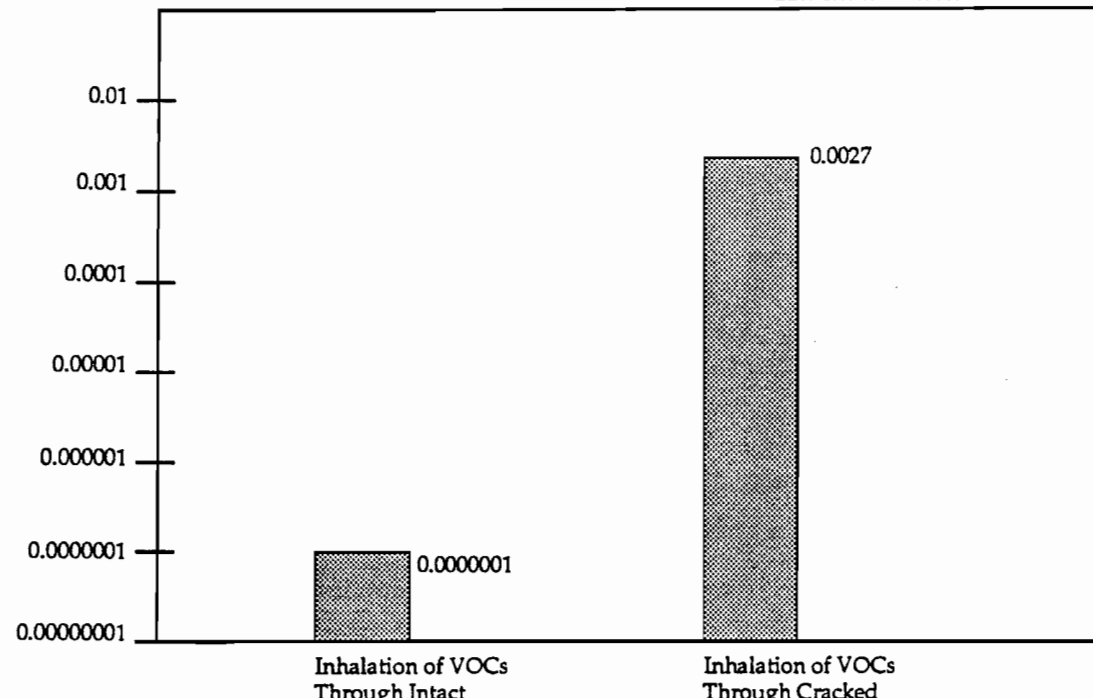




Cancer Risk Estimates



Hazard Index Estimates



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child trespassing scenario. Although within USEPA's target risk range, the carcinogenic risk estimate associated with soil contact and the inhalation of VOCs by a long-term site worker (1×10^{-5}) exceeds the NYDOH target guideline of 10^{-6} .

Both USEPA's and NYDOH's target risk levels are, however, exceeded for the scenario involving installation of a private well in the upper glacial aquifer and domestic use of the groundwater.

It should be emphasized that the risks estimated here are based on numerous assumptions. The assumptions about exposure and modeling procedures used in this risk assessment should result in estimates of the upper bound of risk. For all scenarios, exposure to the maximum detected concentrations was assumed. It is unlikely that an individual would be exposed repeatedly to maximum concentrations. The models used to predict ambient VOC concentrations incorporate conservative, health-protective assumptions and minimize or discount processes such as wind dispersion or biodegradation that will decrease chemical concentrations.

7.4 TARGET CLEAN-UP LEVELS

Table 7-3 presents health-based target clean-up levels for groundwater and surface soil. These target levels do not take into account the technical or economic feasibility of achieving the target levels.

Following NYSDEC guidance, target clean-up levels for groundwater are set equal to New York's groundwater quality standards. Surface soil target clean-up levels are risk-based and were developed to protect a site worker exposed by direct contact and incidental ingestion. The site worker represents the maximally exposed individual. A soil target level was developed for PCE which was the only chemical that presented risks greater than NYDOH's target level of 10^{-6} . (Table E-16 in Appendix E is a copy of the spreadsheet used to calculate the soil target level; the same exposure assumptions made in the baseline risk assessment were made to develop the soil target level.)

**TABLE 7-3
TARGET CLEANUP LEVELS FOR GROUNDWATER AND SOIL**

**SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK**

NEW YORK GROUNDWATER QUALITY STANDARDS

COMPOUND	STANDARD (1) µg/L	SOURCE (2)
Vinyl Chloride	2	701.4 Part 5
Tetrachloroethene	5	701.4 Part 5
Trichloroethene	5	701.4 Part 5
1,1-Dichloroethane	5	701.4 Part 5
1,1-Dichloroethene	5	701.4 Part 5
1,2-Dichloroethene	5	701.4 Part 5

(1) Applicable to Class GA groundwater, whose best usage as defined by NY regulation (see next footnote) is as potable water; developed to protect human health.

(2) 701.4 - NYCRR Part 701.4 of Title 6, Part 5 - NY Dept of Health regulations Subpart 5-1, Regulations for Drinking Water.

TARGET CLEANUP LEVELS FOR SOIL

COMPOUND	TARGET LEVEL(1) (mg/kg)
Tetrachloroethene	40

(1) Corresponds to a cancer risk of 10⁻⁶; developed to protect onsite maintenance worker



8.0 REMEDIAL INVESTIGATION SUMMARY AND CONCLUSIONS

Subsection 8.1 presents summaries of Sections 5.0, 6.0 and 7.0. The RI conclusions in Subsection 8.2 discuss the limitations of the data. Recommendations for further work at ServAll are discussed in Subsection 8.3.

8.1 SUMMARY

The following subsections summarize the major findings concerning the nature and distribution of site contaminants, contaminant fate and transport, and the risk assessment.

8.1.1 Nature and Distribution of Contamination

The predominant site contaminants are the dry cleaning solvent PCE and its degradation products, TCE, 1,2-DCE, and vinyl chloride. PCE and TCE were detected in surface soils, subsurface soils, and groundwater. Vinyl chloride and 1,2-DCE were detected in groundwater and 1,2-DCE in subsurface soils. The distribution of these compounds in the environment is a result of the disposal of dry cleaning fluids at ServAll and fate and transport mechanisms discussed in Section 6.0.

Other organic contaminants, including toluene, bis(2-ethylhexyl) phthalate, and 1,1-DCE, were detected at low concentrations or in single occurrences in site media. The source of these contaminants is not known and there is uncertainty associated with those compounds detected only once. These chemicals are common environmental contaminants in industrialized areas and may be the result of other industrial activities in the site vicinity, unreported practices at ServAll Uniform, present practices at the site, or contaminated fill used at the site.

Several potential site groundwater contaminants -- toluene, benzene, and 2-methylphenol -- were eliminated as final site contaminants because they only appeared in one round of groundwater sampling. Additional groundwater sampling may be required to confirm the presence or absence of these compounds in groundwater. The monitoring well in which arsenic was detected once was resampled in late 1991 and the results were non-detect for arsenic.

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8.1.2 Fate and Transport

The fate and transport analysis concentrated on groundwater transport of PCE, TCE, 1,2-DCE, and vinyl chloride. Contaminant migration via the atmosphere, surface water, and groundwater were evaluated for ServAll; groundwater transport is considered the most significant contaminant migration path. PCE, TCE, 1,2-DCE, and vinyl chloride are the major groundwater contaminants.

Based on their physico-chemical properties, PCE in its pure liquid form (and TCE and DCE) could possibly migrate downward through the aquifer until it reached the clay layer underlying the site (see Table 6-1). The distribution of VOCs, predominantly PCE, indicates downward migration of contaminants to the top of the clay with horizontal migration along the clay surface in the direction of groundwater flow (see Figure 6-1). This distribution pattern, and historical concentrations, suggest that PCE was present in the aquifer as a DNAPL at one time, but is currently moving as a dissolved phase with groundwater flow.

A chronology of events has been constructed from historical records of site operations and previous site investigations, beginning with the installation of dry cleaning equipment at the site in 1972. By 1974, Jordan estimates that a significant contaminant plume accumulated in the aquifer beneath the site. From 1974 to 1988, the plume moved 5,200 feet southeast from the site at a rate of approximately 443 to 484 feet per year. Since 1988, the plume has moved approximately 355 feet per year to a point 7,500 feet southeast of ServAll (see Figure 6-3).

The contaminant plume appears to contain two distinct areas of high PCE concentrations. The southernmost area is expected to represent PCE contamination entering the groundwater from the beginning of site operations to clean-up efforts begun in 1981 and completed in 1984. High PCE concentrations close to the site may indicate that a residual contaminant source persists in soils in the backyard of the site.

Although vinyl chloride may have been present in the effluent waste stream from the dry cleaning process (Burton and Hand, 1983), the evaluation of contaminant distribution suggests that most of the vinyl chloride in the groundwater originates from biodegradation of PCE and DCE. Jordan believes that anaerobic biodegra-

8.1.3 Baseline Risk Assessment

The risk assessment used information collected during the RI to assess human health risks posed by the contamination from ServAll in the absence of any remediation. The chemicals of concern used for the risk assessment were chosen from the site contaminants on the basis of frequency of detection, comparison to background concentrations, and general toxicity. The chemicals of concern identified at ServAll include:

- PCE
- TCE
- vinyl chloride
- toluene
- 1,1-DCA
- 1,1-DCE
- 1,2-DCE

The exposure doses or chemical intakes of these chemicals were estimated from five exposure scenarios developed for working and residential populations in the site vicinity:

- maintenance worker
- child trespasser
- tank excavation worker
- residential use of contaminated groundwater
- VOC migration into residential basements

Dosages resulting from these exposure scenarios were estimated using conservative assumptions about the concentrations to which workers and residents would be exposed.

The risk estimates associated with each exposure scenario were compared to USEPA target risk ranges and NYSDOH target risk guidelines. The risks were characterized as below, within, or above the target risk range, based on those comparisons.

Target risk levels were exceeded for:

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- maintenance worker at ServAll (risk due to PCE)

Health-based target clean-up levels for vinyl chloride, PCE, TCE, 1,1-DCE, and 1,2-DCE in groundwater were set equal to New York State groundwater standards. The groundwater target clean-up levels are 5 $\mu\text{g/L}$ for the listed compounds except vinyl chloride; the target clean-up level for vinyl chloride is 2 $\mu\text{g/L}$. Soil target clean-up levels are risk-based and were developed to protect the on-site maintenance worker. The risk-based soil target clean-up level for PCE is 40 mg/kg.

8.2 CONCLUSIONS

The RI results indicate site-related contamination is present in site soils, and in groundwater both beneath the site and downgradient from the site. The two exposure scenarios exceeding target risk levels identified in the Risk Assessment (see Section 7.0) involved exposure to either on-site (source area) soils or contaminated groundwater.

Historical information from previous investigations and the results of the current RI provide a good general understanding of the nature and distribution of soil contamination in the source area. This information is sufficient for estimating the volume of soils requiring remediation.

One data gap remains with respect to the source area soils:

1. The Burton & Hand engineering report (1983) referred to a cesspool on the west side of the ServAll facility. This reference is not in agreement with other reports of cesspool locations, and the existence of a cesspool in this area has not been investigated. The existence of this cesspool and potential contamination associated with it is unknown (no subsurface soil samples deeper than 7 feet bgs were collected in this area); if a cesspool existed in this area, the calculations of volume of soils requiring remediation may be adjusted.

Excess risk calculated from exposure to contaminated groundwater occurred via domestic use of groundwater. The nature and distribution of the groundwater

1. The potential for domestic use of contaminated groundwater in the site area is not well-characterized. Investigations to date have focused on the contaminant plume in the upper glacial aquifer. Although local residents are connected to the public water supply system, several domestic wells, probably tapping the upper glacial aquifer, have been identified in the area of the ServAll plume. The current use of these wells is unknown. The downgradient public water supply system at the Thomas Avenue SCWA wells, when in use, withdraws water from the Magothy Aquifer. The potential for contamination to move from the upper glacial aquifer to the Magothy Aquifer is not known. These factors determine the potential risk of exposure to contaminants via domestic use of groundwater.
2. The presence of arsenic, detected in one round of groundwater samples is suspect and unconfirmed. If present, significant concentrations of arsenic in groundwater at the site could affect the risk assessment conclusions. However, on November 19, 1991, a groundwater sample and a duplicate sample were collected from MW-7 to confirm the presence or absence of arsenic. The sample results for arsenic from two prior rounds of groundwater laboratory analysis indicated uncertainty (see Subsection 5.3.4). Sample results from the November sampling episode confirmed the absence of arsenic in MW-7.
3. The source of continuing groundwater contamination is not well understood. Contaminant migration via infiltration through the unsaturated zone is not expected to be a significant current source because the site was paved over in 1984. However, the distribution of contaminants in groundwater suggests a continuing source near the site. Limited information is available about the distribution of site contaminants in soils below the water table at the site. Identification of the source of groundwater contamination is important for the evaluation of remedial alternatives since it affects the feasibility of potential remedial technologies.

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8.3 RECOMMENDATIONS FOR FUTURE WORK

The recommendations for future work presented in Table 8-1 address the data gaps identified in Section 8.2. These data gaps impact the design and evaluation of potential remedial alternatives for both the source area soils and on-site and downgradient groundwater.

TABLE 8-1
DATA GAPS AND RECOMMENDED FUTURE ACTIONS

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

DATA GAP	RECOMMENDATION
Domestic use of contaminated groundwater in site vicinity	SCDHS is conducting a survey to determine locations and current usage of local wells which may be drawing water from the upper glacial aquifer.
Continuing source of groundwater contamination	The source of groundwater contamination might never be completely understood. For the purposes of remedial alternative evaluation, Jordan will make assumptions about the nature of the source and discuss the implications of those assumptions with respect to each remedial alternative.



9.0 DEVELOPMENT OF REMEDIAL RESPONSE OBJECTIVES AND TARGET CLEAN-UP LEVELS

This section provides the development of response objectives that serve as the basis for evaluating and refining target clean-up levels and for developing and evaluating site remediation alternatives. This section is the beginning of the FS portion of the combined RI/FS.

9.1 REMEDIAL RESPONSE OBJECTIVES

Remedial response objectives are statements of proposed clean-up goals associated with site-specific chemical contamination. These objectives, developed with the consideration of ARARs and SCGs, address identified human health or environmental concerns. Response objectives are used to guide the identification and screening of remedial technologies and the development and evaluation of remedial alternatives. Response objectives and target clean-up levels for the ServAll site were developed based on site contaminants identified in the RI, and the potential exposure pathways and assessment of risks evaluated in the baseline risk assessment.

The response objectives developed for the ServAll site will focus on remediation of source area soils and contaminated groundwater. The relationship that exists between these two elements requires that site objectives be formulated for both elements to ensure that the comprehensive site response is protective and effective and that the actions are complementary. The response objectives will, therefore, be developed for one operable unit which will include both source area and groundwater remediation elements.

The remedial response objectives for the ServAll site are:

- reduce human health risks associated with exposure to contaminated source area soils;
- reduce human health risks associated with exposure to contaminated groundwater in areas adjacent to and downgradient from the source area; and

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9.2 TARGET CLEAN-UP LEVELS

Target clean-up levels for the two media of concern at ServAll were established. Two separate analyses were conducted to determine appropriate soil clean-up levels. The first approach used the baseline risk assessment to determine risk-based soil target clean-up levels based on exposure to contaminated soils. The second approach presented below analyzed the mechanism by which contaminants are leached from the source area soil to groundwater to determine a soil target clean-up level. This soil clean-up level represents the contaminant level for which leaching to groundwater would not cause exceedance of New York State Water Quality Regulations (NYSWQRs). For groundwater, target clean-up levels were set at NYSWQRs.

9.2.1 Risk Based Soil Target Clean-up Levels

Surface soil target clean-up levels were developed in the RI to protect a site worker exposed by direct contact and incidental ingestion. The site worker represents the maximally exposed individual. Soil target levels were developed for PCE because it presented cumulative risks greater than NYDOH's target level of 10^{-6} (see Subsection 7.3).

The target clean-up level developed for PCE is 40 mg/kg. This target clean-up level was developed using a 10^{-6} target risk point of departure.

9.2.2 Contaminant Leaching Based Soil Target Clean-up Levels

Because subsurface soil at ServAll is suspected to be a continuing source of groundwater contamination, target clean-up levels based on leaching to groundwater were developed. These target clean-up levels were developed using the Modified Summer's Model (USEPA, 1989). Appendix H presents the detailed calculations used in this analysis.

Concentrations of PCE in groundwater sampled from MW-6B indicate that the source soils are continuing to leach contaminants to groundwater. At MW-6B, contamination is near the water table. At distances further from the site, the contaminated groundwater moves downward toward the bottom of the upper glacial aquifer and travels along the surface of the Gardiners Clay. PCE located

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contamination as much as the capillary fringe zone soils. This theory is supported by the fact that the ServAll site is currently paved over with asphalt. The site has been paved since 1984 and little leaching of contaminants due to rainwater infiltration through the surface is believed to have occurred since that time. Fluctuating groundwater table elevations are believed to be mobilizing contaminants in the capillary fringe zone from the sorbed phase to the aqueous phase.

Target clean-up levels for PCE and TCE were calculated using the Modified Summer's Model (USEPA, 1989). This model relates contaminant concentrations in soil to contaminant concentrations in water. The Summer's Model is summarized in the following equation:

$$C_s = (f_{oc}) (K_{oc}) (Df) (C_l)$$

Where:

- C_s = concentration of contaminant in the soil;
- f_{oc} = fraction of organic carbon in the soil;
- K_{oc} = organic carbon partitioning coefficient;
- Df = dilution factor for mixing between water infiltrating through the soil and groundwater at the water table; and
- C_l = concentration of contaminant in water flowing through soil.

Normally, when f_{oc} is known for a given soil, f_{oc} and K_{oc} can be combined into a constant K_d , where $K_d = f_{oc} * K_{oc}$. However, when f_{oc} is not known, a modified K_d , known as K_d^* can be used to relate known groundwater and soil contaminant concentrations. At ServAll, f_{oc} is not known, so the Modified Summer's Model was used and is as follows:

$$C_s = (K_d^*) (Df) (C_l)$$

From this equation, K_d^* can be calculated using the known C_s and C_l numbers. K_d^* represents the site- and chemical-specific relationship between water and soil contaminant concentrations and can be used to establish soil target clean-up levels by substituting the groundwater target clean-up level in the equation for C_l .

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of PCE, including TCE, 1,1 and 1,2-DCE, and vinyl chloride, were not detected as frequently in groundwater samples. In source soil samples, TCE was detected in one sample, and 1,1-DCE, 1,2-DCE, and vinyl chloride were not detected in any samples. Results from the analysis using the Modified Summer's Model are presented in Table 9-1.

9.2.3 Groundwater Target Clean-up Levels

Following NYSDEC guidance, target clean-up levels for groundwater have been set equal to NYSWQRs. A summary of the target clean-up levels developed for both soil and groundwater is presented in Table 9-1.

9.3 GENERAL RESPONSE ACTIONS

General response actions are medium-specific strategies that will satisfy the remedial response objectives. The remedial response objectives for ServAll are summarized as follows: reduce human health risks due to exposure to contaminated source soils and contaminated groundwater; and mitigate leaching of contaminants from source soil to groundwater.

General response actions may include treatment, containment, excavation, extraction, disposal, institutional actions, or a combination of these. They were developed separately for source area soil and groundwater. These were later combined into alternatives capable of addressing the remedial response objectives for both media of concern.

9.3.1 Source Soil Response Actions

General response actions were developed for the source area soil. These would reduce human health risks associated with exposure to contaminated soils and mitigate leaching of contaminants from source area soil to groundwater. The general response actions for source soil range from no action to off-site treatment and disposal and are as follows:

- No Action - Nothing would be done at the site to achieve the remedial action objectives. No Action is included as a baseline condition for detailed analysis.

**TABLE 9-1
SUMMARY OF TARGET CLEAN-UP LEVELS**

**SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK**

Contaminant	Soil Target Clean-up Level (Risk-Based)	Soil Target Clean-up Level (Leaching-Based)	Groundwater Target Clean-up Level (NYSGS-Based)
	40,000	5	5
	NA	6	5
	NA	NA	5
-DCE	NA	NA	5
de	NA	NA	2

concentrations are in $\mu\text{g}/\text{kg}$
water concentrations are in $\mu\text{g}/\text{liter}$
R - New York State Water Quality Regulations
t Applicable

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to limit land usage at the site. Minimal Action may also include some type of environmental monitoring.

- Containment - The purpose of containment would be to limit potential for exposure to contaminants in surface soil and to reduce infiltration of rainwater through contaminated soil. These goals could be obtained by constructing and maintaining a low permeability cover such as an asphalt cap on the site.
- In situ Treatment - Contaminated soil would be treated in place without excavation; this type of treatment would remove or immobilize contaminants to prevent human exposure and leaching to groundwater. Land Disposal Restrictions would not be invoked by an in situ treatment response action.
- Off-site Treatment - Contaminated soil would be excavated, removed from the site and transported off-site to a treatment facility. Land Disposal Restrictions may be invoked by this general response action.
- Disposal - Treated soil would be disposed of in a Resource Conservation and Recovery Act (RCRA) landfill if required by Land Disposal Restrictions.

9.3.2 Groundwater Response Actions

General response actions were developed to reduce risks associated with exposure to contaminated groundwater. Close to the source area, the contaminant plume is located near the water table. Further away from the source the contaminant plume is not near the water table but much deeper in the upper glacial aquifer. The general response actions for groundwater range from No Action to Active Restoration of the contaminated aquifer and are as follows:

- No Action - No actions would be implemented to address the remedial action objectives.
- Minimal Action - These actions would include institutional controls

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- **Source Control** - Groundwater would be collected immediately downgradient of the source, treated, and discharged upgradient of the source. The goal of this response action would be to remove contaminants from the saturated soils that act as a source of continued groundwater contamination. Extracting and treating groundwater from this area would essentially flush contaminants from the saturated soils.
- **Containment** - Groundwater would be collected, treated, and discharged but the goal would be to restrict migration of the contaminated plume rather than to actively restore the entire aquifer. This would prevent contamination of presently clean portions of the upper glacial aquifer and eventual discharge to the Atlantic Ocean. Groundwater monitoring would be implemented to record the dispersion, degradation, and migration of contaminants in the groundwater and the effectiveness of the pump and treat system.
- **Active Restoration** - Groundwater would be collected from all portions of the contaminant plume, treated, and discharged with the goal to be restoration of the entire aquifer. Groundwater monitoring would be implemented to record the dispersion, degradation, and migration of contaminants and the effectiveness of the Active Restoration pump and treat system.
- **Groundwater Treatment** - This general response action would be included with any groundwater extraction system to meet discharge requirements.
- **Discharge** - Treated groundwater would require disposal and could be discharged to any of several receiving water bodies including groundwater, surface water, and publicly owned treatment works (POTW). Pretreatment and/or discharge requirements would need to be developed for each of these discharge options.

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estimated for source area soils and downgradient groundwater separately.

9.4.1 Volume of Contaminated Soil

The volume of contaminated soils that may be subject to remediation was estimated. The volume of contaminated soil may be useful for evaluating technologies or alternatives during screening steps and will be used for cost estimating purposes in the detailed analysis of alternatives. The detailed calculations and assumptions are presented in Appendix I.

The soil contamination at the site is confined to a well defined area associated with drum storage activities and subsurface cesspools. Analytical data was not used to determine the areal extent of contamination because it is better defined by the location of the drum storage area and the cesspools.

The estimation of the soil volume was broken down into three groups: the drum storage area; the cesspools; and the septic tank/lint interceptor. Contamination in both the drum storage area and the cesspools was assumed to extend to the groundwater level 20 feet below the surface based on analytical data. The septic tank/lint interceptor is assumed to be free from leaks and therefore only the tank and immediately surrounding soils down to a depth of 10 feet below the surface were included in the estimation. The total volume of contaminated soil at the site was estimated to be 1,800 cubic yards.

9.4.2 Volume of Contaminated Groundwater

Contaminated water or pure contaminants discharged to the cesspools from the washing processes have infiltrated into the groundwater and created a plume of contaminated groundwater that extends approximately 7,500 feet downgradient of the site. The estimated horizontal distribution of contaminants in groundwater is shown in Figure 6-2. The migration rate of the plume downgradient has been estimated at 1.2 feet per day between 1974 and 1983, 1.3 feet per day between 1983 and 1987, and 0.9 feet per day between 1988 and the RI investigation. The contaminant plume begins at the water table beneath the site and is moving downward through the aquifer. Approximately 3,500 feet south-southeast of the site, most of the groundwater contamination appears confined to an area within approximately 20 feet of the top of the Gardiners Clay, although small

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The size of one pore volume of contaminated groundwater was estimated and is presented in Appendix J. The plume was estimated to contain 6.5×10^8 gallons (gal) of contaminated water. The porosity used in calculating this was 0.30 as estimated in Subsection 4.2. Further discussion of the plume and transport of contaminants in groundwater is presented in Subsection 6.1.3.



10.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

This section identifies technologies that address the preliminary remedial response objectives discussed in Subsection 9.1. The technologies are then screened further based on effectiveness and implementability to produce an inventory of suitable technologies that can be assembled into a complete list of remedial alternatives. The identification and screening processes are conducted for the source area and groundwater separately.

10.1 TECHNOLOGY IDENTIFICATION

Technologies were identified based on a review of literature, vendor information, performance data, and experience in developing other FSs. Technologies were identified for the soils and groundwater separately and are presented in Tables 10-1 and 10-2. A total of 18 soil and 13 groundwater technologies were determined potentially applicable to attaining the preliminary remedial response objective.

On-site treatment technologies that require excavation were not identified for this site because they would be very difficult to implement. The site is small and the building occupies most of the site property. There would not be enough space to excavate the soils and have treatment equipment on site.

Other technologies may be necessary as support for containment, treatment, or disposal actions. These technologies are known as ancillary actions and include actions such as screening soils to remove large objects to assure maximum treatment efficiency. Ancillary actions are not listed in Table 10-1 or 10-2, but are described in Section 13.0 for each of the alternatives that underwent detailed analysis.

10.2 TECHNOLOGY SCREENING

The purpose of technology screening is to reduce the number of potentially applicable technologies carried forward for incorporation into alternatives. Technologies are evaluated based on characteristics that may influence their effectiveness or implementability. In general, cost is not considered during this

TABLE 10-1 (Page 1 of 2)
IDENTIFICATION OF TECHNOLOGIES FOR THE SOURCE AREA

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

TECHNOLOGY	DESCRIPTION
<u>No Action</u>	No actions would be taken to reduce risk or control the source of groundwater contamination.
<u>Minimal Action</u>	
Fencing/Posting	Site access would be restricted by constructing a chainlink fence. Warning signs would be posted.
Institutional Controls	Zoning or land-use restrictions would be implemented to limit future use or development of the site.
<u>Containment</u>	
Capping	A low-permeability material (e.g., clay, asphalt, synthetic membrane) would be placed over the area of concern to prevent human exposure and infiltration of surface water through the contaminated soils.
<u>In-Situ Treatment</u>	
Vacuum Extraction	Air is mechanically drawn through the vadose zone using a system of vacuum extraction wells. Contaminated soil is remediated as adsorbed VOCs volatilize to the gaseous phase and are drawn off by means of the vacuum extraction equipment. To enhance volatilization of organics in soil steam may be injected into perimeter wells.
Solidification/ Stabilization	A setting agent is mixed with contaminated soil. The soil solidifies into a low permeability matrix which entraps most contaminants. Solidification agents are usually Portland cement-based or silicate-based compounds.
Vitrification	Electrodes are placed in the contaminated soil. Electric current is passed through the soil causing it to heat up to about 3,000°F and melt. The soil then cools to form a glassy, vitrified solid. Organics are destroyed or driven off while inorganics are encapsulated in the vitrified mass.
Radio-Frequency Heating	Rows of conductors are placed on the surface of soils to be treated. A modified radio transmitter supplies energy to the conductors which heat the soil via molecular agitation. Volatilized contaminants rise to the surface for collection and treatment.
Steam and Hot Air Stripping	Steam and hot air are forced through hollow stem augers into the soil. Heat from the steam and hot air vaporizes VOCs which are carried to the surface and collected under a steel shroud for further treatment.
Bioremediation	Nutrients and oxygen are added to the subsurface contaminated soils to enhance the decomposition of contaminants by indigenous or introduced microorganisms.
Soil Flushing	Clean water is applied to contaminated soil at high rates to mobilize soluble contaminants into the aqueous phase. Contaminated water is then extracted using a collection system surrounding the contaminated soil.
<u>Off-site Treatment</u>	
Thermal Desorption	Soil is mixed in the presence of a stream of heated air. Organics are volatilized and driven off. The contaminated air stream is then processed to destroy or remove the organic constituents.
Solvent Extraction	A solvent such as triethylamine or liquid propane is mixed with contaminated soil. The soil/solvent mixture is settled and separated. The contaminant containing solvent is recycled and the clean soil

TABLE 10-1 (Page 2 of 2)
IDENTIFICATION OF TECHNOLOGIES FOR THE SOURCE AREA

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

TECHNOLOGY	DESCRIPTION
<u>Off-site Treatment</u> <u>(continued)</u>	
Slurry Phase Biological Treatment	Soils are excavated and mixed with water or groundwater to form a slurry. Waste slurry is fed into a bioreactor with controlled environmental conditions to optimize biodegradation.
Incineration	High temperature oxidation under controlled conditions completely destroys all organic compounds in the soil. Inorganics remain in the ash.
<u>Disposal</u>	
Off-site Landfill	Soils are excavated and transported for disposal in an off-site landfill. Soils may require disposal as a RCRA hazardous waste. Treated soils may also be disposed of in this manner.

**TABLE 10-2
IDENTIFICATION OF TECHNOLOGIES FOR GROUNDWATER**

**SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK**

TECHNOLOGY	DESCRIPTION
<u>No Action</u>	No actions are taken to address contaminated groundwater. Current risks remain the same.
<u>Minimal Action</u>	
Institutional Controls	Controls are put in place that restrict use of groundwater from the contaminated aquifer.
<u>Containment</u>	
Slurry wall	A low-permeability wall is constructed around the plume of contaminated water by excavating soils, mixing them with bentonite to form a slurry, returning them to the trench, and allowing the slurry to harden.
<u>Groundwater Extraction</u>	
Interception trenches	Highly permeable trenches are installed down-gradient of the plume. Contaminated groundwater is allowed to flow into the trenches for collection and treatment.
Extraction wells	Groundwater extraction wells are installed that pump contaminated water to the surface for treatment. Several wells may be necessary to extract different parts of the plume.
<u>Groundwater Treatment</u>	
Metals Precipitation	Chemicals are added to extracted groundwater to form insoluble metal compounds which are then settled out and removed. This inorganics pretreatment may be required prior to organic treatment because certain metals can foul organic treatment equipment.
Carbon Adsorption	Contaminated groundwater flows through activated carbon canisters. Contaminants in the groundwater are adsorbed from the aqueous phase by activated carbon.
Air Stripping	Water flows down through a tower while air flows countercurrently up the tower. VOCs and some SVOCs are transferred from the aqueous phase to the gaseous phase.
Ultraviolet Radiation/Oxidation	Extracted groundwater is passed through a reaction vessel where it is exposed to ultraviolet light and an oxidizing agent. Under these conditions, organic contaminants are broken down to simpler, non-toxic compounds.
<u>Disposal</u>	
POTW	Treated groundwater would be introduced into local sewer lines that lead to the Bergen Point Treatment Plant.
Surface Water Discharge	Treated groundwater would be discharged to a stream, pond, or other surface water body and be carried out to the Atlantic Ocean.
Reinjection	Treated groundwater would be reinjected back into the ground using reinjection wells.
Leaching	Treated groundwater would be allowed to infiltrate back into the ground through leaching fields or storm water leaching pits.

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Tables 10-3 and 10-4 present technology screening. Technology screening was conducted separately for soil and groundwater. Technologies considered not effective or implementable were eliminated from further consideration. The technologies remaining after the screening were subsequently used to develop remedial alternatives in Section 11.0. Table 10-5 provides a summary of the technology screening process.

TABLE 10-3 (Page 1 of 4)
SCREENING OF TECHNOLOGIES FOR THE SOURCE AREA

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

ADVANTAGES	DISADVANTAGES	CONCLUSIONS
• Nothing required for implementation • No cost	• Contaminated soils are not treated • Risk would not be reduced • Allows continued degradation of groundwater quality	Retained: A no action alternative is useful as a baseline comparison
• Easily installed • Restricts access to the site • Can prevent future land use that would increase exposure to contaminated soils and vapors	• Contaminated soils are not treated • Allows continued degradation of groundwater quality • Contaminated soils are not treated • Allows continued degradation of groundwater quality	Retained: Effective means of restricting site access Retained: Effective means of restricting future site use
• Would reduce infiltration of water through the contaminated soils • Would reduce potential for direct contact with or ingestion of contaminated soils	• Close proximity of the building may reduce effectiveness of the cap • Contaminated soils are not treated	Retained: Reduces infiltration and direct contact risk
• Effective for VOCs and some SVOCs • Does not require excavation • Space requirements are minimal • Would reduce leachability of contaminants, especially inorganics • Does not require excavation	• Water table depression may be required • Off-gases require treatment • Cesspools and pipes may provide preferential pathways for vapors, reducing desorption in areas outside of these pathways • Pilot test is usually required • Contaminants are not destroyed, only immobilized • Not proven for organics • May be difficult to treat soils in close proximity to the building • Long-term stability of treated soils is unknown • Treatability study required	Retained: Effective means of removing contaminants Eliminated: Not proven to be effective for organics at the site

TABLE 10-3 (Page 2 of 4)
SCREENING OF TECHNOLOGIES FOR THE SOURCE AREA

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

ADVANTAGES	DISADVANTAGES	CONCLUSIONS
Destroys organics Inorganics are immobilized in vitrified mass Does not require excavation Effective on soils contaminated with VOCs and SVOCs with low boiling points. Does not require excavation Effective for removing VOCs and SVOCs from soils Does not require excavation Does not require excavation Uses naturally occurring organisms to destroy contaminant/s Does not require excavation Space requirements are minimal Effective for soluble compounds such as PCE	- Only demonstrated at full scale for radioactive materials - Expensive compared to other treatments that destroy organics - Buried metals can short-circuit melt - Building and oil tank are in close proximity - Very high electrical requirements - Off-gases must be collected and treated to remove or destroy contaminants - Unproven at full-scale - Pilot test required - Off-gases and steam must be collected and treated to remove or destroy contaminants - Technology is not well developed and proven - Pilot test required - Treatment area must be greater than 0.5 acre in size, and a total site area of 2.0 acres must be available - Treatment of chlorinated solvents has not been demonstrated in field tests. - If all flushing water is not retrieved by extraction wells, increased groundwater contamination could occur - Requires water treatment on-site - Would require removal of asphalt - Underground utilities can set up preferential flow pathways, decreasing efficiency and completeness of flushing	Eliminated: Not demonstrated for organics Eliminated: Technology is not well developed Eliminated: Limited space available for use of this technology at the site Eliminate: Not demonstrated for the contaminants of concern at this site Eliminated: Because of risk of increased groundwater contamination

TABLE 10-3 (Page 3 of 4)
SCREENING OF TECHNOLOGIES FOR THE SOURCE AREA

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

ADVANTAGES	DISADVANTAGES	CONCLUSIONS
Effective at removing VOCs and some SVOCs Treatment may be available at some disposal facilities	- Excavation is required and may be difficult in close proximity to buildings - Scrubber water and/or carbon require further treatment - Availability of off-site treatment facilities are limited - Excavation would cause volatilization of contaminants - Treatability study required	Retained: May treat soils sufficiently to meet RCRA regulations for landfill disposal
Effectively removes some organics from contaminated soils	- Excavation is required and may be difficult in close proximity to buildings - Concentrated contaminant must be further treated - Commercial off-site treatment facilities are not available - Several passes through the extraction process could be required to reach target clean-up levels - Treatability study required - Excavation would cause volatilization of contaminants - Not proven for contaminants at ServAll	Eliminated: No off-site solvent extraction facilities are available
Volatile organic contaminants are easily removed by soil washing with the use of correct surfactant	- Excavation is required and may be difficult in close proximity to buildings - Commercial off-site treatment facilities are not available - Added surfactants require treatment and disposal - Excavation would cause volatilization of contaminants	Eliminated: Not a proven technology

TABLE 10-3 (Page 4 of 4)
SCREENING OF TECHNOLOGIES FOR THE SOURCE AREA

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

ADVANTAGES	DISADVANTAGES	CONCLUSIONS
• Immobilizes inorganics • Can reduce leachability of organics • Treatment is available at some landfills	• Contaminants are not destroyed, only immobilized • Not proven for organics • Excavation is required and may be difficult in close proximity to buildings • Long-term stability of solidified solid is unknown • Treatability study required • Excavation would cause volatilization of contaminants	Eliminated: Not proven effective for organics at the site
• Microorganisms degrade organic contaminants • Operating conditions can be easily controlled	• Excavation is required and may be difficult in close proximity to buildings • Commercial slurry phase treatment is not available off site • Excavation would cause volatilization of contaminants	Eliminated: Because of difficulty in treating contaminants and lack of off-site commercial treatment
• Organics are completely destroyed • Incineration technologies have been in use for many years and are a proven treatment method	• Excavation is required and may be difficult in close proximity to buildings • Inorganics remain in ash which requires disposal • Excavation would cause volatilization of contaminants	Retained: Readily available and completely destroys organics
• RCRA landfill would prevent further transport of contaminants	• Excavation is required and may be difficult in close proximity to buildings • Excavation would cause volatilization of contaminants • Transportation required • Soils may be classified as a RCRA hazardous waste and require treatment prior to disposal	Retained: Can be used in combination with other off-site treatment

TABLE 10-4 (Page 1 of 2)
SCREENING OF TECHNOLOGIES FOR GROUNDWATER

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

	ADVANTAGES	DISADVANTAGES	CONCLUSIONS
	• Nothing required for implementation • No cost	• Contaminated groundwater is not treated • Risk would not be reduced • Groundwater plume would continue to migrate	Retained: A no action alternative is useful for a baseline comparison
	• Can prevent groundwater use that would increase exposure to contamination	• Groundwater would remain untreated • Groundwater plume would continue to migrate	Retained: Would provide protection by preventing use of contaminated groundwater
	• Restricts migration of contaminated groundwater	• Depth to clay increases cost, chance of wall failure, and difficulty of implementation • Area is heavily populated	Eliminated: Depth to clay and densely settled area make implementation impossible
	• Efficient means to completely capture groundwater • Can be positioned to prevent further migration of the plume and to remove highest contaminated areas • Can be positioned easily even in heavily populated areas • Can be installed to great depths	• Could not be installed deep enough to intercept all contaminated groundwater • Highly populated area would make construction difficult • Extensive piping may be necessary to connect wells to a treatment plant	Eliminated: Contaminated groundwater is too deep for use of trenches - not implementable Retained: An effective and implementable method of removing contaminated groundwater
	• Effectively removes selected metals from extracted groundwater	• Significantly increases treatment plant space requirements • Produces metal sludge that requires disposal	Retained: Organic treatment methods may require metals pretreatment

TABLE 10-4 (Page 2 of 2)
SCREENING OF TECHNOLOGIES FOR GROUNDWATER

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

	ADVANTAGES	DISADVANTAGES	CONCLUSIONS
Continued)	- Effectively removes most organics - Well demonstrated at many full scale operations - Volatile compounds are easily removed from groundwater - Minimal space requirements - Well demonstrated at many full scale operations	- Vinyl chloride is poorly absorbed by carbon - Off-gases may require further treatment	Eliminated: Carbon can not be used effectively for vinyl chloride Retained: Would effectively remove contaminants from groundwater
ation	- Effectively oxidizes all of the contaminants of concern at this site - Demonstrated as part of the USEPA SITE program	- Less proven than other treatment methods - Products of incomplete oxidation may require further treatment	Retained: Would effectively destroy contaminants in groundwater
	- Efficient means for disposal - Minimal cost - None - Returns treated groundwater to the aquifer from which it was extracted - Returns treated groundwater to the aquifer from which it was extracted	- Sewer lines leading to a POTW exist south of the Southern State Parkway only - POTW may not be willing to accept large volumes of water - Would require extensive piping from the treatment location to surface water - Water may have to be treated to meet more stringent requirements - Could influence plume migration - Could influence plume migration	Retained: Potential method for discharge of treated groundwater Retained: Potential method for discharge of treated groundwater Retained: Potential method for discharge of treated groundwater Retained: Potential method for discharge of treated groundwater

**TABLE 10-5
SUMMARY OF TECHNOLOGY SCREENING**

**SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK**

		TECHNOLOGY	RETAINED	ELIMINATED
	No Action	No Action	X	
	Minimal Action	Fencing/Posting	X	
		Institutional Actions	X	
	Containment	Capping	X	
	In Situ Treatment	Vacuum Extraction	X	
		Solidification/Stabilization		X
		Vitrification		X
		Radio Frequency Heating		X
		Steam and Hot Air Stripping		X
		Bioremediation		X
		Soil Flushing		X
	Off-site Treatment	Thermal Desorption	X	
		Solvent Extraction		X
		Soil Washing		X
		Solidification/Stabilization		X
		Slurry Phase Biological Treatment		X
		Incineration	X	
	Disposal	Off-site Disposal	X	
	No Action	No Action	X	
	Minimal Action	Institutional Control	X	
	Containment	Slurry Wall		X
	Extraction	Interception Trenches		X
		Extraction Wells	X	
	Treatment	Metals Precipitation	X	
		Carbon Adsorption		X
		Air Stripping	X	
		Ultraviolet Radiation/Oxidation	X	

11.0 DEVELOPMENT OF REMEDIAL ALTERNATIVES

The retained technologies listed in Tables 10-3 and 10-4 are considered technically feasible and applicable to the waste types and site conditions at ServAll. These medium-specific technologies were assembled into potential site-wide remedial alternatives capable of achieving the remedial response objectives and complying with the intent of the Superfund Amendments and Reauthorization Act of 1986 (SARA). Alternatives were developed that cover a range of possible remedial approaches, varying in the degree to which they require long-term site management. The limits of this range extend from a no action alternative (for both soil and groundwater) to alternatives providing permanent remediation, eliminating the need for long-term management.

Thirteen site-wide alternatives (lettered A through M) were developed which were designed to address remediation of both source area soil and downgradient groundwater contamination. Table 11-1 presents the alternative development process. These alternatives combine the response actions for soil with the response actions for groundwater in a logical fashion. Under each response action, technologies retained in Chapter 10 which could be implemented to achieve the response action are listed. At least one of these technologies would be included in the alternative during detailed analysis. For example, as part of a groundwater treatment system, metals precipitation, if required, would precede treatment of organics using either air stripping or ultraviolet (UV)/oxidation.

Alternative A is a No Action alternative for both soil and groundwater. This alternative is required in the detailed analysis to assess baseline conditions. Alternative B is a Minimal Action alternative for both soil and groundwater. Alternative B was developed to provide an alternative which does not have a treatment or containment component but would provide protection through fencing, institutional controls, and continued environmental monitoring.

Alternatives C, D, and E combine Minimal Action for groundwater with Containment, In situ Treatment, and Off-site Treatment/ Disposal for the source soil, respectively. Minimal Action for the groundwater would include institutional controls and environmental monitoring. Containment for source soils would involve paving the site with asphalt to limit rainwater infiltration and direct

TABLE 11-1
ALTERNATIVE DEVELOPMENT
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

		ALTERNATIVE DEVELOPMENT												
RESPONSE ACTION														
S O U R C E S O I L S	No Action	A	B	C	D	E	F	G	H	I	J	K	L	M
		X												
	Minimal Action Fencing Deed Restrictions		X				X				X			
	Containment Asphalt Cap			X				X				X		
	In Situ Treatment Vacuum Extraction				X				X				X	
	Off-site Treatment Incineration Thermal Desorption					X				X				X
	Disposal RCRA Landfill					X				X				X
G R O U N D W A T E R	No Action	X												
	Minimal Action Deed Restrictions Environmental Monitoring		X	X	X	X								
	Source Control Extraction Wells								X					
	Containment Extraction Wells						X	X		X				
	Active Restoration Extraction Wells										X	X	X	X
	Groundwater Treatment Air Stripping						X	X	X	X	X	X	X	X

incineration, thermal desorption, or solidification/stabilization. The treatment and disposal components of this response action would occur at off-site facilities.

Alternatives F, G, H, and I combine the Containment remedial response action for groundwater with Minimal Action, Containment, and Off-site Treatment/Disposal for source soils, respectively. Groundwater Containment would involve the extraction of groundwater at the leading edge of the plume to prevent it from migrating further. Extraction wells would only be placed at the leading edge of the plume rather than along the length of the plume. Pumping rates would, therefore, be less than the pumping rates for the Active Restoration response action. The groundwater containment response action would also include groundwater treatment and discharge.

Alternative H combines the In situ Treatment of the source soils with source control groundwater response action. A few wells would be placed immediately downgradient of the source to remove contamination from the source area in the saturated zone. The pumping rate would be less than for the containment or active restoration response actions.

Alternatives J, K, L, and M combine Active Restoration of contaminated groundwater in the upper glacial aquifer using an more aggressive pumping strategy with Minimal Action, Containment, In situ Treatment, and Off-site Treatment/ Disposal for soils, respectively. The Active Restoration response action would involve installing groundwater extraction wells along the length of the plume to provide a quicker groundwater cleanup strategy. Pumping rates would therefore be greater than for the Containment response action. The Active Restoration response action would also include groundwater treatment and discharge.

Section 12.0 evaluates and screens the thirteen alternatives developed in this section. The purpose of this screening step is to evaluate potential remedial alternatives and reduce the number of alternatives to be retained for detailed analysis while preserving a range of options. The effectiveness and implementability criteria will be used to evaluate alternatives as a whole, while cost has a limited role at this stage of alternative screening. This approach to alternatives screening is consistent with the remedy selection process set forth in



12.0 SCREENING OF REMEDIAL ALTERNATIVES

The alternatives developed in Section 11.0 were screened to reduce the total number of alternatives that undergo detailed analysis while preserving a range of options. The screening step eliminates from further consideration any alternatives with undesirable characteristics regarding effectiveness and implementability. In general, cost was considered during the screening but was not used as a primary factor in screening the alternatives. The primary evaluation criteria are Effectiveness and Implementability, which are discussed in the following Subsections 12.1 and 12.2. The evaluations of the thirteen alternatives are presented in Subsection 12.3.

12.1 EFFECTIVENESS

Each alternative was judged for its ability to effectively protect human health and the environment by reducing the toxicity, mobility, or volume of contaminants through treatment. Both short- and long-term aspects of effectiveness were considered. Short-term effectiveness generally involves risks to the community and workers during implementation of remedial actions while long-term effectiveness provides a measure of the alternatives's ability to protect human health and the environment in the future.

12.2 IMPLEMENTABILITY

The implementability criterion is used to evaluate the technical and administrative feasibility of constructing, operating, and maintaining a remedial action. Technical feasibility refers to the ability to reliably construct, operate, and meet regulations for technologies in an alternative until the remedial action is complete. It also includes long-term operation, maintenance, and monitoring considerations for the alternative in the future after remedial activities are complete. Administrative feasibility is evaluated by assessing the ability to obtain approvals for each alternative from regulatory agencies. Availability and capacity of treatment, storage, and disposal facilities are also assessed as part of implementability.

12.3 ALTERNATIVE EVALUATIONS

TABLE 12-1
REMEDIAL ALTERNATIVES SCREENING

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

	EFFECTIVENESS	IMPLEMENTABILITY	CONCLUSION
ion Action	- Does not meet response objectives - Does not protect human health and the environment	- Easiest to implement - Requires no construction activities	Retained as <u>ALTERNATIVE 1</u> for baseline comparison with other alternatives
ion Action	- Restricts access to site, which will reduce exposure to contaminated soils - Inhalation risks would continue - Contaminated soil may continue to act as a source for groundwater contamination - Restricts use of private wells that may extract contaminated water	Easily implemented, although fencing may make continued use of the back part of the property difficult	This Alternative has been eliminated from further consideration because there are no significant differences between this alternative and Alternative C with regard to implementability and cost because the site is already covered with asphalt; Alternative C has the added benefit of reducing inhalation and direct exposure to soil contaminants
t Action	- Reduces dermal contact and inhalation risks - Contaminated soils in the capillary fringe may continue to act as a source for groundwater contamination - Containment is not permanent, maintenance of cover system will be required - Reduces possibility of private wells from extracting contaminated groundwater	- Cover materials and construction services are readily available - Approximately 90 percent of the is already covered with asphalt - A periodic maintenance program for the cover system could be easily implemented	This alternative was retained as <u>ALTERNATIVE 2</u> because it provides protection against dermal contact at the site and prevents further use and development of domestic wells in the contaminated groundwater plume

TABLE 1.1 (Page 2 of 5)
REMEDIAL ALTERNATIVES SCREENING

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

	EFFECTIVENESS	IMPLEMENTABILITY	CONCLUSION
Alternative 1 Remedial Action	- Contaminants would be removed from the soils, thus reducing the source of groundwater contamination and risk to the onsite maintenance worker - Reduces possibility of private wells from extracting contaminated groundwater	- Vacuum extraction is a demonstrated technology - Small site area may make implementation difficult	This alternative was retained as <u>ALTERNATIVE 3</u> because it provides a cost effective method for treatment of source soils combined with a minimal action for groundwater
Alternative 2 Remedial Action	- Contaminated soils would be removed from the site eliminating the source of groundwater contamination and the risk to a maintenance worker - Reduces possibility of private wells from extracting contaminated groundwater	- Off-site treatment and disposal facilities are well developed and available - Excavation of soils will be difficult because of the close proximity of the building and the relatively small site area	This alternative was retained as <u>ALTERNATIVE 4</u> because it provides a permanent treatment and disposal of contaminated site soils combined with a groundwater option that prevents further use and development of domestic wells in the area surrounding the contaminant plume
Alternative 3 Remedial Action	- Reduces dermal contact risks - Inhalation risks would continue - Contaminated soils may continue to act as a source for groundwater contamination - Prevents groundwater contamination from migrating further downgradient	- May be difficult to locate groundwater treatment equipment - Groundwater extraction and treatment technologies are well developed and available - Easily implemented, although fencing may make continued use of the back part of the property difficult	This alternative does not meet response objectives for either the source soils or for the groundwater, and it is not considered a permanent remedy for the site; therefore, it was eliminated from further consideration

TABLE 12-1 (Page 3 of 5)
REMEDIAL ALTERNATIVES SCREENING

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

E	EFFECTIVENESS	IMPLEMENTABILITY	CONCLUSION
nt tainment	• Reduces dermal contact and inhalation risks • Contaminated soils in the capillary fringe may continue to act as a source for groundwater contamination • Containment is not permanent • Prevents groundwater contamination from migrating further downgradient	• May be difficult to locate groundwater treatment equipment • Groundwater extraction and treatment technologies are well developed and available • Cover materials and construction services are readily available • Approximately 90 percent of the site is already covered with asphalt	This alternative does not meet response objectives for either the source soils or for groundwater, and it is not considered a permanent remedy for the site; therefore, it was eliminated from further consideration
tment ource Control	• A significant portion of the soil contamination would be removed using vacuum extraction, thus the source of groundwater contamination and the risk to the onsite maintenance worker would be reduced • Vacuum extraction process will not completely remove all contamination in the source soils • Groundwater source control pump and treat system will provide cleanup of saturated soils beneath the site • Institutional controls will reduce possibility of extracting groundwater for domestic purposes in the detached contaminant plume	• Groundwater extraction and injection wells and treatment systems can be located on or in the vicinity of the site • Groundwater extraction and treatment technologies are well developed and available • Vapor extraction is a demonstrated technology, and availability of vendors to perform remedial activities is good • Small site area may make implementation of remedial actions difficult	This alternative was retained as <u>ALTERNATIVE 5</u> because it provides an effective method for eliminating residual contaminant source in both the unsaturated and saturated soils beneath the site area; It also prevents further use and development of domestic wells in the area of the detached contaminant plume

TABLE 12-1 (Page 4 of 5)
REMEDIAL ALTERNATIVES SCREENING

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

	EFFECTIVENESS	IMPLEMENTABILITY	CONCLUSION
ment ment	- Contaminated soils would be removed from the site eliminating the source of groundwater contamination and the risk to a maintenance worker - Prevents groundwater contamination from migrating further downgradient	- May be difficult to locate groundwater treatment equipment - Groundwater extraction and treatment technologies are well developed and available - Off-site treatment facilities are well developed and available - Excavation of soils will be difficult because of the close proximity of the building and the relatively small site area	This alternative has been retained as <u>ALTERNATIVE 6</u> because it provides a permanent remedy for the site soils, and provides a method to prevent continued migration of the groundwater contaminant plume
on	- Reduces dermal contact risks - Inhalation risks would continue - Contaminated soils may continue to act as a source for groundwater contamination - Actively treats groundwater contamination in an effort to meet New York State groundwater quality criteria	- May be difficult to locate groundwater treatment equipment - Groundwater extraction and treatment technologies are well developed and available - Easily implemented, although fencing may make continued use of the back part of the property difficult	This alternative was eliminated from further consideration because the potential that soils would continue to act as a source of groundwater contamination negates the advantage of an aggressive groundwater clean-up strategy
	- Reduces dermal contact and inhalation risks - Contaminated soils in the capillary fringe may continue to act as a source for groundwater contamination - Containment is not permanent - Actively treats groundwater contamination in an effort to meet New York State groundwater quality criteria	- May be difficult to locate groundwater treatment equipment - Groundwater extraction and treatment technologies are well developed and available - Cover materials and construction services are readily available	This alternative was eliminated from further consideration because the potential that soils would continue to act as a source of groundwater contamination negates the advantage of an aggressive groundwater clean-up strategy

TABLE 12-1 (Page 5 of 5)
REMEDIAL ALTERNATIVES SCREENING

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

E	EFFECTIVENESS	IMPLEMENTABILITY	CONCLUSION
Treatment Alternative 7	- A significant portion of the soil contamination would be removed using vacuum extraction, thus the source of groundwater contamination and the risk to the onsite maintenance worker would be reduced - Vacuum extraction process will not completely remove all contamination in the source soils - Actively treats groundwater contamination in an effort to meet New York State groundwater quality criteria	- May be difficult to locate groundwater treatment equipment - Groundwater extraction and treatment technologies are well developed and available - Vapor extraction is a demonstrated technology, and availability of vendors to perform remedial activities is good - Small site area may make implementation of remedial actions difficult	This alternative was retained as <u>ALTERNATIVE 7</u> as a remedy that provides a cost effective approach for treatment of source area soils, and provides for an aggressive groundwater clean-up strategy
Treatment Alternative 8	- Contaminated soils would be removed from the site eliminating the source of groundwater contamination and the risk to a maintenance worker - Actively treats groundwater contamination in an effort to meet New York State groundwater quality criteria	- May be difficult to locate groundwater treatment equipment - Groundwater extraction and treatment technologies are well developed and available - Off-site treatment facilities are well developed and available - Excavation of soils will be difficult because of the close proximity of the building and the relatively small site area	This alternative was retained as <u>ALTERNATIVE 8</u> as a remedy that provides a permanent approach for the treatment and disposal of source area soils, and provides for an aggressive groundwater clean-up strategy

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screening process. The major considerations related to effectiveness and implementability for each of the alternatives is presented along with the decision and reasoning for either retaining or eliminating the alternative.

Although Alternative A, the No Action Alternative, does not provide any protection of human health or the environment, it was retained to provide a baseline assessment of risk if nothing was done to address contamination at the site. This alternative will be used as a baseline for comparison with other alternatives during the remedy selection process.

Of the four alternatives that paired various source alternatives with a minimal action response to contaminated groundwater, Alternatives C (containment of source), Alternative D (in situ treatment of source) and E (off-site treatment of source) were retained. Because the site is already 90 percent covered with asphalt Alternative C (containment at source) would not require significantly different expenditures to implement than Alternative B; however, Alternative C would protect against inhalation risks and still allow the back portion of the site to be used by the occupants of the building. For these reasons, Alternative B was eliminated from further consideration. Retaining Alternatives D and E provide two options for treatment of source soils combined with minimal activities relating to remediation of contaminated groundwater.

Alternative H combines in situ treatment of source soil with a groundwater source control pump and treat option. The objective of this alternative is to remove all potential source of contamination from both unsaturated and saturated soils beneath the site. In this alternative the leading edge of the groundwater contaminant plume will continue to migrate downgradient. Institutional controls and a groundwater monitoring program will be a part of this alternative, and will provide the mechanisms necessary to prevent further use and development of domestic wells in the area of contamination. This alternative will be retained for detailed analysis because the combination of the in situ soil treatment with the groundwater source control pump and treat element provides an option that will best address the source of contamination.

Groundwater containment was paired with various source area alternatives to form three site alternatives (I, J, and K). Of the three, Alternatives I (off-site treatment of source) was retained. The basis for selection of an alternative that

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off-site treatment of source area soils provides a permanent remedy for source area soil.

Two of the four alternatives that paired source area alternatives with an active pump and treat scenario for groundwater were screened out. Alternatives J and K were eliminated because these alternatives would not remove the contaminated soils that have acted as the source in the past. These soils could continue to act as a source and negate the aggressive groundwater pumping scenario. Alternatives L and M (in situ and off-site treatment of source) were retained. The inclusion of both in situ and off-site treatment options for the source area soils provide for alternatives that provide a range that will allow for an adequate cost/effectiveness analysis.

12.4 SUMMARY OF ALTERNATIVES SCREENING

A summary of the screening is provided in Table 12-2. The screening process reduced the number of remedial alternatives developed in Section 11.0 from a total of 13 to 8. The alternatives retained for detailed analysis have been renumbered prior to further analysis and are highlighted in Table 12-2. These eight remaining alternatives are examined in more detail in Section 13.0.



13.0 DETAILED ANALYSIS OF ALTERNATIVES

This section presents the detailed analysis and comparative analysis of the eight remaining alternatives for ServAll, which are summarized in Table 13-1. These analyses present the relevant information that will allow decision-makers to select a site remedy. The detailed analysis of each alternative includes the following:

- detailed descriptions of each remedial alternative emphasizing the application of various technologies as components of the alternative
- detailed analysis of each alternative against the seven evaluation criteria outlined in the NCP (USEPA, 1990) and in the NYSDEC TAGM (NYSDEC, 1990)

A detailed description of the technologies or processes used is provided for each alternative. Where appropriate, the description includes preliminary site layouts, process flow diagrams, preliminary design calculations, sizing of key components, and a discussion of limitations, assumptions, and uncertainties for each component. These descriptions are intended to provide a conceptual design of each alternative and are used for cost estimating purposes only. The eight remedial alternatives summarized in Table 13-1 are also evaluated according to the seven criteria listed in Table 13-2.

Subsection 3.2.5, federal ARARs and New York SCGs for ServAll are defined, and chemical- and location-specific ARARs and SCGs are identified. Action-specific ARARs and SCGs are technology- or activity-based limitations that direct how remedial actions are conducted. Potential action-specific ARARs and SCGs for the ServAll site are presented in Table 13-3 along with a short synopsis of the requirements. Each alternative will be evaluated with respect to chemical-, location-, and action-specific ARARs and SCGs under the criteria evaluations.

13.1 ALTERNATIVE 1 - NO ACTION

Alternative 1 was developed as a baseline to compare other remedial alternatives with. This alternative would involve no actions to protect human health or the environment. It would include environmental monitoring and five-year reviews. This alternative would not meet the remedial action objectives because it would

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Environmental Monitoring. The objectives of the environmental monitoring program are to evaluate whether the source area at the ServAll site is continuing to degrade groundwater quality in the upper glacial aquifer and to monitor the migration of contamination in groundwater. The monitoring plan developed and described in this FS is for cost-estimating purposes only. The final, detailed monitoring plan would be developed and submitted for regulatory agency review and comment prior to implementation.

Environmental monitoring would involve the routine periodic sampling of groundwater from the upper glacial aquifer. Samples would be analyzed for TCL VOCs. It is assumed that groundwater from 17 monitoring wells (15 existing, two new) would be sampled and analyzed, to monitor source contribution to groundwater contamination and the migration of the plume (Figure 13-1).

Groundwater from four upgradient wells (i.e., MW-3A, MW-3B, MW-2, and one new well) would be sampled and analyzed. These upgradient wells would provide information on the concentrations of contamination in upgradient groundwater. The three existing wells are all screened at various depths below the water table. Because groundwater contamination near the source is believed to be near the water table, an additional monitoring well screened at the water table would require installation and sampling in order to sufficiently characterize upgradient groundwater quality.

To monitor groundwater contamination immediately downgradient of the source area, six wells would be sampled (i.e., MW-1, MW-4, MW-5, MW-6A, MW-6B, and one new well). These wells would provide information on the contaminant concentrations in groundwater immediately after it has passed beneath the source area. MW-1 is screened at depth in the upper glacial aquifer and is the closest monitoring well to the source area. Because groundwater contamination is suspected near the water table in the vicinity of the source area, another monitoring well screened at the water table would require installation and sampling. Data from this well would better characterize groundwater quality near the source of contamination.

Groundwater from three existing monitoring wells approximately midway along the present length of the plume would be sampled and analyzed (i.e., MW-12, MW-13, and MW-14). MW-13, located approximately on the longitudinal axis of

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temporarily increased. It would take approximately one week to install the wells. A month or more may be required for bidding and contracting of drilling services.

13.1.4 Long-term Effectiveness and Permanence

The No-action Alternative would not reduce the risks posed by the contaminants of concern in source soils and groundwater in the upper glacial aquifer.

13.1.5 Reduction of Toxicity, Mobility, or Volume

Treatment processes would not be employed to address site contamination. No reduction in toxicity, mobility, or volume of contaminated soil and groundwater would be achieved.

13.1.6 Implementability

Installation of monitoring wells would be the only activity associated with this alternative. Equipment, materials, and services for installing monitoring wells, sampling groundwater, and laboratory analyses are readily available. Some coordination between the state, local officials, and the contractor would be required. The No-action Alternative would not interfere with possible future remedial actions such as pump and treat or source removal.

13.1.7 Cost

Capital, indirect, and operation and maintenance costs for Alternative 1 are presented in Table 13-4 and are \$10,000, \$12,000, and \$456,000, respectively. Cost backup is presented in Appendix K. The total present-worth cost for Alternative 1 is estimated to be \$574,000. This total includes a contingency of \$96,000 (20 percent of the subtotal of capital, indirect, and present-worth operating costs) to account for unforeseen costs.

13.2 ALTERNATIVE 2 - MINIMAL ACTION

The Minimal Action Alternative would include construction of an asphalt cover over source soils and minimal actions for contaminated groundwater and consists of the following components:

TABLE 13-4
COST ESTIMATE ALTERNATIVE 1
NO ACTION

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

COST PARAMETER	COST	PRESENT WORTH COST(1)
CAPITAL COSTS		
Installation of Monitoring Wells*	\$10,000	\$10,000
Total Capital Costs		\$10,000
INDIRECT COSTS		
Health and Safety (20% of Capital (2))	\$2,000	\$2,000
Legal, Administrative, Permitting (5% of Capital)	\$1,000	\$1,000
Engineering (50% of Capital)	\$5,000	\$5,000
Construction Management (40% of Capital)	\$4,000	\$4,000
Total Indirect Costs		\$12,000
OPERATING COSTS		
Environmental monitoring		
First 2 Years (4 Events Per Year)	\$100,000	\$177,000
Remaining 28 Years (1 Event Per Year)	\$25,000	\$219,000
Additional Monitoring Wells(3)	\$24,000	\$42,000
Five-year Reviews(3)	\$10,000	\$18,000
Total Operating Costs		\$456,000
SUBTOTAL		\$478,000
Contingency (20% of Subtotal)		\$96,000
TOTAL		\$574,000

NOTES:

(1) = Discount Rate is 8.75%

(2) = Includes only those capital costs that would require health and safety training and equipment as indicated by an asterisk.

(3) = Present-worth cost based on new wells and reviews conducted every five years until year 30. Cost are conceptual only (-30/+50% accurate) and should not be considered an engineers estimate.

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Five-year Reviews. Because contamination would remain in the soils and groundwater, reviews would be conducted of the site and the chosen remedial alternative every five years. The five-year review process is described under Alternative 1 (see Subsection 13.1).

13.2.1 Compliance with ARARs and New York SCGs

Alternative 2 does not involve any treatment of soils or groundwater; therefore, no change in contaminant concentrations would be expected except through natural degradation of contaminants. The cover would reduce exposure to contaminated soils so that risks from soils would not exceed USEPA's level of acceptable risk based on RfDs and CPFs. Groundwater contamination would remain at levels above state drinking water regulations, federal MCLs, and federal MCLGs; however, protection of human health and the environment would be maintained. NYSDEC water quality regulations would not be met. No releases of contaminants to the air are expected for this alternative; therefore, federal and state ambient air quality regulations would be met.

Because of the relatively small size of the ServAll site and its location in a developed, suburban area, few location-specific ARARs and SCGs apply. The designation of the aquifer as a sole-source aquifer, or the principal source of drinking water, allows for USEPA review of the project if federal financial assistance is involved. This alternative is expected to comply with these location-specific ARARs and SCGs.

The only actions associated with this alternative include construction of the cover and installation and sampling of monitoring wells. This would require that safe working practices are followed according to regulations outlined by OSHA.

13.2.2 Protection of Human Health and the Environment

Construction of a cover over the site would significantly reduce risks associated with direct contact or incidental ingestion of contaminated soils. Human health would be protected as long as the cover is properly maintained and no invasive activities occur that could reestablish exposure routes. Institutional controls would prohibit such activities.

migrate south and eventually discharge into the Great South Bay. Institutional controls are included as part of this alternative and, if enforced, would provide protection of human health.

13.2.3 Short-term Impacts and Effectiveness

Construction of the cover may require easements from abutting property owners to allow for maneuvering of construction equipment; however, these construction activities would not pose any significant threat to the community. Construction workers would not be exposed to excessive risk because no invasive activities would take place. In addition, the risk assessment for the site evaluated the risks to workers removing the oil tank from the south side of the building and found that the risks were not unacceptable (E.C. Jordan Co., 1991). Construction of the cover would provide less exposure to workers than the tank removal. The only risks to workers installing the cover would be associated with physical construction hazards that would be reduced by using appropriate safety practices.

Installation of monitoring wells would include potential exposure to contaminated soils and groundwater and, therefore, drillers would require OSHA health and safety training. Work would be conducted according to a site HASP and in accordance with appropriate safety practices. Minor impacts on the community, such as noise and traffic restrictions, would be associated with drilling activities.

Due to the industrial/residential nature of the area surrounding the site, construction activities would not significantly impact the environment. Repairs to fencing and lawns would be made at the conclusion of the construction as needed. The time required to design and construct the cover is estimated to be two months.

13.2.4 Long-term Effectiveness and Permanence

Alternative 2 would not treat or remove any contamination currently at the ServAll site or in downgradient groundwater. The cover would deteriorate over time because of freeze/thaw conditions and use of the asphalt surface for storage of equipment. Semi-annual inspections and repairs and periodic resurfacing would be required to maintain the cover and its protective functions.

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contaminant leaching from capillary fringe soils.

Institutional controls should be effective at preventing invasive activities at the site and at preventing new water supply wells from being constructed in the path of the plume. Institutional controls may not be completely effective at preventing the use of any existing wells in the path of the plume.

13.2.5 Reduction of Toxicity, Mobility, or Volume

This alternative would not involve any treatment of soils or groundwater; therefore, it would not reduce the toxicity, mobility, or volume of contaminants through treatment. Some reduction in the mobility of contaminants may be achieved by preventing rainwater infiltration through the contaminated soils; however, it is questionable how effective this would be as discussed under the long-term effectiveness criteria (see Subsection 13.2.4).

13.2.6 Implementability

Construction of an asphalt cover would encounter few implementation difficulties. Construction of asphalt surfaces are common and well developed. Few difficulties would be expected with this alternative and conformance to the cover specifications could be easily achieved. Construction services and materials are readily available. It may be necessary to obtain easements from abutting property owners for the temporary use of their land to maneuver equipment during construction. This would require coordination between the state, the local officials, the contractor, and the property owners.

Inspections to evaluate and maintain the condition of the cover would be easy to implement, and monitoring to determine the effectiveness at reducing groundwater contamination also would face few difficulties. Implementation of institutional controls would require some coordination with other agencies such as the SCDHS. Implementation of additional remedial activities in the future would not be adversely affected by the cover.

13.2.7 Cost

Capital, indirect, and operation and maintenance costs for Alternative 2 are

TABLE 13-5
COST ESTIMATE ALTERNATIVE 2
MINIMAL ACTION

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

COST PARAMETER	COST	PRESENT WORTH COST(1)
CAPITAL COSTS		
Asphalt Cover	\$9,000	\$9,000
Installation of Monitoring Wells*	\$10,000	\$10,000
Institutional Controls	\$19,000	\$19,000
Total Capital Costs		\$38,000
INDIRECT COSTS		
Health and Safety (20% of Capital (2))	\$2,000	\$2,000
Legal, Administrative, Permitting (5% of Capital)	\$2,000	\$2,000
Engineering (40% of Capital)	\$15,000	\$15,000
Construction Management (35% of Capital)	\$13,000	\$13,000
Total Indirect Costs		\$32,000
OPERATING COSTS		
Site Inspections and Surface Repairs (2 Per Year)	\$4,000	\$42,000
Environmental monitoring		
First 2 Years (4 Events Per Year)	\$100,000	\$177,000
Remaining 28 Years (1 Event Per Year)	\$25,000	\$219,000
Resurfacing (After 10 and 20 Years)	\$5,000	\$3,000
Additional Monitoring Wells(3)	\$24,000	\$42,000
Five-year Reviews(3)	\$10,000	\$18,000
Total Operating Costs		\$501,000
SUBTOTAL		\$571,000
Contingency (20% of Subtotal)		\$114,000
TOTAL		\$685,000

NOTES:

(1) = Discount Rate is 8.75%

(2) = Includes only those capital costs that would require health and safety training and equipment as indicated by an asterisk.

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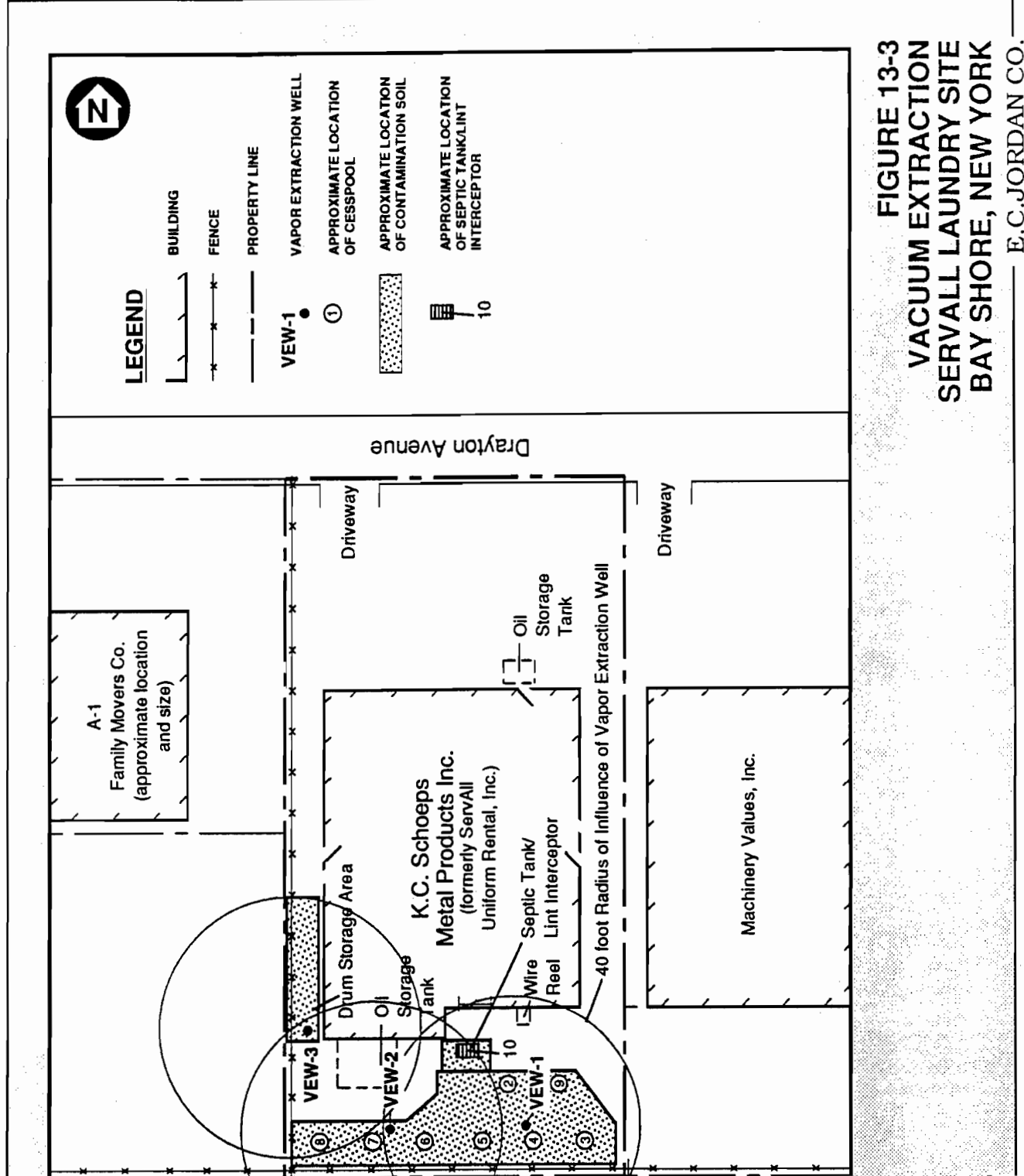
airflow could be set up and either limit the radius of influence or cause flows to be non-uniform through the source area.

The soils at ServAll are expected to be readily vacuum extracted. The soil is classified as a fine-to-medium sand with a porosity of approximately 0.3. The soils also have a relatively low organic carbon content estimated to be in the range of 0.1 to 0.3 percent by weight. Soils high in organic matter tend to sorb VOCs more tightly, increasing the time required to vacuum extract them. Therefore, soils with low organic carbon content are ideal for vacuum extraction.

Implementation of vacuum extraction at the site would begin with a pilot study to provide information necessary for final design of the system. A pilot study would involve installing a vacuum extraction well at the site. The pilot system would be operated for a minimum of two weeks and not more than two months. The pilot study would gather physical and chemical data required to design and run a full-scale system. Information from the pilot study would be used to evaluate the adequacy of the existing asphalt cover at limiting air infiltration near the extraction well, provide accurate full-scale cost estimation, better estimate the time for remediation, assess effects on the water table, test vapor phase treatment, and determine other parameters needed to design and run a full-scale system.

Preliminary design calculations conducted for cost-estimating purposes determined that three venting wells would be installed in soils to vent the vadose zone at the site. Figure 13-3 shows the layout of the vacuum extraction system (VES) used for preliminary design and cost-estimating purposes. This network is based on a radius of influence for each well of approximately 40 feet. Locations of the wells were chosen to influence an area greater than the expected extent of contamination because of the uncertainty involved with determining contaminated soil volumes.

During well installation, soil samples would be collected and analyzed to further define the contaminated zone at the site. Figure 13-4 illustrates a typical vacuum extraction well. Groundwater is generally extracted along with the soil vapor. The extracted vapor/liquid mixture is pumped to a vapor/liquid separator. The two streams are then sent to vapor and liquid phase carbon absorbers to remove contaminants. For cost estimating purposes, it was assumed that off-gases would require treatment prior to discharge to the atmosphere. The actual determination



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13.3.1 Compliance with ARARs and New York SCGs

Alternative 3 includes the removal of contaminants from site soils but no treatment of groundwater. In situ vacuum extraction would reduce concentrations of contaminants in soils so that risks from soils would not exceed USEPA's level of acceptable risk based on RfDs and CPFs. Groundwater contamination would remain at levels above state drinking water regulations, federal MCLs, and federal MCLGs; however, protection of human health and the environment would be maintained. NYSWQRs would not be met. It was assumed that vapors from the vacuum extraction process would be collected and treated to remove contaminants before discharge to the air; however, the need for this would be verified during the design phase. Vapor treatment would achieve levels required by federal Clean Air Act (CAA) and state ambient air quality regulations.

Because of the relatively small size of the ServAll site and its location in a developed, suburban area, few location-specific ARARs and SCGs apply. The designation of the aquifer as a sole source aquifer, or the principal source of drinking water, allows for USEPA review of the project if federal financial assistance is involved. This alternative is expected to comply with these location-specific ARARs and SCGs.

Operation of the vacuum extraction system would require compliance with state and RCRA regulations for hazardous waste Treatment, Storage, and Disposal Facilities (TSDFs). Treatment of off-gases would comply with NYSDEC and CAA regulations for emissions. Construction and operation of the treatment plant would require health and safety training and safe working practices as outlined by OSHA.

13.3.2 Protection of Human Health and the Environment

This alternative would provide an increased level of protection to human health over baseline conditions. This alternative includes a component to expedite removal of a source of groundwater contamination through vacuum extraction. Removal of contaminants from the source area would reduce contamination to levels protective of on-site workers or other individuals. Risks from direct contact and incidental ingestion would be reduced to acceptable levels. No treatment of

13.3.3 Short-term Impacts and Effectiveness

Implementation of vacuum extraction would not result in any significant adverse impacts to the community. Exhaust from the vacuum extraction system would be captured and treated to remove contaminants by both liquid and vapor phase carbon. Therefore, emissions from the vacuum extraction system are not expected to pose a safety hazard to workers or the community. It may be necessary to obtain easements from abutting property owners to allow construction of the vacuum extraction treatment.

Workers would be required to have OSHA health and safety training for work at a hazardous waste site. An appropriate HASP would be followed to minimize risks to workers during well installation, system operation, and monitoring. Personal protective equipment would minimize the possibility of exposure to contamination.

Due to the industrial/residential nature of the area surrounding the site, construction activities would not significantly impact the environment. The estimated time for design, well installation, and construction activities is two to three months. The treatment time to achieve target cleanup levels is estimated to be four months (see Appendix L). Once treatment to cleanup levels is verified through the use of a monitoring program, treatment of soils would be considered complete.

13.3.4 Long-term Effectiveness and Permanence

VOCs would be removed from source soil to concentrations that would reduce direct contact and incidental ingestion risks to acceptable levels.

The physical structures of the cesspools could hinder removal of contaminants from the soils by setting up preferential pathways for vapors in the soils along cesspool walls or connection piping, or by isolating contaminated soils within the cesspools. In the former case, contaminated soils lying outside the preferential pathway would be unaffected by the vapor extraction well. However, the potential for establishing preferential pathways for vapors should be minimal because of the high permeability of soils at the site.

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fine particles and lint that could hinder the passage of vapors through the pores. Consequently, contaminants would not be able to pass through the cesspool walls; thereby, leaving some soils isolated and unaffected by the treatment. This scenario is identified only as a potential problem. Results of the pilot study should show if this could be a real problem during full-scale implementation.

The leaching-based target cleanup levels of 5 and 6 ppb for PCE and TCE respectively would be more difficult to obtain than the risk-based target cleanup level of 40 parts per million (ppm) for PCE. Injection of steam or hot air would enhance the removal of contamination by vacuum extraction to help attain these target cleanup levels. Initially, the extraction system would be operated using vacuum pressure alone. However, if removal were not effective enough, steam or hot air would be injected into wells surrounding the area of contamination to enhance the removal of contaminants and achieve lower target cleanup levels.

Although the leaching-based target cleanup levels are particularly low for a vacuum extraction system, the process would undoubtedly remove significant amounts of contaminants from the soil. It may not be able to achieve the leaching-based target cleanup levels. However, the development of leaching-based target cleanup level provides only a conservative estimate of the soil cleanup levels necessary to prevent further groundwater contamination. The actual levels necessary to prevent further leaching may be higher. Environmental monitoring would verify when groundwater contamination no longer exceeds NYSWQRs. It is possible that vacuum extraction will be unable to remove contamination to concentrations that would protect groundwater from further contamination.

Institutional controls would be effective at preventing new wells from being constructed in the path of the plume. However, they may not be completely effective at enforcing the restrictions on the use of wells already in the path of the plume.

13.3.5 Reduction of Toxicity, Mobility, or Volume

Vacuum extraction is an irreversible process that would transfer VOCs from the aqueous and sorbed phases to the vapor phase. Typically both the aqueous and vapor phases of contaminants are extracted due to the presence of water in the

catalytic incinerator could be used to remove contaminants from the vapor. Contaminants sorbed to the carbon would be destroyed in the regeneration process conducted off site. This would yield a reduction in toxicity, mobility, and volume. Carbon may also be disposed of in an off-site hazardous waste landfill, which results in reduction of mobility and volume.

The mass of contaminants in the vadose zone would be reduced substantially. Achieving the target cleanup level of 5 micrograms per kilogram ($\mu\text{g}/\text{kg}$) for PCE would yield a removal efficiency of 99.99 percent. A total of about 90 lbs of PCE would be removed from the soil in this process (see Appendix M for calculations). Approximately 0.03 lb of PCE would remain in source area soils. Reducing the mobility, toxicity, and volume of source contaminants would reduce the amount of leaching of contaminants to groundwater.

No treatment of groundwater contamination would be implemented for this alternative. Therefore, no reduction in toxicity, mobility, or volume of groundwater contamination would be achieved.

13.3.6 Implementability

Vacuum extraction is an innovative technology participating in USEPA's Superfund Innovative Technology Evaluation (SITE) program. USEPA's demonstration of vacuum extraction at the Groveland, Massachusetts (1989a), site showed that this technology could effectively remove solvent-related contamination from unsaturated soil. Operation of the system is not complicated, so significant downtime is not expected. Because the estimated treatment time for this alternative is only four months, replacement of equipment is not expected. In soil with a significant percentage of fines, the screens in the vapor extraction wells may become clogged, requiring cleaning. The soils at the ServAll site are not expected to cause these problems.

Vacuum extraction would not prevent additional remedial actions from being undertaken if deemed necessary. Vendors are available who provide vacuum extraction equipment and services. It may be necessary to obtain easements from abutting property owners during construction and operation of the treatment. Implementation of institutional controls would require some coordination with

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13.3.7 Cost

Capital, indirect, and operation and maintenance costs for Alternative 3 are presented in Table 13-6 and are \$200,000, \$117,000, and \$456,000, respectively. Cost backup is provided in Appendix K. The total present-worth cost for Alternative 3 is estimated to be \$928,000. This total includes a contingency of \$155,000 (20 percent of the subtotal of capital, indirect, and present-worth operating costs) to account for unforeseen costs that could increase the cost of this alternative.

13.4 ALTERNATIVE 4 - OFF-SITE SOURCE SOIL TREATMENT/ MINIMAL ACTION ON GROUNDWATER

Alternative 4 combines excavation and off-site treatment of source soil with minimal action for treatment of the contaminant plume, and includes the following components:

- excavation of source soil
- off-site incineration or thermal desorption of contaminated soils
- disposal of treated soil
- institutional controls
- environmental monitoring
- five-year reviews

This alternative would achieve the response objectives for source soils by excavating the contaminated source soil and treating it at an off-site facility. Removing the source of contamination would prevent further contamination of groundwater and eliminate direct contact and incidental ingestion risks.

No treatment of the contaminant plume would be implemented under this alternative. Contaminated groundwater would continue to migrate toward the Great South Bay where it would eventually discharge. An environmental monitoring program would be implemented as part of this alternative, and deed restrictions would apply to properties potentially affected by the plume. Each component of this alternative is described in the following paragraphs.

Excavation. The first step would be additional sampling to verify the extent of

TABLE 13-6
COST ESTIMATE ALTERNATIVE 3
IN SITU SOURCE SOIL TREATMENT
MINIMAL ACTION ON GROUNDWATER

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

COST PARAMETER	COST	PRESENT WORTH COST(1)
CAPITAL COSTS		
Vacuum Extraction*	\$171,000	\$171,000
Installation of Monitoring Wells*	\$10,000	\$10,000
Institutional Controls	\$19,000	\$19,000
Total Capital Costs		\$200,000
INDIRECT COSTS		
Health and Safety (15% of Capital (2))	\$27,000	\$27,000
Legal, Administrative, Permitting (5% of Capital)	\$10,000	\$10,000
Engineering (20% of Capital)	\$40,000	\$40,000
Construction Management (20% of Capital)	\$40,000	\$40,000
Total Indirect Costs		\$117,000
OPERATING COSTS		
Environmental monitoring		
First 2 Years (4 Events Per Year)	\$100,000	\$177,000
Remaining 28 Years (1 Event Per Year)	\$25,000	\$219,000
Additional Monitoring Wells(3)	\$24,000	\$42,000
Five-year Reviews(3)	\$10,000	\$18,000
Total Operating Costs		\$456,000
SUBTOTAL		\$773,000
Contingency (20% of Subtotal)		\$155,000
TOTAL		\$928,000

NOTES:

(1) = Discount Rate is 8.75%

(2) = Includes only those capital costs that would require health and safety training and equipment as indicated by an asterisk.

(3) = Present-worth cost based on new wells and reviews conducted every five years until year 30.

Cost are conceptual only (± 30% to 50% accurate) and should not be considered an engineers estimate.

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installation of sheet piling for this alternative to provide adequate shoring of the walls of the excavation; therefore, confirmatory sampling would be divided into two parts. To confirm that all contaminated soils are contained within the sheet piling, sampling and analysis would be conducted prior to installation. During excavation, samples would also be collected and analyzed to verify that the soils next to the sheet piling on the inside are clean.

A TerraProbe system would be used to collect soil samples prior to the installation of sheet piling. The TerraProbe is mounted on the back of a van or pickup, and can collect up to 10 soil samples per day, depending on soil type and sample depth. Hollow stainless steel rods are driven through the soil to appropriate depths with a hydraulic jackhammer. The sample tube is then opened and driven to collect a soil sample. Soil samples would be analyzed on site using gas chromatography for PCE, TCE, 1,2-DCE, and vinyl chloride. Confirmatory samples from clean areas would be sent to an off-site laboratory. For cost-estimating purposes, it was assumed that TerraProbe borings would be made at 40 locations and that samples would be collected every 5 feet from the surface to 25 feet below ground surface.

As determined by the preliminary investigation with the TerraProbe borings, sheet piling would be driven around the area to be excavated. The sheet piling would be driven to a depth of 46 feet using a crane-operated pile driver.

After installation of the sheet piling, excavation using a backhoe or a crane with a clamshell bucket would proceed. Trucks would be filled with contaminated soils as the excavation proceeds. The sheet piling would be reinforced with steel as the excavation deepens. For cost-estimating purposes, it was assumed that the excavation would proceed to 2 feet below the water level or a total excavation depth of 23 feet. Air would be monitored during the excavation and depending on the amount of contaminant volatilization measured, some controls of VOC emissions may be required; however, this was not included in the cost estimates.

To maneuver the crane or backhoe around the excavation site, easements from the surrounding property owners would be needed. Fences would be moved and the ground surface prepared to handle heavy equipment. The proposed locations of sheet piling and the extent of easements required for implementation of this alternative are shown in Figure 13-5. An estimated 2,400 cubic yards of soil

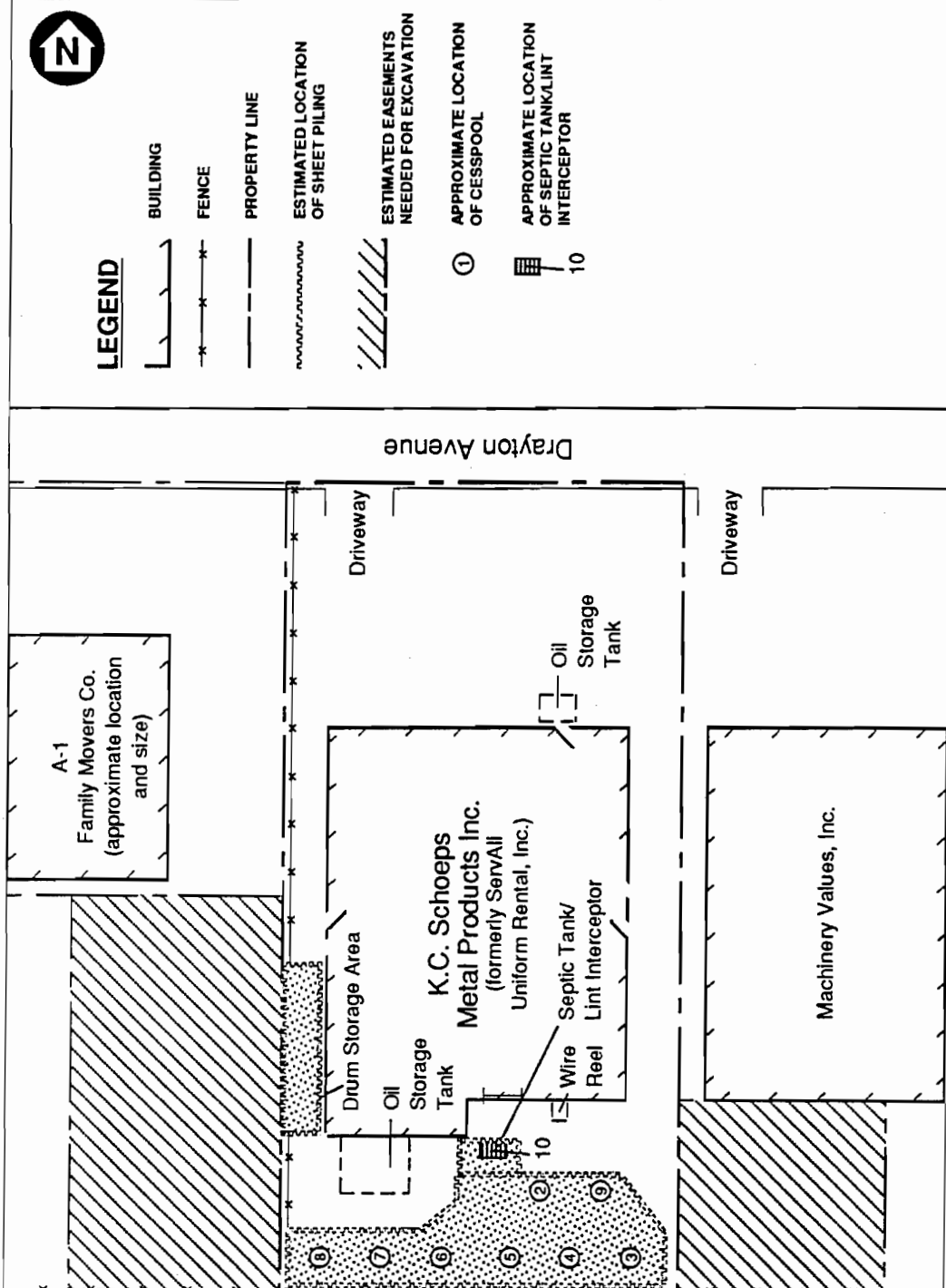


FIGURE 13-5
EXCAVATION OF SOILS
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

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Three major wastestreams are generated by incineration: ash from the incinerator and APC system, water from the APC system, and emissions from the incinerator. Ash may be contaminated with heavy metals; however, with the soils from ServAll, this is not very likely. The APC system's solids, such as fly ash, may contain high concentrations of volatile metals. If these residues fail required TCLP analysis, they can be treated by a process such as stabilization/solidification and disposed of in a permitted disposal facility. Liquid waste from the APC system may contain highly caustic residuals, high chlorides, volatile metals, trace organics, metal particulates, and inorganic particulates. Treatment may require neutralization, chemical precipitation, reverse osmosis, settling, evaporation, filtration, or carbon adsorption before discharge.

Thermal Desorption. Thermal desorption is any number of processes that use either indirect or direct heat exchange to vaporize organic contaminants from soil. The soil is excavated from the site and transported to the thermal desorption unit. The material is screened to remove oversized objects larger than approximately 1.5 to 2 inches. Oversized material can either be ground and processed in the treatment unit or disposed of in an appropriate manner. The screened material is then fed into the desorption chamber. Typically, the desorption portion of the process occurs in an indirectly fired rotary kiln, in a set of internally heated screw augers, or in a series of externally heated distillation chambers. The type of desorption chamber used in a process is specific to the vendor's equipment. An example of a thermal desorption system is illustrated in Figure 13-7.

The soil is intimately contacted with a heat transfer surface within the desorption chamber. Operating temperatures vary depending on the characteristics of contaminants of concern in the soil, and range from 200 to 1,000 °F. An inert gas, such as nitrogen, can be injected in a countercurrent sweep stream to prevent contaminant oxidation and act as a gas carrier from the desorption chamber to the gas treatment system.

The actual bed temperature and residence time are the primary factors affecting performance in thermal desorption. These parameters are controlled in the desorption unit by using any of several methods. The material can be processed from lower to higher temperature zones within the desorption chamber, by passing the material through the desorption chamber multiple times where the operating temperature is increased for each pass, or by passing it through separate

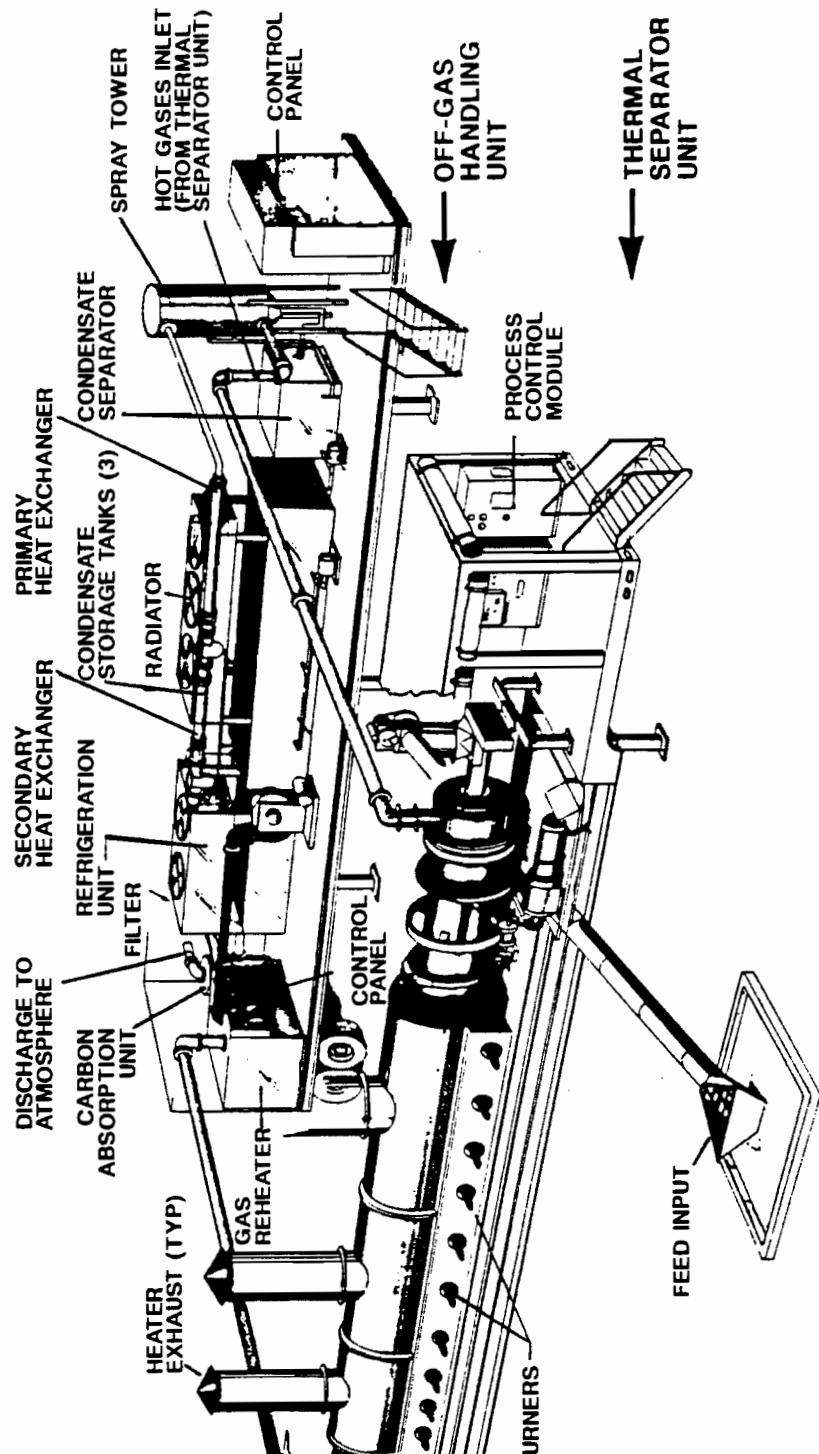


FIGURE 13-7
CWM X*TRAX™ THERMAL DESORPTION SYSTEM
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK
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however, this is not expected to be necessary. This type of treatment would increase the soil volume to be disposed of. Water generated by the APC system may require treatment prior to discharge. Treated off-gases are released from the APC system to the atmosphere.

No reduction in toxicity, mobility, and volume of contaminated groundwater would be achieved because no treatment processes would be implemented to address groundwater contamination.

13.4.6 Implementability

Excavation and shoring techniques are commonly used in construction. However, installation of sheet piling and excavation would require more space than is currently available at the site. Easements would have to be obtained from adjacent property owners to implement construction activities for shoring and excavation and to store equipment. This would require coordination among the state, the local officials, the contractor, and the property owners. Several contractors qualified to work at hazardous waste sites would be contacted for competitive bidding on construction.

Incineration is a proven technology for the destruction of organic contaminants such as PCE and TCE in soils. The process is well developed and can reliably meet performance goals. However, operation of an incinerator is mechanically complex and has stringent monitoring requirements to assure proper performance. The incinerator and associated facilities require highly trained staff and substantial attention. An inventory of off-site incineration facilities would be conducted at the time of the remedial design to determine the availability of these facilities to receive waste.

The implementability of institutional controls, environmental monitoring, and five-year reviews is the same as that presented in Subsection 13.2.13.

13.4.7 Cost

Capital, indirect, and operation and maintenance costs for Alternative 4 are presented in Table 13-7 are \$5,270,000, \$1,084,000, and \$456,000, respectively. Cost backups are presented in Appendix K. The total present-worth cost for Alternative 4 is estimated to be \$2,172,000. This total includes the operation and

TABLE 13-7
COST ESTIMATE ALTERNATIVE 4
OFF-SITE SOURCE SOIL TREATMENT
MINIMAL ACTION ON GROUNDWATER

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

COST PARAMETER	COST	PRESENT WORTH COST(1)
CAPITAL COSTS		
TerraProbe Investigation*	\$52,000	\$52,000
Excavation – non-intrusive activities	\$344,000	\$344,000
Excavation – intrusive activities*	\$130,000	\$130,000
Transportation	\$395,000	\$395,000
Incineration	\$4,320,000	\$4,320,000
Installation of monitoring wells*	\$10,000	\$10,000
Institutional Controls	\$19,000	\$19,000
Total Capital Costs		\$5,270,000
INDIRECT COSTS		
Health and Safety (15% of Capital (2))	\$29,000	\$29,000
Legal, Administrative, Permitting (5% of Capital)	\$264,000	\$264,000
Engineering (10% of Capital)	\$527,000	\$527,000
Construction Management (5% of Capital)	\$264,000	\$264,000
Total Indirect Costs		\$1,084,000
OPERATING COSTS		
Environmental monitoring		
First 2 Years (4 Events Per Year)	\$100,000	\$177,000
Remaining 28 Years (1 Event Per Year)	\$25,000	\$219,000
Additional Monitoring Wells(3)	\$24,000	\$42,000
Five-year Reviews(3)	\$10,000	\$18,000
Total Operating Costs		\$456,000
SUBTOTAL		\$6,810,000
Contingency (20% of Subtotal)		\$1,362,000
TOTAL		\$8,172,000

NOTES:

(1) – Discount Rate is 8.75%

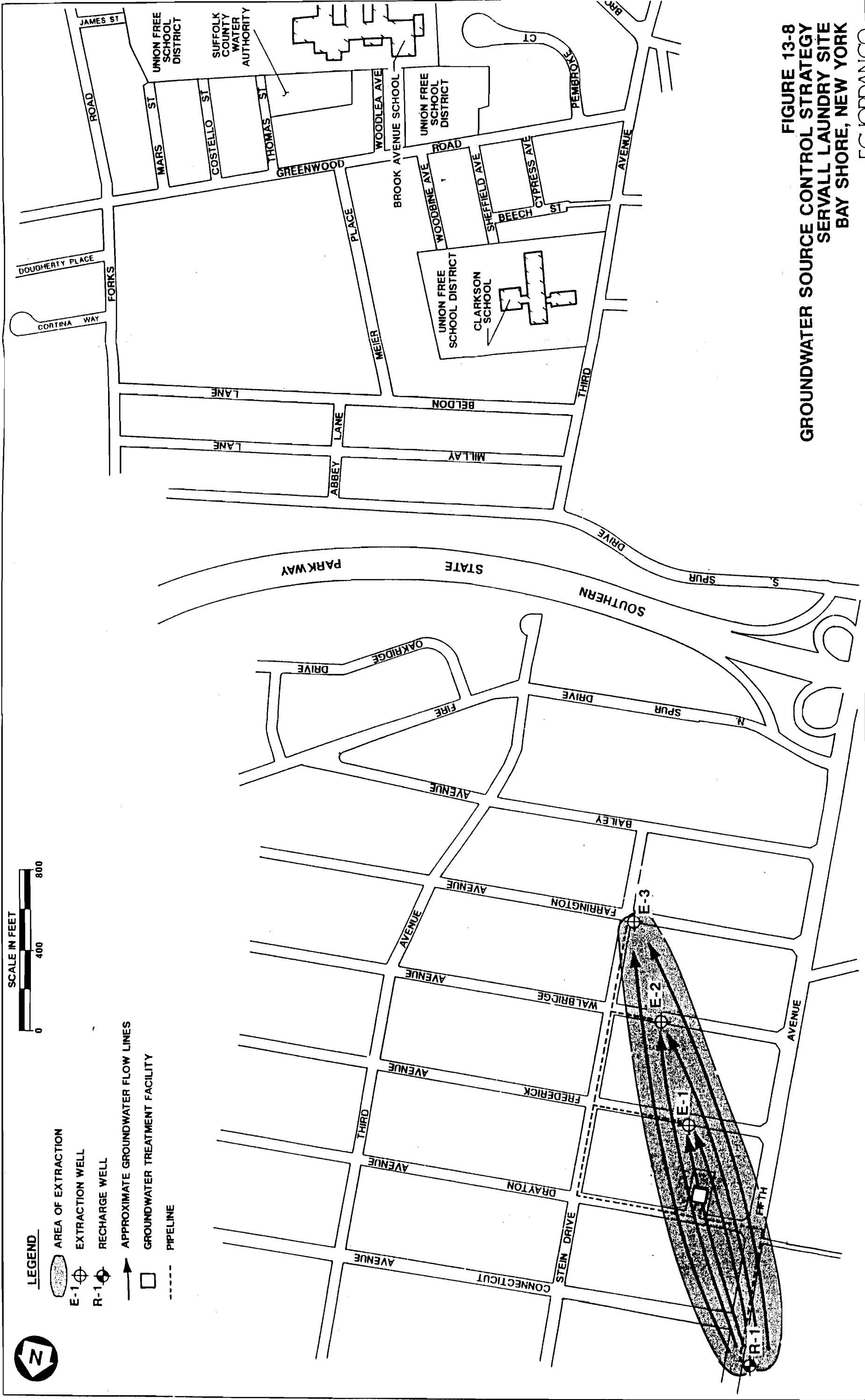
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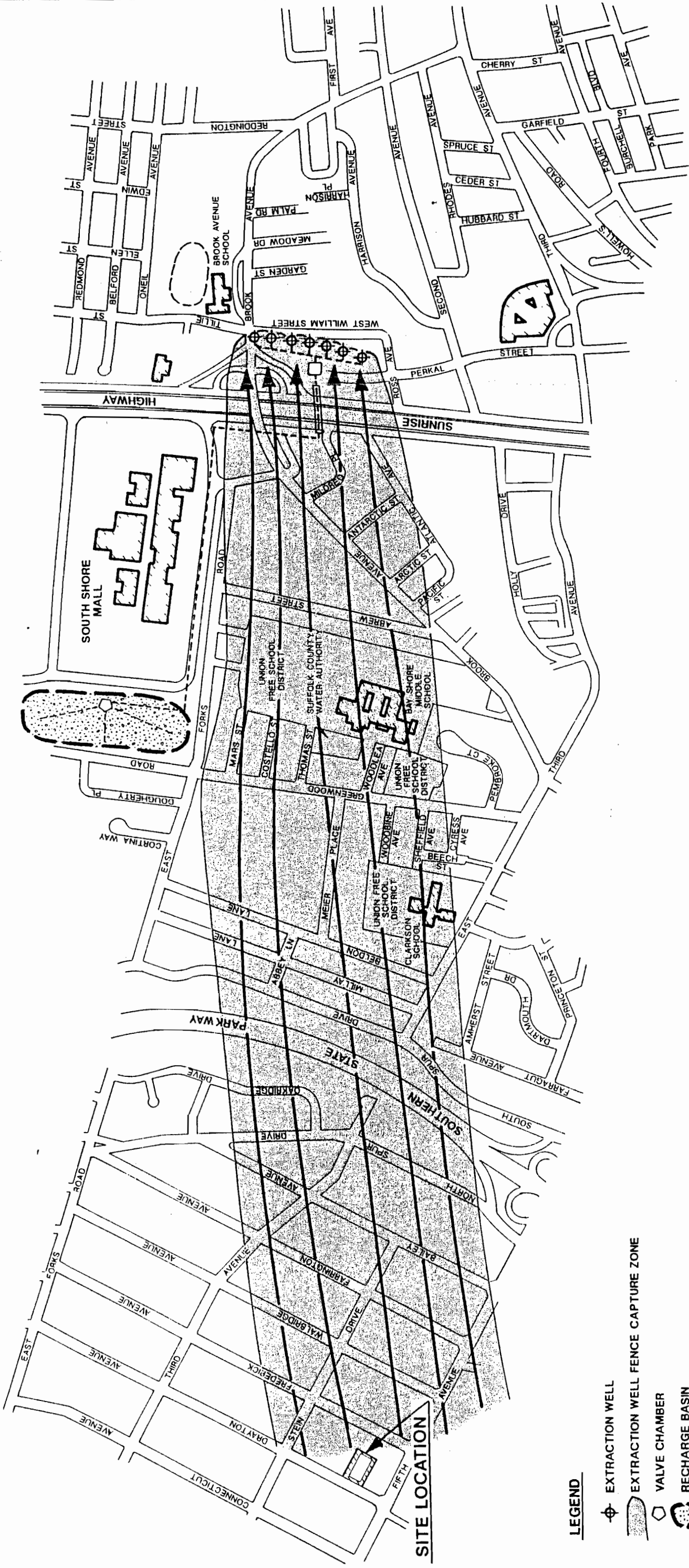
The source area groundwater extraction system consists of three extraction wells placed along residential roads south of the ServAll property (see Figure 13-8). These wells would pump a total of 115 gallons/minute (gpm) to be treated and recharged to the aquifer via a recharge well north of the site. The wells would be screened over the entire thickness of the plume. The pumping rates are 30, 35, and 50 gpm for wells E-1, E-2, and E-3, respectively. The recharge well is directly upgradient of the extraction wells and serves to increase the gradient and the flow rate toward the extraction wells.

The resultant capture zone is approximately 400 feet wide and 2000 feet long, including the area close to the source with the highest concentrations of contaminants (see Figure 13-8). The extraction system will include the capability of varying pumping rates plus or minus 25 percent to move the location of the stagnation points between wells so no area within the capture zone is out of reach of the extraction system. The system would remove one pore volume of the source plume every two years. Based on chemical properties of the contaminants, groundwater pumping rates, and site conditions, a contaminant removal efficiency of 35 percent with each pore volume removed was estimated. Details of these calculations are presented in Appendix O. Groundwater contaminant concentrations would, therefore, be reduced to levels below NYSWQRs after approximately 20 years of pumping.

Groundwater Treatment. The two water treatment technologies retained following technology screening are air stripping and UV/oxidation. Both technologies can effectively treat VOCs; however, both would require pretreatment for removal of iron and manganese. Dissolved iron and manganese oxidize to a less soluble form and precipitate out of solution in the presence of air or other oxidants. This precipitate can foul the packing material in the air stripper or the UV lamps in the UV/oxidation reactor vessel, reducing the efficiency of the treatment systems and increasing costs. Iron and manganese concentrations from previous sampling suggests pretreatment would be required. This would be verified by sampling water from pump tests of the new extraction wells. For cost-estimating purposes, it was assumed that the treatment plant could be located on site as shown in Figure 13-8.

Pretreatment of the raw water, if necessary, would involve the following processes:





LEGEND

- EXTRACTION WELL
- EXTRACTION WELL FENCE CAPTURE ZONE
- VALVE CHAMBER
- RECHARGE BASIN
- PIPELINE
- GROUNDWATER TREATMENT FACILITY
- EFFLUENT PIPE HIGHWAY CROSSING
- APPROXIMATE GROUNDWATER FLOW LINES

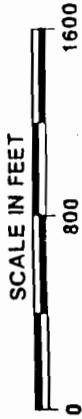


FIGURE 13-13
GROUNDWATER CONTAINMENT STRATEGY
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

13.6.1 Compliance with ARARs and New York SCGs

Alternative 6 includes construction of a cover over contaminated soils and extraction and treatment of groundwater to prevent the plume from migrating further. The cover would reduce exposure to contaminated soils so that risks from soils would not exceed USEPA's level of acceptable risk based on RfDs and CPFs. Groundwater contamination would remain at levels above state drinking water regulations, federal MCLs, and federal MCLGs for an estimated 73 years. However, protection of human health and the environment would be maintained by preventing further migration of the plume and through institutional controls. NYSWQRs would not be met. No releases of contaminants to the air are expected for this alternative; therefore, federal and state ambient air quality regulations would not be violated.

Because of the relatively small size of the ServAll site and its location in a developed, suburban area, few location-specific ARARs and SCGs apply. The designation of the aquifer as a sole source aquifer, or the principal source of drinking water, allows for USEPA review of the project if federal financial assistance is involved. This alternative is expected to comply with location-specific ARARs and SCGs.

Construction activities associated with cover construction and monitoring and extraction well installation would require health and safety trained personnel and safe working practices as outlined by OSHA. Vendors who handle well installation would be required to comply with the appropriate RCRA regulations for disposal of contaminated water collected during construction activities.

13.6.2 Protection of Human Health and the Environment

This alternative would provide an increased level of protection of human health over baseline conditions. Construction of a cover over the site would significantly reduce risks associated with direct contact or incidental ingestion of contaminated soils. Human health would be protected as long as the cover is properly maintained and no invasive activities occur that could reestablish exposure routes. Institutional controls would prohibit such activities. The cover is also intended to prevent rainwater from infiltrating through the contaminated soils and leaching contamination to groundwater.

Extraction wells would prevent contaminated groundwater from migrating further downgradient. Human health risks associated with the use of contaminated

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groundwater would be reduced through institutional controls prohibiting the use of contaminated groundwater until NYSWQRs are achieved. The containment groundwater pump-and-treat scenario is estimated to require 73 years to achieve NYSWQRs. Treated water to be discharged to the recharge basin would meet drinking water regulations. No significant environmental impacts would be expected by implementing this alternative because the site is located in a highly settled industrial/residential area.

13.6.3 Short-term Impacts and Effectiveness

Construction of a cover over contaminated soil would not be expected to cause significant short-term effects for the community or workers. The short-term effectiveness of cover construction is presented in more detail in Subsection 13.2.3 for the Minimal-action Alternative.

Installation of groundwater extraction wells and operation of the groundwater treatment plant would require OSHA health and safety training for workers. Construction of the treatment system would have minimal short-term effects on the community. These may include temporary increases in truck traffic and noise. The short-term effectiveness of construction associated with installation of extraction wells, piping, and the treatment plant is presented in detail in Subsection 13.5.3. Treated water to be discharged would meet NYSWQRs and off-gases would be treated to meet New York ambient air guidelines to protect the community.

The short-term effectiveness of the environmental monitoring and five-year review components of this alternative would be similar to that discussed previously in Subsection 13.2.3 under Alternative 2 - Minimal Action.

The treatment plant is estimated to require 18 months to design and construct and would continue to operate with equipment replacement for at least 73 years before target cleanup levels would be met. Design and construction of a cover is estimated to take 2 months.

13.6.4 Long-term Effectiveness and Permanence

Constructing and maintaining a cover over contaminated soil at the site would significantly reduce the baseline health risks associated with direct contact and incidental ingestion of contaminated soil. Infiltration of rainwater through contaminated soil would be reduced by the cover, limiting the amount of

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contamination leaching to groundwater. The long-term effectiveness of covering contaminated soil is discussed in Subsection 13.2.4 in greater detail.

The groundwater extraction system for the plume containment strategy would effectively prevent further migration of groundwater contamination. Although the intention of the containment option is not to remediate the aquifer, over an estimated period of 73 years of pumping and treating, it would be remediated. Because this alternative does not include a component to address a possible source of contamination in the saturated soil beneath the site, reducing leaching from the unsaturated source only may not completely address the source of groundwater contamination.

The long-term effectiveness of the water treatment technologies was evaluated in Subsection 13.5.4 and is the same for this alternative. Treated water would be discharged into the recharge basin located north of the South Shore Mall. The basin is currently used to infiltrate storm water runoff and is expected to be able to handle the additional flow rate of 400 gpm. Filtration used in the pretreatment processes would reduce the amount of suspended particulates in the effluent. A high particulate loading to the recharge basin could reduce the rate at which water could be infiltrated by blinding the surficial soil pores.

The long-term effectiveness of the institutional controls and environmental monitoring components of this alternative are similar to that presented in Subsections 13.2.4 and 13.1.4, respectively. Environmental monitoring would provide information useful for assessing how well the extraction well system prevents further migration of the plume and for tracking the progress of the cleanup.

13.6.5 Reduction of Toxicity, Mobility, or Volume

No reduction of mobility, toxicity, or volume through treatment would be achieved for contaminants in source soil for this alternative. However, the asphalt cover would reduce infiltration through the contaminated soil and, therefore, the mobility of contaminants in the soil. Fluctuations in the groundwater table may cause leaching of contamination in unsaturated soil to the groundwater.

Although this alternative does not contain a component that would address the possible source of groundwater contamination located in saturated soil beneath the site, some reduction in toxicity, mobility, and volume of contaminated groundwater would be achieved because groundwater would be extracted and

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treated to prevent further migration of the plume. An estimated 400 gpm of groundwater would be extracted and treated over an estimated period of 73 years.

PCE, TCE, 1,1-DCE, cis- and trans-1,2-DCE, and vinyl chloride would be removed from the water and destroyed through treatment. A discussion of the reduction of toxicity, mobility, or volume for the groundwater treatment technologies portion of this alternative is discussed in Subsection 13.5.5.

13.6.6 Implementability

The implementability of cover construction, well installation, treatment plant construction, and water treatment technologies is described under Alternative 5 in Subsection 13.5.13.

The implementability of the environmental monitoring portion of this alternative is the same as that presented in Subsection 13.1.13. Environmental monitoring would be used to assess the effectiveness of the contaminant system at preventing contaminated groundwater from migrating further. Additional extraction wells and treatment facilities would be easily constructed if the contaminant system requires expanding. Coordination would be required among the state, the local officials, the contractor, and the property owners to obtain the necessary right-of-ways for construction activities.

Pumping treated water to the existing recharge basin north of the South Shore Mall for discharge to the aquifer is technically feasible. This discharge method would concur with NYSDEC's preference to return treated water to the aquifer. The capacity of the basin to accommodate the increased flow would need to be reviewed and approvals from appropriate regulatory agencies would be required prior to implementation of this discharge option.

13.6.7 Costs

Capital, indirect, and operation and maintenance costs for Alternative 6 for the air stripping and UV/oxidation options are presented in Tables 13-10 and 13-11, respectively. Cost backups are presented in Appendix K. For the air stripping option, capital, indirect, and operation and maintenance costs are \$3,365,000, \$698,000, and \$3,085,000, respectively. The total present-worth cost for Alternative 6 using air stripping is estimated to be \$8,578,000. This total includes a contingency of \$1,430,000 (20 percent of the subtotal of capital, indirect, and present-worth operating costs) to account for unforeseen costs that could increase

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TABLE 13-10
COST ESTIMATE ALTERNATIVE 6
MINIMAL ACTION SOURCE AREA
PLUME CONTAINMENT STRATEGY
AIR STRIPPING

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

COST PARAMETERS	COST	PRESENT WORTH COST(1)
CAPITAL COSTS		
Asphalt Cover	\$9,000	\$9,000
Groundwater Extraction Wells*	\$144,000	\$144,000
Groundwater Treatment Plant with Air Stripping	\$2,467,000	\$2,467,000
Replacement of treatment plant in 15 years	\$2,467,000	\$701,000
Installation of monitoring wells*	\$25,000	\$25,000
Institutional Controls	\$19,000	\$19,000
Total Capital Costs		\$3,365,000
INDIRECT COSTS		
Health and Safety (15% of Capital (2))	\$25,000	\$25,000
Legal, Administrative, Permitting (5% of Capital)	\$168,000	\$168,000
Engineering (10% of Capital)	\$337,000	\$337,000
Construction Management (5% of Capital)	\$168,000	\$168,000
Total Indirect Costs		\$698,000
OPERATING COSTS		
Site Inspections and Surface Repairs (2 Per Year)	\$4,000	\$42,000
Groundwater Treatment (for 30 years)(4)	\$253,000	\$2,658,000
Environmental monitoring		
First 2 Years (4 Events Per Year)	\$100,000	\$177,000
Remaining 28 Years (1 Event Per Year)	\$25,000	\$219,000
Resurfacing (After 10 and 20 Years)	\$5,000	\$3,000
Five-year Reviews(3)	\$10,000	\$18,000
Total Operating Costs		\$3,117,000
SUBTOTAL		\$7,180,000
Contingency (20% of Subtotal)		\$1,436,000
TOTAL		\$8,616,000

NOTES:

(1) = Discount Rate is 8.75%

(2) = Includes only those capital costs that would require health and safety training and equipment as indicated by an asterisk.

(3) = Present-worth cost based on reviews conducted every five years until year 30.

(4) = Cost estimates do not typically extend beyond 30 years although treatment is estimated for 73 years.

Cost are conceptual only (-30/+50% accurate) and should not be considered an engineers estimate.

TABLE 13-11
COST ESTIMATE ALTERNATIVE 6
MINIMAL ACTION SOURCE AREA
PLUME CONTAINMENT STRATEGY
UV/OXIDATION

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

COST PARAMETERS	COST	PRESENT WORTH COST(1)
CAPITAL COSTS		
Asphalt Cover	\$9,000	\$9,000
Groundwater Extraction Wells*	\$144,000	\$144,000
Groundwater Treatment with UV/oxidation	\$3,004,000	\$3,004,000
Replacement of treatment plant in 15 years	\$3,004,000	\$854,000
Installation of monitoring wells*	\$25,000	\$25,000
Institutional Controls	\$19,000	\$19,000
Total Capital Costs		\$4,055,000
INDIRECT COSTS		
Health and Safety (15% of Capital (2))	\$25,000	\$25,000
Legal, Administrative, Permitting (5% of Capital)	\$203,000	\$203,000
Engineering (10% of Capital)	\$406,000	\$406,000
Construction Management (5% of Capital)	\$203,000	\$203,000
Total Indirect Costs		\$837,000
OPERATING COSTS		
Site Inspections and Surface Repairs (2 Per Year)	\$4,000	\$42,000
Groundwater Treatment (for 30 Years)(4)	\$308,000	\$3,236,000
Environmental monitoring		
First 2 Years (4 Events Per Year)	\$100,000	\$177,000
Remaining 28 Years (1 Event Per Year)	\$25,000	\$219,000
Resurfacing (After 10 and 20 Years)	\$5,000	\$3,000
Five-year Reviews(3)	\$10,000	\$18,000
Total Operating Costs		\$3,695,000
SUBTOTAL		\$8,587,000
Contingency (20% of Subtotal)		\$1,717,000
TOTAL		\$10,304,000

NOTES:

(1) = Discount Rate is 8.75%

(2) = Includes only those capital costs that would require health and safety training and equipment as indicated by an asterisk.

(3) = Present-worth cost based on reviews conducted every five years until year 30.

(4) = Cost estimates do not typically extend beyond 30 years although treatment is estimated for 73 years.

Cost are conceptual only (-30/+50% accurate) and should not be considered an engineers estimate.

the cost of this alternative.

For the UV/Oxidation option, capital, indirect, and operation and maintenance costs are \$4,055,000, \$837,000, and \$3,695,000, respectively. The total present-worth cost for Alternative 6 using UV/oxidation is estimated to be \$10,304,000. This total includes a contingency of \$1,717,000.

13.7 ALTERNATIVE 7 - IN SITU SOURCE TREATMENT/ ACTIVE PLUME REMEDICATION STRATEGY

Alternative 7 combines an in situ source-control component with a groundwater pump-and-treat scenario that would actively remediate the entire plume of groundwater contamination. The alternative consists of the following components:

- vacuum extraction
- hot air or steam injection
- groundwater extraction (active remediation strategy)
- groundwater treatment
- discharge of treated water
- institutional controls
- environmental monitoring
- five-year reviews

This alternative includes treatment of the source area with in situ vacuum extraction to extract VOCs from the unsaturated zone. Removing the source of VOCs would eliminate further groundwater contamination from soils in the unsaturated zone. Hot air or steam could be injected into source soils to enhance the vapor extraction process.

A groundwater extraction system would be installed to intercept and actively remove contaminated groundwater from the entire plume. It would prevent further migration and reduce the size of the plume. Groundwater would be extracted and treated until contaminant levels meet MCLs. Treated groundwater would be discharged to a recharge basin to be returned to the aquifer from which it was removed.

Institutional controls, environmental monitoring, and five-year reviews would be implemented to protect human health and monitor the location and migration of contamination during the implementation of this alternative. Each component is discussed in the following paragraphs.

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Vacuum Extraction. In situ vacuum extraction would be used to volatilize and remove VOCs from unsaturated source soils by mechanically drawing air through the vadose zone using a system of vacuum extraction wells. Vacuum extraction is described in more detail under Alternative 3 in Subsection 13.3.

Hot Air or Steam Injection. Hot air or steam could be injected around the perimeter of the contaminated soil to enhance the removal of contaminants. The higher temperatures would increase volatilization of contaminants from the soil, increasing the VOC removal rates. Hot air and steam injection are described in more detail under Alternative 3 in Subsection 13.3.

Groundwater Extraction. The active extraction scenario includes three well fences consisting of four wells along the Southern State Parkway, five wells at the Bay Shore Middle School, and six wells along the Sunrise Highway (Figure 13-14). Under the scenario designed for evaluation of this alternative, the wells would pump a total of 867 gallons per minute. The pumping rates for each well vary along each fence, with the highest pumping rates in the interior wells and the lower rates for the wells on the ends of each fence. This was estimated using the same model and simplifying assumptions described in Alternative 5. The assumptions that wells would be fully penetrating differs from the most efficient design where well screens would be placed only in the lower portion of the aquifer. The effect of this assumption is a conservative overestimation of the amount of water to be extracted for treatment.

The resulting capture zone is 9,500 feet long (from the source area to the last extraction well fence) and 2,500 feet wide at its widest point. The location of the recharge well within 1,000 feet of the plume affects the shape of the capture zone (see Figure 13-14). Due to the effect of the recharge basin, after approximately three years the easternmost wells of each well fence will be pumping uncontaminated groundwater from outside the plume. At this point, wells E3-1, E3-2, and E2-1 would be turned off. After five years, one entire pore volume will have been removed.

Depending on contaminant concentrations at this time, well Fences 1 and 2 may be turned off and the extraction and treatment system become limited to Fence 3. If the concentrations at the fences are too low to justify extraction and treatment costs, turning off Fences 1 and 2 will reduce the speed at which groundwater moves through the plume area, allowing more time for contaminants to diffuse from stagnant pockets in the porous media and the concentrations observed at Fence 3 will be higher. Although reducing operations to a single well fence will

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- clarification
- sludge handling

A schematic flow diagram of the treatment process is shown in Figures 13-9 and 13-10.

The first step in pretreatment would be to oxidize the iron and manganese to their insoluble forms. Potassium permanganate (KMnO_4 , the assumed oxidizing agent for the preliminary pretreatment design) would be added to oxidize the dissolved iron from the relatively soluble +II state to the more insoluble +III state. Dissolved manganese would also be oxidized from the +II state to the more insoluble +IV state. The precipitates would consist mostly of ferric hydroxide and manganese dioxide.

Oxidation would occur in a device known as a greensand filter. This type of pretreatment technology was selected for preliminary cost-estimating purposes because the levels of iron and manganese detected in monitoring well samples were not high enough to warrant a coagulation and flocculation system. A coagulation and flocculation system is more cost effective for levels of manganese and iron greater than 1 mg/L. The greensand filter is a more cost-effective option for the removal of iron and manganese between levels of approximately 0.5 and 1.0 mg/L.

Some greensand filters inject the KMnO_4 directly into the bed of the filter with the influent water. The products of the reaction, an insoluble ferric hydroxide and manganese dioxide, are immediately filtered out by the sand.

Some greensand filters have the KMnO_4 coated on the actual sand particles of the filter bed as well. The sand particles then act as reaction sites for oxidation and simultaneously filter out the suspended solids. These filters require backwash and batch regeneration. Batch regeneration occurs after the filter is backwashed. Excessive amounts of KMnO_4 are allowed to slowly flow through the filter and coat the surfaces of the sand particles. A pink color in the filter effluent during batch regeneration indicates that regeneration is complete and the filter can be returned to service.

The conceptual design of the pretreatment system includes three greensand filters arranged in parallel. This allows for continuous operation of the system when one of the filters requires backwashing. Backwash from the greensand filter would be thickened in a gravity thickener to a concentration of approximately 3 percent

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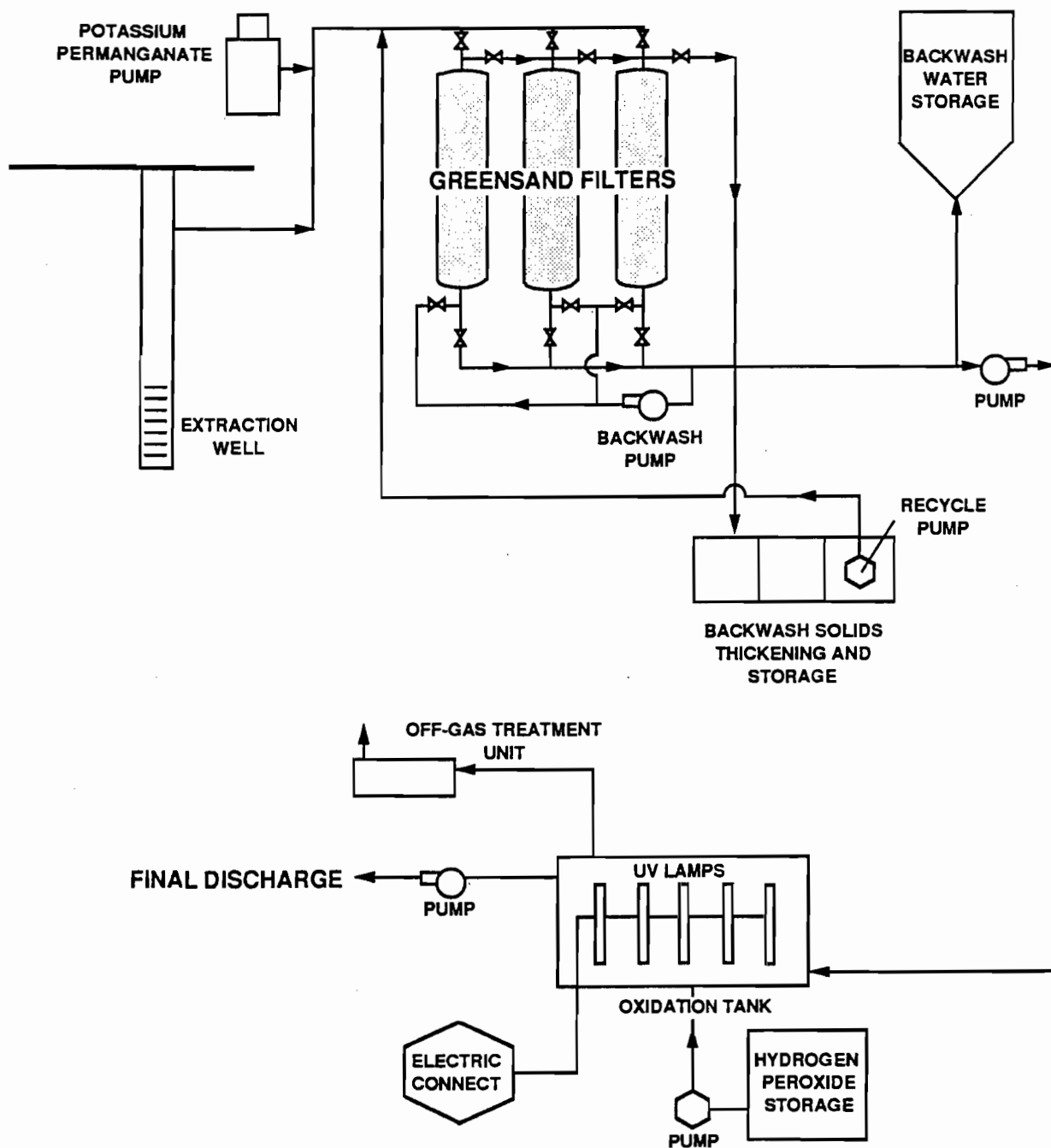


FIGURE 13-9
U.V. OXIDATION PROCESS FLOW DIAGRAM
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

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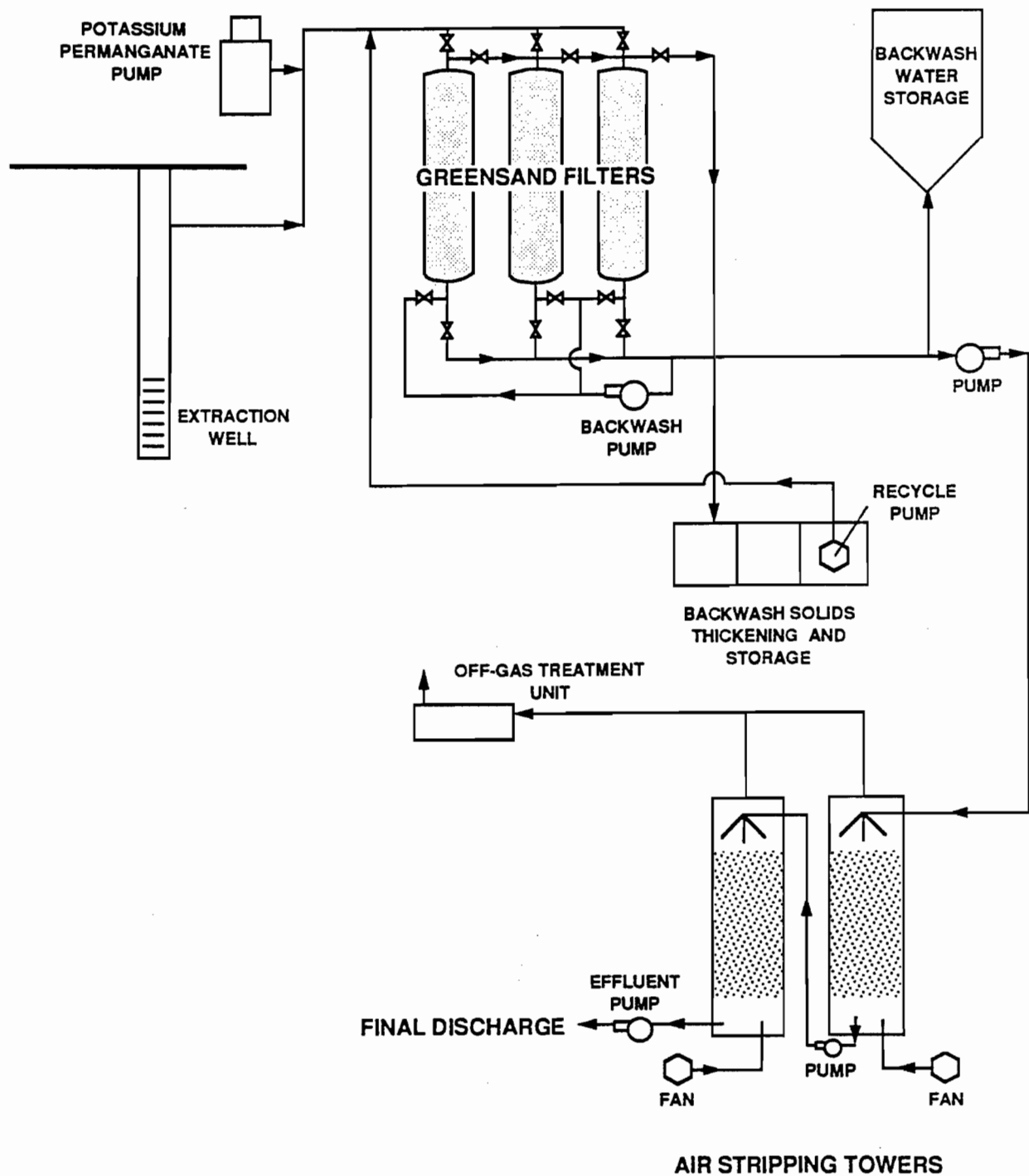


FIGURE 13-10
AIR STRIPPING PROCESS FLOW DIAGRAM
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

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solids. Sludge would be collected, tested for characteristics of hazardous waste, and properly disposed of off site.

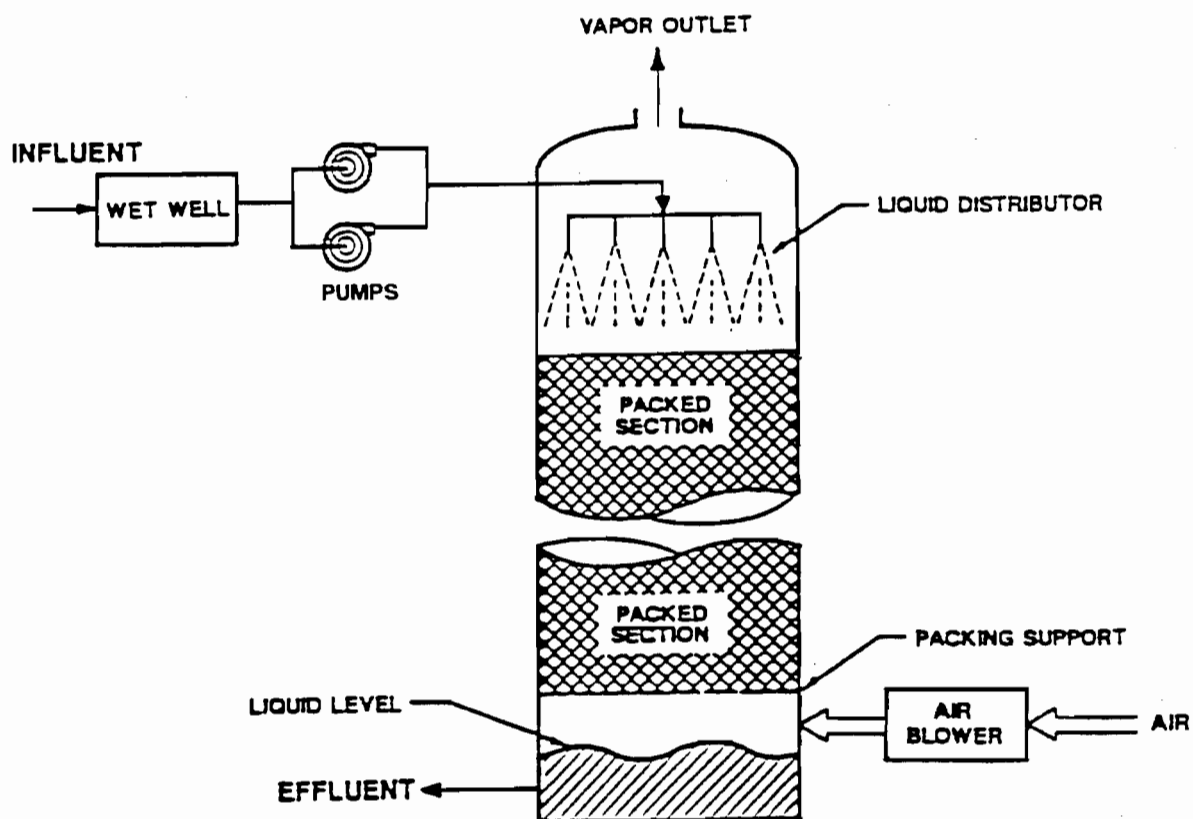
After pretreatment, the water would be treated to remove VOCs, specifically PCE, TCE, 1,1-DCE, cis- and trans-1,2-DCE, and vinyl chloride. Air stripping (Figure 13-9) and UV/oxidation (Figure 13-10) are the technology options for VOC removal that were retained after technology screening. Air stripping is a method frequently used to remove VOCs from groundwater. During the process, contaminated water contacts large volumes of clean air. Contaminated water enters the top of the air stripping tower and trickles down through the packing material, while air enters at the bottom and is blown upward through the packing material. The contaminants are transferred from the liquid phase to the gas phase and carried off with the effluent air. Figure 13-11 shows a cross section of a typical packed air stripping tower. The air stripping column design is essentially dictated by the column fluid dynamics and the desired removal efficiencies for the compounds of concern. Several vendors can custom-design a tower if a standard-size tower does not meet design specifications.

An air stripper treating water from the ServAll plume for this alternative is estimated to emit a total of about 24 pounds per day of VOCs. This emission rate was calculated based on preliminary design parameters for the air stripping unit (i.e. water and initial VOC concentrations) (see Appendix P). Emission rates would be expected to decline over time as contaminant concentrations in groundwater decrease. If air stripping were implemented, actual emission rates would be determined and compared to the New York State air guidelines to evaluate the need for off-gas treatment. The estimated emission rate suggests that off-gas treatment would be required.

There are several off-gas treatment technologies available to address the airstream emitted from the air stripper. The choice of control technology depends on the type and concentration of VOCs, the desired level of destruction, and the duration of the project. For cost-estimating purposes, it was assumed that off-gas treatment with thermal and catalytic incineration would be used for air emissions from the air stripper. Vapor phase carbon (VPC) could also be evaluated during remedial design.

Thermal and catalytic incinerators are commercially available for destroying gaseous organic compounds. Thermal incineration of VOCs occurs at temperatures averaging 1,600°F. The operating temperature would be determined by field testing to achieve the desired destruction removal efficiencies.

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Not To Scale

FIGURE 13-11
AIR STRIPPING TOWER
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

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Catalytic incinerators operate at lower temperatures and can, in principle, be used to destroy essentially any organic compound in an airstream (van der Vaart et al., 1991).

Another process option suitable for treating VOCs is UV/oxidation. This process destroys organic compounds in water through chemical oxidation enhanced by exposure to UV light. Typically, hydrogen peroxide (H_2O_2) is used as the oxidant in the UV/oxidation vessel. However, ozone can be used as the oxidant for compounds that are more difficult to break down. For preliminary design and cost-estimating purposes, a UV/oxidation system with H_2O_2 was selected.

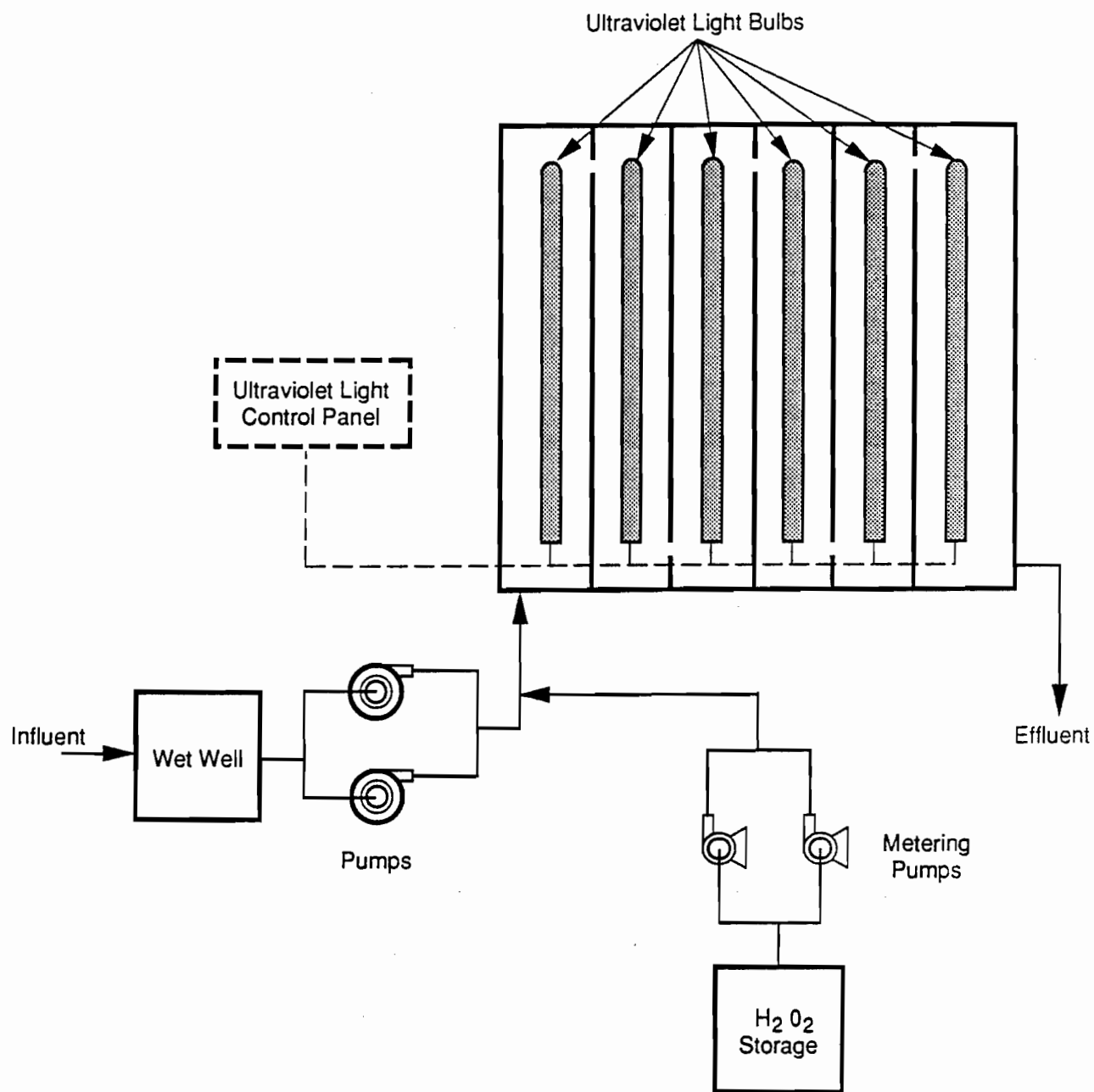
The UV/oxidation system rapidly produces hydroxyl radicals under oxidizing conditions. Organic molecules in the contaminated groundwater absorb energy from the UV light, promoting reactions with hydroxyl radicals. The combined effects of UV light and concentrated hydroxyl radicals synergistically promote rapid breakdown of organic molecules. Some vendors also use proprietary catalysts to enhance the reaction rates. In the oxidation process, organic contaminants are broken down into simpler substances such as carbon dioxide, water, salts, acetone, sulfates, nitrates, and organic and inorganic acids (USEPA, 1991). The formation of organic acids or acetone could raise additional restrictions for discharge of treated water. Treatability studies would be used to determine the expected concentrations of these compounds and evaluate if further treatment would be required prior to discharge.

UV/oxidation occurs in a stainless steel chamber containing vertically or horizontally mounted UV lamps. A typical reaction vessel has six chambers designed to provide intimate contact between the oxidant and the water while in the presence of UV light. A solution of H_2O_2 is metered into the influent waste stream as an oxidizer (ozone is sometimes used instead). Figure 13-12 is a schematic diagram of the UV/oxidation system with hydrogen peroxide as the oxidant.

For preliminary design purposes, a flow rate of 115 gpm was used to size the reactor vessel for the UV/oxidation system with a detention time of 1 hour. For the UV/oxidation system, the preliminary design includes: UV reactor, wet well, process pumps, level controls, metering pumps, and H_2O_2 storage.

Bench- and/or pilot-scale tests for all the water treatment processes (i.e., pretreatment, air stripping, and UV/oxidation (H_2O_2)) would be conducted concurrently. These studies would determine which process option would provide

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Not To Scale

FIGURE 13-12
ULTRAVIOLET/PEROXIDE REACTOR
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

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better, more cost-effective treatment for the contaminants in the ServAll plume.

Although VOC treatment options will be evaluated and their effectiveness assessed by treatability tests before one is selected, air stripping and UV/oxidation (H_2O_2) will be used for the cost estimate for this alternative.

Treatability studies prior to full-scale operation would provide the necessary information for detailed design and operation of the system. The final design would be subject to regulatory agency review and approval prior to implementation.

Discharge. Treated groundwater would be piped upgradient of this site and returned to the aquifer through an injection well. NYSDEC has expressed a preference for discharge options on Long Island that return treated water to the aquifer from which it was removed. Further, discharge to surface waters or to POTWs is not possible in the site vicinity. Upgradient discharge would return the treated water to the aquifer and enhance the leaching of contaminants through flushing of the saturated soils. The proposed location of the reinjection well is shown in Figure 13-8.

Institutional Controls. As part of this alternative, institutional controls would be implemented to restrict the use of groundwater from the upper glacial aquifer in the path of the plume. Institutional controls are described in greater detail under Alternative 2 in Subsection 13.2. Institutional controls placing restrictions on the site soils would not be necessary for this alternative, because the soils would be remediated to target cleanup levels.

Environmental Monitoring. Monitoring would be included as part of this alternative as described for the No-action Alternative in Subsection 13.1. It would be used to assess the effectiveness of the source area extraction scenario at isolating the plume from the source of contamination.

Five-year Reviews. Because most of the contaminated groundwater would remain untreated, five-year reviews would be conducted to evaluate the status of the contamination. Five-year reviews would be conducted as described for the No-action Alternative in Subsection 13.1.

13.5.1 Compliance with ARARs and New York SCGs

Alternative 5 includes the removal of contaminants from site soils and extraction

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and treatment of contaminated groundwater near the source. In situ vacuum extraction would reduce concentrations of contaminants in soils so that risks from soils would not exceed USEPA's level of acceptable risk based on RfDs and CPFs. Vapors from the vacuum extraction process would be collected and treated to remove contaminants before discharge to the air. Vapor treatment would achieve levels required by the federal CAA and state ambient air quality regulations.

Groundwater contamination in the vicinity of the source would be reduced to levels in compliance with state drinking water regulations, and federal MCLs and MCLGs. NYSWQRs would be met near the source area. However, groundwater contamination downgradient of the source area would remain at levels above state drinking water regulations, federal MCLs, and federal MCLGs and would continue to migrate toward the Great South Bay. Protection of human health would be maintained by implementing institutional controls. NYSWQRs would not be met for this portion of the plume. Treatment of off-gases from the air stripper would comply with NYSDEC and CAA regulations for emissions.

Because of the relatively small size of the ServAll site and its location in a developed, suburban area, few location-specific ARARs and SCGs apply. The designation of the aquifer as a sole source aquifer, or the principal source of drinking water, allows for USEPA review of the project if federal financial assistance is involved. This alternative is expected to comply with location-specific ARARs and SCGs.

Operation of the vacuum extraction system would require compliance with state and RCRA regulations for hazardous waste TSDFs. Construction and operation of the treatment plant would require health and safety training and safe working practices as outlined by OSHA.

13.5.2 Protection of Human Health and the Environment

Alternative 5 would provide an increased level of protection of human health over baseline conditions. This alternative includes two components to remove the source of groundwater contamination. Vacuum extraction would remove contaminants from the unsaturated source soils. Groundwater extraction would remove contaminated groundwater and flush the remaining source of contamination from saturated soil beneath the site. Removal of contaminants from unsaturated source soils would reduce contamination to levels that are protective of on-site workers or other individuals. Risks from direct contact and

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incidental ingestion would be reduced to acceptable levels. Leaching of contaminants from both saturated and unsaturated soils would be reduced.

A large portion of contaminated groundwater would not be treated as part of this alternative. It would continue to migrate toward the Great South Bay where it would eventually discharge. Human health risks associated with ingestion of contaminated groundwater would be controlled through the use of institutional controls prohibiting the use of water in the vicinity of the plume.

13.5.3 Short-term Impacts and Effectiveness

Implementation of Alternative 5 is not expected to result in any significant adverse impacts to the community or on-site workers. Short-term impacts and effectiveness for vacuum extraction, institutional controls, and environmental monitoring are discussed in Subsections 13.3.3, 13.2.3, and 13.1.3, respectively.

Construction activities connected with this alternative, including installation of injection and extraction wells, piping, and construction of the treatment plant, would cause some temporary inconveniences for the nearby community. These inconveniences may be increased truck traffic and additional noise. Emissions from the air stripper would not pose a safety hazard to workers or the community. Off-gases from the air stripping towers would be captured and combined with vacuum extraction off-gases and treated to remove contaminants by VPC or incineration. It may be necessary to obtain easements from abutting property owners during construction of the vacuum extraction and groundwater treatment.

Due to the industrial/residential nature of the area surrounding the site, construction activities would not significantly impact the environment. The estimated time for design and construction of a treatment plant and well installation is one year. Groundwater treatment would continue until the target cleanup levels are met. Preliminary calculations for cost-estimating purposes indicate that groundwater extraction and treatment would be required for approximately 20 years (see Appendix D for calculations). Vacuum extraction is estimated to take two to three months to design and construct and four months to treat the soils.

Workers would be required to have OSHA health and safety training for work at hazardous waste sites. An appropriate HASP would be followed to minimize risks to workers during construction activities. Personal protective equipment would minimize the possibility of exposure to contamination.

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The short-term effectiveness of the environmental monitoring and five-year review components of this alternative would be similar to that discussed in Subsection 13.2.3 under Alternative 2 - Minimal Action.

13.5.4 Long-term Effectiveness and Permanence

Vacuum extraction would remove VOCs from unsaturated source soil to levels that would reduce direct contact and incidental ingestion risks to acceptable levels and provide permanent remediation of unsaturated source soil. The long-term effectiveness and performances of the vacuum extraction component of this alternative are discussed in greater detail for Alternative 3 in Subsection 13.3.

Groundwater extraction would remove contaminants from the saturated source area soil to levels that would prevent further groundwater contamination. The role of saturated soils as a source of groundwater contamination at the ServAll site is not clearly understood. Recovery of soil samples from this zone has proven difficult and, therefore, little data are available on the extent of contamination in saturated soils. However, results of field screening analyses of groundwater samples collected during screened-auger sampling near the saturated source of contamination indicate that significant levels of contamination are present in groundwater beneath the site. These results indicate that saturated soils beneath the site may be acting as a source by continuing to leach contamination to the groundwater. Although groundwater extraction and treatment would not treat the saturated soils directly, it would remove contaminants by leaching them from the soils into the groundwater for removal and treatment.

The groundwater extraction and treatment scenario for this alternative would reduce the amount of contamination in soil located within the saturated zone. This groundwater would be treated until contaminant levels reach NYSWQRs. Once these levels are achieved, the saturated source would be remediated. However, contaminated groundwater downgradient of the source area would continue to migrate.

Extracted groundwater would be treated to remove VOCs using either air stripping or UV/oxidation. Treatability testing would determine the more effective of the technologies for VOC treatment. This testing would also be used to optimize pretreatment and organic treatment parameters for removing VOCs from water. For the source area wells, it has been assumed that catalytic oxidation or incineration would be used for air pollution control. It is expected that APC equipment will be necessary to meet state ambient air guidelines.

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UV/oxidation is an innovative technology that destroys organic compounds by oxidizing them to simpler, non-toxic compounds. The metals sludge generated by pretreatment (if necessary) would be sampled and analyzed for hazardous waste characteristics to determine proper disposal requirements. Reinjection of treated water upgradient of the source would enhance the flushing of contaminants from the saturated zone.

The long-term effectiveness and permanence of environmental monitoring is similar to that described in Subsection 13.1.4 for the portion of the plume that would not be treated under this alternative. Samples collected from monitoring wells located near the source would provide information to help characterize the effectiveness of the extraction system, both for the capture of contaminated groundwater and the reduction of contaminant concentrations.

13.5.5 Reduction of Toxicity, Mobility, or Volume

Vacuum extraction is an irreversible process that would transfer VOCs in saturated soil from the aqueous and sorbed phases to the vapor phase. The reduction of mobility, toxicity, or volume of contaminants associated with vacuum extraction is detailed under Alternative 3 in Subsection 13.3.5.

Groundwater extraction in the source area would induce the leaching of contaminants from saturated soils into the groundwater for removal and treatment. The toxicity, mobility, and volume of these contaminants would be reduced during the treatment process. UV/oxidation would destroy contaminants by oxidizing them to simpler nontoxic compounds. Air stripping would transfer contaminants to the vapor phase where they would be removed by adsorption on carbon. Regeneration of the carbon would destroy the contaminants. Regardless of which treatment method is used, reduction of mobility, toxicity, or volume of contaminated groundwater would be achieved. Concentrations of contaminants would not exceed NYSWQRs when treatment is completed.

The plume of contaminated groundwater not captured by the extraction wells would migrate away from the source. No treatment would be implemented for this portion of the plume. Therefore, no reduction in toxicity, mobility, or volume for this portion of contaminated groundwater would be achieved.

13.5.6 Implementability

The implementability of vacuum extraction, institutional controls, and

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environmental monitoring is discussed in Subsections 13.3.6, 13.2.6, and 13.1.6, respectively.

Groundwater injection and extraction wells have been installed at many hazardous waste sites. These construction services are commonly available and several contractors would be contacted for competitive bidding. Construction activities associated with installation of extraction wells would require coordination among the state, the local officials, the contractor, and the property owners to secure the necessary right-of-ways.

The processes involved in the pretreatment of groundwater for iron and manganese removal are well developed, reliable, and commonly used in industrial and municipal wastewater treatment applications. Treatability studies would help determine the proper processes, chemical dosages, and other parameters to optimize the system. Influent and effluent to the pretreatment system would be monitored to ensure system performance. Sludge generated in the pretreatment processes would be tested to determine disposal requirements. The availability and capacity of waste disposal facilities would be investigated prior to implementation of this alternative.

Air stripping and VPC are commonly used, well developed, and available technologies for removing VOCs from water. Vendors are available to supply the required equipment and several would be contacted for competitive bidding. UV/oxidation is an innovative technology that has not been as widely used as air stripping. It has been demonstrated to effectively treat contaminants of concern in a study conducted by USEPA as a part of the SITE program. This technology is available through several vendors and has been used in full-scale applications to treat industrial wastewater and contaminated groundwater at a number of sites in the United States and Canada.

Space to locate a treatment plant is limited. For preliminary cost estimating it was assumed that the treatment plant could be located on site in the existing building or in a new building. Coordination among the state, the local officials, the contractors, and the property owners would be required to obtain the necessary right-of-ways for building and treatment plant construction. ReInjection of treated water would comply with NYSDEC's preference for discharge options for Long Island that return water to the aquifer from which it was removed.

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13.5.7 Cost

Capital, indirect, and operation and maintenance costs for Alternative 5 for the air stripping and UV/oxidation options are presented in Tables 13-8 and 13-9, respectively. Cost backups are presented in Appendix K. For the air stripping option, capital, indirect, and operation and maintenance costs are \$1,591,000, \$598,000, and \$1,515,000, respectively. The total present-worth cost for Alternative 5 using air stripping is estimated to be \$4,445,000. This total includes a contingency of \$741,000 (20 percent of the subtotal of capital, indirect, and present-worth operating costs) to account for unforeseen costs that could increase the cost of this alternative.

For the UV/oxidation option, capital, indirect, and operation and maintenance are \$1,797,000, \$670,000, and \$1,636,000, respectively. The total present-worth cost for Alternative 5 using UV/oxidation is estimated to be \$4,924,000. This total includes a contingency of \$821,000.

13.6 ALTERNATIVE 6 - MINIMAL ACTION SOURCE TREATMENT/ PLUME CONTAINMENT STRATEGY

Alternative 6 combines a minimal action source soil treatment component with a groundwater pump-and-treat scenario that would prevent further migration of the groundwater plume. The alternative consists of the following components:

- cover construction
- groundwater extraction (plume containment)
- groundwater treatment
- discharge of treated water
- institutional controls
- environmental monitoring
- five-year reviews

An asphalt cover would be constructed over source area soils to prevent direct contact and incidental ingestion of contaminated soil. The cover would also minimize further contamination of groundwater by limiting rainwater infiltration through the contaminated soil. Institutional controls would be implemented to prevent future disturbance of contaminated soils.

A groundwater extraction system would be installed to intercept and contain the contaminated groundwater at the leading edge of the plume and prevent the

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TABLE 13-8
COST ESTIMATE ALTERNATIVE 5
IN SITU SOURCE SOIL TREATMENT
SOURCE AREA GROUNDWATER EXTRACTION
AIR STRIPPING

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

COST PARAMETER	COST	PRESENT WORTH COST(1)
CAPITAL COSTS		
Vacuum Extraction*	\$171,000	\$171,000
Groundwater Extraction/Reinjection Wells*	\$95,000	\$95,000
Treatment Plant with Air Stripping	\$1,296,000	\$1,296,000
Installation of Monitoring Wells*	\$10,000	\$10,000
Institutional Controls	\$19,000	\$19,000
Total Capital Costs		\$1,591,000
INDIRECT COSTS		
Health and Safety (15% of Capital (2))	\$41,000	\$41,000
Legal, Administrative, Permitting (5% of Capital)	\$80,000	\$80,000
Engineering (20% of Capital)	\$318,000	\$318,000
Construction Management (10% of Capital)	\$159,000	\$159,000
Total Indirect Costs		\$598,000
OPERATING COSTS		
Groundwater Treatment (for 20 Years)	\$115,000	\$1,069,000
Environmental monitoring		
First 2 Years (4 Events Per Year)	\$100,000	\$177,000
Remaining 28 Years (1 Event Per Year)	\$25,000	\$219,000
Additional Monitoring Wells(3)	\$24,000	\$42,000
Five-year Reviews(3)	\$10,000	\$18,000
Total Operating Costs		\$1,525,000
SUBTOTAL		\$3,714,000
Contingency (20% of Subtotal)		\$743,000
TOTAL		\$4,457,000

NOTES:

(1) = Discount Rate is 8.75%

(2) = Includes only those capital costs that would require health and safety training and equipment as indicated by an asterisk.

(3) = Present-worth cost based on new wells and reviews conducted every five years until year 30. Cost are conceptual only (-30/+50% accurate) and should not be considered an engineers estimate.

TABLE 13-9
COST ESTIMATE ALTERNATIVE 5
IN SITU SOURCE SOIL TREATMENT
SOURCE AREA GROUNDWATER EXTRACTION
UV/OXIDATION

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

COST PARAMETER	COST	PRESENT WORTH COST(1)
CAPITAL COSTS		
Vacuum Extraction*	\$171,000	\$171,000
Groundwater Extraction/Reinjection Wells*	\$95,000	\$95,000
Treatment Plant with UV/oxidation	\$1,502,000	\$1,502,000
Installation of Monitoring Wells*	\$10,000	\$10,000
Institutional Controls	\$19,000	\$19,000
Total Capital Costs		\$1,797,000
INDIRECT COSTS		
Health and Safety (15% of Capital (2))	\$41,000	\$41,000
Legal, Administrative, Permitting (5% of Capital)	\$90,000	\$90,000
Engineering (20% of Capital)	\$359,000	\$359,000
Construction Management (10% of Capital)	\$180,000	\$180,000
Total Indirect Costs		\$670,000
OPERATING COSTS		
Groundwater Treatment (for 20 Years)	\$127,000	\$1,180,000
Environmental monitoring		
First 2 Years (4 Events Per Year)	\$100,000	\$177,000
Remaining 28 Years (1 Event Per Year)	\$25,000	\$219,000
Additional Monitoring Wells(3)	\$24,000	\$42,000
Five-year Reviews(3)	\$10,000	\$18,000
Total Operating Costs		\$1,636,000
SUBTOTAL		\$4,103,000
Contingency (20% of Subtotal)		\$821,000
TOTAL		\$4,924,000

NOTES:

(1) = Discount Rate is 8.75%

(2) = Includes only those capital costs that would require health and safety training and equipment as indicated by an asterisk.

(3) = Present-worth cost based on new wells and reviews conducted every five years until year 30. Cost are conceptual only (-30/+50% accurate) and should not be considered an engineers estimate.

continued downgradient migration of contaminated groundwater. The plume containment strategy is designed to prevent changes to the location and size of the plume. The extracted groundwater would be treated to remove contamination. Treated water would be discharged to a recharge basin to allow water to return to the aquifer from which it was removed.

Institutional controls, environmental monitoring, and five-year reviews would be implemented to protect human health and monitor the location and migration of contamination. Each component is described in the following paragraphs.

Cover Construction. A bituminous asphalt cover would be constructed over the portions of the site west and south of the building as shown in Figure 13-2. A more detailed description of cover construction is presented in Subsection 13.2

Groundwater Extraction. For the groundwater containment alternative, extraction well placement was limited to areas away from private property, such as highway right-of-ways and schools. Proximity to the recharge basin north of the South Shore Mall was also considered. The groundwater containment extraction system consists of one fence of wells along the Sunrise Highway. The well fence consists of seven monitoring wells pumping, from west to east, 60, 60, 60, 55, 55, 50, and 60 gpm for a total of 400 gpm. This was estimated using the same model and simplifying assumptions described in Alternative 5. The assumptions that wells would be fully penetrating differs from the most efficient design where well screens would be placed only in the lower portion of the aquifer. The effect of this assumption is a conservative overestimation of the amount of water to be extracted for treatment.

The resulting capture zone is approximately 9,500 feet long and 2,000 feet wide. The shape of the capture zone is influenced by the recharge basin, widening the capture north of the basin. The extraction system will include the capability of varying pumping rates plus or minus 25 percent to move the location of the stagnation points between wells so no area within the capture zone is out of reach of the extraction system.

This extraction system is designed to prevent further migration of contaminants. It would remove one pore volume every 11 years. Based on chemical properties of the contaminants, contaminant concentrations, groundwater pumping rates, and site conditions, a contaminant removal efficiency of 37 percent with each pore volume removed would be expected. Details of these calculations are presented in Appendix O. Groundwater contaminant concentrations would, therefore, be

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reduced to levels below NYSWQRs after about 73 years of pumping.

Groundwater Treatment. Two water treatment technologies retained after the screening of technologies are air stripping and UV/oxidation. Both technologies can effectively treat VOCs. Pretreatment to remove iron and manganese may be required for either technology. A detailed discussion of the groundwater treatment technologies can be found in Subsection 13.5 Alternative 5. The only differences from the treatment described in Alternative 5 and this alternative are the treatment plant size (400 gpm instead of 115 gpm) and the VOC emissions of the air stripper (66 lbs/day instead of 24 lbs/day). For cost estimating purposes, the treatment plant was assumed to be located at the center of the extraction well fence as shown in Figure 13-13.

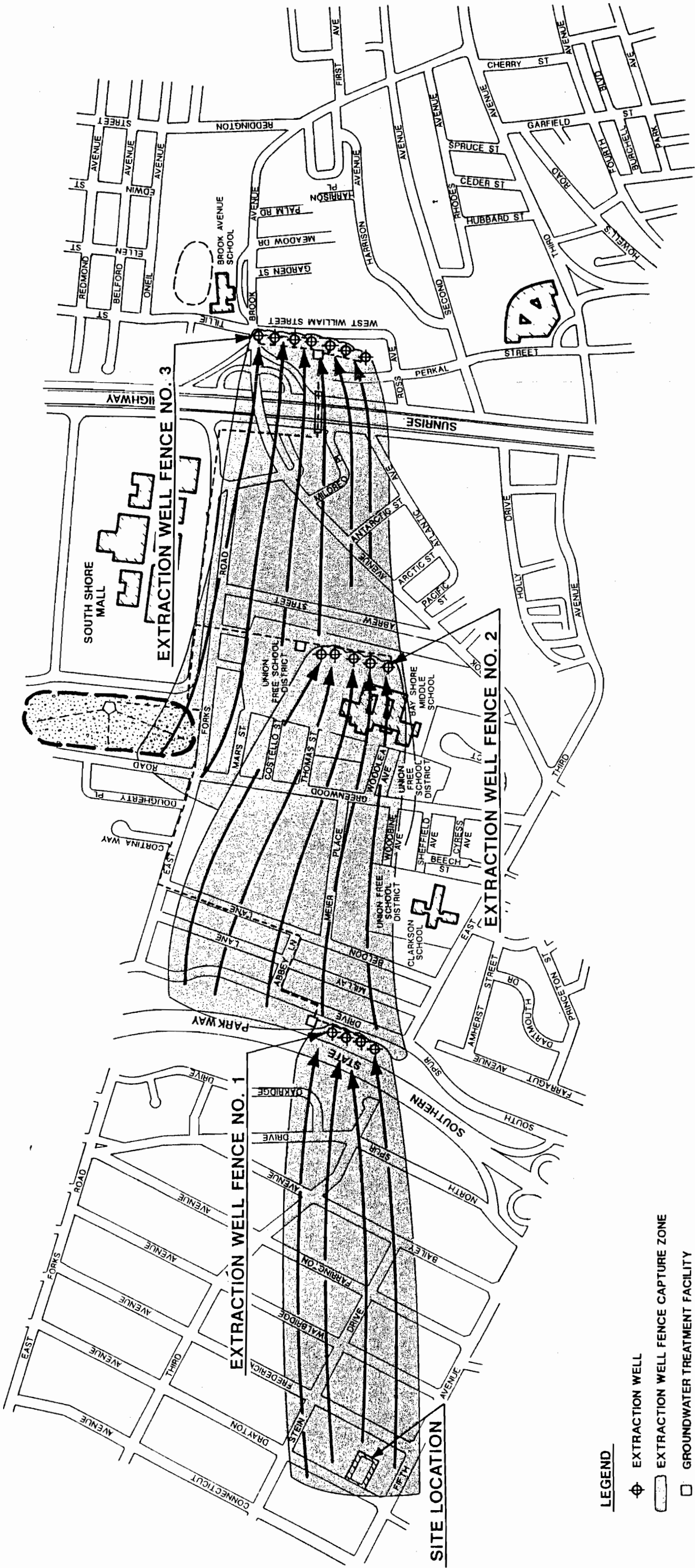
Discharge. Treated groundwater from the containment wells could be discharged by several methods. Discharge to the local POTW or surface water would be possible, but would not meet NYSDEC's preference for returning water to the aquifer from which it was removed. Returning treated groundwater could be accomplished through injection wells or discharge to an infiltration basin located just north of the South Shore Mall (see Figure 13-13). For cost-estimating purposes, the discharge of treated water to the infiltration basin was assumed.

Institutional Controls. As part of this alternative, institutional controls would be implemented to restrict the use of groundwater from the upper glacial aquifer in the path of the plume. Institutional controls are described in more detail under Alternative 2 in Subsection 13.2. Institutional controls placing restrictions on site soils would be necessary for this alternative, because contaminated soils would be left untreated at the site.

Environmental Monitoring. Monitoring would be included as part of this alternative as described for the No Action Alternative in Subsection 13.1. In addition, three monitoring wells would be installed downgradient of the groundwater extraction wells to verify that all contaminated water is being intercepted.

Five-year Reviews. Because contaminated soil and contaminated groundwater would remain untreated, five-year reviews would be conducted to evaluate the status of the contamination. Five-year reviews would be conducted as described for the No Action Alternative in Subsection 13.1.

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LEGEND

- ⊕ EXTRACTION WELL
- ▭ EXTRACTION WELL FENCE CAPTURE ZONE
- GROUNDWATER TREATMENT FACILITY
- +— EFFLUENT PIPE HIGHWAY CROSSING
- ➔ APPROXIMATE GROUNDWATER FLOW LINES
- ◡ RECHARGE BASIN
- ◻ VALVE CHAMBER
- PIPELINE



FIGURE 13-14
GROUNDWATER ACTIVE TREATMENT STRATEGY
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

more efficiently and economically treat groundwater, the time required to pump and treat one pore volume will increase substantially.

To maximize the efficiency of the groundwater treatment system, Jordan also recommends use of a pumping strategy designed to use the treatment system to its best advantage. The pumping strategy combines varying pumping rates and turning off well fences as the treatment program proceeds. Varying pumping rates within a well fence moves the stagnation point between wells so that no area of the aquifer is out of reach of the extraction system. Turning off Fences 1 and 2 after one pore volume has been removed (approximately five years) ensures that the extraction system will be extracting and treating the contaminated portions of the aquifer.

With all three fences in operation, one pore volume is removed every five years. With only Fence 3 in operation, one pore volume will be removed approximately every 20 years. Based on chemical properties of the contaminants, groundwater pumping rates, and site conditions, a contaminant removal efficiency of 36 percent with each pore volume removed would be expected. Details of these calculations are presented in Appendix O. Groundwater contaminant concentrations would therefore be reduced to levels below NYSWQRs after about 30 years of pumping.

Groundwater Treatment. The two water treatment technologies which were retained following technology screening are air stripping and UV/oxidation. Both technologies can effectively treat VOCs. However, both may require pretreatment to remove iron and manganese. The treatment methods for active remediation are the same as for the containment strategy. A detailed discussion of the groundwater treatment technologies can be found in Subsection 13.5 under Alternative 5. For cost-estimating purposes, it was assumed that treatment plants would be located adjacent to each of the three extraction well fences as shown in Figure 13-14. Two treatment plants would treat approximately 280 gpm and the third would treat approximately 400 gpm. The total estimated emissions rate for VOCs from the three treatment plants is 188 lbs/day (see Appendix O).

Discharge. For this alternative, it was assumed that treated groundwater would be returned to the aquifer by pumping it to the infiltration basin as discussed under Alternative 13. The location of the infiltration basin and the associated piping are shown in Figure 13-14. Returning treated water to the aquifer from which it was extracted would comply with NYSDEC's discharge preference for Long Island.

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Institutional Controls. As part of this alternative, institutional controls would be implemented to restrict the use of groundwater from the upper glacial aquifer in the path of the plume. The institutional controls that would be implemented are the same as described for the Minimal-action Alternative in Subsection 13.2. Institutional controls placing restrictions on site soils would not be necessary for this alternative, because contaminated soils would be remediated to target leaching based cleanup levels.

Environmental Monitoring. Monitoring would be included as part of this alternative as described for the No-action Alternative in Subsection 13.1. Monitoring would be used to evaluate the progress and effectiveness of remediating the plume and to determine when groundwater treatment can cease.

Five-year Reviews. Because the plume of contaminated groundwater would exceed NYSWQRs before remediation is completed, five-year reviews would be conducted to evaluate the status of the contamination. Five-year reviews would be conducted as described for the No-action Alternative in Subsection 13.1.

13.7.1 Compliance with ARARs and New York SCGs

Alternative 7 includes the removal of contaminants from site soils and active remediation of groundwater. In situ vacuum extraction would reduce concentrations of contaminants in soils so that risks from soils would not exceed USEPA's level of acceptable risk based on RfDs and CPFs. Groundwater contamination would be reduced to levels in compliance with state drinking water regulations, and federal MCLs and MCLGs. NYSWQRs would also be met. Vapors from the vacuum extraction process would be collected and treated to remove contaminants before discharge to the air. Vapor treatment would achieve levels required by federal and state ambient air quality regulations.

Because of the relatively small size of the ServAll site and its location in a developed, suburban area, few location-specific ARARs and SCGs apply. The designation of the aquifer as a sole-source aquifer, or the principal source of drinking water, allows for USEPA review of the project if federal financial assistance is involved. This alternative is expected to comply with location-specific ARARs and SCGs.

Operation of the vacuum extraction system would require compliance with state and RCRA regulations for hazardous waste TSDFs. Treatment of off-gases would comply with NYSDEC and CAA regulations for emissions. Construction and

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operation of the vacuum extraction and groundwater treatment plant would require health and safety training and safe working practices as outlined by OSHA.

13.7.2 Protection of Human Health and the Environment

This alternative would provide an increased level of protection to human health over baseline conditions. Alternative 7 includes a component to remove the source of groundwater contamination in unsaturated soils using vacuum extraction.

Removal of contaminants from the source area would reduce contamination to levels that are protective of on-site workers or other individuals. Risks from direct contact and incidental ingestion would be reduced to acceptable levels. Further contamination of groundwater by contaminant leaching would be significantly reduced.

Active extraction and treatment would remove contaminated groundwater from the entire plume. Contaminated groundwater would be removed by the extraction wells until drinking water regulations are met. Human health risks associated with the domestic use of contaminated groundwater would be controlled through institutional controls that prohibit its use.

13.7.3 Short-term Impacts and Effectiveness

Implementation of Alternative 7 would not result in any significant adverse impacts to the community or on-site workers. The short-term effectiveness for vacuum extraction is discussed under Alternative 3 in Subsection 13.3.3. No significant short-term impacts from the groundwater extraction and treatment process are expected.

Treatment of groundwater would continue for an estimated 30 years; however, results of many actual pump-and-treat remediations at other hazardous waste sites have shown that target cleanup levels cannot always be achieved in the estimated time period. Due to the industrial/residential nature of the area surrounding the site, construction activities would not significantly impact the environment. The estimated time for construction of three treatment plants and well installation is two years. The estimated time to design and construct the vacuum extraction is two to three months followed by approximately four months of treatment. Short-term effectiveness of groundwater extraction and treatment are described in detail under Alternative 5 in Subsection 13.5.3.

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The short-term effectiveness of the environmental monitoring and five-year review components of this alternative would be similar to that discussed in Subsection 13.2.3 under Alternative 2 - Minimal Action.

13.7.4 Long-term Effectiveness and Permanence

Vacuum extraction would remove VOCs from unsaturated source soils to levels that would reduce direct contact and incidental ingestion risks to acceptable levels. The long-term effectiveness of vacuum extraction is discussed in detail under Alternative 3 (see Subsection 13.3.4).

Active groundwater extraction would reduce the extent and quantity of contaminated groundwater. The proposed extraction wells would effectively remove large volumes of contaminated groundwater for treatment and reduce the size of the plume and mass of contaminants in the water. Active remediation would remove contaminated groundwater until federal MCLs are met; however, achieving these goals could take longer than the estimated time of 30 years.

The water treatment technologies proposed for Alternative 7 are the same as those proposed in Alternative 5. The long-term effectiveness of the water treatment technologies is evaluated in Subsection 13.5.4.

Treated water would be discharged to the recharge basin located north of the South Shore Mall. For cost-estimating purposes, it was assumed that the recharge basin has adequate capacity to be able to handle the 960 gpm flow from the active remediation pumping wells. If it is determined during remedial design that the recharge basin does not have adequate capacity, additional methods of discharge would be required.

The long-term effectiveness of environmental monitoring is presented in Subsection 13.1.4. Environmental monitoring would provide information necessary to characterize the effectiveness of the active remediation strategy at reducing the size of the plume and preventing further migration of contaminated groundwater.

The long-term effectiveness of institutional controls is presented in Subsection 13.2.4 for the Minimal-action Alternative. Under Alternative 7, institutional controls would only be required for the time until MCLs are achieved, approximately 30 years.

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13.7.5 Reduction of Toxicity, Mobility, or Volume

Vacuum extraction is an irreversible process that would transfer VOCs from the aqueous and sorbed phases to the vapor phase. The reduction of mobility, toxicity, or volume of contaminants associated with vacuum extraction is presented in detail under Alternative 3 in Subsection 13.3.5.

Active groundwater extraction would remove contaminated groundwater for treatment and destruction of contaminants. The active groundwater extraction option is an aggressive approach to reducing the mobility, toxicity, or volume of contaminants in groundwater. Approximately 960 gpm of contaminated water would be extracted and treated. Active remediation would prevent the plume from migrating further and would reduce its size. Extraction will be complete when contaminant concentrations no longer exceed MCLs.

PCE, TCE, 1,1-DCE, cis- and trans-1,2-DCE, and vinyl chloride would be removed from the water and destroyed through treatment. The toxicity, mobility, and volume of these contaminants would be reduced during the treatment process. An evaluation of the reduction of toxicity, mobility, or volume provided by the water treatment technologies is presented in Subsection 13.5.5.

13.7.6 Implementability

Vacuum extraction is an innovative technology participating in USEPA's SITE program. Implementability of vacuum extraction is described in detail under Alternative 3 in Subsection 13.3.5.

The implementability of groundwater extraction and treatment technologies is discussed under Alternative 5 in Subsection 13.5.13. Implementation of the active groundwater extraction option would involve difficulties in citing the treatment plants and installing piping to the discharge location. The high degree of development in the area would make obtaining land and implementing construction complicated.

It may be necessary to obtain easements from abutting property owners during construction and operation of the treatment plant. Implementation of institutional controls would require some coordination with other agencies such as the SCDHS.

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The implementability of discharging treated water to the recharge basin located north of the South Shore Mall is discussed in Subsection 13.13.13.

Implementability of environmental monitoring and five-year reviews is discussed in Subsection 13.1.13.

Institutional controls would be required for as long as groundwater exceeds MCLs. A discussion of the implementability of institutional controls is provided in Subsection 13.2.13.

13.7.7 Cost

Capital, indirect, and operation and maintenance costs for Alternative 7 for the air stripping and UV/oxidation options are presented in Tables 13-12 and 13-13, respectively. Cost backup is presented in Appendix K. For the air stripping option, capital, indirect, and operation and maintenance costs are \$8,461,000, \$1,770,000, and \$6,528,000, respectively. The total present-worth cost for Alternative 7 using air stripping is estimated to be \$20,111,000. This total includes a contingency of \$3,352,000 (20 percent of the subtotal of capital, indirect, and present-worth operating costs) to account for unforeseen costs that could increase the cost of this alternative.

For the UV/oxidation option, capital, indirect, and operation and maintenance costs are \$10,670,000, \$2,213,000, and \$7,547,000, respectively. The total present-worth cost for Alternative 7 using UV/oxidation is estimated to be \$24,516,000. This total includes a contingency of \$4,086,000.

13.8 ALTERNATIVE 8 - OFF-SITE SOURCE TREATMENT/ ACTIVE PLUME REMEDICATION STRATEGY

Alternative 8 combines an excavation and off-site soil treatment component with a groundwater pump-and-treat scenario that would actively remediate the entire plume of groundwater contamination. The alternative consists of the following components:

- excavation
- off-site treatment
- groundwater extraction (active remediation strategy)
- groundwater treatment
- discharge of treated water
- institutional controls

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TABLE 13-12
COST ESTIMATE ALTERNATIVE 7
IN SITU SOURCE TREATMENT
ACTIVE PLUME REMEDIATION STRATEGY
AIR STRIPPING

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

COST PARAMETERS	COST	PRESENT WORTH COST(1)
CAPITAL COSTS		
Vacuum Extraction*	\$171,000	\$171,000
Groundwater Extraction Wells*	\$327,000	\$327,000
Treatment Plant with Air Stripping	\$6,167,000	\$6,167,000
Replacement of Treatment Plant in 15 Years	\$6,167,000	\$1,752,000
Installation of Monitoring Wells*	\$25,000	\$25,000
Institutional Controls	\$19,000	\$19,000
Total Capital Costs		\$8,461,000
INDIRECT COSTS		
Health and Safety (15% of Capital (2))	\$78,000	\$78,000
Legal, Administrative, Permitting (5% of Capital)	\$423,000	\$423,000
Engineering (10% of Capital)	\$846,000	\$846,000
Construction Management (5% of Capital)	\$423,000	\$423,000
Total Indirect Costs		\$1,770,000
OPERATING COSTS		
Groundwater Treatment (for 30 Years)	\$590,000	\$6,198,000
Environmental monitoring		
First 2 Years (4 Events Per Year)	\$100,000	\$177,000
Remaining 28 Years (1 Event Per Year)	\$25,000	\$219,000
Five-year Reviews(3)	\$10,000	\$18,000
Total Operating Costs		\$6,612,000
SUBTOTAL		\$16,843,000
Contingency (20% of Subtotal)		\$3,369,000
TOTAL		\$20,212,000

NOTES:

(1) = Discount Rate is 8.75%

(2) = Includes only those capital costs that would require health and safety training and equipment as indicated by an asterisk.

(3) = Present-worth cost based on reviews conducted every five years until year 30.

Cost are conceptual only (-30/+50% accurate) and should not be considered an engineers estimate.

TABLE 13-13
COST ESTIMATE ALTERNATIVE 7
IN SITU SOURCE TREATMENT
ACTIVE PLUME REMEDIATION STRATEGY
UV/OXIDATION

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

COST PARAMETERS	COST	PRESENT WORTH COST(1)
CAPITAL COSTS		
Vacuum Extraction*	\$171,000	\$171,000
Groundwater Extraction Wells*	\$327,000	\$327,000
Treatment Plant with UV/oxidation	\$7,887,000	\$7,887,000
Replacement of Treatment Plant in 15 Years	\$7,887,000	\$2,241,000
Installation of Monitoring Wells*	\$25,000	\$25,000
Institutional Controls	\$19,000	\$19,000
Total Capital Costs		\$10,670,000
INDIRECT COSTS		
Health and Safety (15% of Capital (2))	\$78,000	\$78,000
Legal, Administrative, Permitting (5% of Capital)	\$534,000	\$534,000
Engineering (10% of Capital)	\$1,067,000	\$1,067,000
Construction Management (5% of Capital)	\$534,000	\$534,000
Total Indirect Costs		\$2,213,000
OPERATING COSTS		
Groundwater Treatment (for 30 Years)	\$679,000	\$7,133,000
Environmental monitoring		
First 2 Years (4 Events Per Year)	\$100,000	\$177,000
Remaining 28 Years (1 Event Per Year)	\$25,000	\$219,000
Five-year Reviews(3)	\$10,000	\$18,000
Total Operating Costs		\$7,547,000
SUBTOTAL		\$20,430,000
Contingency(20% of Subtotal)		\$4,086,000
TOTAL		\$24,516,000

NOTES:

(1) = Discount Rate is 8.75%

(2) = Includes only those capital costs that would require health and safety training and equipment as indicated by an asterisk.

(3) = Present-worth cost based on reviews conducted every five years until year 30.

Cost are conceptual only (-30/+50% accurate) and should not be considered an engineers estimate.

- environmental monitoring
- five-year reviews

This alternative includes treatment of source area soils by excavation and off-site treatment. The soils would be excavated, loaded in trucks, and transported to an off-site location for treatment by incineration or thermal desorption.

A groundwater extraction system would be installed to intercept and actively remove contaminated groundwater from the entire plume. It would prevent further migration of groundwater contamination and reduce the size of the plume. Groundwater would be extracted and treated using either air stripping or UV/oxidation until contaminant concentrations meet MCLs. Treated groundwater would be discharged to a recharge basin to be returned to the aquifer from which it was removed.

Institutional controls, environmental monitoring, and five-year reviews would be implemented to protect human health and monitor the location and migration of contamination during the implementation of this alternative. Each component is discussed in the following paragraphs.

Excavation. Excavation would involve confirmatory sampling to verify the extent of contamination using a TerraProbe, installation of sheet piling to provide shoring for excavation, and excavation of soils into trucks for transport off site. A detailed description of this process is presented in Alternative 4 in Subsection 13.4.

Off-site Treatment. Off-site treatment would involve either incineration or thermal desorption treatment and disposal of treatment residuals. Both technologies were discussed in detail in Alternative 4 in Subsection 13.4.

Groundwater Extraction. Groundwater would be extracted from all areas of the plume in order to remediate the upper glacial aquifer. The active remediation extraction well system for Alternative 8 is described in more detail in Section 13.7 for Alternative 7.

Groundwater Treatment. The two water treatment technologies retained following technology screening are air stripping and UV/oxidation. Both technologies can effectively treat VOCs. However, both would require pretreatment to remove iron and manganese. The treatment methods for active remediation are the same as they are for the plume source control strategy. A

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detailed discussion of groundwater treatment technologies can be found in Subsection 13.5 for Alternative 5. For cost-estimating purposes it was assumed that treatment plants would be located adjacent to each of the three extraction well fences as shown in Figure 13-14.

Discharge. For this alternative, it was assumed that treated groundwater would be returned to the aquifer by pumping it to the infiltration basin north of the South Shore Mall as discussed under Alternative 13. The location of the infiltration basin and associated piping are shown in Figure 13-14.

Institutional Controls. As part of this alternative, institutional controls would be implemented to restrict the use of groundwater from the upper glacial aquifer in the path of the plume. Institutional controls that would be implemented are the same as described for the Minimal-action Alternative in Subsection 13.2. However, institutional controls placing restrictions on site soils would not be necessary for this alternative, because contaminated soil would be excavated and removed from the site for off-site treatment.

Environmental Monitoring. Monitoring would be included as part of this alternative as described for the No-action Alternative in Subsection 13.1. Monitoring would be used to evaluate the progress and effectiveness of remediating the plume and to determine when groundwater treatment can cease.

Five-year Reviews. Because the plume of groundwater contamination would remain until remediation is completed, five-year reviews would be conducted to evaluate the status of the contamination. Five-year reviews would be conducted as described for the No-action Alternative in Subsection 13.1.

13.8.1 Compliance with ARARS and New York SCGs

Alternative 8 includes the excavation of contaminated soils for off-site treatment and active remediation of groundwater. Excavation and off-site treatment would remove contaminated soils so that risks from soils would not exceed USEPA's level of acceptable risk based on RfDs and CPFs. Groundwater contamination would be reduced to levels in compliance with state drinking water regulations, and federal MCLs and MCLGs. NYSWQRs would also be met. Particle and contaminant emissions during the excavation may be high enough to exceed ambient air quality regulations; however, engineering controls could be used to meet the regulations, if necessary. Such engineering controls were not included in cost estimates for this alternative.

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Because of the relatively small size of the ServAll site and its location in a developed, suburban area, few location-specific ARARs and SCGs apply. The designation of the aquifer as a sole-source aquifer, or the principal source of drinking water, allows for USEPA review of the project if federal financial assistance is involved. This alternative is expected to comply with location-specific ARARs and SCGs.

Excavation of contaminated soils would require compliance with state and RCRA regulations for hazardous waste TSDFs. Emissions during excavation would be controlled, if necessary, to comply with NYSDEC and CAA regulations for emissions. Excavation and monitoring well installation would require health and safety training and safe working practices as outlined by OSHA. Vendors who handle the transportation and off-site treatment of soils would be required to comply with the appropriate NYSDEC, RCRA, and DOT regulations for transportation, stockpiling, and incineration of the soils.

13.8.2 Protection of Human Health and the Environment

This alternative would provide protection of human health and the environment. Contaminated soils would be excavated and treated off site, eliminating direct contact and incidental ingestion risks and further leaching of contaminants to groundwater. No significant environmental impacts are expected to be caused by this alternative because of the high settled industrial/residential location of the site.

Active extraction and treatment would remove contaminated groundwater from the entire plume. Contaminated groundwater would be removed by the extraction wells until drinking water regulations are met. Human health risks associated with the domestic use of contaminated groundwater would be minimized through institutional controls that prohibit the use of contaminated groundwater.

13.8.3 Short-term Impacts and Effectiveness

The most significant short-term impacts that would be caused by implementing Alternative 8 are associated with excavation of source soils. These impacts as well as those associated with incineration are described in detail under Alternative 4 in Subsection 13.4.3.

Treatment of groundwater would continue for an estimated 30 years; however, many actual pump-and-treat remediations at other hazardous waste sites have

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shown that target cleanup levels cannot always be achieved in the estimated time. Due to the industrial/residential nature of the area surrounding the site, construction activities would not significantly impact the environment. The estimated time for construction of three treatment plants and well installation is two years. Design and implementation of the excavation and off-site treatment is estimated to take six months. Short-term effectiveness of groundwater extraction and treatment are described in detail under Alternative 5 in Subsection 13.5.3.

The short-term effectiveness of the environmental monitoring and five-year review components of this alternative would be similar to that discussed previously in Subsection 13.2.3 under Alternative 2 - Minimal Action.

13.8.4 Long-term Effectiveness and Permanence

The excavation and removal of contaminated soil from the site would significantly reduce the baseline health risks associated with direct contact and incidental ingestion of contaminated soil. Leaching of contaminants from unsaturated soil to groundwater would be reduced, preventing further groundwater contamination. The long-term effectiveness of excavation and off-site treatment is presented in greater detail in Subsection 13.4.4.

Active remediation would extract contaminated groundwater from all parts of the plume, reducing the amount of contaminated groundwater and preventing further migration. The long-term effectiveness of the active remediation groundwater pumping strategy is presented in detail in Subsection 13.7.4.

The groundwater treatment technologies proposed for this alternative are the same as those in Alternative 5. A discussion of the long-term effectiveness of air stripping and UV/oxidation is presented in Subsection 13.5.4.

The long-term effectiveness of environmental monitoring is presented in Subsection 13.1.4. Environmental monitoring would provide information necessary to characterize the effectiveness of the active remediation strategy at reducing the size of the plume and preventing further migration of contaminated groundwater.

The long-term effectiveness of institutional controls is presented in Subsection 13.2.4 for the Minimal Action Alternative. Under Alternative 8, institutional controls would only be required for the time until MCLs are achieved, approximately 30 years.

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13.8.5 Reduction of Toxicity, Mobility, or Volume

Excavation and off-site treatment of contaminated source soil would provide a permanent reduction of mobility, toxicity, or volume of contaminants. This is described in greater detail under Alternative 4 in Subsection 13.4.5.

Active remediation would prevent the plume from migrating further and reduce its size. The reduction of mobility, toxicity, or volume of contaminated groundwater provided by the active remediation strategy is presented in Subsection 13.7.5.

PCE, TCE, 1,1-DCE, cis- and trans-1,2-DCE, and vinyl chloride would be removed from the water and destroyed through treatment. The toxicity, mobility, and volume of these contaminants would be reduced during the treatment process. An evaluation of the reduction of toxicity, mobility, or volume provided by the water treatment technologies is presented in Subsection 13.5.5.

13.8.6 Implementability

The implementability of shoring, excavation, and off-site treatment technologies are described under Alternative 4 in Subsection 13.4.13. The implementability of the environmental monitoring portion of this alternative is the same as that presented in Subsection 13.2.13.

The implementability of groundwater extraction and treatment technologies is discussed under Alternative 5 in Subsection 13.5.13. Implementation of the active groundwater extraction option would involve difficulties in siting the treatment plants and installing piping to the discharge location. The high degree of development in the area would make obtaining land and implementing construction complicated.

It may be necessary to obtain easements from abutting property owners during construction and operation of the treatment plant. Implementation of institutional controls would require some coordination with other agencies such as the SCDHS.

The implementability of discharging treated water to the recharge basin north of the South Shore Mall is discussed in Subsection 13.13.13. The implementability of environmental monitoring and five-year reviews is discussed in Subsection 13.1.13.

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Institutional controls would be required for as long as groundwater exceeds MCLs. A discussion of the implementability of institutional controls is provided in Subsection 13.2.13.

13.8.7 Cost

Capital, indirect, and operation and maintenance costs for Alternative 8 for the air stripping and UV/oxidation options are presented in Tables 13-14 and 13-15, respectively. Cost backups are presented in Appendix K. For the air stripping option, capital, indirect, and operation and maintenance costs are \$13,531,000, \$2,787,000, and \$6,528,000, respectively. The total present-worth cost for Alternative 8 using air stripping is estimated to be \$27,415,000. This total includes a contingency of \$4,569,000 (20 percent of the subtotal of capital, indirect, and present-worth operating costs) to account for unforeseen costs that could increase the cost of this alternative.

For the UV/oxidation option, capital, indirect, and operation and maintenance costs are \$15,740,000, \$3,228,000, and \$7,547,000, respectively. The total present-worth cost for Alternative 8 using UV/oxidation is estimated to be \$31,818,000. This total includes a contingency of \$5,303,000.

13.9 COMPARATIVE ANALYSIS OF ALTERNATIVES

The comparative analysis evaluates the relative performance of each alternative using the same criteria on which the detailed analysis of each alternative was conducted. The purpose of the comparative analysis is to identify the advantages and disadvantages of the alternatives relative to one another to aid in selecting a remedy for the ServAll site. The following subsections highlight differences between the alternatives for each criterion.

13.9.1 Compliance with ARARs and New York State SCGs

Only Alternatives 7 and 8 would be in compliance with all ARARs and SCGs. Alternatives 2 through 6 would include measures that would meet ARARs and SCGs for the source area; however, because the contaminated groundwater would not be remediated completely, federal and state ARARs and SCGs would not be met for these alternatives. Alternative 1 would also not be in compliance with federal and state ARARs and SCGs for water, and contaminated soil left at the site, posing a risk to workers that exceeds acceptable risk guidelines.

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TABLE 13-14
COST ESTIMATE ALTERNATIVE 8
OFF-SITE SOURCE SOIL TREATMENT
ACTIVE PLUME REMEDIATION STRATEGY
AIR STRIPPING

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

COST PARAMETER	COST	PRESENT WORTH COST(1)
CAPITAL COSTS		
TerraProbe Investigation*	\$52,000	\$52,000
Excavation – non-intrusive activities	\$344,000	\$344,000
Excavation – intrusive activities*	\$130,000	\$130,000
Transportation	\$395,000	\$395,000
Incineration	\$4,320,000	\$4,320,000
Groundwater Extraction Wells*	\$327,000	\$327,000
Groundwater Treatment with Air Stripping	\$6,167,000	\$6,167,000
Replacement of Treatment Plants in 15 Years	\$6,167,000	\$1,752,000
Installation of monitoring wells*	\$25,000	\$25,000
Institutional Controls	\$19,000	\$19,000
Total Capital Costs		\$13,531,000
INDIRECT COSTS		
Health and Safety (15% of Capital (2))	\$80,000	\$80,000
Legal, Administrative, Permitting (5% of Capital)	\$677,000	\$677,000
Engineering (10% of Capital)	\$1,353,000	\$1,353,000
Construction Management (5% of Capital)	\$677,000	\$677,000
Total Indirect Costs		\$2,787,000
OPERATING COSTS		
Groundwater Treatment (for 30 Years)	\$590,000	\$6,198,000
Environmental monitoring		
First 2 Years (4 Events Per Year)	\$100,000	\$177,000
Remaining 28 Years (1 Event Per Year)	\$25,000	\$219,000
Five-year Reviews(3)	\$10,000	\$18,000
Total Operating Costs		\$6,612,000
SUBTOTAL		\$22,930,000
Contingency (20% of Subtotal)		\$4,586,000
TOTAL		\$27,516,000

NOTES:

(1) = Discount Rate is 8.75%

(2) = Includes only those capital costs that would require health and safety training and equipment as indicated by an asterisk.

(3) = Present-worth cost based on reviews conducted every five years until year 30.

Cost are conceptual only (-30/+50% accurate) and should not be considered an engineers estimate.

TABLE 13-15
COST ESTIMATE ALTERNATIVE 8
OFF-SITE SOURCE SOIL TREATMENT
ACTIVE PLUME REMEDIATION STRATEGY
UV/OXIDATION

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

COST PARAMETER	COST	PRESENT WORTH COST(1)
CAPITAL COSTS		
TerraProbe Investigation*	\$52,000	\$52,000
Excavation – non-intrusive activities	\$344,000	\$344,000
Excavation – intrusive activities*	\$130,000	\$130,000
Transportation	\$395,000	\$395,000
Incineration	\$4,320,000	\$4,320,000
Groundwater Extraction Wells*	\$327,000	\$327,000
Groundwater Treatment with UV/oxidation	\$7,887,000	\$7,887,000
Replacement of Treatment Plants in 15 Years	\$7,887,000	\$2,241,000
Installation of monitoring wells*	\$25,000	\$25,000
Institutional Controls	\$19,000	\$19,000
Total Capital Costs		\$15,740,000
INDIRECT COSTS		
Health and Safety (15% of Capital (2))	\$80,000	\$80,000
Legal, Administrative, Permitting (5% of Capital)	\$787,000	\$787,000
Engineering (10% of Capital)	\$1,574,000	\$1,574,000
Construction Management (5% of Capital)	\$787,000	\$787,000
Total Indirect Costs		\$3,228,000
OPERATING COSTS		
Groundwater Treatment (for 30 Years)	\$679,000	\$7,133,000
Environmental monitoring		
First 2 Years (4 Events Per Year)	\$100,000	\$177,000
Remaining 28 Years (1 Event Per Year)	\$25,000	\$219,000
Five-year Reviews(3)	\$10,000	\$18,000
Total Operating Costs		\$7,547,000
SUBTOTAL		\$26,515,000
Contingency (20% of Subtotal)		\$5,303,000
TOTAL		\$31,818,000

NOTES:

(1) = Discount Rate is 8.75%

(2) = Includes only those capital costs that would require health and safety training and equipment as indicated by an asterisk.

(3) = Present-worth cost based on reviews conducted every five years until year 30.

Cost are conceptual only (-30/+50% accurate) and should not be considered an engineers estimate.

13.9.2 Overall Protection of Human Health and the Environment

Only Alternative 1 would not provide protection of human health and the environment. Alternative 1 includes no remedial actions; therefore, contaminants would remain in the soils that pose a risk to site workers exceeding the acceptable risk level determined by the USEPA. Alternative 1 also includes no actions to ensure that no consumption of contaminated groundwater is occurring downgradient of the site.

Alternatives 2 and 6 provide protection for site workers by installing an asphalt cover over all contaminated soils at the site, eliminating exposure to contamination at the site. Alternatives 3, 5, and 7 include in situ treatment of source soils by vacuum extraction. Vacuum extraction would remove contaminants from the soils to levels that are protective of site workers. Alternatives 4 and 8 include the removal of all contaminated soils for off-site treatment; thereby eliminating risk to site workers.

Alternatives 2 through 8 include institutional controls that would restrict the extraction and use of groundwater from the plume. These restrictions would protect the public from consuming contaminated groundwater that may pose a health risk. In addition, Alternatives 5 through 8 include extraction and treatment of groundwater. Groundwater would be treated to remove contamination to levels protective of human health and the environment. Alternatives 7 and 8 would effectively treat all contaminated groundwater to levels protective of human health and the environment.

13.9.3 Short-term Impacts and Effectiveness

Alternative 1 would have no short-term impacts because no actions would be taken. Alternatives 2 and 6 would involve construction of the asphalt cover, which could be accomplished by a sidewalk paving crew with little to no exposure to workers or the community except possibly some dust emissions and construction hazards. Measures would be taken to minimize these effects. Alternatives 3, 5, and 7 include vacuum extraction, which would require that operators be health and safety trained because invasive activities would be conducted. Vapors would be collected and treated and effects on the community would be minimal. Alternatives 4 and 8 pose the greatest potential effects on workers and the community. Workers would require health and safety training and the limited space could increase the chances of construction accidents. If excessive dust or emissions of VOCs occur, engineering controls would have to be implemented.

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Easements would restrict use of land by property owners and heavy equipment would cause noise and traffic disturbance to the community.

Groundwater extraction and treatment facilities would all involve the same short-term effects. Construction of the treatment plants would not involve exposure to contaminated water or soils. Operation of the treatment plants would involve potential exposure to hazardous materials and would require health and safety training for plant operators.

The times required to achieve the response objectives for each alternative are presented in the Table 13-16.

13.9.4 Long-term Effectiveness and Permanence

In addressing the source area there are a range of alternatives with a range of effectiveness. Alternative 1 would not be effective at reducing risk because no actions would be taken. Alternatives 2 and 6 include an asphalt cover over the source area. This would be effective at preventing exposure to contaminated soils by site workers. It would also reduce rainwater infiltration through contaminated soils in the vadose zone; however, fluctuations in the water table and contamination of the saturated soils or the capillary fringe may continue to contaminate groundwater. The cover must also be properly maintained to prevent the infiltration of water through the unsaturated soils.

Alternatives 3, 5, and 7 include vacuum extraction. Vacuum extraction would effectively and permanently remove contaminants from unsaturated soils. It may be difficult to attain the target cleanup levels with vacuum extraction. Demonstration of vacuum extraction at achieving low concentrations of soil comminution as proposed for this site is very limited. There is little doubt that a significant portion of the contamination would be removed. Contamination of groundwater could continue following vacuum extraction if saturated soils or the capillary fringe are contaminated. Only Alternative 5 would address this possibility by extracting and treating groundwater from the source area.

Alternatives 4 and 8 would effectively remove and treat contaminated soils. Correct positioning of the sheet piling would be essential to ensure that all contaminated soils are removed. Incineration or thermal desorption would effectively destroy the contaminants. Contamination of groundwater could continue following excavation if saturated soils or the capillary fringe are contaminated.

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TABLE 13-16
DESIGN, CONSTRUCTION, AND TREATMENT TIME
ESTIMATES FOR EACH ALTERNATIVE

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

ALTERNATIVE	SOURCE		GROUNDWATER	
	Design & Construction	Treatment	Design & Construction	Treatment
Alternative 1	5 weeks	N/A	N/A	N/A
Alternative 2	2 months	N/A	N/A	N/A
Alternative 3	3 months	4 months	N/A	N/A
Alternative 4	6 months	N/A	N/A	N/A
Alternative 5	3 months	4 months	1 year	20 years
Alternative 6	2 months	N/A	1.5 years	30 years
Alternative 7	3 months	4 months	2 years	30 years
Alternative 8	6 months	N/A	2 years	30 years

NOTE:

N/A = Not Applicable

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All of the treatment options included in Alternatives 5 through 8 would be equally effective at treating the groundwater that is extracted. They would also be equally effective at meeting the stated objectives of their respective pumping strategies. Only Alternatives 7 and 8, however, would remove and treat all contaminated groundwater. With Alternatives 1 through 6, contaminated groundwater would remain that exceeds drinking water standards and that would be harmful to human health if consumed. Institutional controls would be effective at preventing consumption over the long-term, provided they are maintained and enforced.

13.9.5 Reduction of Toxicity, Mobility, and Volume

Alternatives 1 and 2 do not include any treatment of soils or groundwater; therefore, no reduction in the toxicity, mobility, and volume through treatment would be achieved. Some reduction in mobility of contaminants through limiting infiltration in Alternative 2 would be achieved. Alternatives 3 and 4 include reductions of toxicity, mobility, and volume of contaminants in the source area but no reduction in the groundwater. Alternatives 5 through 8 all involve treatment that would reduce the toxicity, mobility, and volume of contaminants in groundwater to different degrees. Alternatives 5, 7, and 8 also include reductions in toxicity, mobility, and volume of contaminants in the source area. Alternative 6 does not include treatment of the source area. The estimated mass of contaminants removed by each of the alternatives is summarized in the following Table 13-17.

13.9.6 Implementability

An asphalt cover, vacuum extraction, and institutional controls are not expected to pose any technical implementation difficulties. Therefore, Alternatives 1, 2, and 3 would also include few difficulties. Alternatives 4 and 8 may be difficult to implement based on the limited space available for excavation of soils. Easements from abutting property owners may be difficult to obtain and measures to control dust and VOC emissions from the excavation could restrict the excavation process substantially. Alternatives 5, 6, 7, and 8 include groundwater extraction and treatment. Difficulties may be encountered in obtaining space for treatment plants. Installation of piping to and from the treatment plants is also likely to be very difficult because of the existing heavy development and associated utilities in the roads. These implementation difficulties with groundwater extraction and treatment increase with the size of the treatment; therefore, they are likely to be more difficult to overcome for Alternatives 7 and 8 than for Alternative 5.

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In general, the larger and more aggressive the alternative, the greater the need for effective coordination among agencies to implement the alternative. State and local agencies would be involved in the implementation of each alternative and no major difficulties that would limit the implementation of the alternatives are anticipated.

All the alternatives under consideration include services and materials that are available and adequate. For specialized services such as vacuum extraction and off-site treatment it may be difficult to find several vendors to bid on the project. Construction services should be readily available for all alternatives.

13.9.7 Cost

A wide range of costs is represented by the eight alternatives included in the detailed analysis. The costs range from \$574,000 for Alternative 1, No Action to \$31,818,000 for Alternative 8, Off-site Source Treatment/Active Plume Remediation Strategy with UV/oxidation treatment. The range of costs is summarized in Table 13-18.

TABLE 13-17
CONTAMINANT MASS REMOVAL FOR EACH ALTERNATIVE

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

ALTERNATIVE	MASS REMOVED FROM UNSATURATED SOILS	MASS REMOVED FROM SATURATED SOILS	MASS REMOVED FROM GROUNDWATER	TOTAL MASS REMOVED
Alternative 1	0 Pounds	0 Pounds	0 Pounds	0 Pounds
Alternative 2	0 Pounds	0 Pounds	0 Pounds	0 Pounds
Alternative 3	96 Pounds	0 Pounds	0 Pounds	96 Pounds
Alternative 4	96 Pounds	0 Pounds	0 Pounds	96 Pounds
Alternative 5	96 Pounds	5,768 Pounds	2,568 Pounds	8,400 Pounds
Alternative 6	0 Pounds	12,561 Pounds	5,972 Pounds	18,500 Pounds
Alternative 7	96 Pounds	12,561 Pounds	5,972 Pounds	18,600 Pounds
Alternative 8	96 Pounds	12,561 Pounds	5,972 Pounds	18,600 Pounds

NOTE: Removal rates are estimated for comparison purposes only. Estimates of contaminant mass treated in groundwater are based on treatment of one pore volume. Attainment of target clean-up levels may require the removal of additional pore volumes of groundwater in order to address contaminants adsorbed onto soils within the water column. As much as two times the amount of contaminants in the groundwater, or approximately 12,700 lbs., may be adsorbed on to soil particles within the plume. Calculations are presented in Appendix J.

TABLE 13-18
COST COMPARISON OF ALTERNATIVES

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

ALTERNATIVE	CAPITAL COST	INDIRECT COST	OPERATING COST	TOTAL COST(1)
Alternative 1	\$10,000	\$12,000	\$456,000	\$574,000
Alternative 2	\$38,000	\$32,000	\$501,000	\$685,000
Alternative 3	\$200,000	\$117,000	\$456,000	\$928,000
Alternative 4	\$5,270,000	\$1,084,000	\$456,000	\$8,172,000
Alternative 5				
Air Stripping	\$1,591,000	\$598,000	\$1,525,000	\$4,457,000
UV/oxidation	\$1,791,000	\$670,000	\$1,636,000	\$4,924,000
Alternative 6				
Air Stripping	\$3,365,000	\$698,000	\$3,117,000	\$8,616,000
UV/oxidation	\$4,055,000	\$837,000	\$3,695,000	\$10,304,000
Alternative 7				
Air Stripping	\$8,461,000	\$1,770,000	\$6,612,000	\$20,212,000
UV/oxidation	\$10,670,000	\$2,213,000	\$7,547,000	\$24,516,000
Alternative 8				
Air Stripping	\$13,531,000	\$2,787,000	\$6,612,000	\$27,516,000
UV/oxidation	\$15,740,000	\$3,228,000	\$7,547,000	\$31,818,000

NOTES:

All costs given are present worth using a discount rate of 8.75%

(1) Includes a 20% contingency factor

Conceptual design costs are assumed -30/+50% accurate and are not for remedial design.



14.0 SELECTION OF REMEDY

This section presents the selection of a remedy from the eight alternatives that were evaluated in detail in Section 13.0 and includes a conceptual plan for the implementation of the selected remedy. The rationale for selecting the remedy and for not selecting other alternatives is also presented. The conceptual plan describes the selected remedy in detail and a proposed schedule for implementation is presented at the end of the section.

14.1 RATIONALE FOR SELECTING THE PREFERRED REMEDY

Based on the detailed and comparative analyses of the alternatives in Section 13.0, Alternative 5 was chosen as the preferred alternative for the ServAll Laundry site. Alternative 5 would provide the greatest long-term effectiveness for remediating the source of groundwater contamination and would be protective of human health. It would meet ARARs and SCGs for the source area. It would reduce the toxicity, mobility, and volume of contaminants. It would be cost effective. Short-term effects would be minimal. Alternative 5 would provide an aggressive treatment of the source area to prevent further contamination of groundwater but would allow the existing plume of contaminated groundwater to migrate south and discharge into the Great South Bay. The selected alternative is Alternative 5 with a contingency plan of constructing a pump and treat containment system for the plume.

14.2 ELIMINATION OF OTHER ALTERNATIVES

In the process of comparing the eight alternatives and selecting a preferred alternative, criteria for eliminating the other alternatives from consideration were also developed. In the following paragraphs, the major reasons for eliminating the other seven alternatives are summarized. The selection of one alternative and elimination of the others involves comparing many aspects of each alternative. The primary reasons for eliminating alternatives are given below; however, other aspects of the alternatives also affected the decision. The comparison process did not necessarily proceed in the order listed below.

Alternative 1, the No Action alternative, was not selected because contamination at the source would continue to contaminate groundwater indefinitely. Alternative 1 would not be in compliance with ARARs and SCGs and would not provide protection of human health and the environment.

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Alternative 2 was not chosen because it would not be able to effectively remediate the unsaturated source area. Most of the site has been paved since 1983 and there is little indication that this has prevented further contamination of groundwater. In addition, Alternative 2 would not prevent contamination of groundwater from contaminated saturated soils. Alternative 2 would not be in compliance with ARARs and SCGs because contamination would continue to migrate.

Alternative 3 was eliminated because it would not address the source of groundwater contamination below the water table. It would also allow all of the contaminated groundwater to continue to migrate toward the Great South Bay.

Alternative 4 was not selected because of the complexity, risks, and the cost associated with excavation and off-site treatment compared to in situ source treatment. Alternative 4 would have serious short-term effects and would not be in compliance with ARARs and SCGs.

Although Alternative 6 would prevent further migration of contamination toward the Great South Bay, it would not provide a permanent long-term solution for the site. This alternative was eliminated, however, a pump and treat containment system will be retained as a contingency to supplement the selected remedy (see Subsection 14.3.9). Alternative 6 does not have components that would remediate the saturated and unsaturated source soils.

Alternative 7 was eliminated because the increased protection of human health from addressing the entire plume of groundwater contamination is outweighed by increased implementation difficulties, short-term effects on the community, and costs associated with construction and integration of three large groundwater treatment plants.

Alternative 8 was eliminated for the same reasons as Alternatives 4 and 7. The active remediation strategy does not provide adequate increased protection to human health compared to the plume source control pump and treat strategy over the source area pump and treat scenario. Alternative 8 would have the same problems associated with excavation as Alternative 4.

14.3 CONCEPTUAL PLAN

The conceptual plan describes all of the components of the selected remedial action and includes a site plan, process flow diagrams, a proposed implementation

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schedule, preliminary equipment lists, and a cost estimate. It contains information presented previously in the description of Alternative 5 in Section 13.5 as well as additional information to address some necessary contingencies.

Alternative 5 would combine an in situ source control component with a source area groundwater pump and treat scenario and would consist of the following components:

- vacuum extraction
- hot air or steam injection
- groundwater extraction (plume source control scenario)
- groundwater treatment
- discharge of treated water
- institutional controls
- environmental monitoring
- contingency plans
- five-year reviews

This alternative would include treatment of the source area with in situ vacuum extraction to extract VOCs from the unsaturated zone. Removing the source of VOCs would eliminate further groundwater contamination from soils in the unsaturated zone. Hot air or steam could be injected into source soils to enhance the vapor extraction process.

A groundwater extraction system would be installed near the source to remove contaminated groundwater and flush contaminants from the saturated soils. The downgradient portion of the plume would detach from the site and continue to migrate toward the Great South Bay.

Contaminated groundwater would be treated to remove PCE and TCE by air stripping and UV/oxidation. Pretreatment of the groundwater for removal of iron and manganese may be necessary to prevent fouling of the VOC treatment system. Treated water would be discharged to a recharge well upgradient of the site.

Institutional controls, environmental monitoring, and five-year reviews would be implemented to protect human health and monitor the location and migration of contamination. Plans have been added to this alternative to evaluate contingencies associated with the plume of contamination that will be allowed to migrate to the Great South Bay. A site plan is presented in Figure 14-1. Each

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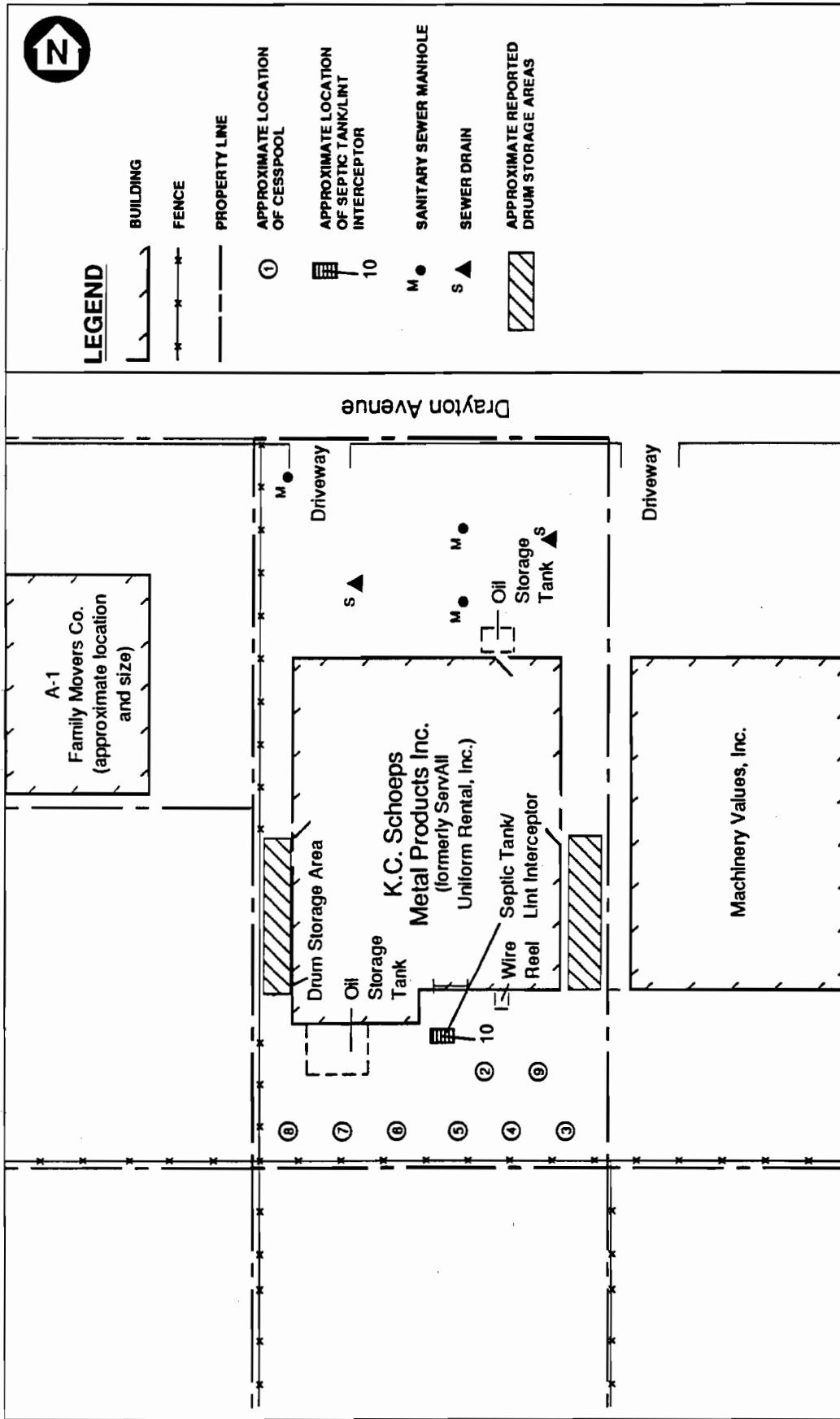


FIGURE 14-1
SITE LAYOUT MAP
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK
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component is described in greater detail in the following paragraphs.

14.3.1 Vacuum Extraction

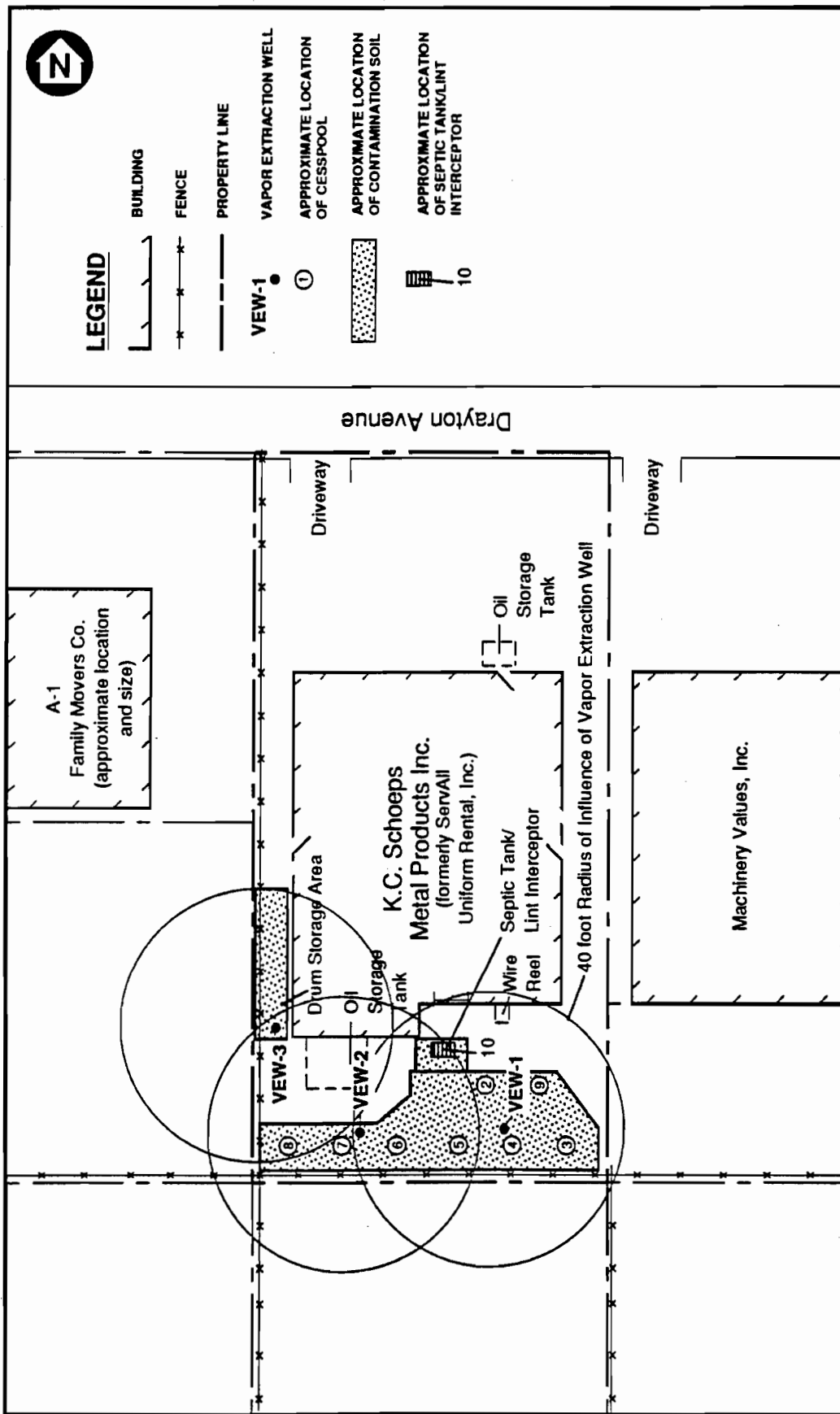
In situ vacuum extraction is an innovative approach for extracting VOCs from unsaturated soils without excavation. VOCs are removed from the soil matrix by mechanically drawing air through the vadose zone using a system of vacuum extraction wells. The contaminated soil is gradually remediated as the VOCs volatilize from the soil and are drawn off by means of the vacuum extraction equipment. A discussion of some of the factors that influence the effectiveness of vacuum extraction can be found in Subsection 13.3 of this report.

The soils at the ServAll site are expected to be readily treated by vacuum extraction. The soil is classified as a fine-to-medium sand with a porosity of approximately 30 percent. The soils also have a relatively low organic carbon content estimated to be in the range of 0.1 to 0.3 percent by weight. Soils high in organic matter tend to adsorb VOCs more tightly, increasing the time required for extraction. Therefore, soils with low organic carbon content are ideal for vacuum extraction.

Implementation of vacuum extraction at the site would begin with a pilot study to provide information necessary for final design of the system. A pilot study would involve installing a vacuum extraction well at the site. The system would be operated for a minimum of two weeks and not more than two months. The pilot study would gather physical and chemical data required to design and run a full-scale system. Information from the pilot study would be used to evaluate the adequacy of the existing asphalt cover at limiting air infiltration near the extraction well, provide data for accurate full-scale cost estimation, estimate the time for remediation, assess effects on the water table, test vapor phase treatment, and evaluate other parameters needed to design and run a full-scale system.

Preliminary design calculations conducted for cost-estimating purposes determined that three venting wells would be installed in soils to vent the vadose zone at the site. Figure 14-2 shows the layout of the VES used for preliminary design and cost-estimating purposes. This network is based on a radius of influence for each well of approximately 40 feet. Locations of the wells were chosen to influence an area greater than the expected extent of contamination because of the uncertainty involved with determining contaminated soil volumes.

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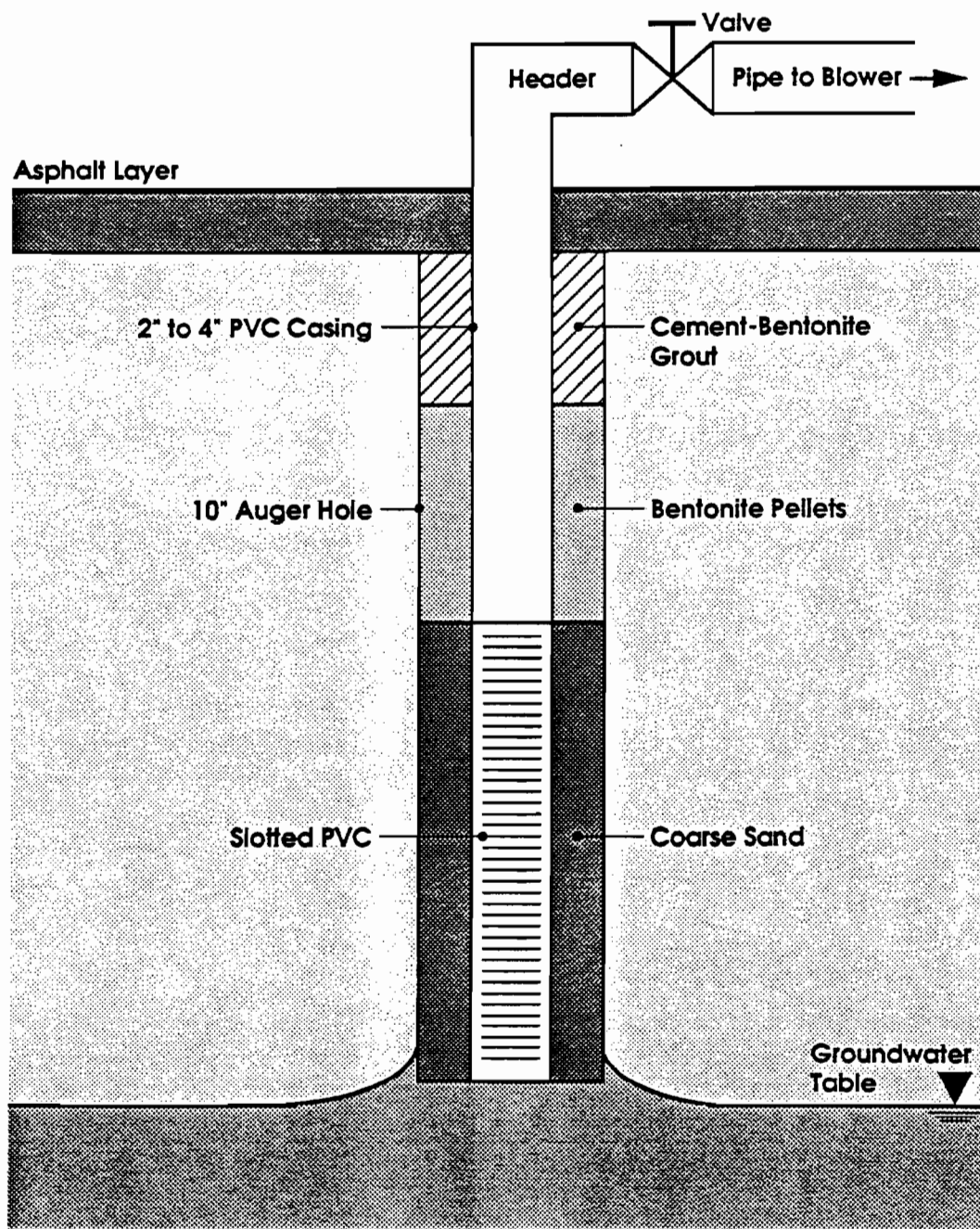


FIGURE 14-3
TYPICAL VACUUM EXTRACTION WELL
SERVALL LAUNDRY SITE
BAYSHORE, NEW YORK
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During well installation, soil samples would be collected and analyzed to further define the contaminated zone at the site. Figure 14-3 illustrates a typical vacuum extraction well. Groundwater is generally extracted along with the soil vapor.

The extracted vapor/liquid mixture is pumped to a vapor/liquid separator. The two streams are then sent to vapor and liquid phase carbon absorbers to remove contaminants. For cost estimating purposes, it was assumed that off-gases would require treatment prior to discharge to the atmosphere. The actual determination of whether off-gas treatment would be required would be determined during the design phase. The decision would include estimation of emissions from the treatment and assessment to determine that the emissions are permissible. Activated carbon is commonly used for treatment of off-gases. Other off-gas treatment methods may be used in place of carbon adsorption, depending on the compounds present in the off-gas.

14.3.2 Hot Air or Steam Injection

The soil target cleanup levels for PCE and TCE of 5 and 6 ppb, respectively, can be difficult to achieve by using vacuum extraction wells alone. Removal of contaminants by vacuum extraction can be enhanced by injecting steam or hot air into wells surrounding the contaminated soils. Capital costs for the in situ treatment would be increased if hot air or steam injection were added; however, the required treatment time would be less. Hot air or steam injection at the ServAll site would be included as part of the remedial design, but would only be implemented after initial operation of the VES alone is evaluated and the necessity of improved contaminant removal is determined. Therefore, the capital cost for installing the hot air or steam injection system has not been included in the cost estimate for Alternative 5. Monitoring wells installed around the vapor extraction area can also be designed for use as hot air and steam injection wells.

14.3.3 Groundwater Extraction

Preliminary design of extraction systems for remedial alternatives involving groundwater extraction and treatment requires information about the nature and distribution of groundwater contamination, aquifer characteristics, and local land use. For the purposes of this evaluation, information from scientific literature was used and simplifying assumptions about site conditions were made. The final number of wells, well depths, screened intervals, and pumping rates will be determined during the design phase. This evaluation was conducted for cost estimating purposes only.

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The groundwater flow patterns under pumping conditions were estimated using CAPTURE, a simple two-dimensional model (see Appendix N). Use of this model required several simplifying assumptions concerning site conditions, the most important of which required using fully penetrating extraction wells. This assumption is reasonable because groundwater contamination extends from the water table to the bottom of the upper glacial aquifer near the source area. Because of the limitations of the current analysis, Jordan recommends additional aquifer characterization and groundwater flow simulation during the design phase (see Appendix N).

The source area groundwater extraction system consists of three extraction wells placed along residential roads south of the ServAll property (see Figure 14-4). These wells would pump a total of 115 gpm. The pumping rates are estimated to be 30, 35, and 50 gpm for wells E-1, E-2, and E-3, respectively. Treated water would be recharged to the aquifer via a recharge well directly upgradient of the site, which should increase the hydraulic gradient toward the extraction wells.

The resultant capture zone is approximately 400 feet wide and 2,000 feet long, including the area close to the source with the highest concentration of contaminants (see Figure 14-4). Pumping rates would be varied to move the location of stagnation points between wells so that all areas within the capture zone are remediated. Based on a 115 gpm flow rate, the system would remove one pore volume of the source plume every two years. Based on chemical properties of the contaminants, groundwater pumping rates, and site conditions, a contaminant removal efficiency of 35 percent with each pore volume removed was estimated. Details of these calculations are presented in Appendix O. Based on these calculations, groundwater contaminant concentrations would be reduced to levels below NYSWQRs after approximately 20 years of pumping.

14.3.4 Groundwater Treatment

The two groundwater treatment technologies retained following technology screening are air stripping and UV/oxidation. Both technologies can effectively treat VOCs; however, both would require pretreatment for removal of iron and manganese. Dissolved iron and manganese oxidize to a less soluble form and precipitate out of solution in the presence of air or other oxidants. This precipitate can foul the packing material in the air stripper or the UV lamps in the UV/oxidation reactor vessel, reducing the efficiency of the treatment systems and increasing costs. Iron and manganese concentrations from previous sampling suggests pretreatment would be required. This would be verified by sampling

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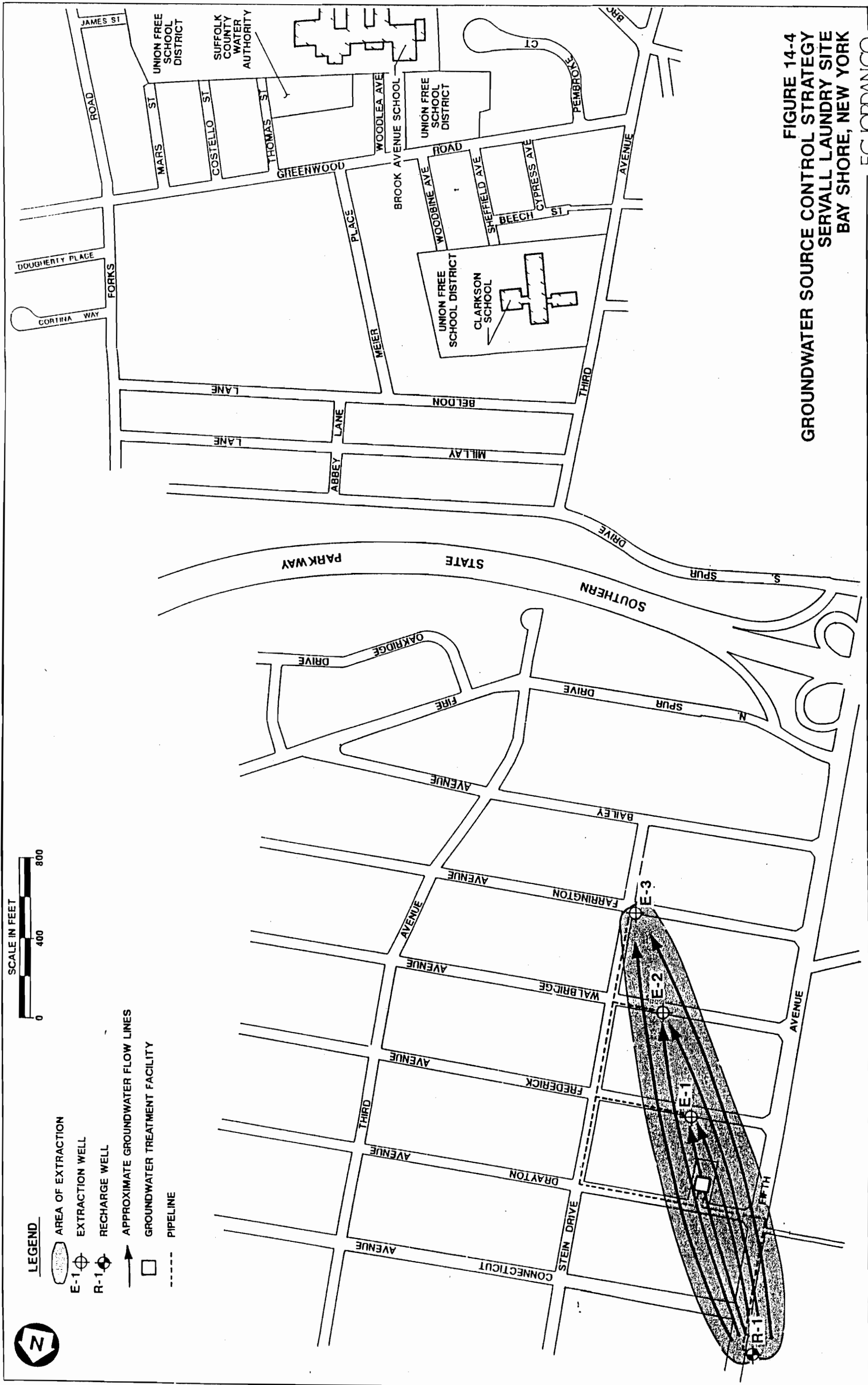


FIGURE 14-4
GROUNDWATER SOURCE CONTROL STRATEGY
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

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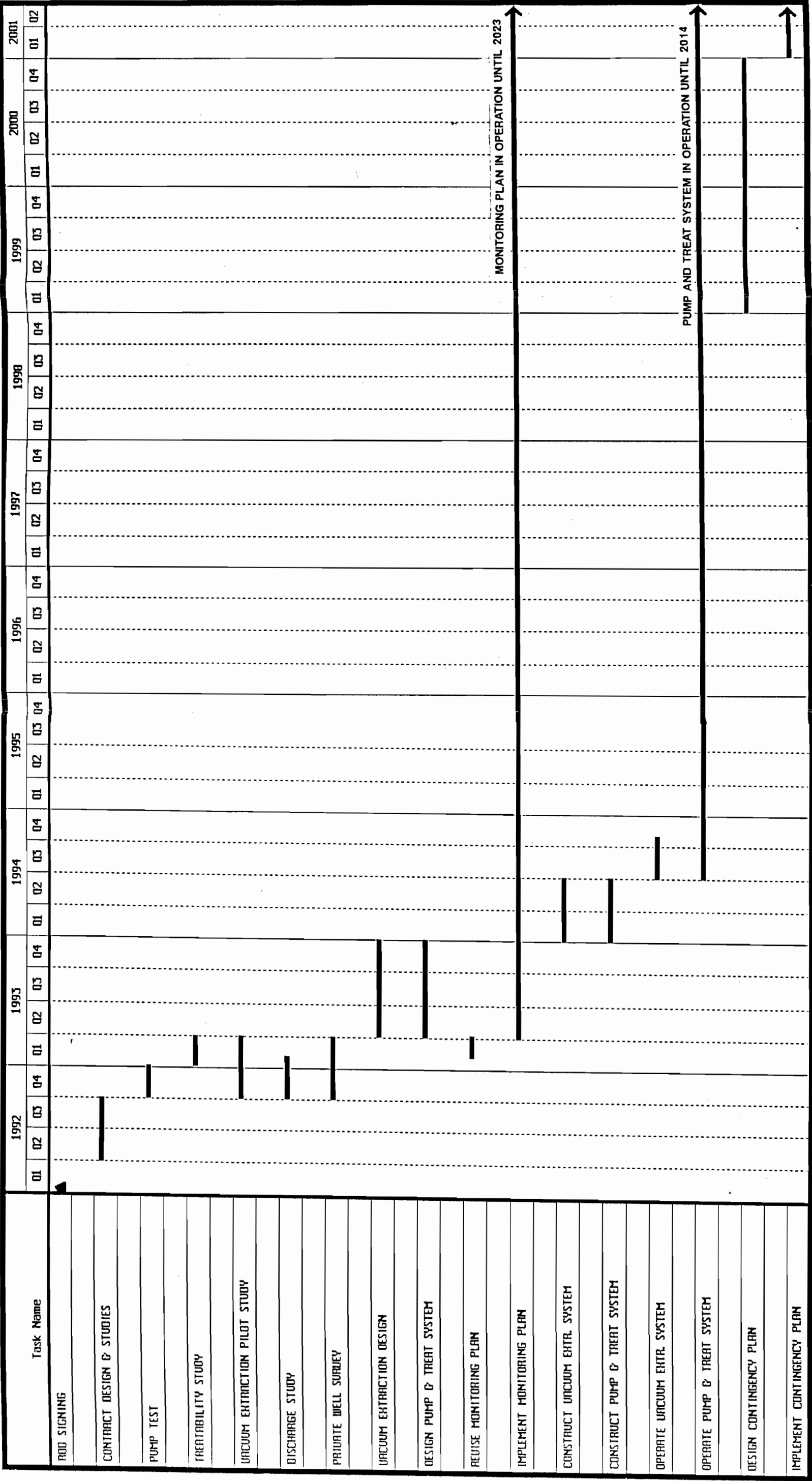


FIGURE 14-11
CONCEPTUAL PLAN IMPLEMENTATION SCHEDULE
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

ARARs Applicable or Relevant and Appropriate Requirements
ASP Analytical Services Protocols
APC air pollution control

bgs below ground surface

C Celsius
CAA Clean Air Act
CLP Contract Laboratory Program
cm/sec centimeters per second
CPF carcinogenic potency factor
CRQLs contract-required quantitation limits

D dilution prior to analysis
1,1-DCA 1,1-dichloroethane
1,1-DCE 1,1-dichloroethene
1,2-DCE 1,2-dichloroethene (total)
DL detection limit
DNAPL dense nonaqueous phase liquid
DOT Department of Transportation (U.S.)
DQO Data Quality Objective

E exceeded the calibration range
ELCD electrolytic conductivity detector

F Fahrenheit
FS Feasibility Study

gal gallon
GC gas chromatograph
gpm gallons per minute
GPR ground-penetrating radar

HASP Health and Safety Plan
H₂O₂ hydrogen peroxide

ID inside diameter

J estimated concentration
Jordan E.C. Jordan Company

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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

K_{oc}	organic carbon partition coefficient
KMnO ₄	potassium permanganate
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MDL	method detection limit
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
Mhz	Megahertz
mm Hg	millimeters of mercury
Mn ²⁺	manganous ion
MSL	mean sea level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NYDOH	New York Department of Health
NYSDEC	New York State Department of Environmental Conservation
NYSWQRs	New York State Water Quality Regulations
OD	outside diameter
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
PARCC	precision, accuracy, representativeness, completeness, comparability
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethene (perchloroethene)
PID	photoionization detector
POTW	publicly owned treatment works
ppb	parts per billion
ppm	parts per million
psi	pounds per square inch
PVC	polyvinyl chloride
QA/QC	quality control/quality assurance
QAPP	Quality Assurance Project Plan
RI	Remedial Investigation

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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

RCRA	Resource Conservation and Recovery Act of 1976
RfD	risk reference dose
SARA	Superfund Amendments and Reauthorization Act of 1986
SCDHS	Suffolk County Department of Health Services
SCGs	State Criteria and Guidelines
SCWA	Suffolk County Water Authority
ServAll	ServAll Laundry Site
SIR	subsurface interface radar
SITE	Superfund Innovative Technology Evaluation (program)
SPDES	State Pollution Discharge Elimination System
SVOCs	semivolatile organic compounds
TAGM	Technical and Administrative Guidance Memorandum
TBCs	other requirements to be considered
1,1,1-TCA	trichloroethane
TCE	trichloroethene
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TDS	total dissolved solids
TIC	tentatively identified compounds
TOC	total organic carbon
TSDF	Treatment, Storage, and Disposal Facility
TSS	total suspended solids
USEPA	U. S. Environmental Protection Agency
USGS	U. S. Geological Survey
UV	ultraviolet
VES	vacuum extraction system
VOCs	volatile organic compounds
VPC	vapor phase carbon
WP	Work Plan

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APPENDIX A-1

FIELD PROGRAM LOG

E.C. Jordan Co.



FIELD PROGRAM LOG

SHIFT 1 DURATION: 12/10/90 to 12/21/90

12/10/90

Jordan field personnel: Linda Healey (LH), FOL; Nadia Glucksberg (NG), HSO; Tom Francoeur (TF), GC operator; Kathy Hewitt (KH), Jim Andrews (JA), and Stewart Pearson (SP), Geologists.

WTD field personnel: Jon Weeks and Dan Zielazowski, Drillers; Scott Buttke and Roger Hoffman, Helpers; Rick O'Gorman, Mechanic/Runner.

NYSDEC field personnel: Edward Blackmer (EB), NYSDEC PM.

Jordan and WTD personnel arrive onsite to set up equipment storage and office, review Health and Safety Plan and requirements, and decon. drill rigs and equipment. FOL and NYSDEC PM work on access agreements and drilling permits.

WTD arrived with 3 supply trucks and 2 drill rigs. Rig 1 is a Diedrich 120; Rig 2 is a Diedrich 50.

12/11/90

Same personnel.

No drilling due to (1) multi-gas monitors (mgm) not working for 3-4 hours due to extreme cold weather, and (2) Schoeps has not moved machinery in back of his building. By the time the site was clear and the mgms working, it was 2 pm. Ed identified a DOT maintenance depot where rigs and support trucks can be parked over the shift break at Christmas. Moved the proposed locations of the "onsite" wells to Fredrick St. due to lack of space behind the Servall and Machinery Values bldgs.

12/12/90

Same personnel.

Rig 1 Started SB-1/MW-1 source area well location behind Servall Bldg. Drilled from 0-22 ft with cont. split spoon (ss) sampling, 22-60' with 5 ft int. ss sampling w/ 6.25-inch ID HSA. Thirteen drums of soil cuttings collected. Augers tightened up too much to move at 60'. Talked to driller about the need to drill with strong down pressure and not to clear auger flights, i.e., to reduce the amount of cuttings at the surface so the formation doesn't tighten around the augers. Pulled augers to prepare to switch to 6-inch ID casing.

Rig 2 Completed SB-2 and SB-3 beside (east side) the Servall bldg. with 4.25-inch ID HSA with cont. ss sampling from 0 - 22 ft bgs. Drilled SB-4 behind the Servall bldg. by the same method from 0 - 14 ft bgs. SB-4 penetrated a vault (old cesspool) at 1.5 ft bgs. 2-3 ft of open space in vault, with high vinyl chloride headspace.

Three ppm vinyl chloride in the breathing zone was measured. The HSO had the rig crew pull back to allow the ventilation fans to disperse the vapors, then continue the exploration.

SAMPLING Every other ss was sampled for GC screening. CLP soil samples shipped:

SB-1/MW-1

SVBSXX1XX801XX (FULL TCLP)
SVBSXX1X1201XX (TCL VOA & METALS)
SVBSXX1X2001XX (FULL TCL)

SB-2

SVBSXX2XX401XX (TCL VOA & METALS)
SVBSXX2XX801XX (TCL VOA & METALS)
SVBSXX2X1801XX (FULL TCL)

SB-3

SVBSXX3XX601XX (TCL VOA & METALS)
SVBSXX3X1201XX (TCL VOA & METALS)
SVBSXX3X1801XX (FULL TCL)
SVBSXX3X1801XD (FULL TCL (duplicate))

12/13/90

Same personnel; Cindy Sunquist visits for the day to do a health & safety audit and finds no concerns other than the lack of an accident report form (in an approved HASP).

RIG 1 Drove 6-inch ID casing in SB/MW-1 from ground surface to 66 ft bgs. Split spoons driven at 5 ft int.; no ss recovery below 55 ft.

RIG 2 Completed SB-4 to 22 ft bgs with 4.25-inch ID HSA and cont. ss sampling. Moved and drilled PZ-2, upgradient water table piezometer, on north side of Drayton Ave. w/ 4.25-inch ID HSA w/ 5 ft int. ss sampling; one CLP soil sample taken at the water table. PZ-2 drilled to 28 ft bgs; water table piezometer installed w/ 10 ft, 10-slot stainless steel (s st) screen at 27-17 ft bgs.

SAMPLING Every other ss screened w/ GC. CLP samples shipped:

SB-4

SVBSXX4X1401XX (TCL VOA & METALS and FULL TCLP)
SVBSXX4X1601XX (TCL VOA & METALS and MS/MSD extra volume)
SVBSXX4X1801XX (FULL TCL)

PZ-2

SVBSPZ2X2001XX (FULL TCL)

QS-1

SVQSXX1XXX01XX (AQUEOUS SAMPLER BLANK FULL TCL)

A note was made on the ARF to NYTEST that the GC screening of three samples from SB-4 (SVBSXX4....) showed ppm levels of our target volatile organic compounds.

12/14/90

Same personnel. S. Pearson back to Ptld. late aft.

RIG 1 Advanced 6-inch diameter casing in SB-1/MW-1 from 66 to 85 ft bgs. No sample recovery; no clay encountered at 85 ft.

RIG 2 Completed MW-2, upgradient well, on north side of Drayton Ave. (east of PZ-2) from 0-85 ft bgs with screened 4.25-inch ID HSA, taking GC water samples from 25 to 85 ft at 5 ft int. Installed MW-2 well with 10 ft, 10-slot s st screen at 83-73 ft.

SAMPLING All screened auger water samples screened on the GC. No CLP samples collected.

One of the generators from Kennebec Rental in Portland browned out, causing the ground fault circuit interruptor that is wired into the Double Duty Heat Killer fans to fail. We couldn't fix it, so a replacement rental generator was obtained from Taylor Rental in Bay Shore. Kennebec Rental agreed to charge us for only one generator.

12/15/90

Same personnel except for SP.

RIG 1 Advanced 6-inch ID casing to 90 ft bgs in SB/MW-1. WTD has only 90 ft of 6-inch with them. Started to get ss sample recovery with the 88 ft sample. Sampled ahead of the bottom of the casing to 104 ft bgs without encountering clay.

RIG 2 Completed installation of MW-2, deconned. Drilled MW-3 (located upgradient of the site, west of MW-2 on Drayton Ave.) from 0 -30 ft bgs with 4.25-inch ID HSA and no sampling. Rig 2 doing well using a strong down pressure and slow auger speed, not clearing the auger flights.

SAMPLING All screened auger water samples and every other ss sample screened with the GC. CLP soil sample collected but not shipped on Saturday. Hand delivered to NYTEST on Monday.

SB/MW-1

SVBSXX1X9501XX (TCL VOA & METALS)

12/16/90

Same personnel except for SP.

RIG 1 Installed MW-1 with 10 ft, 10-slot Schedule 80 PVC screen at 87.3 ft bgs. Deconned and drilled SB-5 behind the Servall bldg. to 14 ft bgs with 4.25-inch ID HSA and cont. ss sampling.

RIG 2 Completed MW-3 from 30 ft to 90 ft bgs with 4.25-inch ID screened HSA, sampling groundwater at 5 ft int. Installed MW-3 at 89.2 ft with 10 ft, 10-slot s st screen.

Don Patanjo, the water hauler, made a visit to the site to scope

out the program.

SAMPLING Every other soil sample and every water sample screened with the GC. CLP samples collected not shipped on Sunday; hand-delivered to NYTEST on Monday.

SB-5

SVBSXX5XX401XX (TCL VOA & METALS)
SVBSXX5X1001XX (TCL VOA & METALS)
SVBSXX5X1401XX (FULL TCLP)

12/17/90

Same personnel except for SP. Jordan SM Mark Seelen visits.

RIG 1 Completed SB-5 from 14 to 22 ft bgs with cont. ss sampling and 22 to 47 ft bgs w/ 5 ft. int. sampling.
Completed SB-6 behind the Servall bldg. from 0 to 22 ft bgs w/ 4.25-inch ID HSA and cont. ss sampling.

RIG 2 Completed PZ-4, (shallow water table piezometer of the eastern wing pair) on Fredrick Ave. from 0 to 27 ft bgs. Installed a water table piezometer with a 10 ft, 10-slot s st screen at 27 ft bgs.

Completed PZ-5 (shallow water table piezometer of the western wing pair, located on Fredrick Ave. west of PZ-4) from 0 to 27 ft bgs. Installed a water table piezometer with a 10 ft, 10-slot s st screen at 27 ft bgs. Drilled MW-5, western wing well, on Fredrick Ave. (west of PZ-5) from 0 to 25 ft. bgs w/ 4.25-inch ID screened HSA and no sampling.

SAMPLING Every other soil sample and every water sample screened with the GC. CLP soil samples collected and shipped to NYTEST:

SB-5

SVBSXX5X2001XX (FULL TCL)
SVBSXX5X4001XX (TCL VOA & METALS)

SB-6

SVBSXX6XX401XX (TCL VOA & METALS)
SVBSXX6XX401XD (TCL VOA & METALS){duplicate}
SVBSXX6XX601XX (FULL TCLP)
SVBSXX6X1201XX (TCL VOA & METALS)
SVBSXX6X2001XX (FULL TCL)

12/18/90

Same personnel except SP; M. Seelen leaves; Steve Turner arrives for GC and sampling audit#1.

RIG 1

Completed SB-7 behind the Servall bldg. from 0 to 22 ft bgs with 4.25-inch ID HSA w/ cont. ss sampling. Completed SB-8 behind the Servall bldg. from 0 to 22 ft bgs with 4.25-inch ID HSA w/ cont. ss

sampling.

EB and LH, in consultation with M. Seelen, decided to do a boring on the axis of the plume on Fredrick Ave. that goes to the clay, since it hadn't been encountered yet. Moved to Fredrick Ave (west of MW-4) and drilled axial well boring MW-6B from 0 to 22 ft with 4.25-inch ID HSA w/ cont. ss sampling, then pulled augers and drove 4-inch ID casing to 25 ft bgs.

RIG 2

Completed MW-5 from 25 to 85 ft bgs with screened auger sampling at 5 ft intervals. Installed a 10-foot, 10-slot s st screen at 85 to 75 ft bgs. Deconned and moved to MW-4, eastern wing well (west of PZ-4 on Fredrick Ave.) and drilled from 0 to 25 ft with 4.25-inch ID HSA w/ no samples.

Patanjo truck used to collect approx. 1000 gals.

SAMPLING

Every other soil sample and every groundwater sample screened with the GC. Ten CLP samples sent to NYTEST via Fed-X:

QS-2

SVQSXX2XXX01XX (FULL TCL - AQUEOUS SS SAMPLER BLANK)

SB-7

SVBSXX7XX601XX (TCL VOA & METALS)

SVBSXX7XX801XX (FULL TCLP)

SVBSXX7X1801XX (TCL VOA & METALS)

SVBSXX7X2001XX (FULL TCL)

SB-8

SVBSXX8XX401XX (TCL VOA & METALS)

SVBSXX8XX401XD (TCL VOA & METALS - DUPLICATE)

SVBSXX8X1001XX (FULL TCLP)

SVBSXX8X1401XX (TCL VOA & METALS)

SVBSXX8X2001XX (FULL TCL incl MS/MSD volume)

12/19/90

Same personnel except SP; Steve Turner leaves.

RIG 1

Drove 4-inch ID casing from 25 to 95 ft bgs in MW-6B. No samples taken between 40 and 90 ft bgs.

RIG 2

Completed MW-4 from 25 to 85 ft bgs with screened auger sampling at 5-foot intervals. Installed a well at w/ 10-foot, 10-slot s st screen at 85.2 to 75.2 ft bgs.

Patanjo truck used to collect approx 1000 gallons.

SAMPLING

All groundwater samples screened with the site GC.

12/20/90

Same personnel except SP. Jordan personnel JA and KH, NYSDEC PM, and WTD crew leave site in late afternoon.

RIG 1

Drove 4-inch ID casing in MW-6B from 95 to 110 ft bgs (with 5-ft int. sampling from 95 to 100 ft and continuous sampling from 100 to 112 ft). Traces of gray clay in the 110-112 ft ss sample. Left casing in the ground with casing capped until Shift 2.

RIG 2

No drilling. Finished installation of protective casings.

SAMPLING

All soil samples from MW-6B screened with the site GC.

Taylor Rental generator returned in early AM.

12/21/90

Jordan crew TF, NG, and LH leave site late morning.

Personnel usage during Shift 1:

- 12 days - LH, TF, NG
- 11 days - KH, JA
- ≈ 58 Person-days incl travel

SHIFT 2

DURATION: 1/2/91 - 1/11/91

Jordan field personnel: Linda Healey (LH), FOL; Nadia Glucksberg (NG), HSO; Tom Francoeur (TF), GC operator; Gerald Fordham (GF), and Jim Andrews (JA), Geologists.

WTD field personnel: Jon Weeks and Dan Zielazowski, Drillers; Scott Buttke, Roger Hoffman, and David Nowicki, Helpers.

NYSDEC field personnel: Edward Blackmer (EB), NYSDEC PM.

1/2/91

LH (FOL) and EB, (NYSDEC PM) arrived onsite. Picked up NYSDEC TIPS at Fed-X. EB, LH, and M. Seelen discussed installing a second axial well adjacent to MW-6B (MW-6A) with screened augers so we will have comparable data between 40 and 90 ft bgs. WTD personnel arrived and deconned rig, which had been stored at DOT depot during the shift break. Filed paperwork.

1/3/91

Jordan personnel arrived: TF, NG, and GF.

Picked up Taylor Rental generator.

LH checked truck restriction signs on streets near the South Shore Mall with the Bay Shore 3rd precinct police, Town of Islip Traffic Safety and Public Safety depts.

Talked with Jeff Pickett about options for dealing with WTD if they find they have problems drilling to greater than 110 ft bgs (90+ ft into the saturated zone). He said that the Diedrich 120 (Rig 1) should have no problems.

RIG 1

Drove 4-inch ID casing in MW-6B from 110 to 117 ft bgs with cont. ss sampling. Encountered greenish-gray silty clay at 115 ft bgs. Took on extra sample to be sure. Put a cap on MW-6B and moved approx. 12 ft east of MW-6B and drilled MW-6A from 0 to 23 ft bgs with 4.25-inch ID HSA with out sampling.

RIG 2

Set up at MW-10, eastern wing well on the east side of East Forks Rd. just south of the South Shore Mall entrance on the grass verge. Drilled from ground surface to the top of the saturated zone at 20 ft bgs with 4.25-inch ID HSA w/ no sampling.

SAMPLING

Soil samples from MW-6B screened with the field GC.

1/4/91

Same personnel.

RIG 1

Drilled MW-6A from 23 to 93 ft bgs with screened auger sampling at 5-ft int. Installed well at 63 ft bgs with s st 10-foot, 10-slot screen from 63 to 53 ft bgs. Moved over and installed a well in MW-6B with a 10-foot, 10-slot s st screen from 35.2 to 25.2 ft bgs. MW-6B is screened in and just below the water table.

RIG 2

Drilled from 20 to 90 ft bgs in MW-10. Installed a well with a 10-foot, 10-slot s st screen from 89.5 to 79.5 ft bgs. Observed some gray clay smeared on the teeth of the lead auger when the augers were pulled.

Collected 2000+ gallons of purge water in Patanjo's water trucks.

SAMPLING

All water samples screened with the site GC.

1/5/91

Same personnel.

RIG 1

Finished well installations, prot. casings, picking up drums. Deconned rig, moved to MW-7 axial well location, on the north side of Walbridge Ave., eastern end of the street. Drilled from 0 to 25 ft bgs with 4.25-inch ID HSA with no sampling.

RIG 2

Deconned rig and moved to MW-9, the western wing well on the grounds of Bay Shore Middle School. Drilled from 0 to 25 ft bgs.

SAMPLING

Sampled 6 drums, #1, 13, 17, 19, 22, 24, (representative drums from the following borings: SB/MW-1, MW-3, SB-5, PZ-2, and PZ-5) and screened the samples with the site GC. Two of the drums from SB/MW-1 were under the 100 ppb limit (so they are classified non-hazardous, the others were ND).

1/6/91

Same personnel.

RIG 1

Completed MW-7 from 25 to 113 ft bgs, obtaining screened auger samples at 5-foot int. Installed MW-7 with a 10-foot, 10-slot s st screen from 112 to 102 ft bgs. Deconned rig.

RIG 2

Completed MW-9 from 25 to 90 ft bgs, obtaining screened auger samples at 5-foot intervals. Installed MW-9 with a 10-foot, 10-slot screen from 88.9 to 78.9 ft bgs. Observed and collected a jar of gray-green clayey silt that was smeared on the auger flights and teeth of the lead auger. Deconned rig and moved to the axial MW-11 location at the Bay Shore Middle School. Drilled from 0 to 25 ft with 4.25-inch ID HSA with no sampling.

Collected 2000+ gallons of purge water in Patanjo's water trucks.

SAMPLING

All water samples screened with the site GC.

1/7/91

Same personnel.

RIG 1

Moved to MW-8 location, the axial well on the south side of Bailey Ave., west of the intersection of Stein Dr. and Bailey Ave. Drilled from 0 to 113 ft bgs. Restricted recharge in the 113 ft. screened auger purge. Installed MW-8 with a 10-foot, 10-slot s st screen from 105 to 95 ft bgs.

RIG 2

Completed MW-11 from 25 to 90 ft bgs. A small amount of gray clay was observed on the flights of the lead auger. Installed MW-11 with a 10-foot, 10-slot s st screen from 89.5 to 79.5 ft bgs. Deconned rig and moved to MW-12 location, the western wing well on the southern side of the southbound lane of the Southern State Parkway. Well is located on the grass near the woods, approx. 80' east of electric light pole #1048. Drilled from 0 to 20 ft bgs with 4.25-inch ID HSA with no sampling.

Collected 2000+ gal. of purge water in Patanjo's water trucks.

SAMPLING

All water samples screened with the site GC.

1/8/90

Same personnel.

RIG 1

Rig deconned and set up at MW-13, the axial well on the southern side of the southbound lane of the Southern State Parkway. Well is located on the grass near the woods close to electric light pole #1052. Drilled from 0 to 20 ft bgs with 4.25-inch ID HSA with no sampling.

RIG 2

Completed MW-12 from 20 to 90 ft bgs, taking screened auger samples at 5-foot intervals. Had some trouble turning the augers at 85 ft bgs prior to taking the screened auger sample. Pulled back augers

to 75 ft bgs and drilled to 90 ft bgs, skipping the 85 ft sample. Installed well with a 10-foot, 10-slot screen from 89.5 to 79.5 bgs. Deconned rig and moved to MW-14 location, further down the grass verge on the Parkway near electric light pole #1056. MW-14 is the eastern wing well. Drilled from 0 to 20 ft bgs with 4.25-inch ID HSA with no sampling.

Collected 2500+ gallons of purge water in Patanjo's water trucks.

SAMPLING

All screened auger groundwater samples screened with the site GC.

Also sampled 4 representative drums, #18, 20, 28, and 38, from PZ-4, MW-4, MW-6, and MW-7. All ND or trace, none are hazardous. EB and LH determined that the drums sampled so far are representative of all of the potentially contaminated borings. Note that the soil from some of the soil borings was disposed in the open cesspools drilled through in SB-4 and SB-7. Since the GC screening results for the drums sampled are all below the 100 ppb (total volatiles) limit established by NYSDEC, all of the drums collected can be disposed in a non-hazardous facility.

1/9/91

Jordan, WTD, and NYSDEC at site ready to work at starting time; weather freezing rain and sleet. WTD felt the weather conditions would make drilling hazardous, so LH and EB agreed on a rain day.

S. Turner arrived at site in late afternoon to conduct a second sampling audit.

1/10/91

Same personnel; S. Turner left at 1100 to return to Portland.

RIG 1

Completed MW-13 from 20 to 98 ft bgs, where recharge was restricted on the 98 ft screened auger sample. Installed MW-13 with a 10-foot, 10-slot screen from 98 to 88 ft bgs.

RIG 2

Completed MW-14 from 20 to 95 ft bgs, where recharge was restricted on the 95 ft screened auger sample. Installed MW-14 with a 10-foot, 10-slot screen from 94.5 to 84.5 ft bgs.

Collected 2500+ gallon of purge water in Patanjo's trucks.

SAMPLING

All screened auger groundwater samples screened with the site GC.

The following hand auger samples were collected for GC screening and CLP analysis and shipped to NYTEST:

QS-3 SVQSXX3XXX01XX (AQUEOUS FULL TCL - HAND AUGER SAMPLER BLANK)
SS-1 SVSSXX1XX101XX (FULL TCL)
SS-2 SVSSXX2XX101XX (TCL VOA & METALS)
SS-3 SVSSXX3XX201XX (TCL VOA & METALS)
SS-4 SVSSXX4XX201XX (FULL TCL)
SS-5 SVSSXX5XX101XX (TCL VOA & METALS)
SVSSXX5XX101XD (TCL VOA & METALS - DUPLICATE)

GC screening indicated ppm levels of PCE in the SS-3 sample.

1/11/91

WTD and Jordan personnel deconned, packed up and left site for the shift break 1 day early because Patanjo could not supply two trucks for today.

Taylor Rental generator returned early AM.

Personnel usage during Shift 2:

- 10 days - LH
- 9 days - TF, NG, JF, JA
- ≈ 46 Person-days incl. travel

THIRD SHIFT

DURATION: 1/14/91 - 1/20/91

Jordan field personnel: Linda Healey (LH), FOL; Nadia Glucksberg (NG), HSO and Geologist; Tom Francoeur (TF), GC operator; and Jim Andrews (JA), Geologist.

WTD field personnel: Jon Weeks and Dan Zielazowski, Drillers; Scott Buttke, Roger Hoffman, and David Nowicki, Helpers.

NYSDEC field personnel: Edward Blackmer (EB), NYSDEC PM.

1/14/91

LH drove Ryder truck from Portland, ME to the site.

1/15/91

WTD crew arrives 0900 and performs rig maintenance.

Jordan crew arrives 1400 and packs minivans, gets the GC ready.

RIG 1

Moved to MW-15 location on the east side of Meier Place just south of the intersection of Meier Place and Beldon Lane. The Meier Place well is on the axis of the plume south of the Southern State Parkway. Checked with the Beldon Point Sewage Treatment plant to have Rich Marrero come out to mark the sewer line. Subsequently placed the well on the lawn of the house on the corner because of the presence of both gas and sewer lines in the street. Drilled from 0 to 20 ft bgs in MW-15 with 4.25-inch ID HSA with no sampling.

RIG 2

Moved to MW-16 location on the south side of Abrew St. in front of the third house west of the intersection of Abrew St. and East Forks Rd. MW-16 is the southernmost axial well, located at the far end of the plume (farthest downgradient from the site). Drilled from 0 to 20 ft bgs with 4.25-inch ID HSA with no sampling.

SAMPLING

No samples collected. TF worked to get the GC ready for sampling tomorrow.

1/16/91

Same personnel.

LH and EB discuss with M. Seelen installing another upgradient well in order to obtain comparable GC data for the interval between 85 ft bgs and the Gardner Clay, estimated at approx 112-115 ft bgs (based on samples from the deep boring on Fredrick Ave.). Mark believes that there is a data gap in this interval. EB agrees that

we will drill to 90 ft bgs without sampling, then continue to advance the boring to 115 ft bgs, obtaining screened auger samples at 5-foot intervals. If the GC screening indicates that target or unknown compound concentrations in groundwater from the sampled zone exceed 100 ppb, then we will install a monitoring well in the boring. If, not, the boring will be backfilled. The boring will be done by Rig 1, the Diedrich 120. If a well is installed, it will be named MW-3A, and the present MW-3 will be renamed MW-3B.

RIG 1

Completed MW-15 to 98 ft bgs. Installed well w/ s st 10-foot, 10-slot screen from 97 to 87 ft bgs. Deconned the rig and tools and moved to MW-3A location, approx. 15 ft east of MW-3B, on the north side of Drayton Ave. Drilled from 0 to 27 ft bgs with 4.25-inch HSA and no sampling.

RIG 2

Completed MW-16 to 95 ft bgs. Installed well w/ s st 10-foot, 10-slot screen from 94.3 to 84.3 ft bgs.

Returned the Taylor Rental generator.

Collected 1500+ gallons of purge water in Patanjo's trucks.

WELL DEVELOPMENT

PZ-2 Nowicki pumped and surged 100+ gallons from PZ-2 to get a sample est. at <50 NTU (based on visual examination by EB).

MW-2 Nowicki pumped 75 gallons before LH asked him to stop because rainwater was running into the well. MW-2 not sufficiently developed yet.

SAMPLING

All screened auger groundwater samples screened with the site GC.

1/17/91

Same personnel. NG returns to Portland at noon.

LH asked M. Seelen send down a description and diagram of the airlift method of well development at EB's request. LH went over the method with EB, to assure him that the method does not aerate the screened section of the well or the sandpack. Discussed which wells are clean enough to discharge development purge water to storm drains. EB decided that 5 ppb total avg. VOCs in the screened interval (based on GC screening) would be the break-off point. Purge water from wells MW-2, MW-3B, MW-5, MW-9, MW-10, MW-12, MW-14 and PZ-2 could be discharged to storm drains or to the ground surface (the latter at the Southern State Parkway wells only). All other development purge water is to be collected in Patanjo's water truck.

RIG 1

Drilled from 27 to 88 ft bgs in MW-3A with no sampling. Collected

screened auger samples at 5-foot intervals from 88 to 123 ft bgs. LH and EB authorize installation of the well at 122 ft bgs. Installed well w/ s st 10-foot, 10-slot screen from 122 to 112 ft bgs. Deconned rig and tools.

RIG 2

Deconned the rig and tools and completed flush mounts and drum staging from other explorations.

Collected 1000+ gallons of purge water in one of Patanjo's trucks.

WELL DEVELOPMENT

D. Nowicki finished pumping MW-2 until the turbidity was estimated by EB as less than 50 NTUs.

D. Zielazowski and Roger Hoffman went shopping for parts to assemble two airlift-type units (using nitrogen instead of air) that will be used to develop the deep wells. They returned with supplies, including two regulators, pressure airline tubing and 5 "T" tanks of nitrogen.

Developed MW-12 with the airline, pumping 195+ gallons at 2.5 gpm. A bailer was placed in the well below the pump intake pipe to surge the screened area. The well intake pipe was adjusted by the FOL so that it was positioned a few feet above the screened interval. The well was developed until the recharge turbidity was less than 50 NTUs.

SAMPLING

All screened auger sampled were analyzed with the site GC.

1/18/91

Same personnel. TF packed up the GC and left at 0830 to return to Portland.

WELL DEVELOPMENT

Wells MW-1, MW-3B, MW-4, MW-5, MW-6A, MW-6B, MW-7, MW-8, MW-14, PZ-4, and PZ-5 developed. Water from all of these wells had an estimated turbidity <50 NTU after development, with the exception of MW-7, which had an estimated turbidity >150 NTUs due to colloidal clay in suspension following pumping of 440+ gallons of purge water.

Patanjo left a 3500 gallon water truck onsite; agreed to leave it overnight, so it was used on 1/18/91 and 1/19/91. 3000+ gallons of purge water collected over the two day period.

1/19/91

Same personnel.

WTD crew finished all well development, installed all flush mounts, staged all drums, and packed up prior to 1830. Departed at 1845.

WELL DEVELOPMENT

Wells MW-9, MW-10, MW-11, MW-13, MW-15, MW-16, and MW-3A developed. Water from all of these wells had an estimated turbidity <50 NTU after development.

1/20/91

Remaining personnel (LH, JA, and EB) packed up the Ryder truck and departed at 1330.

1/21/91

LH drove the Ryder truck back to Portland.

Personnel usage during Shift 3:

- 8 days (incl. 2 driving days) - LH
- 6 days - JA
- 4 days - TF
- 3 days - NG
- ≈ 21 Person-days incl. travel

FOURTH SHIFT

DURATION: 2/4/91 - 2/8/91

E.C. Jordan personnel: Linda Healey, FOL (LH); Willard Dyché Sampling FOL (WD); Tom Hillman, (TH); Tina LeBlanc, (TL)

NYSDEC personnel: Edward Blackmer (EB), NYSDEC PM.

2/4/91

GROUNDWATER SAMPLING

LH and EB arrive at site at 1415. WD, TH, and TL arrive at 1545, unload van, charge all equipment.

2/5/91

GROUNDWATER SAMPLING

Sampler blanks of Keck pumps #2 and #4 and the two bailers used were obtained:

Keck #2 SVQBXX1XXX01XX TCL VOC (524.2), SVOC, METALS,
TOC, TDS, TSS, TOT. ALK.

KECK #4 SVQBXX2XXX01XX TCL VOC (524.2), SVOC, METALS,
TOC, TDS, TSS, TOT. ALK.

TRIP BLANK SVQTX1XXX01XX TCL VOC (524.2)
was shipped with the samples.

Groundwater samples obtained:

MW-1	SVMWXX1XXX01XX	TCL VOC (524.2), SVOC, METALS
MW-1	SVMWXX1XXX01XD	TCL VOC (524.2), SVOC, METALS
MW-2	SVMWXX2XXX01XX	TCL VOC (524.2), SVOC, METALS
MW-3B	SVMWXX3BXX01XX	TCL VOC (89-1)*, SVOC, METALS, TOC, TDS, TSS, TOT. ALK.
MW-11	SVMWX11XXX01XX	TCL VOC (524.2)*, SVOC, METALS
MW-13	SVMWX13XXX01XX	TCL VOC (89-1), SVOC, METALS, TOC, TDS, TSS, TOT. ALK.
MW-13	SVMWX13XXX01MS	TCL VOC (89-1), SVOC, METALS, TOC, TDS, TSS, TOT. ALK.
MW-13	SVMWX13XXX01MD	TCL VOC (89-1), SVOC, METALS, TOC, TDS, TSS, TOT. ALK.
MW-15	SVMWX15XXX01XX	TCL VOC (89-1), SVOC, METALS, TOC, TDS, TSS, TOT. ALK.
MW-15	SVMWX15XXX01XD	TCL VOC (89-1), SVOC, METALS, TOC, TDS, TSS, TOT. ALK.
MW-16	SVMWX16XXX01XX	TCL VOC (89-1), SVOC, METALS, TOC, TDS, TSS, TOT. ALK.

*The MW-3B sample should have been analysed for VOCs using the 524.2 method, but was mistakenly listed on the Analytical Request

Form (ARF) as 89-1; the MW-11 sample should have been analysed for VOCs using the 89-1 method, but was mistakenly listed on the ARF as 524.2.

All samples shipped to NYTEST Environmental 2/5/91 via Fed-X Airbill # 9123513641.

Patanjo truck collected 250 gallons of purge water.

2/6/91

Same personnel.

GROUNDWATER SAMPLING

Groundwater samples obtained:

MW-8	SVMWXX8XXX01XX	TCL VOC (89-1), SVOC, METALS
MW-7	SVMWXX7XXX01XX	TCL VOC (89-1), SVOC, METALS TOC, TSS, TDS, TOT. ALK.
MW-4	SVMWXX4XXX01XX	TCL VOC (89-1), SVOC, METALS
MW-3A	SVMWXX3AXX01XX	TCL VOC (89-1), SVOC, METALS
MW-5	SVMWXX5XXX01XX	TCL VOC (524.2), SVOC, METALS
MW-9	SVMWXX9XXX01XX	TCL VOC (524.2), SVOC, METALS
MW-10	SVMWX10XXX01XX	TCL VOC (524.2), SVOC, METALS

TRIP BLANK SVQTX2XXX01XX TCL VOC (524.2)
was shipped with the samples.

All samples shipped to NYTEST Environmental 2/6/91 via Fed-X Airbill #

Patanjo truck collected 500 gallons.

2/7/91

Same personnel.

GROUNDWATER SAMPLING

Groundwater samples obtained:

MW-6B	SVMWXX6BXX01XX	TCL VOC (524.2), SVOC, METALS
MW-6A	SVMWXX6AXX01XX	TCL VOC (89-1), SVOC, METALS TOC, TSS, TDS, TOT. ALK.
MW-12	SVMWX12XXX01XX	TCL VOC (524.2), SVOC, METALS
MW-14	SVMWX14XXX01XX	TCL VOC (524.2), SVOC, METALS

TRIP BLANK SVQTX3XXX01XX TCL VOC (524.2)
was shipped with the samples.

HAND AUGER SAMPLING

Surface soil samples obtained:

SS-6	SVSSXX6XX301XX	TCL VOC (89-1), TCL METALS
SS-6	SVSSXX6XX401XX	TCL VOC (89-1), TCL METALS
SS-6	SVSSXX6XX601XX	TCL VOC (89-1), TCL METALS

One drum of water from MW-6A collected and pumped by Patanjo.

All samples shipped to NYTEST Environmental 2/7/91 via Fed-X Airbill #9123513652.

TRAILER DEMOBILIZATION

Called J. Hutchings and asked him to send a letter to Gelco to have the site trailer removed on Feb. 14 or 15. Closed down the site trailer, disconnected phone line, called rubbish, porta-john, and water cooler vendors, notified electrician to disconnect power prior to trailer removal.

Field crew pack the truck and are ready to leave site by 1400 hours. EB and JA leave at 1330. LH waits for Patanjo then delivers samples to Fed-X office prior to travelling back to Portland, ME.

Personnel usage during Shift 4:

- 4 days - LH
- 5 days - WD, TH, TL
- ≈ 19 Person-days incl. travel

FIFTH SHIFT

DURATION: 2/11/91 - 2/13/91

ECJ Personnel: Linda Healey (LH), FOL; Nadia Glucksberg (NG), HSO.

NYSDEC personnel: Edward Blackmer (EB), NYSDEC PM.

Equipment: NYSDEC TIP #2, Hermit 1000B (Ser. No. 1KB-621), 20-psi Transducer (No. 5039), slug, WL meter.

2/11/91

Arrived ISLIP airport, picked up equipment at Fed-X in Bohemia.

Linda and Nadia performed falling and rising head slug tests (permeability tests) on the following wells. Tests were performed on the clean wells first.

MW-10

MW-9

MW-12

MW-14

MW-5

MW-2

MW-1

MW-16

MW-11

MW-13

2/12/91

Linda and Nadia performed falling and rising head slug tests (permeability tests) on the following wells:

MW-3A

MW-3B

MW-9 (redone due to erased file)

MW-15

MW-8

MW-7

MW-4

MW-6A

MW-6B

1300-1520 - One round of water level measurements was performed. Water levels were measured in all of the monitoring wells and piezometers with an electronic water level meter.

Packed up the remaining equipment and supplies in the trailer; unwired the telephone line and jack; left the keys for Gelco (outside as requested) who will pick up the trailer on 2/15/91. Returned the equipment to the Fed-X office in Bohemia, NY for shipment to Portland.

2/13/91

Returned to the Fed-X office at their request to redo the paperwork prior to flying back to Portland. Reportedly, the FAA has increased security and tightened shipping regulations due to the ongoing conflict in the Middle East.

ECJ personnel returned to Portland, ME.

Personnel usage during Shift 5:

- 2 days - LH, NG
- ≈ 4 Person-days incl. travel

SIXTH SHIFT**DURATION: 3/4/91 - 3/7/91**

ECJ Personnel: Willard Dyche (WD), acting FOL; Vickie Miller (VM), sampler; Paul Smith (PS), sampler; Nancy Roka (NR), sampler.

NYSDEC personnel: Edward Blackmer (EB), NYSDEC PM.

Equipment: Keck pumps # 2 and # 4; YSI in-line tri-par meters # 3 and # 4; NYSDEC TIPS # 1 and # 2; stainless steel bailers; and equipment to perform Winkler titration for dissolved oxygen analyses.

GROUNDWATER SAMPLING**3/4/91**

ECJ crew arrives at site.

3/5/91

ECJ crew arrives onsite 0700. All equipment calibrated and calibration sheets filled out.

Sampler blanks of Keck pumps #2 and #4 and the two bailers used were obtained. Water from ABB staging was used.

Keck #2 SVQBXX1XXX02XX TCL VOC (89-1), SVOC, METALS,
TOC, TDS, TSS, TOT. ALK.

KECK #4 SVQBXX2XXX02XX TCL VOC (89-1), SVOC, METALS,
TOC, TDS, TSS, TOT. ALK.

TRIP BLANK SVQTX1XXX02XX TCL VOC (524.2)
was shipped with the samples. CVS bottled steam-distilled water was used.

Groundwater samples obtained:

MW-1	SVMWXX1XXX02XX	TCL VOC (524.2), SVOC, METALS
MW-1	SVMWXX1XXX02XD	TCL VOC (524.2), SVOC, METALS
MW-2	SVMWXX2XXX02XX	TCL VOC (524.2), SVOC, METALS
MW-3B	SVMWXX3BXX02XX	TCL VOC (524.2), SVOC, METALS, TOC, TDS, TSS, TOT. ALK.*
MW-11	SVMWX11XXX02XX	TCL VOC (89-1), SVOC, METALS
MW-13	SVMWX13XXX02XX	TCL VOC (89-1), SVOC, METALS, TOC, TDS, TSS, TOT. ALK.
MW-15	SVMWX15XXX02XX	TCL VOC (89-1), SVOC, METALS, TOC, TDS, TSS, TOT. ALK.
MW-15	SVMWX15XXX02XD	TCL VOC (89-1), SVOC, METALS, TOC, TDS, TSS, TOT. ALK.

MW-16 SVMWX16XXX02XX TCL VOC (89-1), SVOC, METALS,
TOC, TDS, TSS, TOT. ALK.
*MS/MSD volume collected at MW-3B.

All samples shipped to NYTEST Environmental 3/5/91 via Fed-X.

Patanjo truck collected 250+ gallons of purge water.

3/6/91

Same personnel.

GROUNDWATER SAMPLING

Groundwater samples obtained:

MW-8	SVMWXX8XXX02XX	TCL VOC (89-1), SVOC, METALS
MW-7	SVMWXX7XXX02XX	TCL VOC (89-1), SVOC, METALS TOC, TSS, TDS, TOT. ALK.
MW-4	SVMWXX4XXX02XX	TCL VOC (89-1), SVOC, METALS
MW-3A	SVMWXX3AXX02XX	TCL VOC (89-1), SVOC, METALS
MW-5	SVMWXX5XXX02XX	TCL VOC (524.2), SVOC, METALS
MW-9	SVMWXX9XXX02XX	TCL VOC (524.2), SVOC, METALS
MW-10	SVMWX10XXX02XX	TCL VOC (524.2), SVOC, METALS
MW-6B	SVMWXX6BXX02XX	TCL VOC (524.2), SVOC, METALS
MW-6A	SVMWXX6AXX02XX	TCL VOC (89-1), SVOC, METALS TOC, TSS, TDS, TOT. ALK.
MW-12	SVMWX12XXX02XX	TCL VOC (524.2), SVOC, METALS
MW-14	SVMWX14XXX02XX	TCL VOC (524.2), SVOC, METALS

TRIP BLANK SVQTX2XXX02XX TCL VOC (524.2)
was shipped with the samples.

All samples shipped to NYTEST Environmental 2/6/91 via Fed-X.

Patanjo truck collected 500+ gallons.

Personnel usage during Shift 6:

- 4 days - WD, VM, PS, NR
- ≈ 16 Person-days incl. travel

END OF GROUNDWATER SAMPLE ROUND TWO. PHASE I FIELDWORK IS
COMPLETE. START DATE 12/10/90. FINISH DATE 3/6/91. APPROXIMATELY
164 PERSON-DAYS WERE USED TO COMPLETE THE WHOLE FIELD PROGRAM.

APPENDIX A-2

BORING LOGS

E.C. Jordan Co.



E.C. JORDAN Co.						MW- 1						
Project Remedial Investigation/Feasibility Study						Site ServAll Laundry			Project No. 6205-21			
Client NYSDEC						Logged By K. Hewitt		Checked By NSG		Ground Elev 65.47		
Drilling Contractor WTD				Driller's Name Jon Weeks		Rig Type D-120		Start Date 12/12/90		Finish Date 12/16/90		
Drilling Method HSA / Drive & Wash				Protection Level Modified D w/ vent.		P.I.D. (eV) 10.0		Casing Size 6 in		Auger Size(in) 4.25 ID		
Soil Drilled (ft) 90		Rock Drilled (ft) NA		Total Depth (ft) 104		Depth to Groundwater (ft) / Date 20.63 / 2-12-91			Piez. Boring Well ☐ ☐ ☒			
DEPTH(Feet)	SAMPLE NO. & PENETRATION / RECOVERY (ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE WELL		
5	S-1 1.5/1.2		24-16-13			Asphalt and roadbed, 6 in thick. Tan to brown medium SAND and GRAVEL, trace fine sand, trace coarse sand, trace debris; poorly graded; medium dense; moist.	SP	140	BKG	42		
	S-2 2.0/1.1		12-7-7-9			BKG		39.5				
	S-3 2.0/1.1		2-4-10-10			290		BKG	87.5			
	S-4 2.0/1.0		4-7-9-11			BKG		96.1				
	S-5 2.0/1.3		5-15-30-45			5+		BKG				
10	S-6 2.0/1.3		12-20-38-25			Tan medium SAND with little gravel; well graded; dense; moist; dense. Dark red-brown lamination a few mm thick.	SP/SW	BKG	11.3		TCLP	
	S-7 2.0/1.2		12-25-37-48			ND		0.2	12.1			
	S-8 2.0/0.8		12-26-35-49			BKG		15.8				
15	S-9 2.0/1.2		6-9-14-29			Brown lamination at 13 ft. Red-brown layer at 14.8 ft with small cobble		14	BKG	75.2		CLP
	S-10 2.0/1.3		12-19-26-42			BKG		46.6				
	S-11 2.0/1.1		4-29-22-32			422		BKG	89.0			
20	S-12 2.0/0.9		4-12-27-30			Tan medium SAND with little gravel; poorly graded; dense; saturated.		BKG	252.2		CLP	
25												
30	S-13 2.0/0.8		6-11-21-ref	32		Some coarse SAND Red/brown laminations up to a few mm wide.		ND	0.8	1.9		
35	S-14 1.5/1.0		15-25-50-29			Tan fine SAND, little medium sand grading to tan medium to coarse SAND, little to some fine sand; uniform; dense; saturated.			0.8	14.1		
	S-15 2.0/1.0		43-10-13-18					34	BKG	23.1		
						OUTWASH						

E.C. JORDAN Co.						MW- 1						
Project Remedial Investigation/Feasibility Study						Site ServAll Laundry			Project No. 6205-21			
DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (Ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		WELL DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE		
45	S-16 2.0/0.5		15-12-8-8			Tan fine SAND, trace medium to coarse sand; uniform; medium; saturated.	SP/SW		BKG	5.9		
50	S-17 2.0/0.0		17-26-21-19			NO RECOVERY						
55	S-18 2.0/0.4		17-19-23-47			Fine tan SAND, trace coarse sand; poorly graded; saturated; dense.		250	BKG	8.6		
60	S-19 2.0/0.0		21-19-22-26			NO RECOVERY.						
65	S-20 2.0/0.0		19-23-42-53	65		NO RECOVERY.			BKG			
70	S-21 2.0/0.0		6-13-21-28			NO RECOVERY.			BKG			
75	S-22 2.0/0.2		29-29-47-42	76		Tan medium to coarse SAND, little fine sand; uniform; saturated; very dense; saturated.		ND	BKG	4.5		
	S-23 2.0/0.0		32-33-36-42	69		NO RECOVERY.						
	S-24 3.0/0.0		1-55-58-63-79			NO RECOVERY.						
80	S-25 3.0/0.8		3-17-19-60-64	46		Tan medium to coarse SAND, little fine sand; uniform; dense; saturated.		ND	BKG	2.3		
	S-26 2.0/0.0		39-59-68-72			NO RECOVERY.						
85	S-27 2.0/0.0		70-84-91-72-77	100		NO RECOVERY. Note: very fine sand lining the spoon and coarse material was falling out of the spoon, new basket was all chewed up after sample.						
	S-28 2.0/0.5		27-30-42-34			Tan medium to coarse SAND, little fine sand; uniform; very dense; saturated.		ND	BKG	BKG		
						OUTWASH						

E.C. JORDAN Co.						MW- 1							
Project						Site			Project No.				
Remedial Investigation/Feasibility Study						ServAll Laundry			6205-21				
DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (Ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		WELL DIAGRAM	LAB TESTS	
									PI METER FIELD SCAN	PI METER HEAD SPACE			
95	S-29 2.0/1.3		29-31-46-81	77		Tan fine to medium SAND, trace coarse sand; uniform; very dense; saturated.	SP/SW	ND	BKG	BKG		CL	
	S-30 3.0/0.0		77-13-16-22-28	29		NO RECOVERY.			BKG				
	S-31 3.0/1.6		24-32-38-44-20			Tan fine to medium SAND, trace coause sand; stratified; very dense; saturated.			BKG				
	S-32 3.0/1.0		25-26-30-45-39	56		Tan medium to fine SAND, trace fine gravel; poorly graded; very dense; saturated.			ND	BKG			0.7
	S-33 3.0/1.6		26-24-29-27-26			Red-brown lamination at 102 ft.			ND	BK			BKG
						OUTWASH							
105						BOB at 104 ft NOTE: 6 in casing advanced to 90 ft below bgs, split spoon sampler advanced to 104 ft bgs.							
110													
115													
120													
125													
130													
135													

E.C. JORDAN Co.						MW- 2					
Project Remedial Investigation/Feasibility Study						Site ServAll Laundry			Project No. 6205-21		
Client NYSDEC						Logged By J. Andrews		Checked By NSG		Ground Elev 65.05	
Drilling Contractor WTD				Driller's Name D. Zielazowski		Rig Type D-50		Start Date 12-14-90		Finish Date 12-14-90	
Drilling Method Screened HSA				Protection Level Modified D w/ vent.		P.I.D. (eV) 10.0		Casing Size NA		Auger Size(in) 4.25 ID	
Soil Drilled (ft) 85		Rock Drilled (ft) NA		Total Depth (ft) 85		Depth to Groundwater (ft) / Date 19.85 / 2-12-91			Piez. Boring ☐		Well ☒

DEPTH(Feet)	SAMPLE NO. & PENETRATION / RECOVERY (ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		WELL DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE		
5						The boring was advanced using a screened lead auger and sampled at 5 ft intervals beginning at the water table. Samples were collected using a teflon bailer after a minimum 3 volume purge with a submersible pump. Purged 11 gallons Rate = 15 gpm Turbid discharge Purged 22 gallons Rate = 15 gpm Turbid discharge Purged 33 gallons Rate = 15 gpm Slightly turbid discharge Purged 44 gallons Rate = 15 gpm Clear discharge OUTWASH						
10												
15												
20	S-1								3+			
25	S-2								2+			
30	S-3							2+				
35	S-4							tr				

E.C. JORDAN Co.						MW- 2					
Project						Site			Project No.		
Remedial Investigation/Feasibility Study						ServAll Laundry			6205-21		
DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (Ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		
									PI METER FIELD SCAN	PI METER HEAD SPACE	WELL DIAGRAM
	S-5					Purged 55 gallons Rate = 15 gpm Clear discharge		1+			
45	S-6					Purged 66 gallons Rate = 15 gpm Clear discharge		2+			
50	S-7					Purged 77 gallons Rate = 15 gpm Clear discharge		2+			
55	S-8					Purged 88 gallons Rate = 15 gpm Clear discharge		tr			
60	S-9					Purged 99 gallons Rate = 15 gpm Clear discharge		1+			
65	S-10					Purged 110 gallons Rate = 15 gpm Clear discharge		1+			
70	S-11					Purged = 122 gallons Rate = 15 gpm Clear discharge		1.5+			
75	S-12					Purged 133 gallons Rate = 15 gpm Clear discharge		3+			
80	S-13					Purged 144 gallons Rate = 15 gpm Clear discharge		2.5+			
						OUTWASH					
85						BOB = 85 ft					

E.C. JORDAN Co.							MW-3A					
Project Remedial Investigation/Feasibility Study							Site ServAll Laundry		Project No. 6205-21			
DEPTH(Feet)	SAMPLE NO. & PENETRATION / RECOVERY (ft)	SAMPLE TYPE	SPT BLOWS/8" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		WELL DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE		
45						The boring was advanced using a screened lead auger and sampled at 5 ft intervals beginning at 83 ft bgs. Samples were collected using a teflon bailer after a minimum 3 volume purge with a submersible pump.						
50												
55												
60												
65												
70												
75												
80												
85	S-1					Purged 155 gallons Rate = 10 gpm Discharge initially turbid, clearing up by the end of the purge.		6				
	S-2					Purged 165 gallons Rate = 10 gpm Clear discharge		4				
						OUTWASH						

Project

Remedial Investigation/Feasibility Study

Site

ServAll Laundry

Project No.

6205-21

DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM			WELL DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE			
95	S-3					Purged 175 gallons Rate = 10 gpm Clear discharge		2					
100	S-4					Purged 190 gallons Rate = 10 gpm Slightly turbid discharge		11					
105	S-5					Purged 210 gallons Rate = 10 gpm Slightly turbid discharge		4					
110	S-6					Purged 220 gallons Rate 10 gpm Turbid discharge		2					
115	S-7					Purged 230 gallons Rate 10 gpm Turbid (reddish-brown) discharge		218					
120	S-8					Purged 240 gallons Rate = 5 gpm Discharge alternating between very clear and slightly turbid		29					
						OUTWASH							
						MARINE CLAY							
125						BOB = 123 ft Formation change inferred from decreased flow rate.							
130													
135													

E.C. JORDAN Co.						MW-3B					
Project Remedial Investigation/Feasibility Study						Site ServAll Laundry			Project No. 6205-21		
Client NYSDEC						Logged By J. Andrews		Checked By NSG		Ground Elev 65.02	
Drilling Contractor WTD				Driller's Name D. Zielazowski		Rig Type D-50		Start Date 12-15-90		Finish Date 12-16-90	
Drilling Method Screened HSA				Protection Level Modified D w/ vent.		P.I.D. (eV) 10.0		Casing Size NA		Auger Size(in) 4.23 ID	
Soil Drilled (ft) 90		Rock Drilled (ft) NA		Total Depth (ft) 90		Depth to Groundwater (ft) / Date 19.84 / 2-12-91			Piez. Boring ☐ Well ☒		

DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE WELL		
5						The boring was advanced using a screened lead auger and sampled at 5 ft intervals beginning at the water table. Samples were collected using a teflon bailer after a minimum 3 volume purge with a submersible pump. Purged 11 gallons Rate 15 gpm Purged 23 gallons Rate 15 gpm Purged 33 gallons Rate 15 gpm Purged 40 gallons Rate 10 gpm OUTWASH						
10												
15												
20	S-1							2+				
25	S-2							ND				
30	S-3						ND					
35	S-4						tr					

E.C. JORDAN Co.						MW-3B						
Project						Site				Project No.		
Remedial Investigation/Feasibility Study						ServAll Laundry				6205-21		
DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC PPB	P. I. D. PPM		WELL DIAGRAM	LAB TESTS
	S-5					Purged 55 gallons Rate 15 gpm		ND	PI METER FIELD SCAN	PI METER HEAD SPACE		
45	S-6					Purged 66 gallons Rate 15 gpm		ND				
50	S-7					Purged 77 gallons Rate 15 gpm		ND				
55	S-8					Purged 88 gallons Rate 15 gpm		ND				
60	S-9					Purged 99 gallons Rate 5 gpm		ND				
65	S-10					Purged 110 gallons Rate = 6 gpm		ND				
70	S-11					Purged 122 gallons Rate = 10 gpm		ND				
75	S-12					Purged 133 gallons Rate 10 gpm		ND				
80	S-13					Purged 144 gallons Rate 14 gpm		ND				
85	S-14					Purged 155 gallons Rate = 14 gpm		ND				
						OUTWASH						
						BOB = 90 ft						

E.C. JORDAN Co.						MW- 4					
Project Remedial Investigation/Feasibility Study						Site ServAll Laundry			Project No. 6205-21		
Client NYSDEC						Logged By J. Andrews		Checked By NSG		Ground Elev 63.69	
Drilling Contractor WTD				Driller's Name D. Zielazowski		Rig Type D-50		Start Date 12-19-90		Finish Date 12-19-90	
Drilling Method Screened HSA				Protection Level Modified D w/ vent.		P.I.D. (eV) 10.0		Casing Size NA		Auger Size(in) 4.25 ID	
Soil Drilled (ft) 86		Rock Drilled (ft) NA		Total Depth (ft) 86		Depth to Groundwater (ft) / Date 19.35 / 2-12-91			Piez. Boring ☐ Well ☒		
DEPTH(Feet)	SAMPLE NO. & PENETRATION / RECOVERY (ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE WELL	
5						The boring was advanced using a screened lead auger and sampled at 5 ft intervals beginning at the water table. Samples were collected using a teflon bailer after a minimum 3 volume purge with a submersible pump. Purged 11 gallons Rate 15 gpm Turbid discharge Purged 22 gallons Rate 15 gpm Turbid discharge Purged 33 gallons Rate 15 gpm Turbid discharge Purged 40 gallons Rate 15 gpm Turbid discharge OUTWASH					
10											
15											
20	S-1							20			
25	S-2						221				
30	S-3						281				
35	S-4						301				

Project

Remedial Investigation/Feasibility Study

Site

ServAll Laundry

Project No.

6205-21

DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM			WELL DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE			
	S-5					Purged 55 gallons Rate 15 gpm Turbid discharge		241					
45	S-6					Purged 66 gallons Rate 15 gpm Turbid discharge		201					
50	S-7					Purged 77 gallons Rate 15 gpm Turbid discharge		191					
55	S-8					Purged 88 gallons Rate 15 gpm Turbid discharge		171					
60	S-9					Purged 100 gallons Rate 15 gpm Turbid discharge		171					
65	S-10					Purged 110 gallons Rate = 15 gpm Slightly turbid discharge		181					
70	S-11					Purged 133 gallons Rate = 15 gpm Slightly turbid discharge		211					
75	S-12					Purged 133 gallons Rate 15 gpm Clear discharge		191					
80	S-13					Purged 144 gallons Rate 15 gpm Clear discharge		201					
85						OUTWASH							
						BOB = 86 ft							

E.C. JORDAN Co.						MW- 5					
Project Remedial Investigation/Feasibility Study						Site ServAll Laundry			Project No. 6205-21		
Client NYSDEC						Logged By J. Andrews		Checked By NSG		Ground Elev 64.44	
Drilling Contractor WTD				Driller's Name D. Zielazowski		Rig Type D-50		Start Date 12-17-91		Finish Date 12-18-91	
Drilling Method Screened HSA				Protection Level Modified D w/ vent.		P.I.D. (eV) 10.0		Casing Size N/A		Auger Size(in) 4.25 ID	
Soil Drilled (ft) 85		Rock Drilled (ft) N/A		Total Depth (ft) 85		Depth to Groundwater (ft) / Date 19.84 / 2-12-91			Piez. Boring ☐		Well ☒

DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM			DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER	HEAD SPACE WELL		
5						The boring was advanced using a screened lead auger and sampled at 5 ft intervals beginning at the water table. Samples were collected using a teflon bailer after a minimum 3 volume purge with a submersible pump. Purged 11 gallons Rate 15 gpm Turbid discharge Purged 22 gallons Rate 15 gpm Turbid discharge Purged 33 gallons Rate 15 gpm Turbid discharge Purged 40 gallons Rate 15 gpm Turbid discharge OUTWASH							
10													
15													
20	S-1							10+					
25	S-2							tr					
30	S-3						3+						
35	S-4						3+						

E.C. JORDAN Co.						MW- 5							
Project						Site				Project No.			
Remedial Investigation/Feasibility Study						ServAll Laundry				6205-21			
DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
	S-5					Purged 55 gallons Rate 15 gpm Turbid discharge		13+					
45	S-6					Purged 66 gallons Rate 15 gpm Turbid discharge		3+					
50	S-7					Purged 77 gallons Rate 15 gpm Turbid discharge		3+					
55	S-8					Purged 88 gallons Rate 15 gpm Turbid discharge		4+					
60	S-9					Purged 100 gallons Rate 15 gpm Turbid discharge		3+					
65	S-10					Purged 110 gallons Rate = 15 gpm Clear discharge		6+					
70	S-11					Purged 120 gallons Rate = 15 gpm Clear discharge		3+					
75	S-12					Purged 130 gallons Rate 15 gpm Clear discharge		2+					
80	S-13					Purged 140 gallons Rate 15 gpm		4+					
						OUTWASH							
85						BOB = 85 ft							

E.C. JORDAN Co.					MW-6A				
Project Remedial Investigation/Feasibility Study					Site ServAll Laundry			Project No. 6205-21	
Client NYSDEC					Logged By G. Fordham		Checked By NSG		Ground Elev 64.24
Drilling Contractor WTD			Driller's Name J. Weeks		Rig Type D-120		Start Date 1-3-91		Finish Date 1-4-91
Drilling Method Screened HSA			Protection Level Modified D w/ vent.		P.I.D. (eV) 10.6		Casing Size NA		Auger Size(in) 4.25 ID
Soil Drilled (ft) 93		Rock Drilled (ft) NA		Total Depth (ft) 93	Depth to Groundwater (ft) / Date 19.93 / 2-12-91			Piez. Boring ☐ Well ☒	

DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE WELL		
5						The boring was advanced using a screened lead auger and sampled at 5 ft intervals beginning at the water table. Samples were collected using a teflon bailer after a minimum 3 volume purge with a submersible pump. Purged 15 gallons Rate = 10 gpm Turbid discharge Purged 25 gallons Rate = 10 gpm Turbid discharge Purged 35 gallons Rate = 10 gpm Slightly turbid discharge Purged 45 gallons Rate = 10 gpm OUTWASH						
10												
15												
20												
25	S-1							3900+	800			
30	S-2						45000	980				
35	S-3						26480	33				
40	S-4						11170*	107				

E.C. JORDAN Co.						MW-6A						
Project						Site			Project No.			
Remedial Investigation/Feasibility Study						ServAll Laundry			6205-21			
DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		WELL DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE		
						Slightly turbid discharge						
45	S-5					Purged 55 gallons Rate = 10 gpm Turbid discharge		3500*		BKGD		
50	S-6					Purged 80 gallons Rate = 10 gpm Turbid discharge		5750*		307		
55	S-7					Purged 90 gallons Rate = 10 gpm Turbid discharge		7450		932		
60	S-8					Purged 90 gallons Rate = 10 gpm Turbid discharge		65000		1300		
65	S-9					Purged 110 gallons Rate = 10gpm Clear discharge		6600		10		
70	S-10					Purged 120 gallons Rate = 10 gpm Clear discharge		2460		15		
75	S-11					Purged 120 gallons Rate = 10 gpm Clear discharge		170				
80	S-12					Purged 135 gallons Rate = 10 gpm Clear discharge		18600				
85	S-13					Purged 150 gallons Rate = 10 gpm Clear discharge		6140*				
	S-14					Purged 60 gallons Rate = 3 gpm		5210				
						OUTWASH						

E.C. JORDAN Co.						MW-6A						
Project Remedial Investigation/Feasibility Study						Site ServAll Laundry			Project No. 6205-21			
DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (Ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		WELL DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE		
						Turbid discharge						
						OUTWASH						
95						BOB = 93 ft						
100												
105												
110												
115												
120												
125												
130												
135												

E.C. JORDAN Co.						MW-6B					
Project Remedial Investigation/Feasibility Study						Site ServAll Laundry			Project No. 6205-21		
DEPTH(Feet)	SAMPLE NO. & PENETRATION / RECOVERY (ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE	WELL DIAGRAM
	S-15 2.0/0.0		9-7-9-9			NO RECOVERY No samples collected from 42 ft to 90 ft.					
45											
50											
55											
60											
65											
70											
75											
80											
85											
						OUTWASH					

E.C. JORDAN Co.						MW-6B						
Project Remedial Investigation/Feasibility Study						Site ServAll Laundry			Project No. 6205-21			
DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (Ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		WELL DIAGRAM	LAB TESTS
	S-16 2.0/0.0		23-30-50-55			NO RECOVERY						
95	S-17 2.0/0.5		20-36-56-65			Tan-brown fine SAND, little coarse sand, trace medium sand; poorly graded; very dense; saturated.		ND	BKG	BKG		
100	S-18 2.0/0.4		32-52-77-86					ND	BKG	0.9		
105	S-19 2.0/0.9		34-37-44-48			Tan-brown fine SAND, little coarse sand, trace medium sand; poorly graded; poorly graded; saturated over	SP/SM	ND	BKG	1.8		
	S-20 2.0/1.3		20-17-32-82			Olive-brown CLAYEY SILT, some fine sand, poorly graded; stratified; very dense; saturated		ND	BKG	0.9		
110	S-21 1.0/0.8		35-36-					2	BKG	BKG		
	S-22 2.0/101		65-80-101-104			Brown fine SAND grading to very fine SAND; laminations grey silty clay and brown and iron stained very fine sand; medium graded; very dense; saturated.		3	BKG	BKG		
	S-23 1.0/0.2		89-100/.4			Gray SILTY CLAY, trace very fine sand, trace medium sand over		10	BKG	BKG		
115	S-24 2.0/1.1		19-39-65-47			CLAYEY SILT	ML	1000	BKG	BKG		
	S-25 2.0/1.2		27-49-46-59			Gray CLAYEY SILT, trace very fine sand; very dense; poorly graded; saturated.		38	BKG	BKG		
						MARINE CLAY						
120						BOB = 117 ft						
125												
130												
135												

E.C. JORDAN Co.						MW- 7										
Project Remedial Investigation/Feasibility Study						Site ServAll Laundry			Project No. 6205-21							
Client NYSDEC						Logged By G. Fordham		Checked By NSG		Ground Elev 61.28						
Drilling Contractor WTD				Driller's Name J. Weeks		Rig Type D-120		Start Date 1-6-91		Finish Date 1-6-91						
Drilling Method Screened HSA				Protection Level Modified D w/ vent.		P.I.D. (eV) 10.6		Casing Size NA		Auger Size(in) 4.25 ID						
Soil Drilled (ft) 113		Rock Drilled (ft) NA		Total Depth (ft) 113		Depth to Groundwater (ft) / Date 17.99 / 2-12-91			Piez. Boring ☐ Well ☒							
DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (Ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION		USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		PI METER FIELD SCAN	PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS	
5						The boring was advanced using a screened lead auger and sampled at 5 ft intervals beginning at the water table. Samples were collected using a teflon bailer after a minimum 3 volume purge with a submersible pump. Purged 11 gallons Rate = 10 gpm Turbid discharge Purged 22 gallons Rate = 10 gpm Turbid discharge Purged 33 gallons Rate = 10 gpm Turbid discharge Purged 44 gallons, encountered pump difficulties, purged another 60 gallons. OUTWASH										
10																
15																
20																
25	S-1								170+							
30	S-2								3100							
35	S-3								15093*							
40	S-4								3400							

E.C. JORDAN Co.						MW- 7					
Project Remedial Investigation/Feasibility Study						Site ServAll Laundry			Project No. 6205-21		
DEPTH(FEET)	SAMPLE NO. & PENETRATION / RECOVERY (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE WELL	DIAGRAM
45	S-5					Rate = 10 gpm Slightly turbid discharge Purged 70 gallons Rate = 10 gpm Clear discharge		4600			
50	S-6					Purged 70 gallons Rate = 10 gpm Clear discharge		3000			
55	S-7					Purged 80 gallons Rate = 10 gpm Clear discharge		370			
60	S-8					Purged 90 gallons Rate = 10 gpm Clear discharge		2200			
65	S-9					Purged 100 gallons Rate = 10gpm Clear discharge		851*			
70	S-10					Purged 110 gallons Rate = 10 gpm Clear discharge		1725			
75	S-11					Purged 125 gallons Rate = 10 gpm Clear discharge		800			
80	S-12					Purged 150 gallons Rate = 10 gpm Clear discharge		55*			
85	S-13					Purged 150 gallons Rate = 10 gpm Clear discharge		303			
	S-14					Purged 160 gallons Rate = 10 gpm OUTWASH		377			

E.C. JORDAN Co.						MW- 7					
Project Remedial Investigation/Feasibility Study						Site ServAll Laundry			Project No. 6205-21		
DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE	WELL DIAGRAM
95	S-15					Clear discharge					
						Purged 180 gallons Rate = 10 gpm Clear discharge		407			
100	S-16					Purged 220 gallons Rate = 10 gpm Clear discharge		518*			
105	S-17					Purged 240 gallons Rate = 10 gpm Clear discharge		3800			
110	S-18					Purged 60 gallons Rate 3 gpm Very turbid discharge		4100*			
						OUTWASH					
						MARINE CLAY					
115						BOB = 113 ft Formation change inferred from decreased flow rate.					
120											
125											
130											
135											

E.C. JORDAN Co.						MW- 8									
Project Remedial Investigation/Feasibility Study						Site ServAll Laundry			Project No. 6205-21						
Client NYSDEC						Logged By G. Fordham		Checked By NSG		Ground Elev 54.94					
Drilling Contractor WTD				Driller's Name J. Weeks		Rig Type D-120		Start Date 1-7-91		Finish Date 1-7-91					
Drilling Method Screened HSA				Protection Level Modified D w/ vent.		P.I.D. (eV) 10.6		Casing Size NA		Auger Size(in) 4.25 ID					
Soil Drilled (ft) 113		Rock Drilled (ft) NA		Total Depth (ft) 113		Depth to Groundwater (ft) / Date 15.50 / 2-12-91			Piez. Boring ☐ Well ☒						
DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION		USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		PI METER FIELD SCAN	PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
5						The boring was advanced using a screened lead auger and sampled at 5 ft intervals beginning at the water table. Samples were collected using a teflon bailer after a minimum 3 volume purge with a submersible pump. Purged 15 gallons Rate = 10 gpm Turbid discharge Purged 25 gallons Rate = 10 gpm Turbid discharge Purged 35 gallons Rate = 10 gpm Turbid discharge Purged 45 gallons Rate = 10 gpm Clear discharge Purged 55 gallons Rate = 10 gpm OUTWASH									
10															
15															
20	S-1								9						
25	S-2								ND						
30	S-3						1								
35	S-4						27								
	S-5						123*								

E.C. JORDAN Co.						MW- 8							
Project Remedial Investigation /Feasibility Study						Site ServAll Laundry			Project No. 6205-21				
DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM			DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE	WELL		
						Slightly turbid discharge							
45	S-6					Purged 70 gallons Rate = 10 gpm Clear discharge		451+					
50	S-7					Purged 80 gallons Rate = 10 gpm Clear discharge		92+					
55	S-8					Purged 90 gallons Rate = 10 gpm Clear discharge		62+					
60	S-9					Purged 100 gallons Rate = 10 gpm Clear discharge		20					
65	S-10					Purged 110 gallons Rate = 10 gpm Clear discharge		ND					
70	S-11					Purged 120 gallons Rate = 10 gpm Clear discharge		56					
75	S-12					Purged 130 gallons Rate = 10 gpm Clear discharge		60*					
80	S-13					Purged 140 gallons Rate = 10 gpm Clear discharge		21					
85	S-14					Purged 160 gallons Rate = 10 gpm Clear discharge		8					
	S-15					Purged 165 gallons Rate = 10 gpm		129					
						OUTWASH							

Project

Remedial Investigation/Feasibility Study

Site

ServAll Laundry

Project No.

6205-21

DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (FT)	SAMPLE TYPE	SPT BLOWS/8" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM			WELL DIAGRAM	LAB T
									PI METER	FIELD SCAN	PI METER		
95	S-16					Clear discharge							
						Purged 180 gallons Rate = 10 gpm Clear discharge		647+					
100	S-17					Purged 190 gallons Rate = 10 gpm Clear discharge		1920*					
105	S-18					Purged 200 gallons Rate = 10 gpm Clear discharge		56					
110	S-19					Purged 100 gallons Rate 5 gpm Slightly turbid discharge		ND					
						OUTWASH							
						MARINE CLAY							
115						BOB = 113 ft Formation change inferred from decreased flow rate.							
120													
125													
130													
135													

E.C. JORDAN Co.						MW- 9					
Project Remedial Investigation/Feasibility Study						Site ServAll Laundry			Project No. 6205-21		
Client NYSDEC						Logged By J. Andrews		Checked By NSG		Ground Elev 41.28	
Drilling Contractor WTD				Driller's Name D. Zielazowski		Rig Type D-50		Start Date 1-5-91		Finish Date 1-6-91	
Drilling Method Screened HSA				Protection Level Modified D w/ vent.		P.I.D. (eV) 10.6		Casing Size NA		Auger Size(in) 4.25 ID	
Soil Drilled (ft) 90		Rock Drilled (ft) NA		Total Depth (ft) 90		Depth to Groundwater (ft) / Date 11.82 / 2-12-91			Piez. Boring ☐ Well ☒		

DEPTH(Feet)	SAMPLE NO. & PENETRATION / RECOVERY (Ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE WELL		
5						The boring was advanced using a screened lead auger and sampled at 5 ft intervals beginning at the water table. Samples were collected using a teflon bailer after a minimum 3 volume purge with a submersible pump. Purged 15 gallons Rate 15 gpm Turbid discharge Purged 30 gallons Rate 15 gpm Turbid discharge Purged 45 gallons Rate 15 gpm Turbid discharge Purged 60 gallons Rate 15 gpm Turbid discharge OUTWASH						
10												
15												
20	S-1							ND				
25	S-2							ND				
30	S-3						ND					
35	S-4						ND					

E.C. JORDAN Co.						MW- 9								
Project						Site				Project No.				
Remedial Investigation/Feasibility Study						ServAll Laundry				6205-21				
DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (Ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		PI METER FIELD SCAN	PI METER HEAD SPACE	WELL DIAGRAM	LAB TEST
	S-5					Purged 75 gallons Rate 15 gpm Turbid discharge		ND						
45	S-6					Purged 90 gallons Rate 15 gpm Clear discharge		ND						
50	S-7					Purged 105 gallons Rate 15 gpm Clear discharge		ND						
55	S-8					Purged 120 gallons Rate 15 gpm Clear discharge		ND						
60	S-9					Purged 135 gallons Rate 15 gpm Clear discharge		ND						
65	S-10					Purged 150 gallons Rate = 15 gpm Clear discharge		ND						
70	S-11					Purged 165 gallons Rate = 15 gpm Clear discharge		ND						
75	S-12					Purged 180 gallons Rate 15 gpm Clear discharge		ND						
80	S-13					Purged 195 gallons Rate 15 gpm Clear discharge		ND						
85	S-14					Purged 40 gallons Rate > 1 gpm Slightly turbid discharge		1						
						OUTWASH								
						MARINE CLAY								

E.C. JORDAN Co.						MW- 9							
Project Remedial Investigation/Feasibility Study						Site ServAll Laundry			Project No. 6205-21				
DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (Ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		HEAD SPACE WELL	DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER			
95						BOB = 90 ft Formation change inferred from decreaseD flow rate, change in discharge, and traces of clay found on the lead auger.							
100													
105													
110													
115													
120													
125													
130													
135													

E.C. JORDAN Co.						MW-10					
Project Remedial Investigation/Feasibility Study						Site ServAll Laundry			Project No. 6205-21		
Client NYSDEC						Logged By J. Andrews		Checked By NSG		Ground Ele 40.54	
Drilling Contractor WTD				Driller's Name D. Zielazowski		Rig Type D-50		Start Date 1-3-91		Finish Date 1-4-91	
Drilling Method Screened HSA				Protection Level Modified D w/ vent.		P.I.D. (eV) 10.6		Casing Size NA		Auger Size(in) 4.25 ID	
Soil Drilled (ft) 90		Rock Drilled (ft) NA		Total Depth (ft) 90		Depth to Groundwater (ft) / Date 13.67 / 2-12-91			Piez. Boring ☐ Well ☒		

DEPTH(Feet)	SAMPLE NO. & PENETRATION / RECOVERY (ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC PPB	P. I. D. PPM		WELL DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE		
5						The boring was advanced using a screened lead auger and sampled at 5 ft intervals beginning at the water table. Samples were collected using a teflon bailer after a minimum 3 volume purge with a submersible pump. Purged 15 gallons Rate 15 gpm Turbid discharge Purged 30 gallons Rate 15 gpm Moderately turbid discharge Purged 45 gallons Rate 15 gpm Clear discharge Purged 60 gallons Rate 15 gpm Clear discharge OUTWASH						
10												
15												
20	S-1							ND				
25	S-2							ND				
30	S-3						ND					
35	S-4						ND					

E.C. JORDAN Co.						MW-10					
Project Remedial Investigation/Feasibility Study						Site ServAll Laundry			Project No. 6205-21		
DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D.		
									PI METER FIELD SCAN	PI METER	HEAD SPACE WELL
	S-5					Purged 75 gallons Rate 15 gpm Clear discharge		ND			
45	S-6					Purged 90 gallons Rate 15 gpm Clear discharge		ND			
50	S-7					Purged 105 gallons Rate 15 gpm Clear discharge		ND			
55	S-8					Purged 120 gallons Rate 15 gpm Clear discharge		ND			
60	S-9					Purged 135 gallons Rate 15 gpm Clear discharge		ND			
65	S-10					Purged 150 gallons Rate = 15 gpm Clear discharge		ND			
70	S-11					Purged 165 gallons Rate = 15 gpm Clear discharge		ND			
75	S-12					Purged 180 gallons Rate 15 gpm Clear discharge		ND			
80	S-13					Purged 195 gallons Rate 15 gpm Clear discharge		ND			
85	S-14					Purged 210 gallons Rate = 15 gpm Discharge initially turbid, clear by the end of the purge.		ND			
						OUTWASH					
						MARINE CLAY					

E.C. JORDAN Co.						MW-12						
Project Remedial Investigation/Feasibility Study						Site ServAll Laundry			Project No. 6205-21			
DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (Ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		WELL DIAGRAM	LAB TFS
									PI METER FIELD SCAN	PI METER HEAD SPACE		
95						BOB = 90 ft Formation change inferred from decreased flow rate and change in discharge.						
100												
105												
110												
115												
120												
125												
130												
135												

E.C. JORDAN Co.					MW-13				
Project Remedial Investigation/Feasibility Study					Site ServAll Laundry			Project No. 6205-21	
Client NYSDEC					Logged By G. Fordham		Checked By NSG		Ground Elev 50.77
Drilling Contractor WTD			Driller's Name J. Weeks		Rig Type D-120		Start Date 1-8-91		Finish Date 1-10-91
Drilling Method Screened HSA			Protection Level Modified D w/ vent.		P.I.D. (eV) 10.6		Casing Size NA		Auger Size(in) 4.25 ID
Soil Drilled (ft) 98		Rock Drilled (ft) NA		Total Depth (ft) 98	Depth to Groundwater (ft) / Date 14.21 / 2-12-91			Piez. Boring ☐	Well ☒

DEPTH(Feet)	SAMPLE NO. & PENETRATION / RECOVERY (ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		PI METER FIELD SCAN	PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
									PI METER	HEAD SPACE				
5						The boring was advanced using a screened lead auger and sampled at 5 ft intervals beginning at the water table. Samples were collected using a teflon bailer after a minimum 3 volume purge with a submersible pump. Purged 11 gallons Rate 10 gpm Purged 20 gallons Rate = 10 gpm Purged 35 gallons Rate = 10 gpm Purged 45 gallons Rate = 10 gpm Purged 55 gallons Rate = 10 gpm Purged 70 gallons Rate = 10 gpm OUTWASH								
10														
15	S-1								ND					
20	S-2								ND					
25	S-3								1					
30	S-4								1					
35	S-5								2					
	S-6							10						

E.C. JORDAN Co.							MW-13						
Project Remedial Investigation/Feasibility Study							Site ServAll Laundry			Project No. 6205-21			
DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		WELL DIAGRAM	LAB TESTS	
									PI METER FIELD SCAN	PI METER HEAD SPACE			
45	S-7					Purged 80 gallons Rate = 10 gpm		27*					
50	S-8					Purged 90 gallons Rate = 10 gpm		18					
55	S-9					Purged 100 gallons Rate = 10 gpm		17					
60	S-10					Purged 100 gallons Rate = 10 gpm		15*					
65	S-11					Purged 120 gallons Rate = 10 gpm		12					
70	S-12					Purged 130 gallons Rate = 10 gpm		20					
75	S-13					Purged 145 gallons Rate = 10 gpm		19					
80	S-14					Purged 155 gallons Rate = 10 gpm		32					
85	S-15					Purged 170 gallons Rate = 10 gpm		16					
	S-16					Purged 180 gallons Rate = 10 gpm		273					
						OUTWASH							

E.C. JORDAN Co.							MW-13				
Project Remedial Investigation/Feasibility Study							Site ServAll Laundry		Project No. 6205-21		
DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE	WELL DIAGRAM
96	S-17					Purged 90 gallons Rate = 3 gpm OUTWASH		136			
						MARINE CLAY					
100						BOB = 98 ft Formation change inferred from decreased flow rate, change in discharge and traces of clay found on the lead auger.					
105											
110											
115											
120											
125											
130											
135											

E.C. JORDAN Co.						MW-14										
Project Remedial Investigation/Feasibility Study						Site ServAll Laundry			Project No. 6205-21							
Client NYSDEC						Logged By J. Andrews		Checked By NSG		Ground Elev 50.33						
Drilling Contractor WTD				Driller's Name D. Zielazowski		Rig Type D-50		Start Date 1-9-91		Finish Date 1-10-91						
Drilling Method Screened HSA				Protection Level Modified D w/ vent.		P.I.D. (eV) 10.6		Casing Size NA		Auger Size(in) 4.25 ID						
Soil Drilled (ft) 95		Rock Drilled (ft) NA		Total Depth (ft) 95		Depth to Groundwater (ft) / Date 14.70 / 2-12-91			Piez. Boring ☐ Well ☒							
DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION		USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		PI METER FIELD SCAN	PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS	
5						The boring was advanced using a screened lead auger and sampled at 5 ft intervals beginning at the water table. Samples were collected using a teflon bailer after a minimum 3 volume purge with a submersible pump. Purged 15 gallons Rate = 15 gpm Turbid discharge Purged 30 gallons Rate 15 gpm Clear discharge Purged 45 gallons Rate 15 gpm Slightly turbid discharge Purged 60 gallons Rate 15 gpm Slightly turbid discharge Purged 75 gallons Rate 15 gpm Clear discharge OUTWASH										
10																
15	S-1									ND						
20	S-2									ND						
25	S-3									ND						
30	S-4								ND							
35	S-5								ND							

water from pumping tests of the new extraction wells. For cost-estimating purposes, it was assumed that the treatment plant could be located on site as shown in Figure 14-4.

Pretreatment of the raw water, if necessary, would involve the following processes:

- oxidation
- filtration
- backwashing
- clarification
- sludge handling

A schematic flow diagram of the treatment process is shown in Figures 14-5 and 14-6.

The first step in pretreatment would be to oxidize the iron and manganese to their insoluble forms. Potassium permanganate, the assumed oxidizing agent for the preliminary pretreatment design) would be added to oxidize the dissolved iron from the relatively soluble +II state to the more insoluble +III state. Dissolved manganese would also be oxidized from the +II state to the more insoluble +IV state. The precipitates would consist mostly of ferric hydroxide and manganese dioxide.

Oxidation would occur in a device known as a greensand filter. This type of pretreatment technology was selected for preliminary cost-estimating purposes because the levels of iron and manganese detected in monitoring well samples were not high enough to warrant a coagulation and flocculation system. A coagulation and flocculation system is more cost effective for levels of manganese and iron greater than approximately 1 mg/L. The greensand filter is a more cost-effective option for removing iron and manganese in concentrations less than 1 mg/L.

Some greensand filters inject the KMnO_4 directly into the bed of the filter with the influent water. The products of the reaction, an insoluble ferric hydroxide and manganese dioxide, are immediately filtered out by the sand. The filters are periodically back washed to remove the precipitates.

Some greensand filters have the KMnO_4 coated on the actual sand particles of the filter bed as well. The sand particles then act as reaction sites for oxidation and simultaneously filter out the suspended solids. These filters require backwash and

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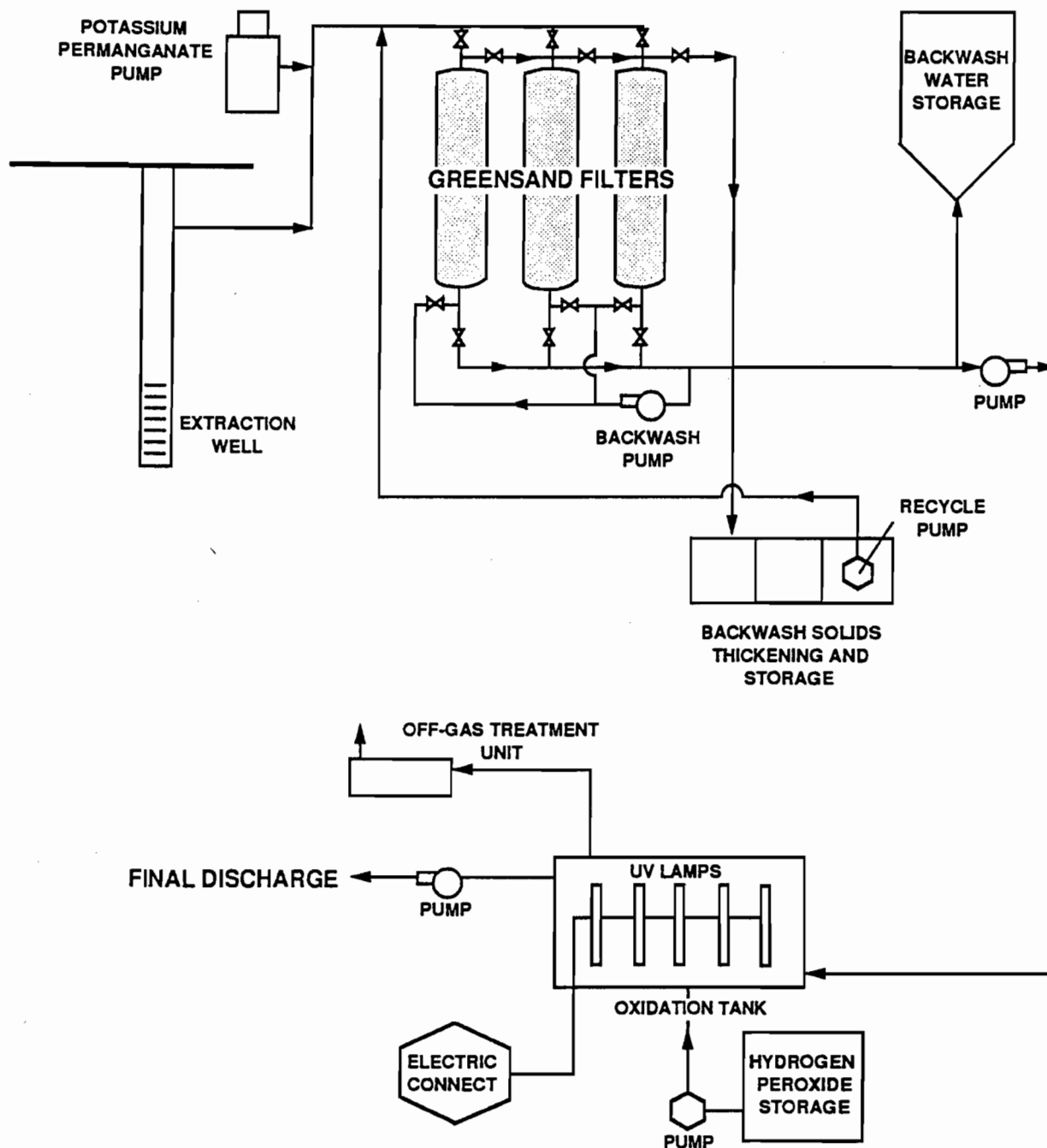


FIGURE 14-5
U.V. OXIDATION PROCESS FLOW DIAGRAM
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

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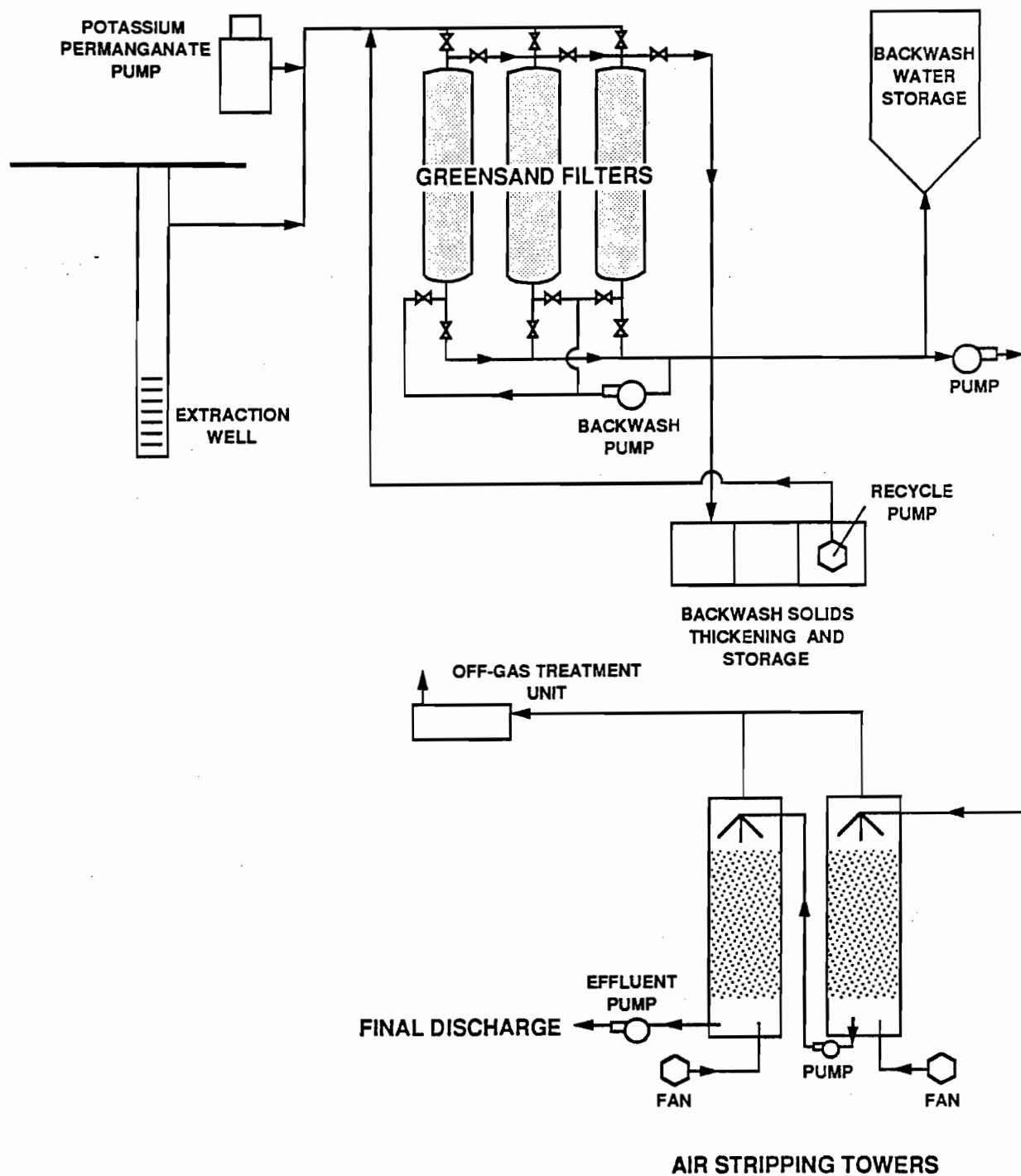


FIGURE 14-6
AIR STRIPPING PROCESS FLOW DIAGRAM
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

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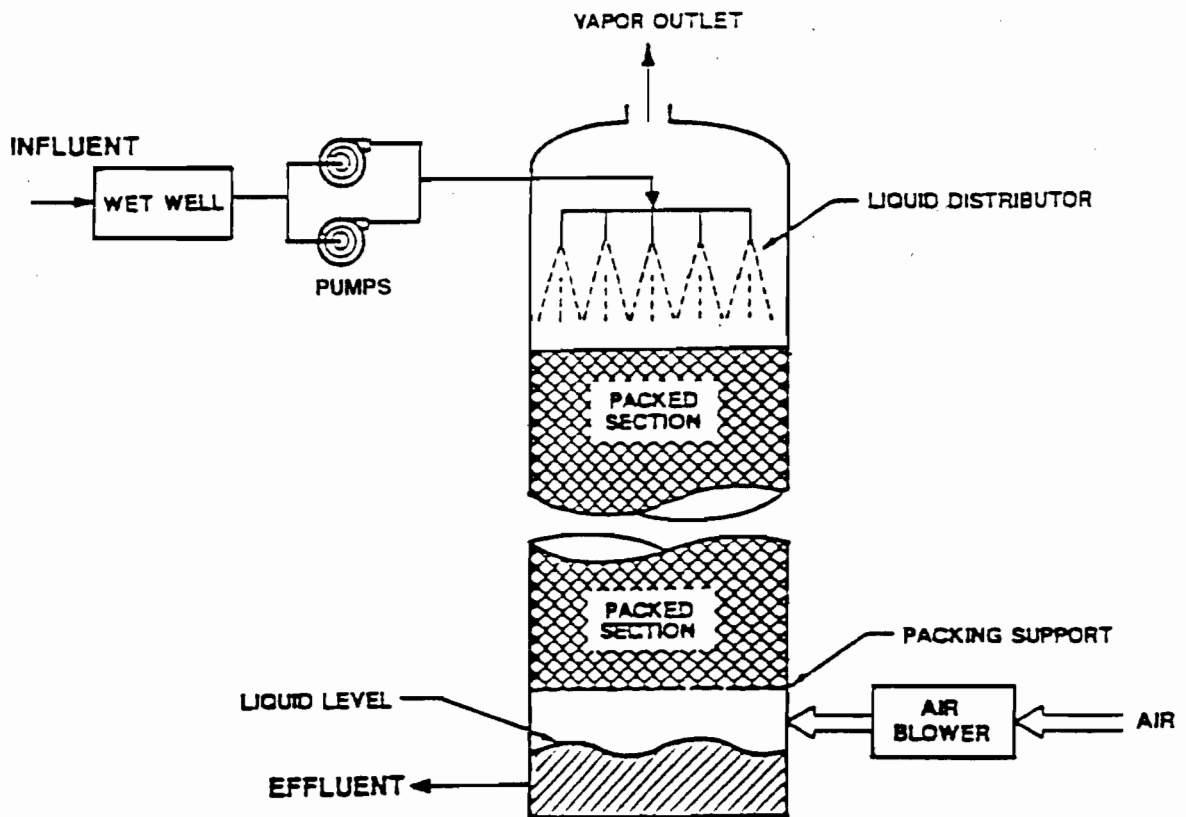
batch regeneration. Batch regeneration occurs after the filter is backwashed. Excessive amounts of KMnO_4 are allowed to slowly flow through the filter and coat the surfaces of the sand particles. A pink color in the filter effluent during batch regeneration indicates that regeneration is complete and the filter can be returned to service.

The conceptual design of the pretreatment system includes three greensand filters arranged in parallel. This allows for continuous operation of the system when one of the filters requires backwashing. Backwash from the greensand filter would be thickened in a gravity thickener to a concentration of approximately 3 percent solids. Sludge would be collected, tested for characteristics of hazardous waste, and properly disposed off site.

After pretreatment, the water would be treated to remove VOCs, specifically PCE, TCE, 1,1-DCE, cis- and trans-1,2-DCE, and vinyl chloride. Air stripping (Figure 14-5) and UV/oxidation (Figure 14-6) are the technology options for VOC removal that were retained after technology screening. Air stripping is a method frequently used to remove VOCs from groundwater. During the process, contaminated water contacts large volumes of clean air. Contaminated water enters the top of the air stripping tower and trickles down through the packing material, while air enters at the bottom and is blown upward through the packing material. The contaminants are transferred from the liquid phase to the gas phase and carried off with the effluent air. Figure 14-7 shows a cross section of a typical packed air stripping tower. The air stripping column design is essentially dictated by the column fluid dynamics and the desired removal efficiencies for the compounds of concern. Several vendors can custom-design a tower if a standard-size tower does not meet design specifications.

An air stripper treating water from the ServAll plume for this alternative is estimated to emit a total of about 24 pounds per day of VOCs. This emission rate was calculated based on preliminary design parameters for the air stripping unit (i.e. water and initial VOC concentrations - see Appendix P). Emission rates would be expected to decline over time as contaminant concentrations in groundwater decrease. If air stripping were implemented, actual emission rates would be determined and compared to the New York State air guidelines to evaluate the need for off-gas treatment. The estimated emission rate suggests that off-gas treatment would be required. A preliminary air monitoring program was developed for cost estimating purposes.

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FIGURE 14-7
AIR STRIPPING TOWER
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

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There are several off-gas treatment technologies available to address the airstream emitted from the air stripper. The choice of control technology depends on the type and concentration of VOCs, the desired level of destruction, and the duration of the project. For cost-estimating purposes, it was assumed that off-gas treatment with thermal and catalytic incineration would be used for air emissions from the air stripper. Vapor phase carbon could also be evaluated during remedial design.

Thermal and catalytic incinerators are commercially available for destroying gaseous organic compounds. Thermal incineration of VOCs occurs at temperatures averaging 1,600°F. The operating temperature would be determined by field testing to achieve the desired destruction removal efficiencies. Catalytic incinerators operate at lower temperatures and can, in principle, be used to destroy essentially any organic compound in an airstream (van der Vaart et al., 1991).

Another process option suitable for treating VOCs in the extracted groundwater is UV/oxidation. This process destroys organic compounds in water through chemical oxidation enhanced by exposure to UV light. Typically, hydrogen peroxide (H_2O_2) is used as the oxidant in the UV/oxidation vessel. However, ozone can be used as the oxidant for compounds that are more difficult to break down. For preliminary design and cost-estimating purposes, a UV/oxidation system with H_2O_2 was selected.

The UV/oxidation system rapidly produces hydroxyl radicals under oxidizing conditions. Organic molecules in the contaminated groundwater absorb energy from the UV light, promoting reactions with hydroxyl radicals. The combined effects of UV light and concentrated hydroxyl radicals synergistically promote rapid breakdown of organic molecules. Some vendors also use proprietary catalysts to enhance the reaction rates. In the oxidation process, organic contaminants are broken down into simpler substances such as carbon dioxide, water, salts, acetone, sulfates, nitrates, and organic and inorganic acids (USEPA, 1991). The formation of organic acids or acetone could raise additional restrictions for discharge of treated water. Treatability studies would be used to determine the expected concentrations of these compounds and evaluate if further treatment would be required prior to discharge.

UV/oxidation occurs in a stainless steel chamber containing vertically or horizontally mounted UV lamps. A typical reaction vessel has six chambers designed to provide intimate contact between the oxidant and the water while in

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the presence of UV light. A solution of H_2O_2 is metered into the influent waste stream as an oxidizer (ozone is sometimes used as a stronger oxidizer).

Figure 14-8 is a schematic diagram of the UV/oxidation system with hydrogen peroxide as the oxidant.

For preliminary design purposes, a flow rate of 115 gpm with a detention time of 1 hour was used to size the reactor vessel for the UV/oxidation system. For the UV/oxidation system, the preliminary design includes: UV reactor, wet well, process pumps, level controls, metering pumps, and H_2O_2 storage.

A preliminary effluent monitoring program was developed for cost estimating purposes. This program includes analyses for VOCs, iron, manganese, and total suspended solids. These analyses would be used to characterize the performance and efficiency of the treatment plant and the extraction well system.

Treatability studies for all the water treatment processes (i.e., pretreatment, air stripping, and UV/oxidation(H_2O_2)) would be conducted before full-scale operation of a pump and treat system was recommended. These studies would evaluate which process option would provide better, more cost-effective treatment for the contaminants in the ServAll plume and provide information for detailed design and operation of the treatment system. The final design would be subject to regulatory agency review and approval before implementation.

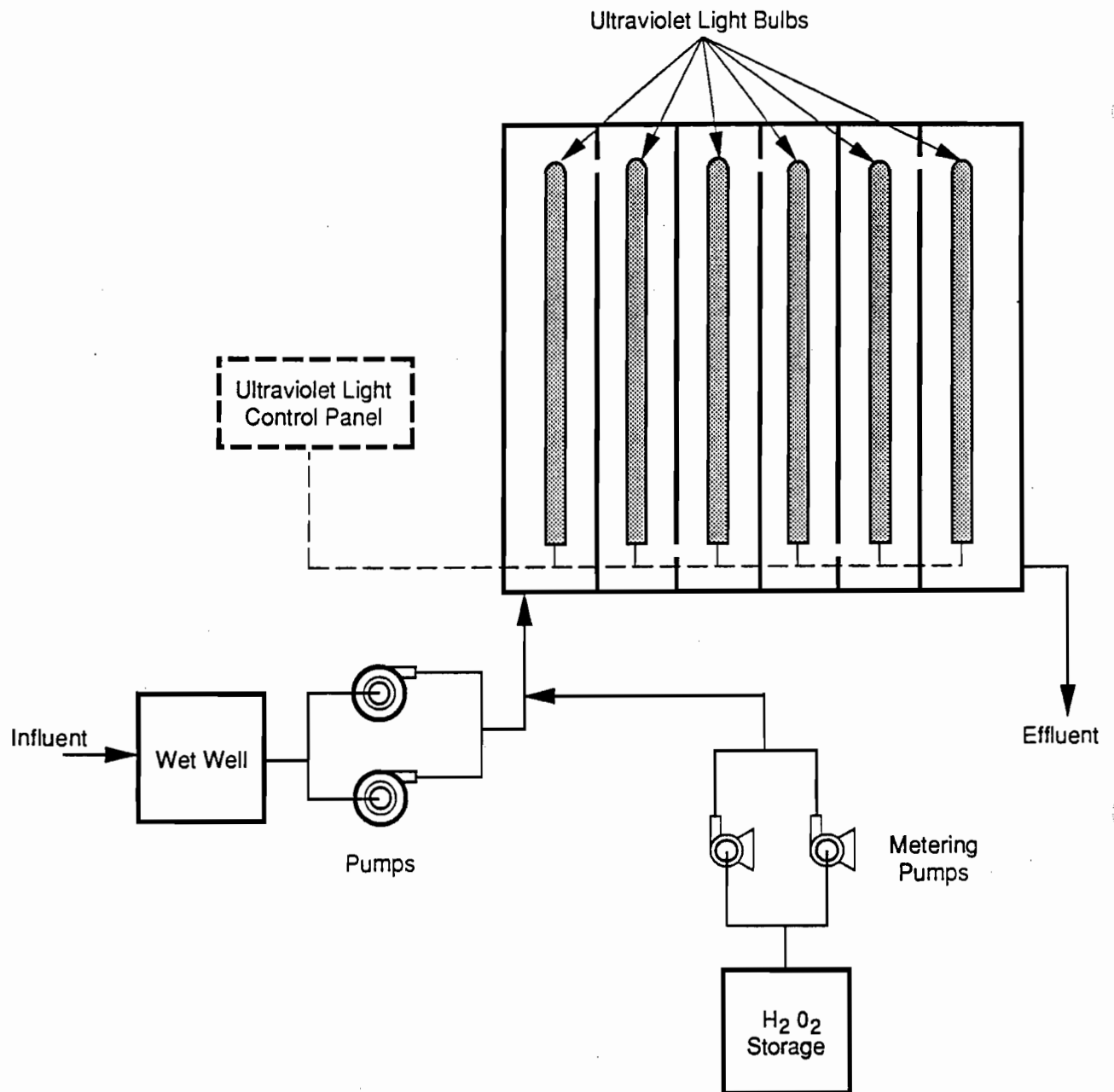
14.3.5 Discharge

Treated groundwater would be piped upgradient of the site and returned to the aquifer through an injection well. NYSDEC has expressed a preference for discharge options on Long Island that return treated water to the aquifer from which it was removed. Further, discharge to surface waters or to a POTW is not possible in the site vicinity. Upgradient discharge would return the treated water to the aquifer and enhance the leaching of contaminants through flushing of the saturated soils. The proposed location of the reinjection well is shown in Figure 14-4.

14.3.6 Institutional Controls

Construction of new domestic wells to extract water from the aquifer would be restricted through the permitting process. An investigation to identify existing wells in the plume's path would be conducted; use of these wells would be restricted.

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FIGURE 14-8
ULTRAVIOLET/PEROXIDE REACTOR
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

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14.3.7 Environmental Monitoring

The objectives of the environmental monitoring program are to evaluate whether the source area at the ServAll site is continuing to contribute to groundwater contamination in the upper glacial aquifer, to evaluate the effectiveness of the pump and treat system, and to monitor the migration of contamination in groundwater downgradient from the site. The monitoring plan developed and described in this conceptual plan is only a proposed monitoring plan for cost-estimating purposes. The final, detailed monitoring plan would be developed and submitted for regulatory agency review and comment prior to implementation.

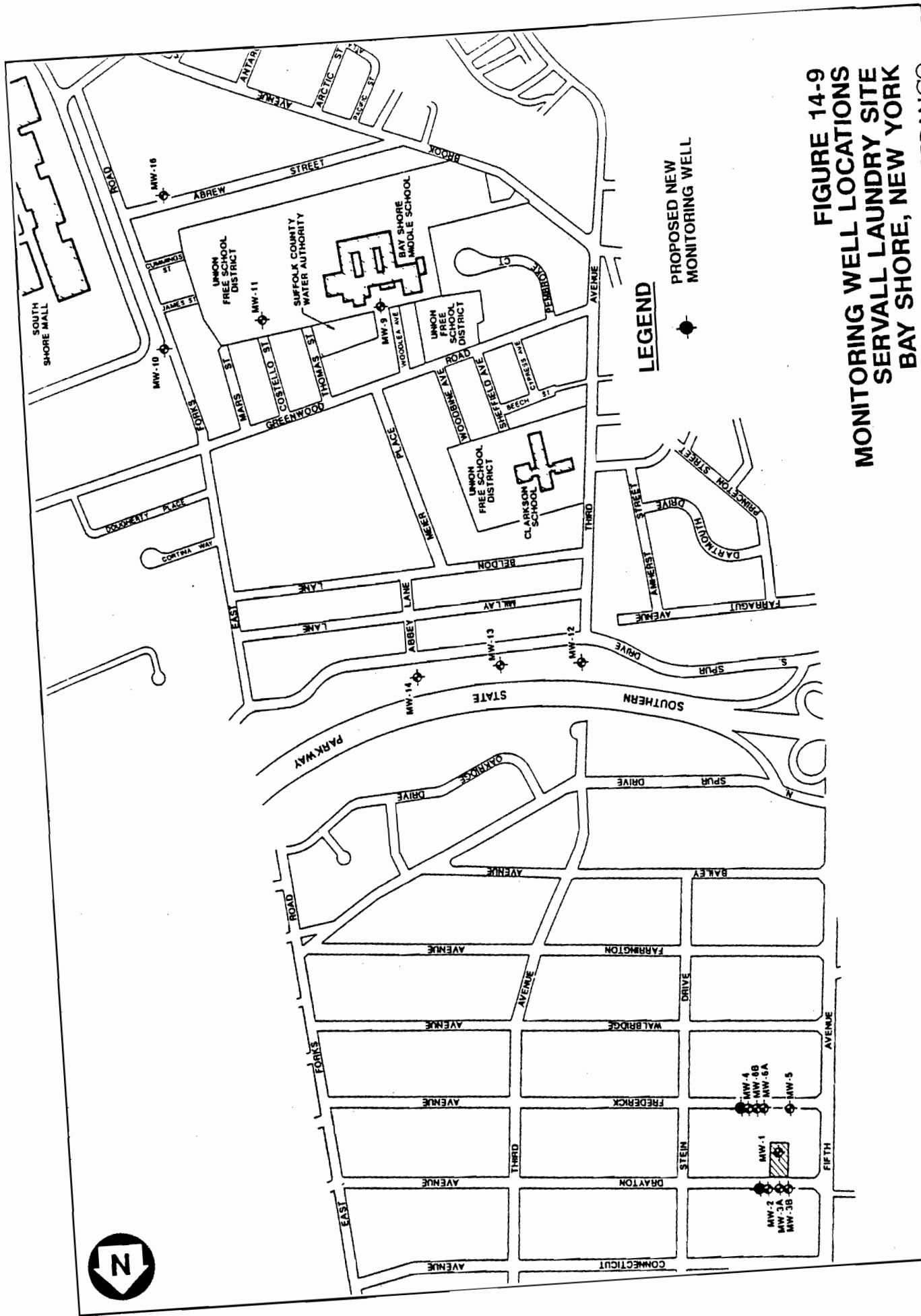
Environmental monitoring would involve the routine periodic sampling of groundwater from the upper glacial aquifer. Samples would be analyzed for TCL VOCs. It is assumed that groundwater from 18 monitoring wells (15 existing, three new) would be sampled and analyzed, to monitor source contribution to groundwater contamination and the migration of the plume (Figure 14-9).

Groundwater from four upgradient wells (i.e., MW-3A, MW-3B, MW-2, and one new well) would be sampled and analyzed. These upgradient wells would provide information on the concentrations of contamination in upgradient groundwater. The three existing wells are all screened at various depths below the water table (see Appendix A-3). Because groundwater contamination near the source is believed to be near the water table, an additional upgradient monitoring well screened at the water table would require installation and sampling in order to more fully characterize upgradient groundwater quality.

To monitor groundwater contamination immediately downgradient of the source area, six wells would be sampled (i.e., MW-1, MW-4, MW-5, MW-6A, MW-6B, and one new well). These wells would provide information on the contaminant concentrations in groundwater immediately after it has passed beneath the source area. MW-1 is screened at depth in the upper glacial aquifer (see Appendix A-3) and is the closest monitoring well to the source area. Because groundwater contamination is suspected near the water table in the vicinity of the source area, another on-site monitoring well screened at the water table would be installed and sampled. Data from this well would be used to characterize groundwater quality near the source of contamination.

Groundwater from three existing monitoring (i.e., MW-12, MW-13, and MW-14) wells approximately midway along the present length of the plume would be sampled and analyzed. MW-13, located approximately on the longitudinal axis of

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SCALE IN FEET
 0 500 1000

the plume, would provide information on the attenuation and degradation of contaminants in the groundwater. Monitoring wells MW-12 and MW-14 complete a fence of wells straddling the plume at this location. Groundwater sampled and analyzed from these wells would provide information on the lateral dispersion of contaminants in the plume.

Groundwater from four wells located near the leading edge of the plume (i.e., MW-9, MW-10, MW-11, and MW-16) would be sampled and analyzed. Monitoring wells MW-9, MW-10, and MW-11 form another well fence near the leading edge of the plume, with MW-11 located near the center. MW-11 would provide information necessary to characterize the attenuation and degradation of contamination in the groundwater. MW-9 and MW-10 would provide information that would help to characterize the lateral dispersion of contamination near the leading edge of the plume. MW-16, located near the current leading edge of the plume, would provide information to characterize the migration and dispersion of the plume near its leading edge. The Well Construction Logs showing screen depths of the plume wells are presented in Appendix A-3.

A monitoring well would also be installed near the SCWA Thomas Avenue public water supply wells. These public water supply wells draw water from the aquifer below the Gardiners Clay. Contaminated groundwater in the upper glacial aquifer is not expected to penetrate the Gardiners Clay and, therefore, is not expected to affect the SCWA wells. To verify that contamination is not penetrating through the Gardiners Clay into the deeper Magothy aquifer, a well would be installed near the SCWA Thomas Avenue wells, screened below the Gardiners Clay at the top of the Magothy aquifer. If contamination does reach the deeper aquifer, this well would provide a warning before contamination reached the SCWA.

For cost-estimating purposes, it is assumed that environmental monitoring would be conducted annually for 30 years. For the first two years, quarterly sampling would occur to:

- increase the database of contaminant concentrations and distribution
- provide additional information for use in the design of the pump and treat system
- provide a basis for statistical evaluation of trends

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- identify seasonal fluctuations associated with contaminant migration.

After the second year, sampling would occur annually. The monitoring well near the SCWA Thomas Avenue public water supply wells may have to be sampled more frequently; however, for cost estimating purposes it was assumed to be sampled at the same frequency as the other wells.

14.3.8 Five-year Reviews

At sites where wastes have not been treated permanently, five-year site reviews are conducted to assure that human health and the environment are being protected. The five-year review would present, organize, and interpret all data gathered during sampling events in report format. The review would recommend future remedial actions at the site. This recommendation could be to continue environmental monitoring and five-year reviews, to continue to pump and treat groundwater, or to add another pump and treat system.

14.3.9 Contingency Plans

This alternative focuses on remediating the source of groundwater contamination. It allows a major portion of the existing plume of groundwater contamination to detach from the source and migrate south until it discharges to the Great South Bay. This does not pose an unacceptable risk to human health, provided that institutional controls effectively prevent the use of private wells in the upper glacial aquifer. The effects of contaminated groundwater discharging to the Great South Bay on environmental receptors are more difficult to predict.

As part of this conceptual plan, a focused study was conducted to evaluate what concentrations of contaminants would be expected in Great South Bay once the plume begins to discharge. The calculations for this study are included in Appendix R. The results of these calculations indicate that 0.31 $\mu\text{g/L}$ of total VOCs and 0.28 $\mu\text{g/L}$ of PCE would be present in the bay due to discharge from the ServAll plume. These calculations do not account for a sediment layer high in inorganic carbon, which would retard the discharge of contamination to the bay through adsorption of dissolved contaminants. Therefore, the calculations probably overestimate actual concentrations of contaminants in the bay.

These levels are below the limits specified in the Ambient Water Quality Standards and Guidance (NYSDEC, 1991). These calculations are an estimate of what would happen during discharge; however, a more detailed evaluation of the

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plume discharge and its effects on environmental receptors will be made during the design phase and may include field work to sample sediments in the bay and investigate the hydrogeology of the discharge area and the bay. This evaluation will include an analysis of the possible effects discharge would have on environmental receptors in the sediments and the bay.

If the results of this evaluation indicate that allowing the plume to discharge into the Great South Bay is unacceptable, it may be possible to install extraction wells and a treatment plant to contain the plume as far south as the Montauk Highway Rte. 27A). The highway is approximately 5,000 feet south of the position of the leading edge of the plume in early 1991. Existing data indicate that the plume traveled approximately 500 feet per year between 1983 and 1987 and 350 feet per year between 1988 and 1991 (see Subsection 6.1.3). Assuming that the plume continues to migrate south at 500 feet per year, it will reach the Montauk Highway in early 2001. Allowing two years for design and construction of the treatment plant, a decision to contain the plume would have to be made by early 1999.

To contain the plume at that time, the extraction and treatment system would most likely be significantly larger and more expensive to construct and operate than the containment system described for Alternative 6 in Subsection 13.6. The plume will become wider as it migrates south due to dispersion. In addition, contaminant plumes migrating south from the Hubbard Wilson Landfill and the Rite Off site (NYSDEC, 1990b), which exist west of the ServAll plume, may converge with the ServAll plume.

14.3.10 Cost

Capital, indirect, and operation and maintenance costs for the selected remedy for the air stripping and UV/oxidation options are presented in Tables 14-1 and 14-2, respectively. Cost backups are presented in Appendix S. The costs in this conceptual plan include some additional components that were not included in the detailed analysis. Costs for treatment plant effluent sampling, off-gas monitoring piezometers, and detail of the indirect costs have been added. Preliminary equipment lists are provided as part of these cost estimates (see Appendix S).

For the air stripping option, capital, indirect, and operation and maintenance costs are \$1,643,000, \$602,000, and \$1,711,000, respectively. The total present-worth cost for the selected remedial action using air stripping is estimated to be

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TABLE 14-1
COST ESTIMATE SELECTED REMEDY
IN SITU SOURCE SOIL TREATMENT
SOURCE AREA GROUNDWATER EXTRACTION
AIR STRIPPING

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

COST PARAMETER	COST	PRESENT WORTH COST(1)
CAPITAL COSTS		
Vacuum Extraction	\$171,000	\$171,000
Groundwater Extraction/Reinjection Wells	\$95,000	\$95,000
Treatment Plant with Air Stripping	\$1,300,000	\$1,300,000
Installation of Monitoring Wells	\$58,000	\$58,000
Institutional Controls	\$19,000	\$19,000
Total Capital Costs		\$1,643,000
INDIRECT COSTS		
Health and Safety	\$37,000	\$37,000
Legal, Administrative, Permitting	\$90,000	\$90,000
Engineering	\$317,000	\$317,000
Construction Management	\$158,000	\$158,000
Total Indirect Costs		\$602,000
OPERATING COSTS		
Groundwater Treatment (for 20 Years)	\$115,000	\$1,069,000
Environmental monitoring		
First 2 Years (4 Events Per Year)	\$100,000	\$177,000
Remaining 28 Years (1 Event Per Year)	\$25,000	\$219,000
Air Monitoring		
First Year	\$32,000	\$29,000
Remaining 19 Years (4 Events Per Year)	\$16,000	\$134,000
Effluent Monitoring		
First Year	\$16,000	\$15,000
Annual Cost after First Year	\$6,000	\$50,000
Five-year Reviews(2)	\$10,000	\$18,000
Total Operating Costs		\$1,711,000
SUBTOTAL		\$3,956,000
Contingency (20% of Subtotal)		\$791,000
TOTAL		\$4,747,000

NOTES:

(1) = Discount Rate is 8.75%

(2) = Present-worth cost based on reviews conducted every five years until year 30. Cost are conceptual only (-30/+50% accurate) and should not be considered an engineers estimate.

SELREM.WK1

TABLE 14-2
COST ESTIMATE SELECTED REMEDY
IN SITU SOURCE SOIL TREATMENT
SOURCE AREA GROUNDWATER EXTRACTION
UV/OXIDATION

SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

COST PARAMETER	COST	PRESENT WORTH COST(1)
CAPITAL COSTS		
Vacuum Extraction	\$171,000	\$171,000
Groundwater Extraction/Reinjection Wells	\$95,000	\$95,000
Treatment Plant with UV/oxidation	\$1,507,000	\$1,507,000
Installation of Monitoring Wells	\$58,000	\$58,000
Institutional Controls	\$19,000	\$19,000
Total Capital Costs		\$1,850,000
INDIRECT COSTS		
Health and Safety	\$41,000	\$41,000
Legal, Administrative, Permitting	\$90,000	\$90,000
Engineering	\$343,000	\$343,000
Construction Management	\$185,000	\$185,000
Total Indirect Costs		\$659,000
OPERATING COSTS		
Groundwater Treatment (for 20 Years)	\$127,000	\$1,180,000
Environmental monitoring		
First 2 Years (4 Events Per Year)	\$100,000	\$177,000
Remaining 28 Years (1 Event Per Year)	\$25,000	\$219,000
Air Monitoring		
First Year	\$32,000	\$29,000
Remaining 19 Years (4 Events Per Year)	\$16,000	\$134,000
Effluent Monitoring		
First Year	\$16,000	\$15,000
Annual Cost after First Year	\$6,000	\$50,000
Five-year Reviews(2)	\$10,000	\$18,000
Total Operating Costs		\$1,822,000
SUBTOTAL		\$4,331,000
Contingency (20% of Subtotal)		\$866,000
TOTAL		\$5,197,000

NOTES:

(1) = Discount Rate is 8.75%

(2) = Present-worth cost based on reviews conducted every five years until year 30. Cost are conceptual only (-30/+50% accurate) and should not be considered an engineers estimate.

SELREMU.V.WK1

SECTION 14

\$4,747,000. This total includes a contingency of \$791,000 (20 percent of the subtotal of capital, indirect, and present-worth operating costs) to account for unforeseen costs that could increase the cost of this alternative.

For the UV/oxidation option, capital, indirect, and operation and maintenance are \$1,850,000, \$659,000, and \$1,822,000, respectively. The total present-worth cost for the selected remedial action using UV/oxidation is estimated to be \$5,197,000. This total includes a contingency of \$866,000.

14.3.11 Schedule

Figure 14-10 presents a schematic of the remediation process and Figure 14-11 presents a proposed implementation schedule for the selected remedial action. The schematic and schedule are preliminary and will need to be revised.

E.C. Jordan Co.

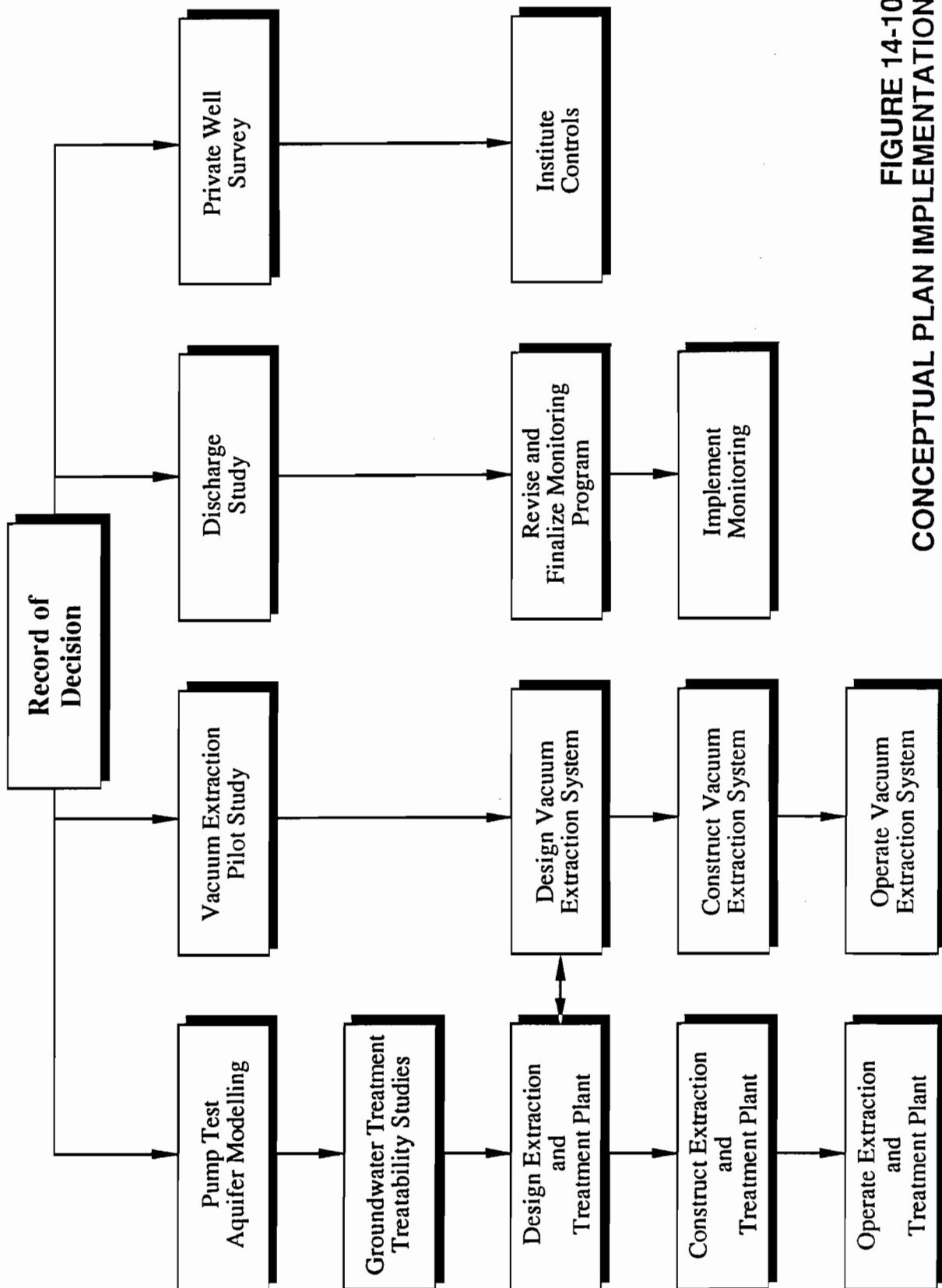


FIGURE 14-10
CONCEPTUAL PLAN IMPLEMENTATION
FLOW CHART
SERVALL LAUNDRY SITE
BAY SHORE, NEW YORK

E.C. JORDAN CO.



E.C. JORDAN Co.						MW-14						
Project Remedial Investigation /Feasibility Study						Site ServAll Laundry			Project No. 6205-21			
DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (Ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		WELL DIAGRAM	LAB TESTS
	S-6					Purged 90 gallons Rate = 10 gpm Clear discharge		ND	PI METER FIELD SCAN	PI METER HEAD SPACE		
45	S-7					Purged 105 gallons Rate 15 gpm Clear discharge		ND				
50	S-8					Purged 120 gallons Rate 15 gpm Clear discharge		ND				
55	S-9					Purged 135 gallons Rate 15 gpm Clear discharge		ND				
60	S-10					Purged 150 gallons Rate 15 gpm Clear discharge		ND				
65	S-11					Purged 165 gallons Rate = 15 gpm Clear discharge		ND				
70	S-12					Purged 180 gallons Rate = 15 gpm Clear discharge		ND				
75	S-13					Purged 195 gallons Rate 15 gpm Clear discharge		ND				
80	S-14					Purged 210 gallons Rate 15 gpm Clear discharge		ND				
85	S-15					Purged 225 gallons Rate = 15 gpm Clear discharge		ND				
						OUTWASH						

Project

Remedial Investigation/Feasibility Study

Site

ServAll Laundry

Project No.

6205-21

DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (Ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM			WELL DIAGRAM	LAB TESTS
									PI METER	FIELD SCAN	PI METER	HEAD SPACE	
95	S-16					Purged 240 gallons Rate = 15 gpm Clear discharge OUTWASH		ND					
95						BOB = 95 ft							
100													
105													
110													
115													
120													
125													
130													
135													

E.C. JORDAN Co.						MW-15						
Project Remedial Investigation/Feasibility Study						Site ServAll Laundry			Project No. 6205-21			
Client NYSDEC						Logged By NSG		Checked By NSG		Ground Elev 49.00		
Drilling Contractor WTD				Driller's Name J. Weeks		Rig Type D-120		Start Date 1-15-91		Finish Date 1-16-91		
Drilling Method Screened HSA				Protection Level Modified D w/ vent.		P.I.D. (eV) 10.6		Casing Size NA		Auger Size(in) 4.25 ID		
Soil Drilled (ft) 98		Rock Drilled (ft) NA		Total Depth (ft) 98		Depth to Groundwater (ft) / Date 14.99 / 2-12-91			Piez. Boring ☐ Well ☒			
DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM			LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE	WELL DIAGRAM	
5						The boring was advanced using a screened lead auger and sampled at 5 ft intervals beginning at the water table. Samples were collected using a teflon bailer after a minimum 3 volume purge with a submersible pump. Purged 15 gallons Rate = 10 gpm Slightly turbid discharge Purged 25 gallons Rate = 10 gpm Slightly turbid discharge Purged 35 gallons Rate = 10 gpm Clear discharge Purged 45 gallons Rate = 10 gpm Clear discharge Purged 55 gallons Rate = 10 gpm OUTWASH						
10												
15												
20	S-1							ND		BKG		
25	S-2							ND		BKG		
30	S-3						ND		BKG			
35	S-4						ND		BKG			
	S-5						3		BKG			

E.C. JORDAN Co.						MW-15						
Project						Site			Project No.			
Remedial Investigation/Feasibility Study						ServAll Laundry			6205-21			
DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		WELL DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE		
						Clear discharge						
45	S-6					Purged 75 gallons Rate = 10 gpm Clear discharge		ND		BKG		
50	S-7					Purged 80 gallons Rate = 10 gpm Clear discharge		(1)		BKG		
55	S-8					Purged 90 gallons Rate = 10 gpm Clear discharge		15		BKG		
60	S-9					Purged 100 gallons Rate = 10 gpm Clear discharge		3		BKG		
65	S-10					Purged 115 gallons Rate = 10 gpm Clear discharge		39		BKG		
70	S-11					Purged 125 gallons Rate = 10 gpm Clear discharge		25		BKG		
75	S-12					Purged 135 gallons Rate = 10 gpm Clear discharge		119*		BKG		
80	S-13					Purged 145 gallons Rate = 10 gpm Clear discharge		128* +		BKG		
85	S-14					Purged 155 gallons Rate = 10 gpm Clear discharge		150 +		BKG		
	S-15					Purged 170 gallons Rate = 10 gpm		149.5 +		BKG		
						OUTWASH						

E.C. JORDAN Co.						MW-15					
Project Remedial Investigation/Feasibility Study						Site ServAll Laundry		Project No. 6205-21			
DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (Ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE	WELL DIAGRAM
95	S-16					Clear discharge Purged 180 gallons Rate = 10 gpm Slightly turbid discharge		228+		BKG	
						MARINE CLAY					
100						BOB = 98 ft					
						Formation change inferred from change in discharge.					
105											
110											
115											
120											
125											
130											
135											

E.C. JORDAN Co.						MW-16										
Project Remedial Investigation/Feasibility Study						Site ServAll Laundry			Project No. 6205-21							
Client NYSDEC						Logged By J. Andrews		Checked By NSG		Ground Elev. 36.80						
Drilling Contractor WTD				Driller's Name D. Zielazowski		Rig Type D-50		Start Date 1-15-91		Finish Date 1-16-91						
Drilling Method Screened HSA				Protection Level Modified D w/ vent.		P.I.D. (eV) 10.6		Casing Size NA		Auger Size(in) 4.25 ID						
Soil Drilled (ft) 95		Rock Drilled (ft) NA		Total Depth (ft) 95		Depth to Groundwater (ft) / Date 11.98 / 2-12-91			Piez. Boring ☐ Well ☒							
DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (Ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION			USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		PI METER FIELD SCAN	PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
5						The boring was advanced using a screened lead auger and sampled at 5 ft intervals beginning at the water table. Samples were collected using a teflon bailer after a minimum 3 volume purge with a submersible pump. Purged 15 gallons Rate = 15 gpm Turbid discharge Purged 30 gallons Rate 15 gpm Turbid discharge Purged 45 gallons Rate 15 gpm Turbid discharge Purged 60 gallons Rate 15 gpm Clear discharge Purged 75 gallons Rate 15 gpm Clear discharge OUTWASH										
10																
15	S-1															
20	S-2															
25	S-3															
30	S-4															
35	S-5															

E.C. JORDAN Co.						MW-16								
Project Remedial Investigation/Feasibility Study						Site ServAll Laundry			Project No. 6205-21					
DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		PI METER FIELD SCAN	PI METER HEAD SPACE WELL	DIAGRAM	LAB TESTS
	S-6					Purged 90 gallons Rate = 10 gpm Clear discharge		ND						
45	S-7					Purged 105 gallons Rate 15 gpm Clear discharge		ND						
50	S-8					Purged 115 gallons Rate 15 gpm Clear discharge		ND						
55	S-9					Purged 130 gallons Rate 15 gpm Clear discharge		ND						
60	S-10					Purged 145 gallons Rate 15 gpm Clear discharge		ND						
65	S-11					Purged 145 gallons Rate = 15 gpm Clear discharge		ND						
70	S-12					Purged 160 gallons Rate = 15 gpm Clear discharge		ND						
75	S-13					Purged 175 gallons Rate 15 gpm Clear discharge		22						
80	S-14					Purged 190 gallons Rate 15 gpm Clear discharge		131 +						
85	S-15					Purged 205 gallons Rate = 15 gpm Slightly turbid discharge		51						
						OUTWASH								

Project

Remedial Investigation/Feasibility Study

Site

ServAll Laundry

Project No.

6205-21

DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (FT)	SAMPLE TYPE	SPT BLOWS/8" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC Ppb	P. I. D. PPM			WELL DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE			
95	S-16					Purged 220 gallons Rate = 15 gpm Slightly turbid discharge OUTWASH		7					
100						BOB = 95 ft							
105													
110													
115													
120													
125													
130													
135													

E.C. JORDAN Co.						PZ- 2					
Project Remedial Investigation/Feasibility Study						Site ServAll Laundry			Project No. 6205-21		
Client NYSDEC						Logged By J. Andrews		Checked By NSG		Ground Elev 64.81	
Drilling Contractor WTD				Driller's Name D. Zielazowski		Rig Type D-50		Start Date 12-13-90		Finish Date 12-13-90	
Drilling Method HSA				Protection Level Modified D		P.I.D. (eV) 10.0		Casing Size NA		Auger Size(in) 4.25 ID	
Soil Drilled (ft) 27		Rock Drilled (ft) NA		Total Depth (ft) 27		Depth to Groundwater (ft) / Date 19.54 / 2-12-91			Piez. Boring ☒ Well ☐		

DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USGS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		WELL DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE		
5 10 15 20 25 30 35	S-1 2.0/1.0		5-6-10-12			Asphalt and roadbed material, 6 in thick. Light brown SILT, little fine sand; poorly graded; loose; moist.	ML		0		CLP	
	S-2 2.0/1.8		16-44-50-72			Tan medium to fine SAND, little fine gravel; poorly graded; very dense; moist.	SP/SW		BKG			
	S-3 2.0/2.0		38-59-58-53			Tan medium to fine SAND, little fine gravel, trace rounded cobbles; well graded; very dense; moist.			BKG			
	S-4 2.0/2.0		50-85-77-88						BKG			
	S-5 2.0/2.0		18-25-24-31			Saturated at 21.0 ft.			BKG			
	S-6 2.0/0.0		45-73-52-35			NO RECOVERY.			BKG			
						BOB = 27 ft						

E.C. JORDAN Co.

SB- 2

Project Remedial Investigation/Feasibility Study				Site ServAll Laundry		Project No. 6205-21	
Client NYSDEC				Logged By J. Andrews		Checked By NSG	
Drilling Contractor WTD				Driller's Name D. Zielazowski		Rig Type D-50	
Drilling Method HSA				Protection Level Modified D w/ vent.		Start Date 12-12-90	
				P.I.D. (eV) 10.0		Finish Date 12-12-90	
Soil Drilled (ft) 22		Rock Drilled (ft) NA		Total Depth (ft) 22		Depth to Groundwater (ft) / Date 21 / 12-12-90	
				Piez. Boring ☐		Well ☒	

DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (FT)	SAMPLE TYPE	SPT BLOWS/8" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM	PI METER FIELD SCAN	PI METER HEAD SPACE	WELL	DIAGRAM	LAB TESTS
5	S-1 2.0/1.5		25-11-12-20			Brown-black SILT, little fine sand, trace black organics; poorly graded; loose; moist; over brown SILT, little fine sand; poorly graded loose; moist.	ML		BKG	49.2				
	S-2 2.0/1.0		6-20-45-56			Brown-tan medium to fine SAND, little silt, trace fine gravel, well graded; dense; moist.	SP/SM	tr	BKG	164.0				
	S-3 2.0/2.0		10-45-65-100/.5			FILL			BKG	5.6				CLP
	S-4 2.0/2.0		45-63-90-100/.5					ND	6	2.2				
10	S-5 2.0/2.0		31-65-100/.6						15	5.6				CLP
	S-6 2.0/2.0		55-38-45-44			Rounded cobbles at 10 ft.		ND	4	3.9				
	S-7 2.0/2.0		25-35-55-40						BKG	21.7				
15	S-8 2.0/2.0		18-26-32-30					ND	BKG	7.3				
	S-9 2.0/2.0		60-36-43-45			Tan fine SAND; poorly graded; dense; moist.	SP/SW		BKG	0.8				
	S-10 2.0/2.0		28-39-50-42					ND	BKG	0.725				CLP
20	S-11 2.0/2.0		11-25-32-38			Tan medium to fine SAND, trace fine gravel; well graded; dense; saturated.			BKG	10.7				
						OUTWASH								
25						BOB = 22 ft								
30														
35														

E.C. JORDAN Co.					SB- 3					
Project Remedial Investigation/Feasibility Study					Site ServAll Laundry			Project No. 6205-21		
Client NYSDEC					Logged By J. Andrews		Checked By NSG		Ground Elev 64.71	
Drilling Contractor WTD			Driller's Name D. Zielazowski		Rig Type D-50		Start Date 12-12-90		Finish Date 12-12-90	
Drilling Method HSA			Protection Level Modified D w/ vent.		P.I.D. (eV) 10.0		Casing Size NA		Auger Size(in) 4.25 ID	
Soil Drilled (ft) 22		Rock Drilled (ft) NA		Total Depth (ft) 22		Depth to Groundwater (ft) / Date 21 / 12-12-90		Piez. Boring ☐ Well ☒		

DEPTH(Feet)	SAMPLE NO. & PENETRATION / RECOVERY (Ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		WELL DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE		
5	S-1 1.5/1.0		50-40-20			Dark brown-black SILT, some fine sand, trace fine gravel; well graded dense; moist.	ML/SP	ND	BKG	2.1		
	S-2 2.0/2.0		13-10-29-5			Brown fine SANDY SILT, trace fine gravel; well graded; loose; moist.			BKG	110.5		
	S-3 2.0/2.0		19-44-41-50			FILL Brown-tan medium to fine SAND, trace fine gravel; well graded; dense; moist.	SP/SW	ND	BKG	1.9		
	S-4 1.4/1.4		70-83-100/0.4					BKG	11.0	CLP		
	S-5 2.0/2.0		53-46-72-70					ND	BKG	2.5		
10	S-6 2.0/2.0		28-40-43-44			Rounded cobbles at 10 ft.			BKG	2.2		
	S-7 2.0/2.0		28-30-34-28					ND	BKG	18.3		CLP
15	S-8 1.3/		40-50-100/0.3			NO RECOVERY.						
	S-9 1.0/		80-100/0.3			NO RECOVERY.						
	S-10 2.0/2.0		22-28-27-25			Brown-tan fine SAND; poorly graded; medium dense; moist.			BKG	2.4		CLP
20	S-11 2.0/2.0		13-14-26-28			Saturated at 21 ft.		ND	BKG	52.3		
						OUTWASH						
25						BOB = 22 ft						
30												
35												

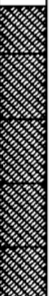
E.C. JORDAN Co.

SB- 4

Project Remedial Investigation/Feasibility Study				Site ServAll Laundry		Project No. 6205-21	
Client NYSDEC				Logged By J. Andrews		Checked By NSG	
Drilling Contractor WTD				Driller's Name D. Zielazowski		Rig Type D-50	
Drilling Method HSA				Protection Level Modified D w/ vent.		Start Date 12-12-90	
						Finish Date 12-13-90	
				P.I.D. (eV) 10.0		Casing Size NA	
						Auger Size(in) 4.25 ID	
Soil Drilled (ft) 22		Rock Drilled (ft) NA		Total Depth (ft) 22		Depth to Groundwater (ft) / Date 21 / 12-13-90	
						Piez. Boring ☐ Well ☒	

DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (FT)	SAMPLE TYPE	SPT BLOWS/8" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM	PI METER FIELD SCAN	PI METER HEAD SPACE	WELL DIAGRAM	LAB TESTS
5	S-1 2.0/2.0		Not Recorded			Asphalt and roadbed, 6 in thick Brown SILT, little fine sand; poorly graded; loose; dry.	ML						
	S-2 2.0/1.2		Not Recorded										
	S-3 1.4/1.4		100/0.4										
	S-4 2.0/2.0		21-14-8-4			VAULT- Drill stem apparently penetrated an old cesspool.		35	BKG				
10	S-5 2.0/2.0		4-4-3-4						5				
	S-6 2.0/2.0		12-30-40-58					1677	25				
	S-7 2.0/2.0		21-45-52-45					70850	20				
15	S-8 2.0/2.0		36-60-81-100			FILL Tan medium to fine SAND, trace fine gravel; uniform; very dense; dry.	SP/SW		50				CLP
	S-9 2.0/2.0		36-61-80-100					34140	60				TCLP
	S-10 2.0/2.0		22-44-70-50						117				CLP
20	S-11 2.0/2.0		14-29-42-66			Saturated at 21 ft.		21870	100				
						OUTWASH							
25						BOB = 22 ft							
30													
35													

E.C. JORDAN Co.						SB- 5					
Project Remedial Investigation/Feasibility Study						Site ServAll Laundry			Project No. 6205-21		
Client NYSDEC						Logged By K. Hewitt		Checked By NSG		Ground Elev 65.54	
Drilling Contractor WTD				Driller's Name J. Weeks		Rig Type D-120		Start Date 12-16-90		Finish Date 12-17-90	
Drilling Method HSA				Protection Level Modified D w/ vent.		P.I.D. (eV) 10.0		Casing Size NA		Auger Size(in) 4.25 ID	
Soil Drilled (ft) 47		Rock Drilled (ft) NA		Total Depth (ft) 47		Depth to Groundwater (ft) / Date 21.1 / 12-16-90			Piez. Boring ☐		Well ☒

DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		DIAGRAM	LAB TESTS	
									PI METER FIELD SCAN	PI METER HEAD SPACE WELL			
5	S-1 1.5/1.5		16-16-15			Asphalt and roadbed, 6 in thick Brown medium to fine SAND, trace coarse; poorly graded; medium loose; dry. Large cobble, fractured at 5.3 ft. Fractured quartz cobble, 4 in wide, at 7.7 ft. Large cobble in tip, oily sheen on split spoon, damp.	SP/SW	65	BKG	7.2		CLP	
	S-2 2.0/0.8		26-31-34-36					BKG	4.8				
	S-3 2.0/0.3		12-21-17-17					248	BKG	40.2			
	S-4 2.0/0.3		36-32-20-16										
	S-5 2.0/0.0		16-12-18-32						BKG				
10	S-6 2.0/1.3		23-26-38-28			Dark brown fine SAND; poorly graded; medium firm; moist over Brown-tan medium to fine SAND, trace coarse sand trace cobbles; faintly stratified; medium to well graded; dense; moist.	3004*	5.6	24.9		CLP		
	S-7 2.0/1.1		13-18-18-24					11940	6.4			731	
	S-8 2.0/1.3		9-18-26-32						12.0			137.4	TCLP
15	S-9 2.0/1.2		13-70-89-100/.2			FILL Tan fine to medium SAND, trace coarse sand; medium to poorly graded, very dense; moist.	36150	5.6	568				
	S-10 2.0/1.2		17-55-100/0.4										
	S-11 2.0/1.3		27-28-48-55						14000			2.1	190
20						Saturated at 21.2 ft.	SP/SW						
	S-12 2.0/1.5		13-29-39-42						11150			2.1	907
30	S-13 2.0/1.0		27-80-100/0.4			Reddish-brown layer of coarse SAND at 26.3 ft.	570	1.3	169				
35	S-14 2.0/1.6		17-29-32-63			OUTWASH	590	52	51				

E.C. JORDAN Co.

SB- 5

Project

Remedial Investigation/Feasibility Study

Site

ServAll Laundry

Project No.

6205-21

DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM			WELL DIAGRAM	LAB TEST
									PI METER FIELD SCAN	PI METER HEAD SPACE			
	S-15 2.0/1.7		71-13-26-40			Large cobble, 4 in across, wedged in the tip of the split spoon.		1412	8.2	78.8			CLP
45	S-16 2.0/0.0		11-25-24-23			NO RECOVERY. OUTWASH	SP/SW						
50						BOB = 47 ft							
55													
60													
65													
70													
75													
80													
85													

E.C. JORDAN Co.						SB- 6					
Project Remedial Investigation/Feasibility Study						Site ServAll Laundry			Project No. 6205-21		
Client NYSDEC						Logged By K. Hewitt		Checked By NSG		Ground Elev 65.47	
Drilling Contractor WTD				Driller's Name J. Weeks		Rig Type D-120		Start Date 12-17-90		Finish Date 12-17-90	
Drilling Method HSA				Protection Level Modified D w/ vent.		P.I.D. (eV) 10.0		Casing Size NA		Auger Size(in) 4.25 ID	
Soil Drilled (ft) 22		Rock Drilled (ft) NSA		Total Depth (ft) 22		Depth to Groundwater (ft) / Date 21.6 / 12-17-90			Piez. Boring ☐		Well ☒

DEPTH (FEET)	SAMPLE NO. & PENETRATION / RECOVERY (FT)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		DIAGRAM	LAB TESTS	
									PI METER FIELD SCAN	PI METER HEAD SPACE WELL			
5	S-1 1.5/1.2		13-17-16			Asphalt and roadbed, 6 in thick. Dark brown fine to medium SAND, trace coarse sand; poorly graded; medium dense; moist. Plastic debris at 2.4 ft.	SP	tr	BKG	32.3			
	S-2 2.0/1.5		28-12-12-14			1.3			17.8				
	S-3 2.0/1.5		11-23-26-21			1.3			31.3	CLP			
	S-4 2.0/1.5		49-23-30-35			44			48.2	ICLP			
10	S-5 2.0/1.3		34-48-52-63			Tan fine SAND, trace coarse sand; faintly laminated; poorly graded, very dense; moist over darker brown coarse SAND; poorly graded; very dense; moist. Tan fine SAND trace medium to coarse sand, trace cobbles; well graded, very dense; moist.	SP/SW	1404	57	62.2			
	S-6 2.0/1.7		37-52-72-89			52.7			142.9				
	S-7 2.0/1.3		70-100/0.5			2970*			23.9	89.3			CLP
	S-8 2.0/1.0		20-59-64-68			21.3			4.2				
15	S-9 0.8/0.8		32-100/0.2			Red to brown laminations up to a 0.1 in thick at 11.2 ft.		170	10	13.7			
	S-10 2.0/0.8		12-35-42-49						14.3	141.6			
	S-11 2.0/1.2		12-23-35-41						2600	132			409
20						Saturated at 21.6 ft.							
						OUTWASH							
25						BOB = 22 ft							
30													
35													

E.C. JORDAN Co.						SB- 7					
Project Remedial Investigation/Feasibility Study						Site ServAll Laundry			Project No. 6205-21		
Client NYSDEC						Logged By K. Hewitt		Checked By NSG		Ground Ele 65.15	
Drilling Contractor WTD				Driller's Name J. Weeks		Rig Type D-120		Start Date 12-18-90		Finish Date 12-18-90	
Drilling Method HSA				Protection Level Modified D w/ vent.		P.I.D. (eV) 10.0		Casing Size NA		Auger Size(in) 4.25 ID	
Soil Drilled (ft) 22		Rock Drilled (ft) NA		Total Depth (ft) 22		Depth to Groundwater (ft) / Date 20.6 / 12-18-90		Piez. Boring ☐		Well ☒	

DEPTH(Feet)	SAMPLE NO. & PENETRATION / RECOVERY (ft)	SAMPLE TYPE	SPT BLOWS/6" OR CORE REC/RQD (%)	SPT-N (BLOWS/FT)	GRAPHIC LOG	SAMPLE DESCRIPTION	USCS GROUP SYMBOL	GC DATA TOTAL VOC ppb	P. I. D. PPM		DIAGRAM	LAB TESTS
									PI METER FIELD SCAN	PI METER HEAD SPACE WELL		
5	S-1 1.5/0.7		20-18-26			Asphalt and roadbed, 6 in thick. Dark brown fine to medium SAND, trace coarse sand, trace cobbles; poorly graded; dense; moist.	SP/SW	84	BKG	8.2		
	FILL VAULT- Drill stem apparently penetrated an old cesspool.											
10	S-2 2.0/1.3		65-22-33-39			Dark brown fine to medium SAND, trace coarse sand, trace cobbles; poorly graded; dense; moist.	SP/SW		BKG	16.0		CLP
	S-3 2.0/1.2		45-13-17-12			Organics roots and a large cobble at 8.0 ft.		114	BKG	16.9		TCLP
	S-4 2.0/0.8		5-4-6-5			Dark brown fine to medium SAND and dark black tar-like material; strong odor; medium dense; moist.		14072*	2.5	29.9		
	S-5 2.0/0.9		6-7-12-19					3.0	91.0			
15	S-6 2.0/0.2		11-21-23-23					37000	BKG	132.4		
	S-7 2.0/0.5		12-21-39-47			Dark brown medium to coarse SAND, trace fine sand; medium to well graded; very dense; moist.			BKG	85.3		
20	S-8 1.4/1.0		39-67-100/0.4			Black tar-like residue at 18.4 to 18.8 ft, strong odor.		24610	5.6	40.3		CLP
	S-9 2.0/1.4		22-37-67-82					SP		BKG		138.2
25						OUTWASH BOB = 22 ft						
30												
35												



APPENDIX A-3
WELL INSTALLATION LOGS

E.C. Jordan Co.



E. C. JORDAN WELL INSTALLATION LOG

JOB # 6205-21

SERVALL LAUNDRY SITE, BAY SHORE, NY

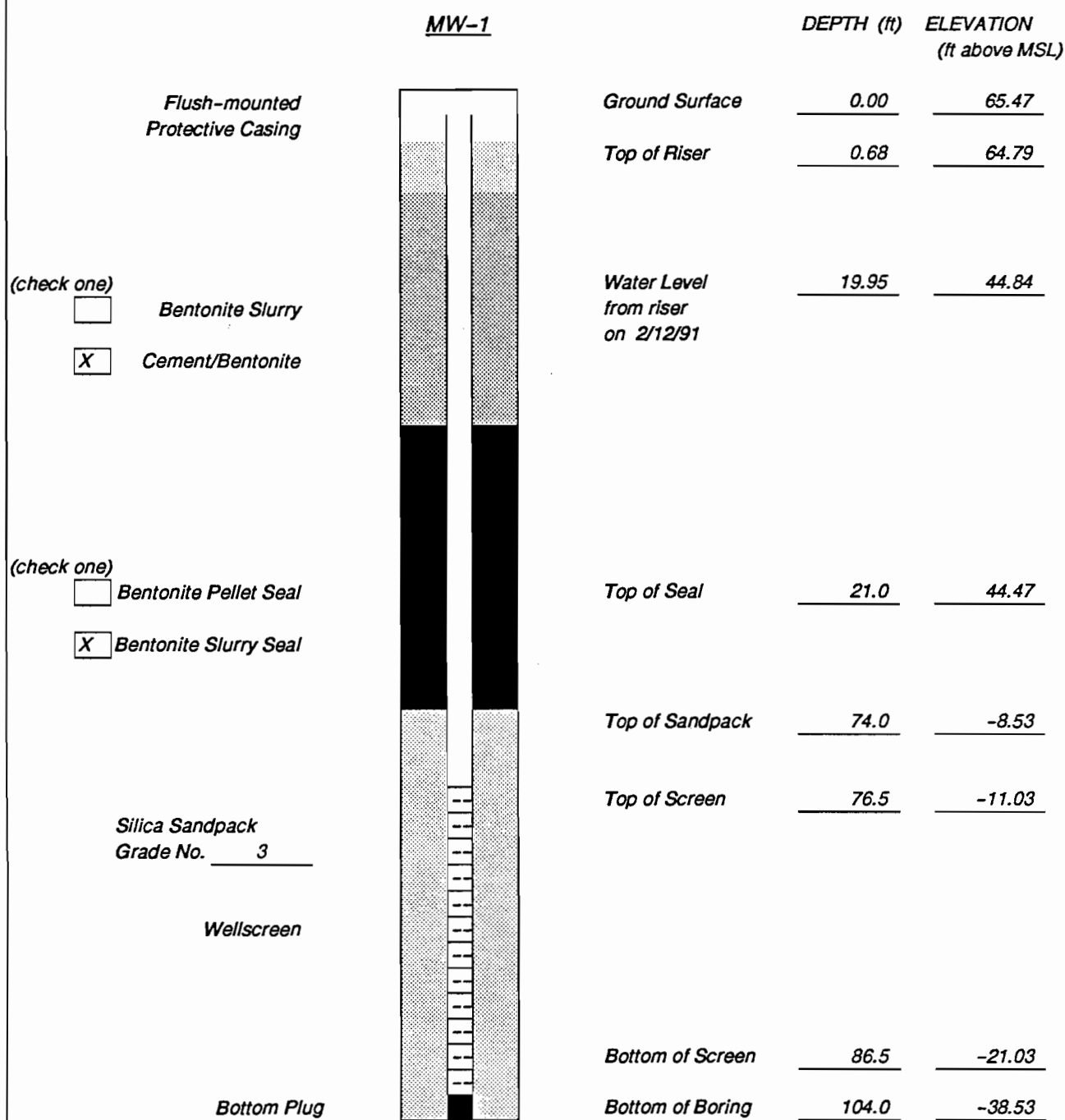
N. Y. STATE DEPT. OF ENV. CONSERVATION

WELL NO. SB-1/MW-1

INSTALLATION DATE: 12/16/90

INSTALLED BY: WTD inc.

LOGGED BY: K. Hewitt



WELL CONSTRUCTION

- ☐ *Riser and screen are constructed with 2-inch ID Sch. 5
flush-joint stainless steel. Screen slot size is: _____*
- ☒ *Riser and screen are constructed with 4-inch ID Sch. 80
flush-joint PVC. Screen slot size is: 0.010-inch.*

E. C. JORDAN WELL INSTALLATION LOG?<

JOB # 6205-21

SERVALL LAUNDRY SITE, BAY SHORE, NY

N. Y. STATE DEPT. OF ENV. CONSERVATION

WELL NO. MW-2

INSTALLATION DATE: 12/14/90

INSTALLED BY: WTD inc.

LOGGED BY: J. Andrews

MW-2		DEPTH (ft)	ELEVATION (ft above MSL)
<i>Flush-mounted Protective Casing</i>		<i>Ground Surface</i>	<u>0.00</u> <u>65.05</u>
		<i>Top of Riser</i>	<u>0.58</u> <u>64.47</u>
(check one) ☐ <i>Bentonite Slurry</i> ☒ <i>Cement/Bentonite</i>		<i>Water Level from riser on 2/12/91</i>	<u>19.27</u> <u>45.20</u>
(check one) ☐ <i>Bentonite Pellet Seal</i> ☒ <i>Bentonite Slurry Seal</i>		<i>Top of Seal</i>	<u>20.0</u> <u>45.05</u>
<i>Silica Sandpack Grade No. <u>3</u></i>		<i>Top of Sandpack</i>	<u>71.0</u> <u>-5.95</u>
<i>Wellscreen</i>		<i>Top of Screen</i>	<u>71.8</u> <u>-6.75</u>
<i>Bottom Plug</i>		<i>Bottom of Screen</i>	<u>81.8</u> <u>-16.75</u>
		<i>Bottom of Boring</i>	<u>85.0</u> <u>-19.95</u>

WELL CONSTRUCTION



Riser and screen are constructed with 2-inch ID Sch. 5 flush-joint stainless steel. Screen slot size is: 0.010-inch.



Riser and screen are constructed with 4-inch ID Sch. 80 flush-joint PVC. Screen slot size is: _____

E. C. JORDAN WELL INSTALLATION LOG

JOB # 6205-21

SERVALL LAUNDRY SITE, BAY SHORE, NY

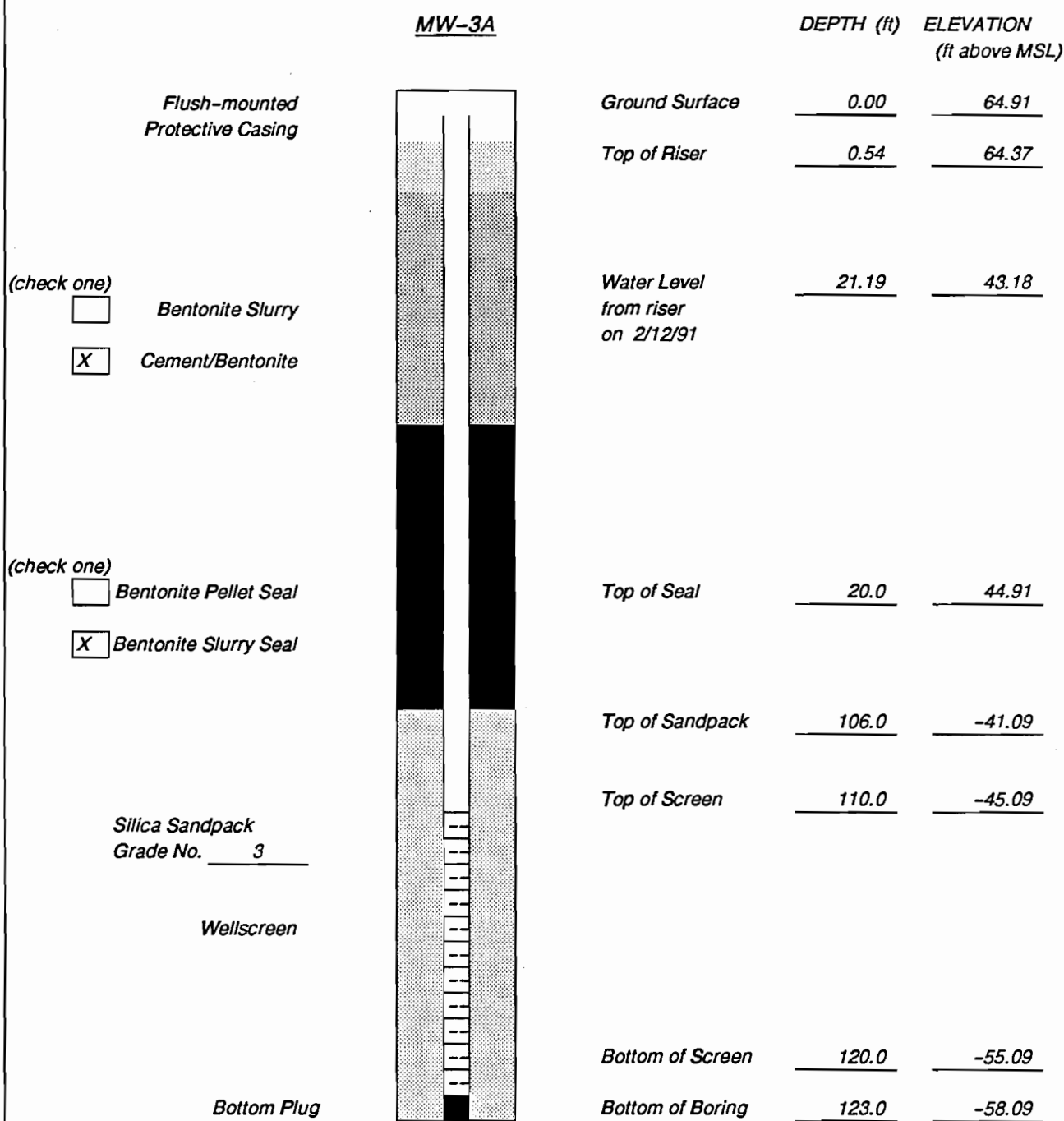
N. Y. STATE DEPT. OF ENV. CONSERVATION

WELL NO. MW-3A

INSTALLATION DATE: 12/17/90

INSTALLED BY: WTD inc.

LOGGED BY: J. Andrews



WELL CONSTRUCTION



Riser and screen are constructed with 2-inch ID Sch. 5 flush-joint stainless steel. Screen slot size is: 0.010-inch.



Riser and screen are constructed with 4-inch ID Sch. 80 flush-joint PVC. Screen slot size is: _____

E. C. JORDAN WELL INSTALLATION LOG

JOB # 6205-21

SERVALL LAUNDRY SITE, BAY SHORE, NY

N. Y. STATE DEPT. OF ENV. CONSERVATION

WELL NO. MW-3B

INSTALLATION DATE: 12/16/90

INSTALLED BY: WTD inc.

LOGGED BY: J. Andrews

MW-3B		DEPTH (ft)	ELEVATION (ft above MSL)
<i>Flush-mounted Protective Casing</i>			
<i>Ground Surface</i>		<u>0.00</u>	<u>65.02</u>
<i>Top of Riser</i>		<u>0.48</u>	<u>64.54</u>
<i>Water Level from riser on 2/12/91</i>		<u>19.36</u>	<u>45.18</u>
(check one) ☐ <i>Bentonite Slurry</i> ☒ <i>Cement/Bentonite</i>			
<i>Top of Seal</i>		<u>20.0</u>	<u>45.02</u>
(check one) ☐ <i>Bentonite Pellet Seal</i> ☒ <i>Bentonite Slurry Seal</i>			
<i>Top of Sandpack</i>		<u>74.5</u>	<u>-9.48</u>
<i>Top of Screen</i>		<u>78.0</u>	<u>-12.98</u>
<i>Silica Sandpack Grade No. 3</i>			
<i>Wellscreen</i>			
<i>Bottom of Screen</i>		<u>88.0</u>	<u>-22.98</u>
<i>Bottom Plug</i>		<u>90.0</u>	<u>-24.98</u>
<i>Bottom of Boring</i>			

WELL CONSTRUCTION

- ☒ *Riser and screen are constructed with 2-inch ID Sch. 5 flush-joint stainless steel. Screen slot size is: 0.010-inch.*
- ☐ *Riser and screen are constructed with 4-inch ID Sch. 80 flush-joint PVC. Screen slot size is: _____*

E. C. JORDAN WELL INSTALLATION LOG

JOB # 6205-21

SERVALL LAUNDRY SITE, BAY SHORE, NY

N. Y. STATE DEPT. OF ENV. CONSERVATION

WELL NO. MW-4

INSTALLATION DATE: 12/19/90

INSTALLED BY: WTD inc.

LOGGED BY: J. Andrews

MW-4		DEPTH (ft)	ELEVATION (ft above MSL)
Flush-mounted Protective Casing		Ground Surface	0.00 63.69
		Top of Riser	0.58 63.11
		Water Level from riser on 2/12/91	18.77 44.34
(check one)	☐ Bentonite Slurry		
	☒ Cement/Bentonite		
(check one)	☐ Bentonite Pellet Seal	Top of Seal	20.0 43.69
	☒ Bentonite Slurry Seal		
		Top of Sandpack	72.0 -8.31
		Top of Screen	74.0 -10.31
Silica Sandpack Grade No. 3			
Wellscreen		Bottom of Screen	84.0 -20.31
Bottom Plug		Bottom of Boring	86.0 -22.31

WELL CONSTRUCTION

- ☒ Riser and screen are constructed with 2-inch ID Sch. 5 flush-joint stainless steel. Screen slot size is: 0.010-inch.
- ☐ Riser and screen are constructed with 4-inch ID Sch. 80 flush-joint PVC. Screen slot size is: _____

E. C. JORDAN WELL INSTALLATION LOG

JOB # 6205-21

SERVALL LAUNDRY SITE, BAY SHORE, NY

N. Y. STATE DEPT. OF ENV. CONSERVATION

WELL NO. MW-5

INSTALLATION DATE: 12/18/90

INSTALLED BY: WTD inc.

LOGGED BY: J. Andrews

MW-5		DEPTH (ft)	ELEVATION (ft above MSL)
<i>Flush-mounted Protective Casing</i>		<i>Ground Surface</i>	<u>0.00</u> <u>64.44</u>
		<i>Top of Riser</i>	<u>0.38</u> <u>64.06</u>
(check one) ☐ <i>Bentonite Slurry</i> ☒ <i>Cement/Bentonite</i>		<i>Water Level from riser on 2/12/91</i>	<u>19.46</u> <u>44.60</u>
(check one) ☐ <i>Bentonite Pellet Seal</i> ☒ <i>Bentonite Slurry Seal</i>		<i>Top of Seal</i>	<u>20.0</u> <u>44.44</u>
<i>Silica Sandpack Grade No. 3</i>		<i>Top of Sandpack</i>	<u>72.3</u> <u>-7.86</u>
<i>Wellscreen</i>		<i>Top of Screen</i>	<u>74.0</u> <u>-9.56</u>
<i>Bottom Plug</i>		<i>Bottom of Screen</i>	<u>84.0</u> <u>-19.56</u>
		<i>Bottom of Boring</i>	<u>85.0</u> <u>-20.56</u>

WELL CONSTRUCTION

☒

Riser and screen are constructed with 2-inch ID Sch. 5 flush-joint stainless steel. Screen slot size is: 0.010-inch.

☐

Riser and screen are constructed with 4-inch ID Sch. 80 flush-joint PVC. Screen slot size is: _____

E. C. JORDAN WELL INSTALLATION LOG

JOB # 6205-21

SERVALL LAUNDRY SITE, BAY SHORE, NY

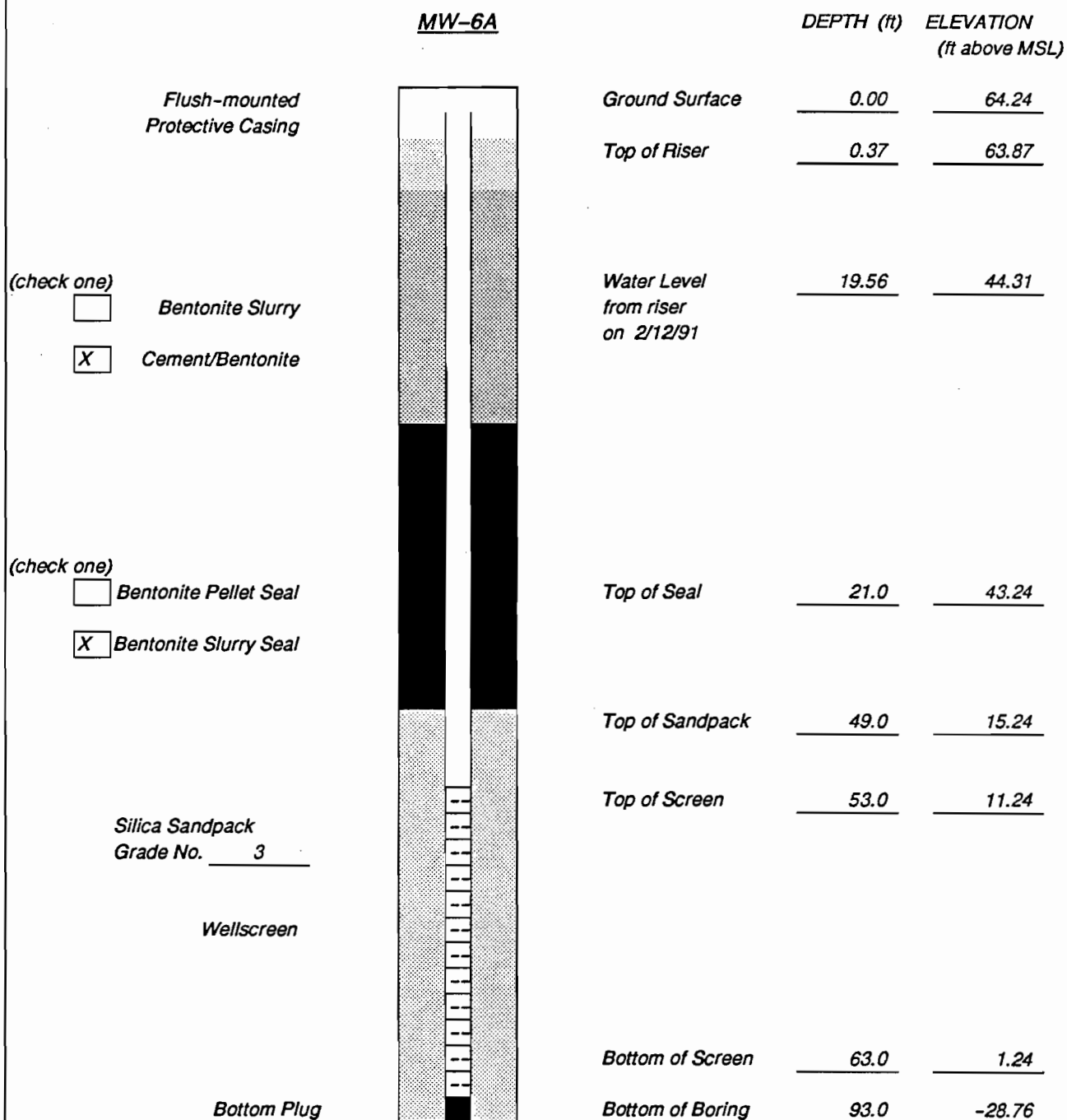
N. Y. STATE DEPT. OF ENV. CONSERVATION

WELL NO. MW-6A

INSTALLATION DATE: 1/4/91

INSTALLED BY: WTD inc.

LOGGED BY: G. Fordham

**WELL CONSTRUCTION**

Riser and screen are constructed with 2-inch ID Sch. 5
flush-joint stainless steel. Screen slot size is: 0.010-inch.



Riser and screen are constructed with 4-inch ID Sch. 80
flush-joint PVC. Screen slot size is: _____

E. C. JORDAN WELL INSTALLATION LOG

JOB # 6205-21

SERVALL LAUNDRY SITE, BAY SHORE, NY

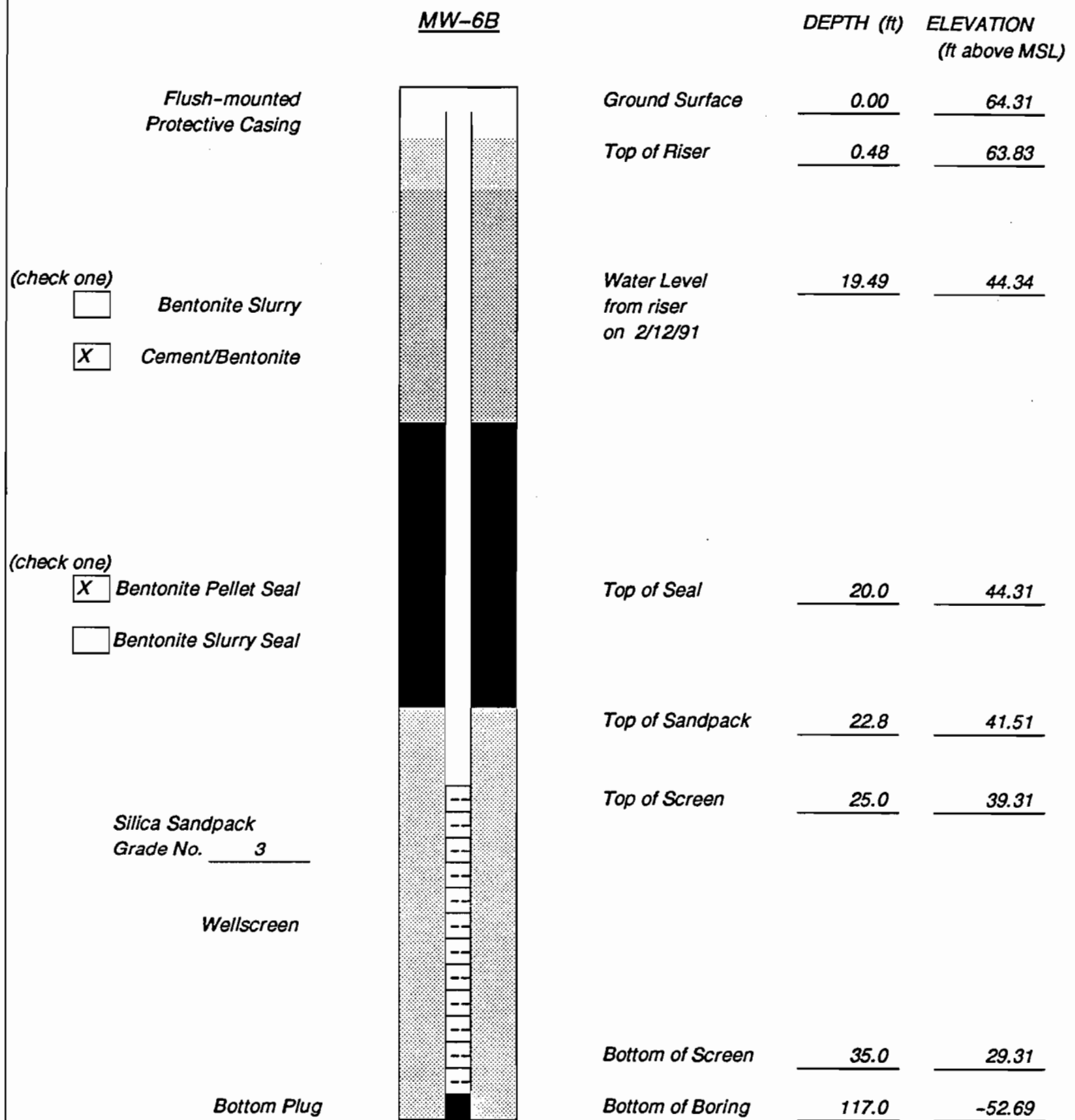
N. Y. STATE DEPT. OF ENV. CONSERVATION

WELL NO. MW-6B

INSTALLATION DATE: 1/5/91

INSTALLED BY: WTD inc.

LOGGED BY: G. Fordham



WELL CONSTRUCTION

- ☒ Riser and screen are constructed with 2-inch ID Sch. 5 flush-joint stainless steel. Screen slot size is: 0.010-inch.
- ☐ Riser and screen are constructed with 4-inch ID Sch. 80 flush-joint PVC. Screen slot size is: _____

E. C. JORDAN WELL INSTALLATION LOG

JOB # 6205-21

SERVALL LAUNDRY SITE, BAY SHORE, NY

N. Y. STATE DEPT. OF ENV. CONSERVATION

WELL NO. MW-7

INSTALLATION DATE: 1/6/91

INSTALLED BY: WTD inc.

LOGGED BY: G. Fordham

<u>MW-7</u>		DEPTH (ft)	ELEVATION (ft above MSL)
Flush-mounted Protective Casing			
		Ground Surface	0.00 61.28
		Top of Riser	0.49 60.79
		Water Level from riser on 2/12/91	17.50 43.29
(check one)			
☐	Bentonite Slurry		
☒	Cement/Bentonite		
(check one)			
☐	Bentonite Pellet Seal		
☒	Bentonite Slurry Seal		
		Top of Seal	20.0 41.28
		Top of Sandpack	98.0 -36.72
		Top of Screen	102.0 -40.72
Silica Sandpack Grade No. 3			
Wellscreen			
		Bottom of Screen	112.0 -50.72
Bottom Plug			
		Bottom of Boring	113.0 -51.72

WELL CONSTRUCTION

Riser and screen are constructed with 2-inch ID Sch. 5
flush-joint stainless steel. Screen slot size is: 0.010-inch.



Riser and screen are constructed with 4-inch ID Sch. 80
flush-joint PVC. Screen slot size is: _____

E. C. JORDAN WELL INSTALLATION LOG

JOB # 6205-21

SERVALL LAUNDRY SITE, BAY SHORE, NY

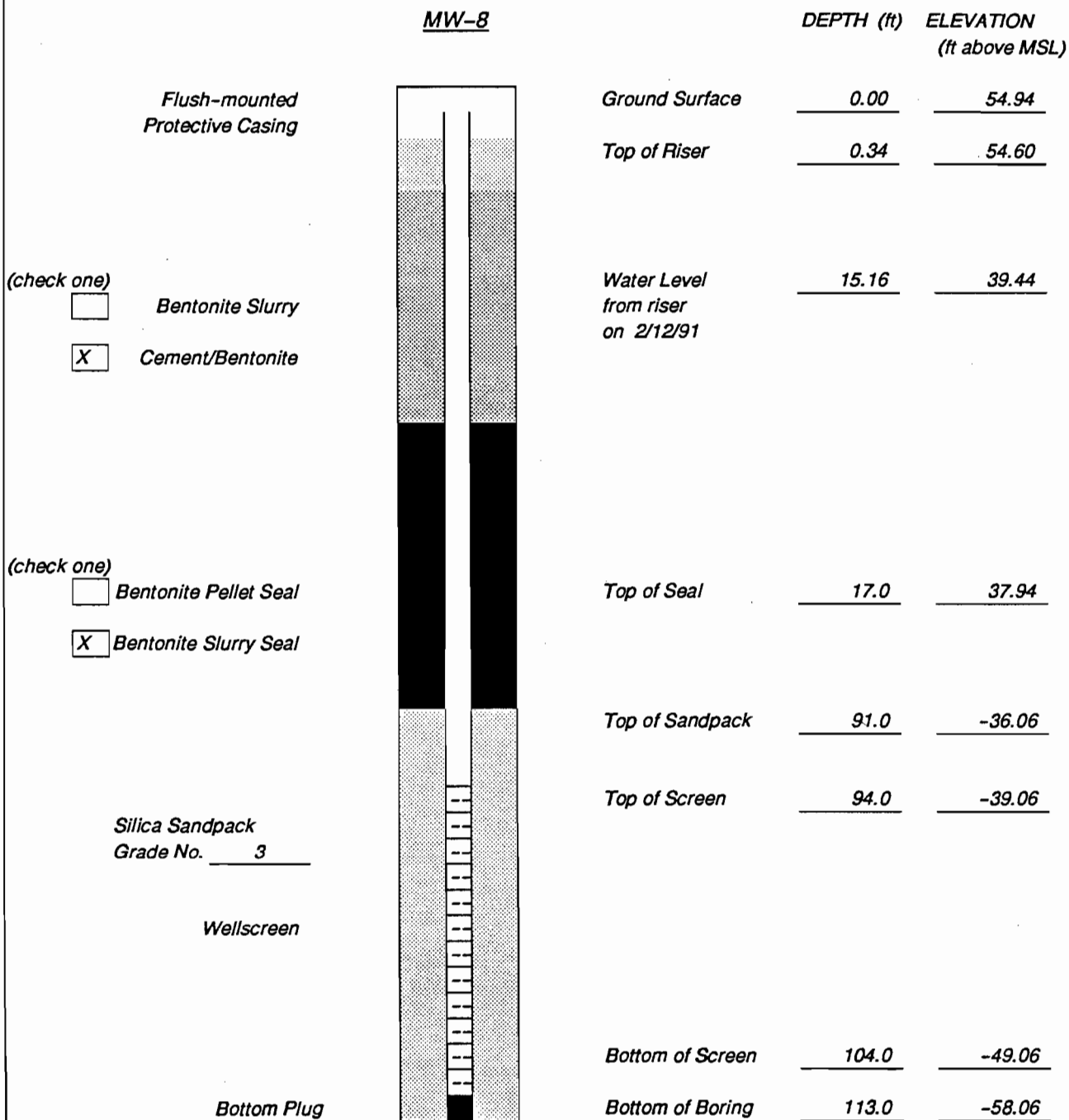
N. Y. STATE DEPT. OF ENV. CONSERVATION

WELL NO. MW-8

INSTALLATION DATE: 1/7/91

INSTALLED BY: WTD inc.

LOGGED BY: G. Fordham



WELL CONSTRUCTION



Riser and screen are constructed with 2-inch ID Sch. 5 flush-joint stainless steel. Screen slot size is: 0.010-inch.



Riser and screen are constructed with 4-inch ID Sch. 80 flush-joint PVC. Screen slot size is: _____

E. C. JORDAN WELL INSTALLATION LOG

JOB # 6205-21

SERVALL LAUNDRY SITE, BAY SHORE, NY

N. Y. STATE DEPT. OF ENV. CONSERVATION

WELL NO. MW-9

INSTALLATION DATE: 1/6/91

INSTALLED BY: WTD inc.

LOGGED BY: J. Andrews

		<u>MW-9</u>	DEPTH (ft)	ELEVATION (ft above MSL)
Flush-mounted Protective Casing			Ground Surface	0.00 41.28
			Top of Riser	0.37 40.91
			Water Level from riser on 2/12/91	11.45 29.46
(check one)	☐ Bentonite Slurry			
	☒ Cement/Bentonite			
			Top of Seal	15.0 26.28
(check one)	☐ Bentonite Pellet Seal			
	☒ Bentonite Slurry Seal			
			Top of Sandpack	75.5 -34.22
			Top of Screen	78.0 -36.72
Silica Sandpack Grade No. 3				
Wellscreen				
		Bottom of Screen	88.0 -46.72	
Bottom Plug				
		Bottom of Boring	90.0 -48.72	

WELL CONSTRUCTION



Riser and screen are constructed with 2-inch ID Sch. 5 flush-joint stainless steel. Screen slot size is: 0.010-inch.



Riser and screen are constructed with 4-inch ID Sch. 80 flush-joint PVC. Screen slot size is: _____

E. C. JORDAN WELL INSTALLATION LOG

JOB # 6205-21

SERVALL LAUNDRY SITE, BAY SHORE, NY

N. Y. STATE DEPT. OF ENV. CONSERVATION

WELL NO. MW-10

INSTALLATION DATE: 1/5/91

INSTALLED BY: WTD inc.

LOGGED BY: J. Andrews

MW-10		DEPTH (ft)	ELEVATION (ft above MSL)
Flush-mounted Protective Casing		Ground Surface	0.00 40.54
		Top of Riser	0.32 40.22
(check one) ☐ Bentonite Slurry ☒ Cement/Bentonite		Water Level from riser on 2/12/91	13.35 26.87
(check one) ☐ Bentonite Pellet Seal ☒ Bentonite Slurry Seal		Top of Seal	13.8 26.74
Silica Sandpack Grade No. 3		Top of Sandpack	77.0 -36.46
Wellscreen		Top of Screen	78.7 -38.16
Bottom Plug		Bottom of Screen	88.7 -48.16
		Bottom of Boring	90.0 -49.46

WELL CONSTRUCTION



Riser and screen are constructed with 2-inch ID Sch. 5 flush-joint stainless steel. Screen slot size is: 0.010-inch.



Riser and screen are constructed with 4-inch ID Sch. 80 flush-joint PVC. Screen slot size is: _____

E. C. JORDAN WELL INSTALLATION LOG

JOB # 6205-21

SERVALL LAUNDRY SITE, BAY SHORE, NY

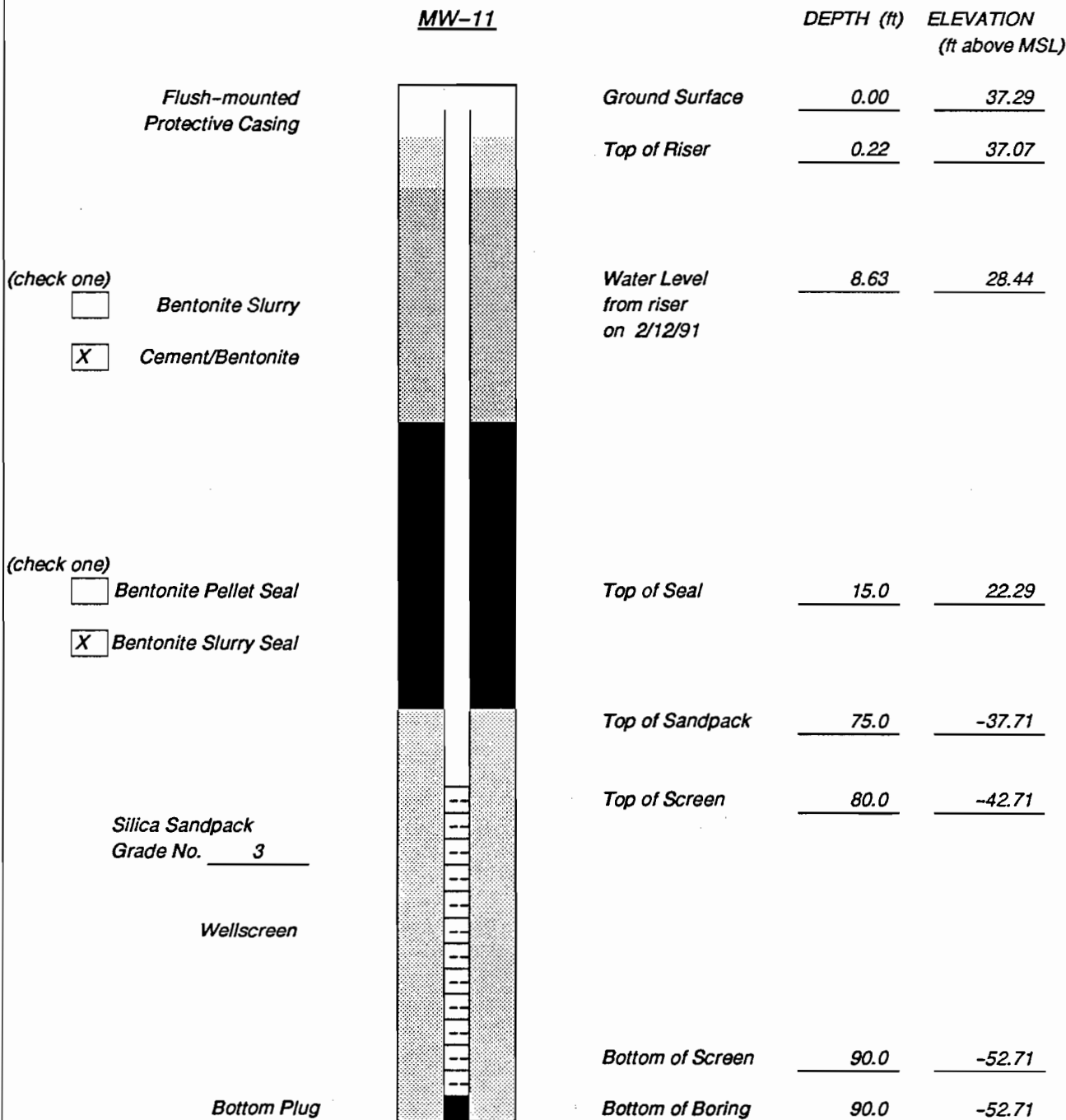
N. Y. STATE DEPT. OF ENV. CONSERVATION

WELL NO. MW-11

INSTALLATION DATE: 1/7/91

INSTALLED BY: WTD inc.

LOGGED BY: J. Andrews


WELL CONSTRUCTION

 Riser and screen are constructed with 2-inch ID Sch. 5 flush-joint stainless steel. Screen slot size is: 0.010-inch.


Riser and screen are constructed with 4-inch ID Sch. 80 flush-joint PVC. Screen slot size is: _____

E. C. JORDAN WELL INSTALLATION LOG

JOB # 6205-21

SERVALL LAUNDRY SITE, BAY SHORE, NY

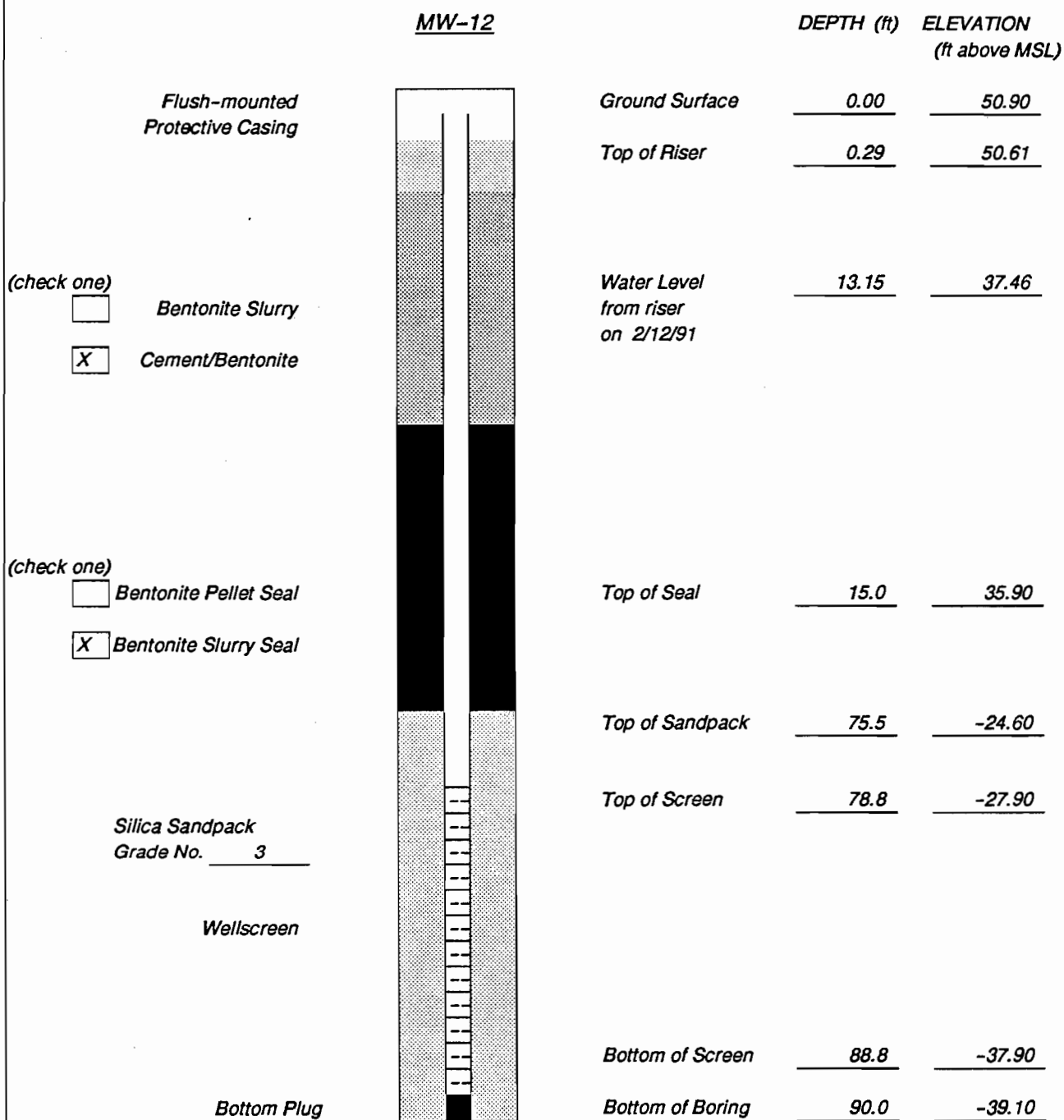
N. Y. STATE DEPT. OF ENV. CONSERVATION

WELL NO. MW-12

INSTALLATION DATE: 1/8/91

INSTALLED BY: WTD inc.

LOGGED BY: J. Andrews



WELL CONSTRUCTION

- ☒ *Riser and screen are constructed with 2-inch ID Sch. 5
flush-joint stainless steel. Screen slot size is: 0.010-inch.*
- ☐ *Riser and screen are constructed with 4-inch ID Sch. 80
flush-joint PVC. Screen slot size is: _____*

E. C. JORDAN WELL INSTALLATION LOG
JOB # 6205-21
SERVALL LAUNDRY SITE, BAY SHORE, NY
N. Y. STATE DEPT. OF ENV. CONSERVATION
WELL NO. MW-13
INSTALLATION DATE: 1/10/91
INSTALLED BY: WTD inc.
LOGGED BY: G. Fordham

		<u>MW-13</u>	DEPTH (ft)	ELEVATION (ft above MSL)
Flush-mounted Protective Casing			Ground Surface	0 50.77
			Top of Riser	0.44 50.33
			Water Level from riser on 2/12/91	13.77 36.56
(check one) ☐ Bentonite Slurry ☒ Cement/Bentonite				
			Top of Seal	15.0 35.77
(check one) ☐ Bentonite Pellet Seal ☒ Bentonite Slurry Seal				
		Top of Sandpack	84.0 -33.23	
Silica Sandpack Grade No. 3				
Wellscreen		Top of Screen	88.0 -37.23	
		Bottom of Screen	98.0 -47.23	
Bottom Plug		Bottom of Boring	98.0 -47.23	

WELL CONSTRUCTION

- ☒ Riser and screen are constructed with 2-inch ID Sch. 5 flush-joint stainless steel. Screen slot size is: 0.010-inch.
- ☐ Riser and screen are constructed with 4-inch ID Sch. 80 flush-joint PVC. Screen slot size is: _____

E. C. JORDAN WELL INSTALLATION LOG

JOB # 6205-21

SERVALL LAUNDRY SITE, BAY SHORE, NY

N. Y. STATE DEPT. OF ENV. CONSERVATION

WELL NO. MW-14

INSTALLATION DATE: 1/10/91

INSTALLED BY: WTD inc.

LOGGED BY: J. Andrews

MW-14		DEPTH (ft)	ELEVATION (ft above MSL)
Flush-mounted Protective Casing			
		Ground Surface	0.00 50.33
		Top of Riser	0.35 49.98
		Water Level from riser on 2/12/91	14.35 35.63
(check one)	☐ Bentonite Slurry		
	☒ Cement/Bentonite		
(check one)	☐ Bentonite Pellet Seal		
	☒ Bentonite Slurry Seal		
		Top of Seal	15.0 35.33
		Top of Sandpack	82.0 -31.67
		Top of Screen	83.3 -32.97
Silica Sandpack Grade No. 3			
Wellscreen			
		Bottom of Screen	93.3 -42.97
Bottom Plug			
		Bottom of Boring	95.0 -44.67

WELL CONSTRUCTION



Riser and screen are constructed with 2-inch ID Sch. 5 flush-joint stainless steel. Screen slot size is: 0.010-inch.



Riser and screen are constructed with 4-inch ID Sch. 80 flush-joint PVC. Screen slot size is: _____

E. C. JORDAN WELL INSTALLATION LOG

JOB # 6205-21

SERVALL LAUNDRY SITE, BAY SHORE, NY

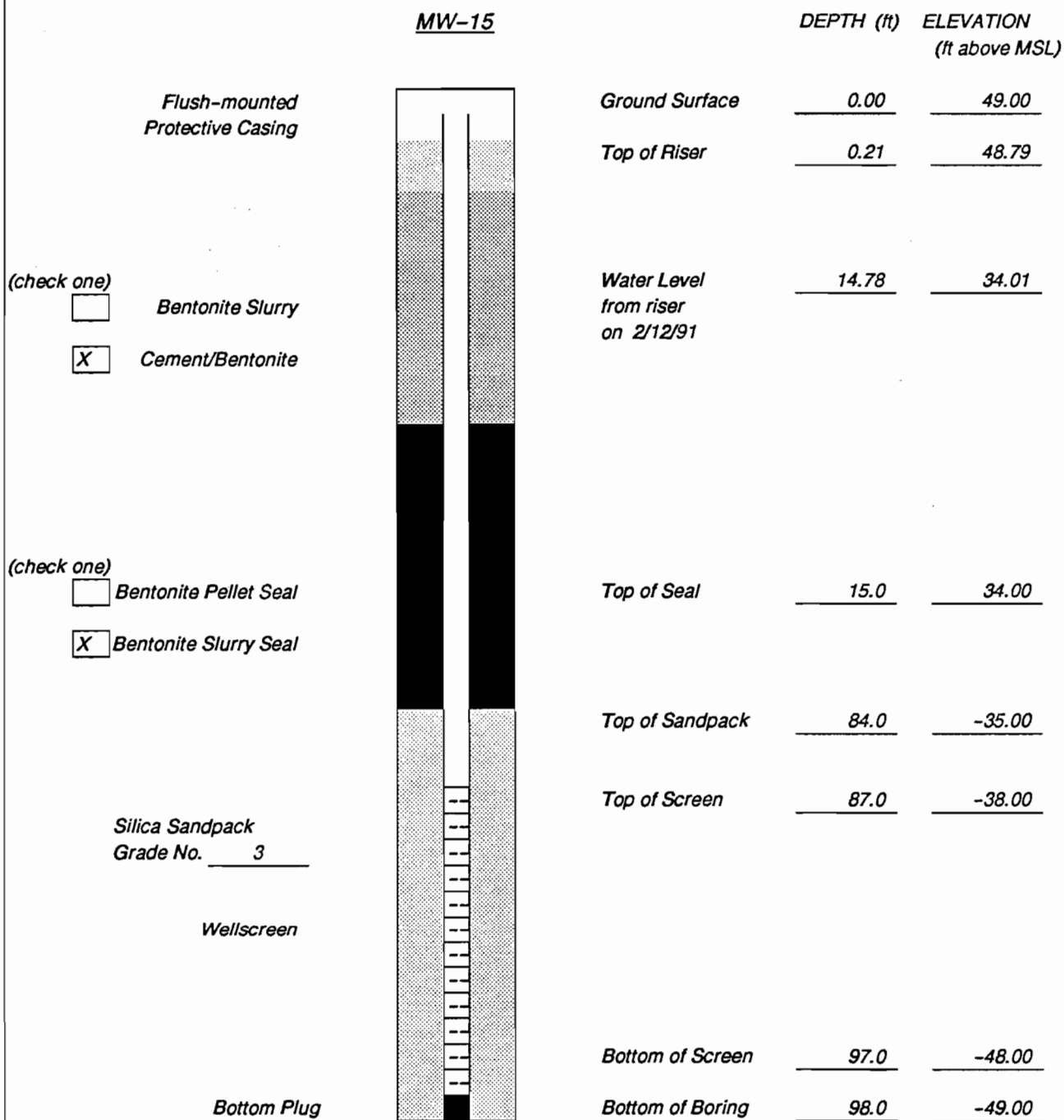
N. Y. STATE DEPT. OF ENV. CONSERVATION

WELL NO. MW-15

INSTALLATION DATE: 1/16/91

INSTALLED BY: WTD inc.

LOGGED BY: N. Glucksberg



WELL CONSTRUCTION



Riser and screen are constructed with 2-inch ID Sch. 5 flush-joint stainless steel. Screen slot size is: 0.010-inch



Riser and screen are constructed with 4-inch ID Sch. 80 flush-joint PVC. Screen slot size is: _____

E. C. JORDAN WELL INSTALLATION LOG

JOB # 6205-21

SERVALL LAUNDRY SITE, BAY SHORE, NY

N. Y. STATE DEPT. OF ENV. CONSERVATION

WELL NO. MW-16

INSTALLATION DATE: 1/16/91

INSTALLED BY: WTD inc.

LOGGED BY: J. Andrews

MW-16		DEPTH (ft)	ELEVATION (ft above MSL)
<i>Flush-mounted Protective Casing</i>		<i>Ground Surface</i>	<u>0.00</u> <u>36.80</u>
		<i>Top of Riser</i>	<u>0.30</u> <u>36.50</u>
		<i>Water Level from riser on 2/12/91</i>	<u>11.68</u> <u>24.82</u>
(check one)	☐ <i>Bentonite Slurry</i>		
	☒ <i>Cement/Bentonite</i>		
		<i>Top of Seal</i>	<u>15.0</u> <u>21.80</u>
(check one)	☐ <i>Bentonite Pellet Seal</i>		
	☒ <i>Bentonite Slurry Seal</i>		
		<i>Top of Sandpack</i>	<u>80.0</u> <u>-43.20</u>
<i>Silica Sandpack Grade No. <u>3</u></i>		<i>Top of Screen</i>	<u>84.0</u> <u>-47.20</u>
<i>Wellscreen</i>			
		<i>Bottom of Screen</i>	<u>94.0</u> <u>-57.20</u>
<i>Bottom Plug</i>		<i>Bottom of Boring</i>	<u>95.0</u> <u>-58.20</u>

WELL CONSTRUCTION

- ☒ *Riser and screen are constructed with 2-inch ID Sch. 5 flush-joint stainless steel. Screen slot size is: 0.010-inch.*
- ☐ *Riser and screen are constructed with 4-inch ID Sch. 80 flush-joint PVC. Screen slot size is: _____*

E. C. JORDAN WELL INSTALLATION LOG

JOB # 6205-21

SERVALL LAUNDRY SITE, BAY SHORE, NY

N. Y. STATE DEPT. OF ENV. CONSERVATION

WELL NO. PZ-2

INSTALLATION DATE: 12/13/90

INSTALLED BY: WTD inc.

LOGGED BY: J. Andrews

		PZ-2		DEPTH (ft)	ELEVATION (ft above MSL)
Flush-mounted Protective Casing				Ground Surface	0.00 64.81
				Top of Riser	0.63 64.18
				Water Level from riser on 2/12/91	18.91 45.27
(check one)	☐ Bentonite Slurry				
	☒ Cement/Bentonite				
(check one)	☒ Bentonite Pellet Seal			Top of Seal	12.4 52.41
	☐ Bentonite Slurry Seal			Top of Sandpack	14.7 50.11
Silica Sandpack Grade No. 3				Top of Screen	17.0 47.81
Wellscreen				Bottom of Screen	27.0 37.81
Bottom Plug				Bottom of Boring	27.0 37.81

WELL CONSTRUCTION



Riser and screen are constructed with 2-inch ID Sch. 5
flush-joint stainless steel. Screen slot size is: 0.010-inch.



Riser and screen are constructed with 4-inch ID Sch. 80
flush-joint PVC. Screen slot size is: _____

E. C. JORDAN WELL INSTALLATION LOG

JOB # 6205-21

SERVALL LAUNDRY SITE, BAY SHORE, NY

N. Y. STATE DEPT. OF ENV. CONSERVATION

WELL NO. PZ-4

INSTALLATION DATE: 12/17/90

INSTALLED BY: WTD inc.

LOGGED BY: J. Andrews

<u>PZ-4</u>		DEPTH (ft)	ELEVATION (ft above MSL)
<i>Flush-mounted Protective Casing</i>		<i>Ground Surface</i>	<u>0.00</u> <u>63.69</u>
		<i>Top of Riser</i>	<u>0.39</u> <u>63.30</u>
(check one)	☐ <i>Bentonite Slurry</i> ☒ <i>Cement/Bentonite</i>	<i>Water Level from riser on 2/12/91</i>	<u>14.96</u> <u>48.34</u>
(check one)	☒ <i>Bentonite Pellet Seal</i> ☐ <i>Bentonite Slurry Seal</i>	<i>Top of Seal</i>	<u>12.8</u> <u>50.89</u>
<i>Silica Sandpack</i> <i>Grade No.</i> <u>3</u>		<i>Top of Sandpack</i>	<u>15.0</u> <u>48.69</u>
		<i>Top of Screen</i>	<u>17.0</u> <u>46.69</u>
<i>Wellscreen</i>		<i>Bottom of Screen</i>	<u>27.0</u> <u>36.69</u>
<i>Bottom Plug</i>		<i>Bottom of Boring</i>	<u>28.0</u> <u>35.69</u>

WELL CONSTRUCTION

- ☒ Riser and screen are constructed with 2-inch ID Sch. 5 flush-joint stainless steel. Screen slot size is: 0.010-inch.
- ☐ Riser and screen are constructed with 4-inch ID Sch. 80 flush-joint PVC. Screen slot size is: _____

E. C. JORDAN WELL INSTALLATION LOG
JOB # 6205-21
SERVALL LAUNDRY SITE, BAY SHORE, NY
N. Y. STATE DEPT. OF ENV. CONSERVATION
WELL NO. PZ-5
INSTALLATION DATE: 12/17/90
INSTALLED BY: WTD inc.
LOGGED BY: J. Andrews

		<u>PZ-5</u>	DEPTH (ft)	ELEVATION (ft above MSL)
Flush-mounted Protective Casing			Ground Surface	0.00 64.33
			Top of Riser	0.36 63.97
			Water Level from riser on 2/12/91	19.65 44.32
(check one)	☐ Bentonite Slurry ☒ Cement/Bentonite			
(check one)	☒ Bentonite Pellet Seal ☐ Bentonite Slurry Seal		Top of Seal	12.4 51.93
Silica Sandpack Grade No. 3			Top of Sandpack	14.5 49.83
Wellscreen			Top of Screen	17.0 47.33
			Bottom of Screen	27.0 37.33
Bottom Plug			Bottom of Boring	28.0 36.33

WELL CONSTRUCTION

- ☒ Riser and screen are constructed with 2-inch ID Sch. 5 flush-joint stainless steel. Screen slot size is: 0.010-inch.
- ☐ Riser and screen are constructed with 4-inch ID Sch. 80 flush-joint PVC. Screen slot size is: _____



APPENDIX A-4
WELL DEVELOPMENT LOGS

E.C. Jordan Co.

1. The first of these is the fact that the
2. second is the fact that the
3. third is the fact that the
4. fourth is the fact that the
5. fifth is the fact that the
6. sixth is the fact that the
7. seventh is the fact that the
8. eighth is the fact that the
9. ninth is the fact that the
10. tenth is the fact that the

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-1

WELL DIAMETER 4"

TOTAL DEPTH 90'

DEPTH TO WATER BEFORE DEVELOPMENT 20.6'

DEPTH TO WATER AFTER DEVELOPMENT 20.6'

PROJECT NO. 2709

DATE 1/18/91

DEVELOPED BY DZ/RH

DESCRIPTION OF DEVELOPMENT METHOD

Nitrogen and Hand Bailer

VOLUME OF WATER REMOVED FROM WELL 165' gal

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Reddish Brn

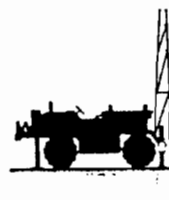
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Clear

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL --

TIME SPENT FOR DEVELOPMENT 1 hr 15 min

COMMENTS'



ENVIRONMENTAL DRILLING
WTD
A DIVISION OF LONGYEAR COMPANY

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-2

WELL DIAMETER 2"

TOTAL DEPTH 83.0'

DEPTH TO WATER BEFORE DEVELOPMENT 20.0'

DEPTH TO WATER AFTER DEVELOPMENT 21.1'

PROJECT NO. 2709

DATE 1/17/91

DEVELOPED BY DN

DESCRIPTION OF DEVELOPMENT METHOD

1.7 BK Handpump

VOLUME OF WATER REMOVED FROM WELL 100 gals

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Turbid

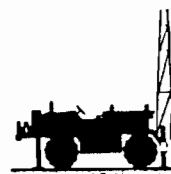
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Clear

VOLUME OF WATER ADDED TO WELL _____

SOURCE OF WATER ADDED TO WELL _____

TIME SPENT FOR DEVELOPMENT 2 hrs 15 min

COMMENTS:



ENVIRONMENTAL DRILLING
WTD
A DIVISION OF LONGYEAR COMPANY

MONITORING WELL DEVELOPMENT

WELL NUMBER PZ-2

WELL DIAMETER 2"

TOTAL DEPTH 27.0'

DEPTH TO WATER BEFORE DEVELOPMENT 16.4'

DEPTH TO WATER AFTER DEVELOPMENT 16.4'

PROJECT NO. 2709

DATE 1/16/91

DEVELOPED BY DN

DESCRIPTION OF DEVELOPMENT METHOD

1.7 BK Handpump

VOLUME OF WATER REMOVED FROM WELL 100 gals

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Turbid

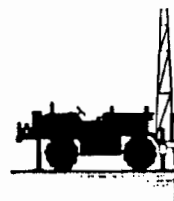
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Clear

VOLUME OF WATER ADDED TO WELL _____

SOURCE OF WATER ADDED TO WELL _____

TIME SPENT FOR DEVELOPMENT 1 hr 45 min

COMMENTS:



ENVIRONMENTAL DRILLING
WTD
A DIVISION OF LONGYEAR COMPANY

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-3
WELL DIAMETER 2"
TOTAL DEPTH 88.2'
DEPTH TO WATER BEFORE DEVELOPMENT 19.9'
DEPTH TO WATER AFTER DEVELOPMENT 19.9'

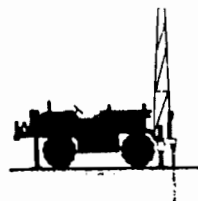
PROJECT NO. 2709
DATE 1/16/91
DEVELOPED BY DN

DESCRIPTION OF DEVELOPMENT METHOD

1.7 BK Handpump

VOLUME OF WATER REMOVED FROM WELL 75 gals
CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Turbid
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Sl. Turbid
VOLUME OF WATER ADDED TO WELL _____
SOURCE OF WATER ADDED TO WELL _____
TIME SPENT FOR DEVELOPMENT 1 hr 15 min

COMMENTS: Told to stop developing because rain water was going into well. Told to stop by EC Jordan rep L. Healy. Dan Z finished the development.



ENVIRONMENTAL DRILLING
WTD
A DIVISION OF LONGYEAR COMPANY

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-3A

WELL DIAMETER 2"

TOTAL DEPTH 119.0'

DEPTH TO WATER BEFORE DEVELOPMENT 20.8'

DEPTH TO WATER AFTER DEVELOPMENT 20.4'

PROJECT NO. 2709

DATE 1/19/91

DEVELOPED BY DN/SB

DESCRIPTION OF DEVELOPMENT METHOD

Nitrogen w/ Bailer at Bottom

VOLUME OF WATER REMOVED FROM WELL 330 glns

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Turbid

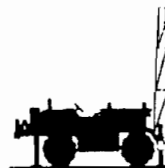
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Slightly Turbid

VOLUME OF WATER ADDED TO WELL _____

SOURCE OF WATER ADDED TO WELL _____

TIME SPENT FOR DEVELOPMENT 2 hrs

COMMENTS:



ENVIRONMENTAL DRILLING
WTD
A DIVISION OF LONGYEAR COMPANY

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-3B

WELL DIAMETER 2"

TOTAL DEPTH 89.6'

DEPTH TO WATER BEFORE DEVELOPMENT 19.7'

DEPTH TO WATER AFTER DEVELOPMENT 19.7'

PROJECT NO. 2709

DATE 1/18/91

DEVELOPED BY DZ/RH

DESCRIPTION OF DEVELOPMENT METHOD

Nitrogen and Hand Bailer

VOLUME OF WATER REMOVED FROM WELL 150 gals

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Dirty Brn Sandy

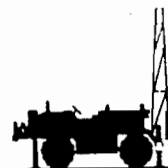
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Clear

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL _____

TIME SPENT FOR DEVELOPMENT 1 hr

COMMENTS:



ENVIRONMENTAL DRILLING
WTD
A DIVISION OF LONGYEAR COMPANY

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-4

WELL DIAMETER 2"

TOTAL DEPTH 85.2'

DEPTH TO WATER BEFORE DEVELOPMENT 19.2'

DEPTH TO WATER AFTER DEVELOPMENT 19.2'

PROJECT NO. 2709

DATE 1/18/91

DEVELOPED BY SB/DN

DESCRIPTION OF DEVELOPMENT METHOD

Nitrogen - Bailer at Bottom

VOLUME OF WATER REMOVED FROM WELL 150 glns

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Turbid

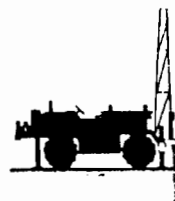
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Clear

VOLUME OF WATER ADDED TO WELL _____

SOURCE OF WATER ADDED TO WELL _____

TIME SPENT FOR DEVELOPMENT 2 hrs

COMMENTS:



ENVIRONMENTAL DRILLING
WTD
A DIVISION OF LONGYEAR COMPANY

MONITORING WELL DEVELOPMENT

WELL NUMBER PZ-4

WELL DIAMETER 2"

TOTAL DEPTH 27.0'

DEPTH TO WATER BEFORE DEVELOPMENT 19.2'

DEPTH TO WATER AFTER DEVELOPMENT 19.0'

PROJECT NO. 2709

DATE 1/18/91

DEVELOPED BY JW/SB/DN

DESCRIPTION OF DEVELOPMENT METHOD

1.7 BK Handpump

VOLUME OF WATER REMOVED FROM WELL 162 glns

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Turbid

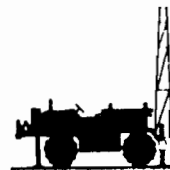
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Clear - Few Fines

VOLUME OF WATER ADDED TO WELL _____

SOURCE OF WATER ADDED TO WELL _____

TIME SPENT FOR DEVELOPMENT 40 minutes

COMMENTS:



ENVIRONMENTAL DRILLING
WTD
A DIVISION OF LONGYEAR COMPANY

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-5

WELL DIAMETER 2"

TOTAL DEPTH 85.0'

DEPTH TO WATER BEFORE DEVELOPMENT 20.0'

DEPTH TO WATER AFTER DEVELOPMENT 20.0'

PROJECT NO. 2709

DATE 1/18/91

DEVELOPED BY DZ/RH

DESCRIPTION OF DEVELOPMENT METHOD

Nitrogen & Hand Bailer

VOLUME OF WATER REMOVED FROM WELL 300 glns

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Dirty Brn

CLARITY OF WATER IN WELL AFTER DEVELOPMENT Clear

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL --

TIME SPENT FOR DEVELOPMENT 2.5 hrs

COMMENTS:



ENVIRONMENTAL DRILLING
WTD
A DIVISION OF LONGYEAR COMPANY

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-PZ5
WELL DIAMETER 2"
TOTAL DEPTH 27.0'
DEPTH TO WATER BEFORE DEVELOPMENT 20.2'
DEPTH TO WATER AFTER DEVELOPMENT 20.2'

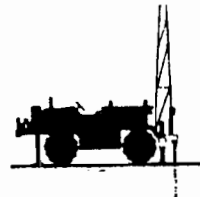
PROJECT NO. 2709
DATE 1/18/91
DEVELOPED BY DZ/RH/JW

DESCRIPTION OF DEVELOPMENT METHOD

1.7 Handpump

VOLUME OF WATER REMOVED FROM WELL 175 glns
CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Dirty Brn
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Clear
VOLUME OF WATER ADDED TO WELL None
SOURCE OF WATER ADDED TO WELL --
TIME SPENT FOR DEVELOPMENT 1/2 hr

COMMENTS:



ENVIRONMENTAL DRILLING
WTD
A DIVISION OF LONGYEAR COMPANY

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-6A

WELL DIAMETER 2"

TOTAL DEPTH 63'

DEPTH TO WATER BEFORE DEVELOPMENT 19.9'

DEPTH TO WATER AFTER DEVELOPMENT 19.9'

PROJECT NO. 2709

DATE 1/18/91

DEVELOPED BY DZ/RH

DESCRIPTION OF DEVELOPMENT METHOD

Nitrogen and Hand Bailer

VOLUME OF WATER REMOVED FROM WELL 165 glns

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Dirty Brn

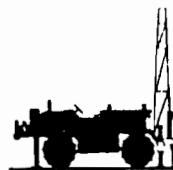
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Clear

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL --

TIME SPENT FOR DEVELOPMENT 1 1/2 hrs

COMMENTS:



ENVIRONMENTAL DRILLING
WTD
A DIVISION OF LONGYEAR COMPANY

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-6B

WELL DIAMETER 2"

TOTAL DEPTH 35.2'

DEPTH TO WATER BEFORE DEVELOPMENT 19.9'

DEPTH TO WATER AFTER DEVELOPMENT 19.9'

PROJECT NO. 2709

DATE 1/18/91

DEVELOPED BY DZ/RH

DESCRIPTION OF DEVELOPMENT METHOD

1.7 BK Handpump

VOLUME OF WATER REMOVED FROM WELL 115 glns

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Dirty Brn

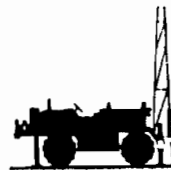
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Clear

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL --

TIME SPENT FOR DEVELOPMENT 1/2 hr

COMMENTS:



ENVIRONMENTAL DRILLING
WTD
A DIVISION OF LONGYEAR COMPANY

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-7

WELL DIAMETER 2"

TOTAL DEPTH 112.0'

DEPTH TO WATER BEFORE DEVELOPMENT 17.4'

DEPTH TO WATER AFTER DEVELOPMENT 18.1'

PROJECT NO. 2709

DATE 1/18/91

DEVELOPED BY SB

DESCRIPTION OF DEVELOPMENT METHOD

Nitrogen and Hand Bailer at Bottom

VOLUME OF WATER REMOVED FROM WELL 440 gals

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Tan; Very Sandy; Some Silts

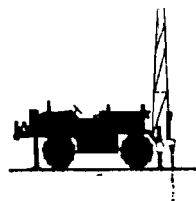
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Cloudy

VOLUME OF WATER ADDED TO WELL --

SOURCE OF WATER ADDED TO WELL --

TIME SPENT FOR DEVELOPMENT 2 ½ hrs

COMMENTS:



ENVIRONMENTAL DRILLING
WTD
A DIVISION OF LONGYEAR COMPANY

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-8

WELL DIAMETER 2"

TOTAL DEPTH 105.0

DEPTH TO WATER BEFORE DEVELOPMENT 14.0'

DEPTH TO WATER AFTER DEVELOPMENT 14.0'

PROJECT NO. 2709

DATE 1/18/91

DEVELOPED BY SB/DN

DESCRIPTION OF DEVELOPMENT METHOD

Nitrogen and Hand Bailer at Bottom

VOLUME OF WATER REMOVED FROM WELL 440 glns

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Silty Grey; Some Fines

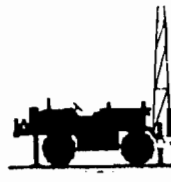
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Cloudy/Milky

VOLUME OF WATER ADDED TO WELL --

SOURCE OF WATER ADDED TO WELL --

TIME SPENT FOR DEVELOPMENT 2 1/2 hrs

COMMENTS:



ENVIRONMENTAL DRILLING
WTD
A DIVISION OF LONGYEAR COMPANY

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-9

WELL DIAMETER 2"

TOTAL DEPTH 88.8'

DEPTH TO WATER BEFORE DEVELOPMENT 11.2'

DEPTH TO WATER AFTER DEVELOPMENT 11.2'

PROJECT NO. 2709

DATE 1/19/91

DEVELOPED BY DZ/RH

DESCRIPTION OF DEVELOPMENT METHOD

Nitrogen and Hand Bailer

VOLUME OF WATER REMOVED FROM WELL 270 gals

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Dirty Brn Silty

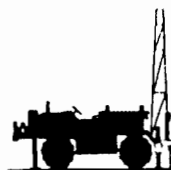
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Clear

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL --

TIME SPENT FOR DEVELOPMENT 1.5 hrs

COMMENTS:



ENVIRONMENTAL DRILLING
WTD
A DIVISION OF LONGYEAR COMPANY

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-10

WELL DIAMETER 2"

TOTAL DEPTH 89.5'

DEPTH TO WATER BEFORE DEVELOPMENT 13.2'

DEPTH TO WATER AFTER DEVELOPMENT 13.2'

PROJECT NO. 2709

DATE 1/19/91

DEVELOPED BY DZ/RH

DESCRIPTION OF DEVELOPMENT METHOD

Nitrogen and Hand Bailer

VOLUME OF WATER REMOVED FROM WELL 240 gals

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Dirty Silty Brn

CLARITY OF WATER IN WELL AFTER DEVELOPMENT Clear

VOLUME OF WATER ADDED TO WELL None

SOURCE OF WATER ADDED TO WELL --

TIME SPENT FOR DEVELOPMENT 1.5 hrs

COMMENTS:



ENVIRONMENTAL DRILLING
WTD
A DIVISION OF LONGYEAR COMPANY

MONITORING WELL DEVELOPMENT

V ☐ - NUMBER MW-11
WELL DIAMETER 2"
TOTAL DEPTH 89.5'
DEPTH TO WATER BEFORE DEVELOPMENT 8.0'
DEPTH TO WATER AFTER DEVELOPMENT 8.0'

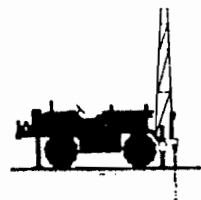
PROJECT NO. 2709
DATE 1/19/91
DEVELOPED BY SB/DN/JW

DESCRIPTION OF DEVELOPMENT METHOD

Nitrogen; Bailer at Bottom

VOLUME OF WATER REMOVED FROM WELL 220 gals
CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Turbid
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Clear
VOLUME OF WATER ADDED TO WELL --
SOURCE OF WATER ADDED TO WELL --
TIME SPENT FOR DEVELOPMENT 2.5 hrs

COMMENTS:



ENVIRONMENTAL DRILLING
WTD
A DIVISION OF LONGYEAR COMPANY

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-12
WELL DIAMETER 2"
TOTAL DEPTH 89.5'
DEPTH TO WATER BEFORE DEVELOPMENT 14.35'
DEPTH TO WATER AFTER DEVELOPMENT 14.35'

PROJECT NO. 2709
DATE 1/17/91
DEVELOPED BY DZ/RH

DESCRIPTION OF DEVELOPMENT METHOD

Nitrogen and Hand Bailer

VOLUME OF WATER REMOVED FROM WELL 350 gals
CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Cloudy w/ Fine Brn Sands
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Very Clear
VOLUME OF WATER ADDED TO WELL None
SOURCE OF WATER ADDED TO WELL --
TIME SPENT FOR DEVELOPMENT 3.45 hrs

COMMENTS: Bail till well clear.
Bailed again till clear.
Very very fine sands.



ENVIRONMENTAL DRILLING
WTD
A DIVISION OF LONGYEAR COMPANY

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-13

WELL DIAMETER 2"

TOTAL DEPTH 98.0

DEPTH TO WATER BEFORE DEVELOPMENT 13.4

DEPTH TO WATER AFTER DEVELOPMENT 13.4

PROJECT NO. 2709

DATE 1/19/91

DEVELOPED BY SB/DN

DESCRIPTION OF DEVELOPMENT METHOD

Nitrogen; Bailer at Bottom

VOLUME OF WATER REMOVED FROM WELL 220 gals

CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Turbid

CLARITY OF WATER IN WELL AFTER DEVELOPMENT Clear

VOLUME OF WATER ADDED TO WELL --

SOURCE OF WATER ADDED TO WELL --

TIME SPENT FOR DEVELOPMENT 1.75 hrs

COMMENTS:



ENVIRONMENTAL DRILLING

WTD

A DIVISION OF LONGYEAR COMPANY

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-14
WELL DIAMETER 2"
TOTAL DEPTH 94.5'
DEPTH TO WATER BEFORE DEVELOPMENT 15.4'
DEPTH TO WATER AFTER DEVELOPMENT 15.4'

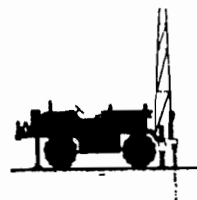
PROJECT NO. 2709
DATE 1/18/91
DEVELOPED BY DZ/RH

DESCRIPTION OF DEVELOPMENT METHOD

Nitrogen and Hand Bailer

VOLUME OF WATER REMOVED FROM WELL 235 gals
CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Dirty Brn
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Clear
VOLUME OF WATER ADDED TO WELL None
SOURCE OF WATER ADDED TO WELL --
TIME SPENT FOR DEVELOPMENT 1 hr 10 mins

COMMENTS:



ENVIRONMENTAL DRILLING
WTD
A DIVISION OF LONGYEAR COMPANY

MONITORING WELL DEVELOPMENT

☐ WELL NUMBER MW-15
WELL DIAMETER 2"
TOTAL DEPTH 97.0'
DEPTH TO WATER BEFORE DEVELOPMENT 14.3'
DEPTH TO WATER AFTER DEVELOPMENT _____

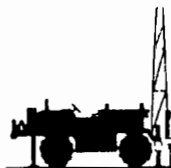
PROJECT NO. 2709
DATE 1/19/91
DEVELOPED BY JW/SB/DN

DESCRIPTION OF DEVELOPMENT METHOD

Nitrogen; Bailer at Bottom

VOLUME OF WATER REMOVED FROM WELL _____ 220 gals
CLARITY OF WATER IN WELL BEFORE DEVELOPMENT _____ Tan Silts/ Some Fines
CLARITY OF WATER IN WELL AFTER DEVELOPMENT _____ Clear - Few Fines
VOLUME OF WATER ADDED TO WELL _____ --
SOURCE OF WATER ADDED TO WELL _____ --
TIME SPENT FOR DEVELOPMENT _____ 1.75 hrs

COMMENTS:



ENVIRONMENTAL DRILLING
WTD
A DIVISION OF LONGYEAR COMPANY

MONITORING WELL DEVELOPMENT

WELL NUMBER MW-16
WELL DIAMETER 2"
TOTAL DEPTH 94.3
DEPTH TO WATER BEFORE DEVELOPMENT 11.5
DEPTH TO WATER AFTER DEVELOPMENT 11.5

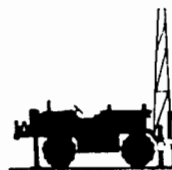
PROJECT NO. 2709
DATE 1/19/91
DEVELOPED BY DZ/RH

DESCRIPTION OF DEVELOPMENT METHOD

Nitrogen and Hand Bailer

VOLUME OF WATER REMOVED FROM WELL 220 gals
CLARITY OF WATER IN WELL BEFORE DEVELOPMENT Dirty Brn Silty Sandy Fine
CLARITY OF WATER IN WELL AFTER DEVELOPMENT Clear
VOLUME OF WATER ADDED TO WELL None
SOURCE OF WATER ADDED TO WELL --
TIME SPENT FOR DEVELOPMENT 1.5 hrs

COMMENTS:



ENVIRONMENTAL DRILLING
WTD
A DIVISION OF LONGYEAR COMPANY

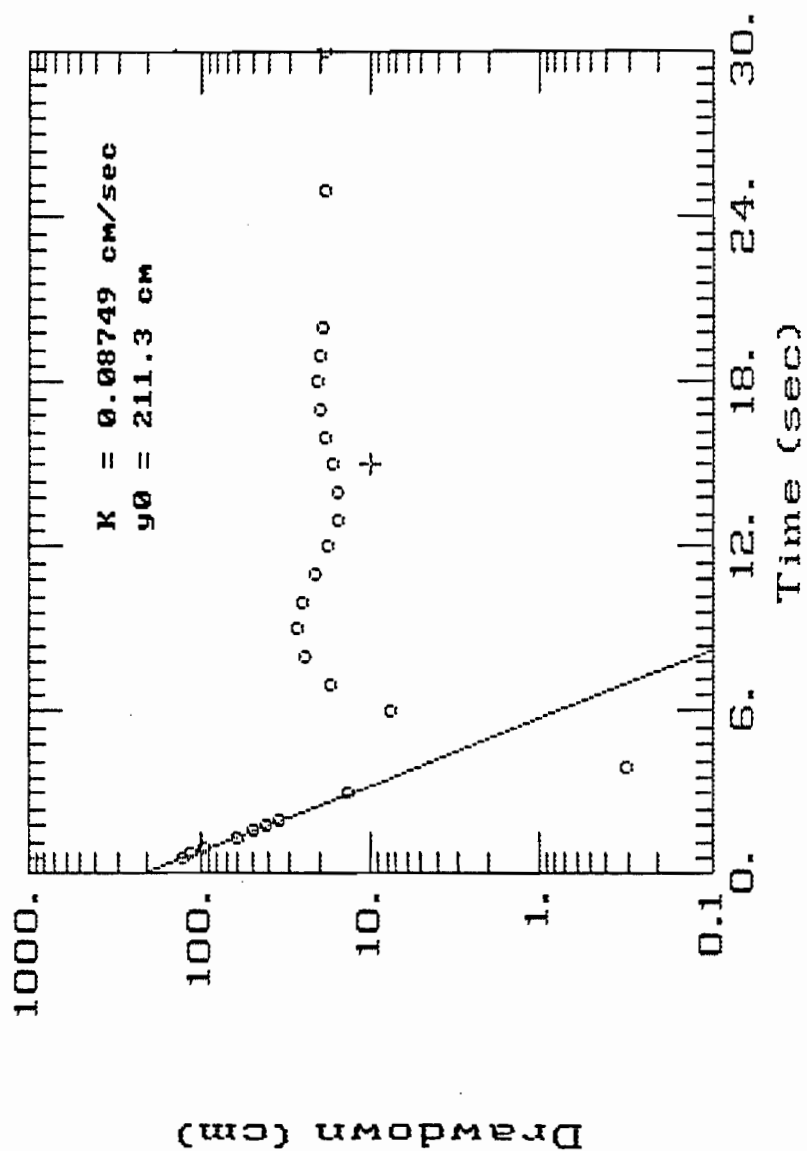
APPENDIX A-5

HYDRAULIC CONDUCTIVITY DATA

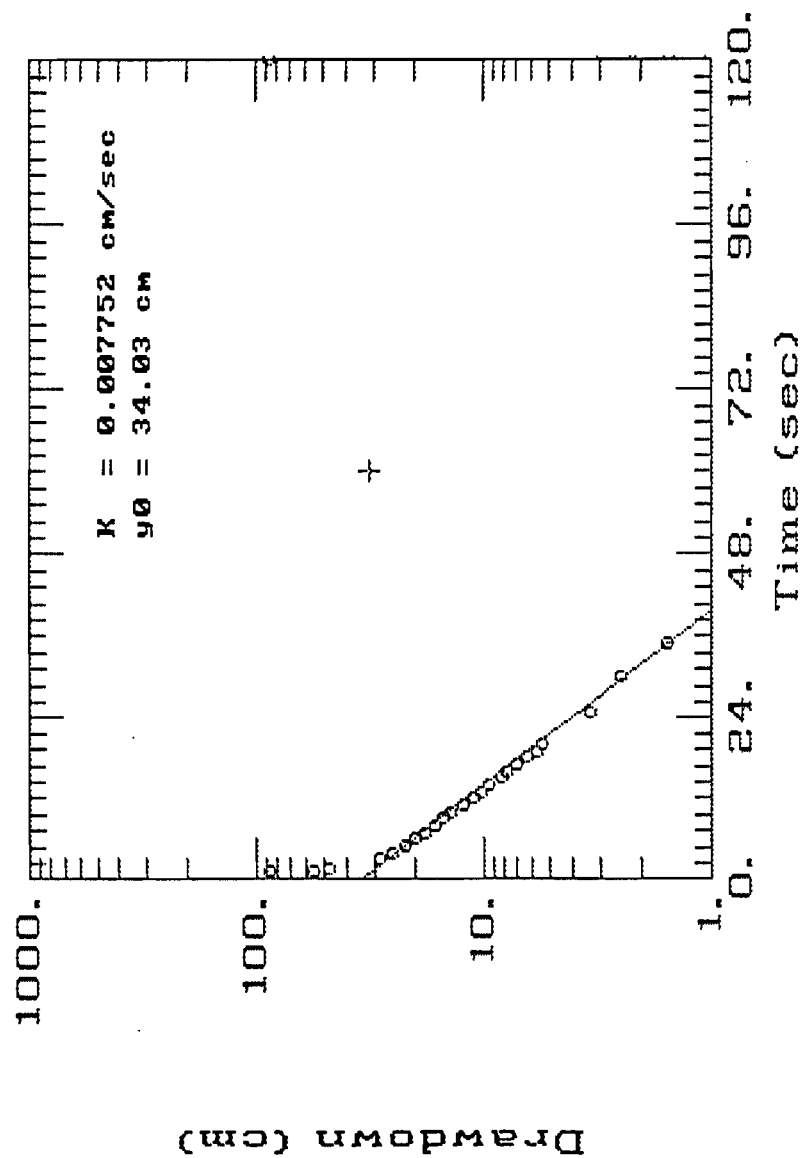
E.C. Jordan Co.

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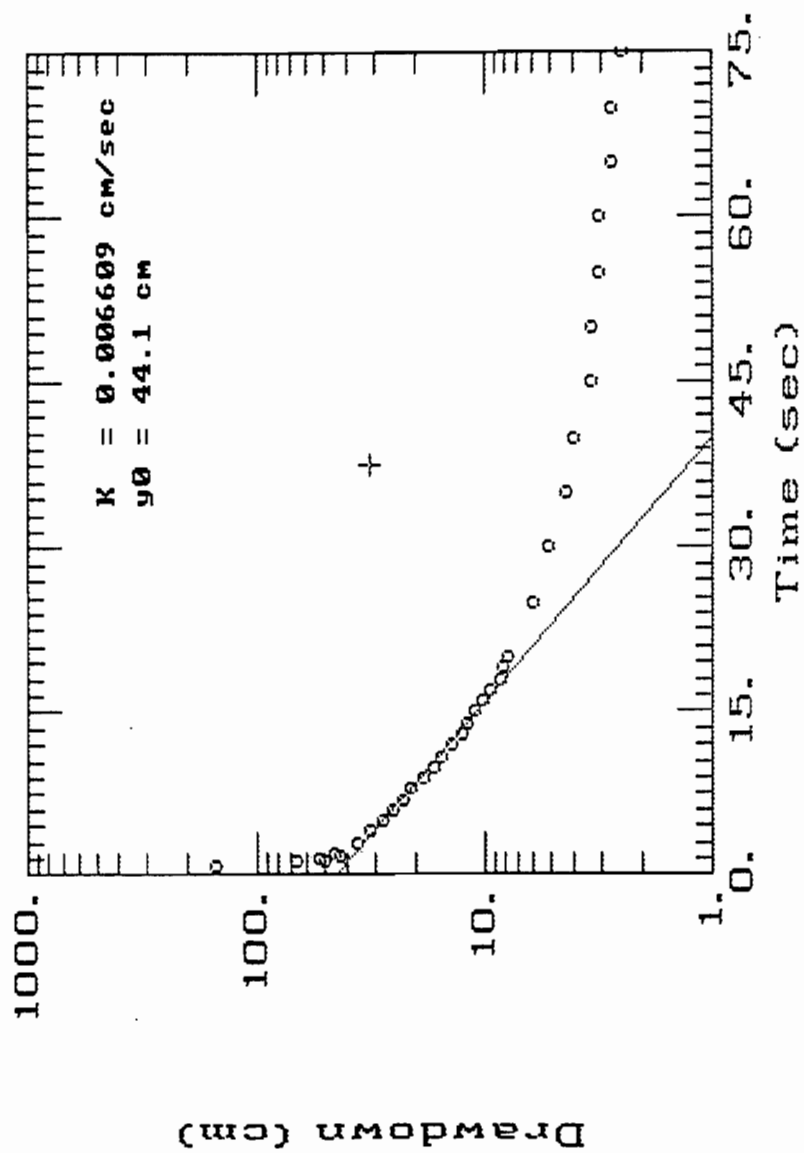
MW-2 RISING HEAD



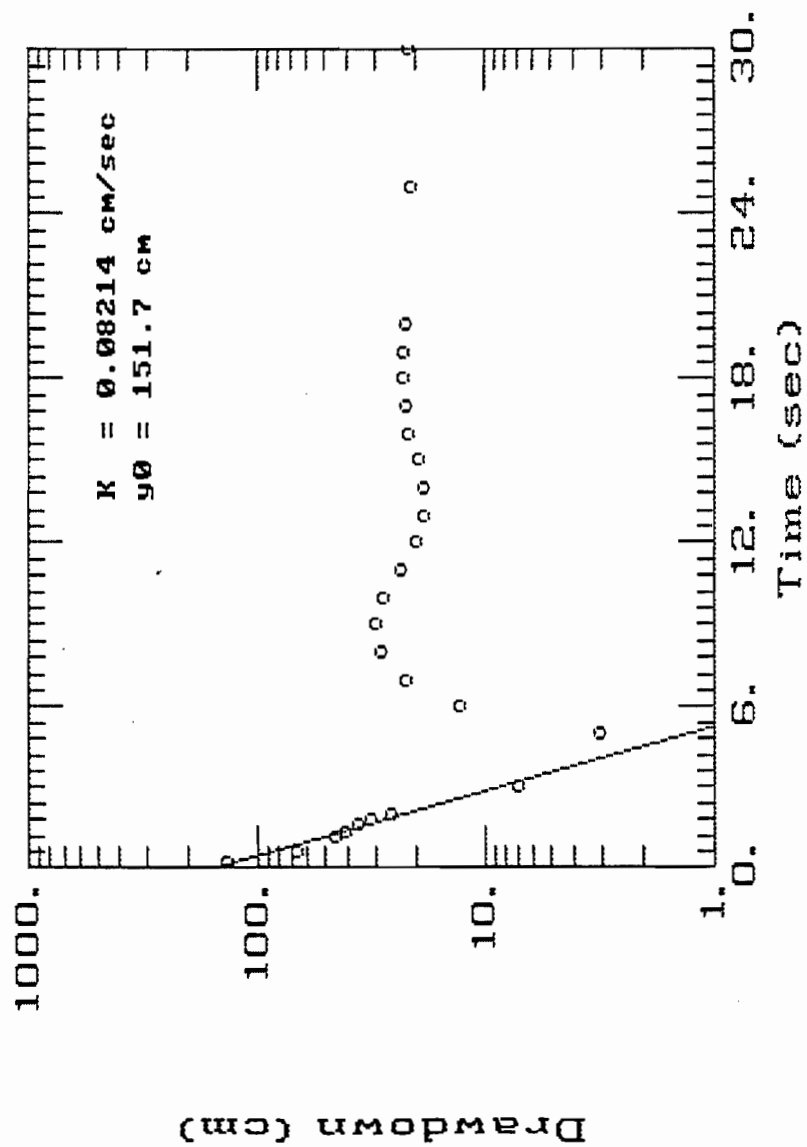
MW-3A FALLING HEAD



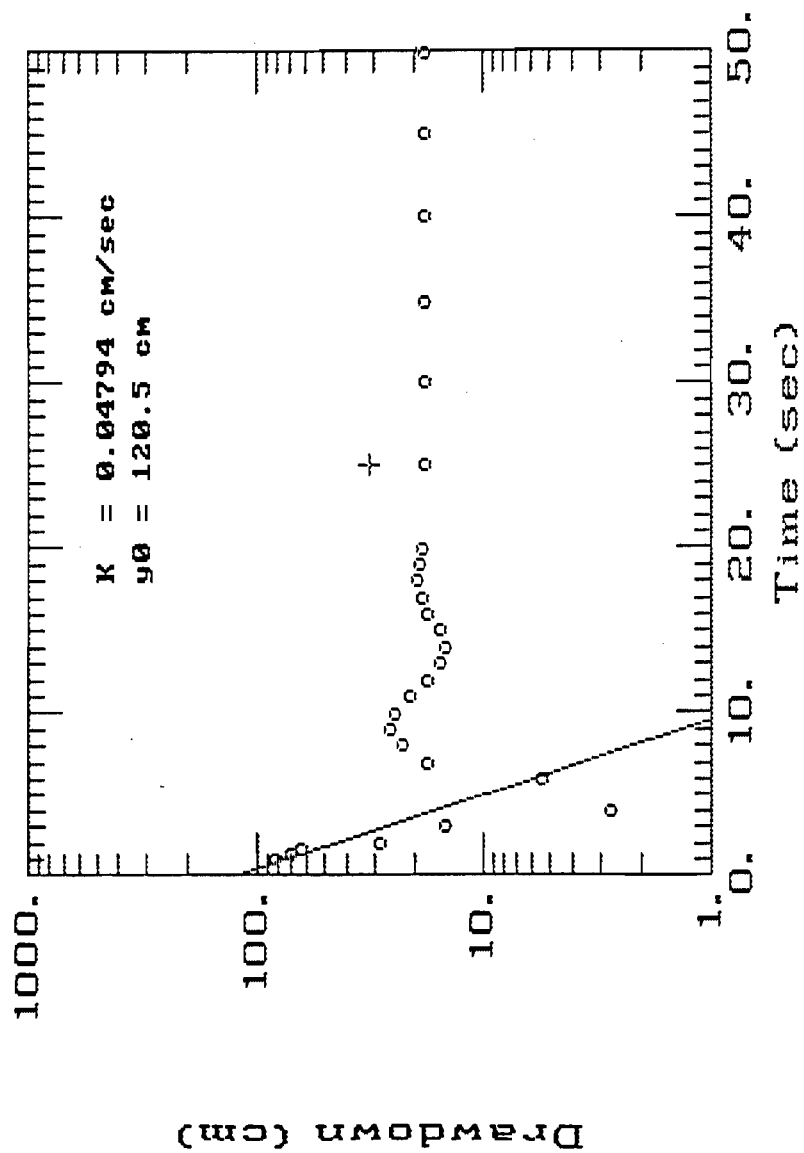
MW-3A RISING HEAD



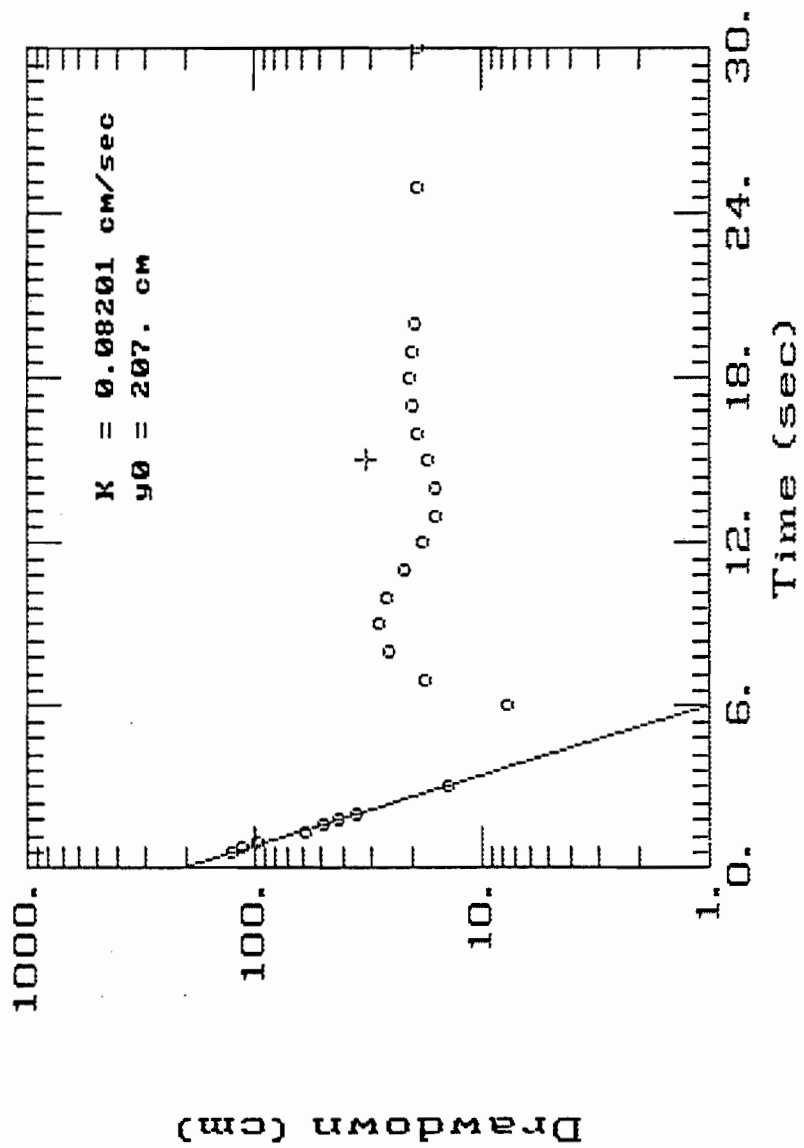
MW-3B RISING HEAD



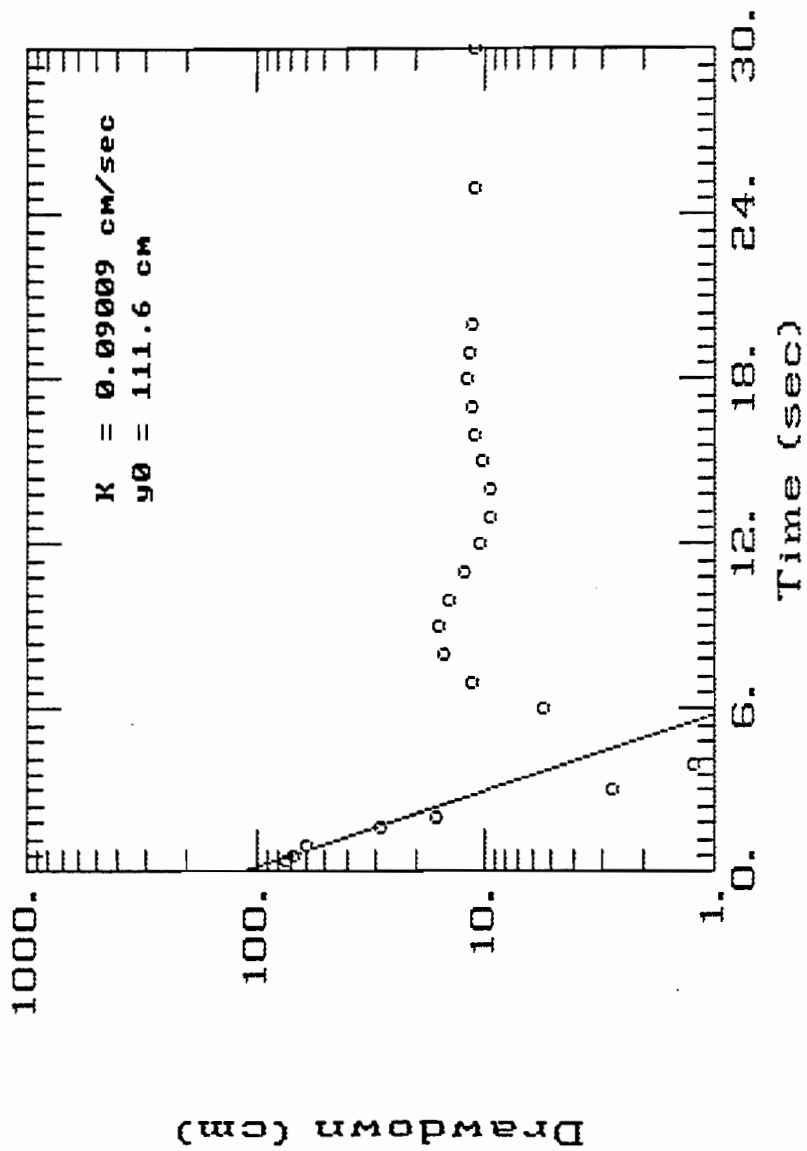
MW-4 FALLING HEAD



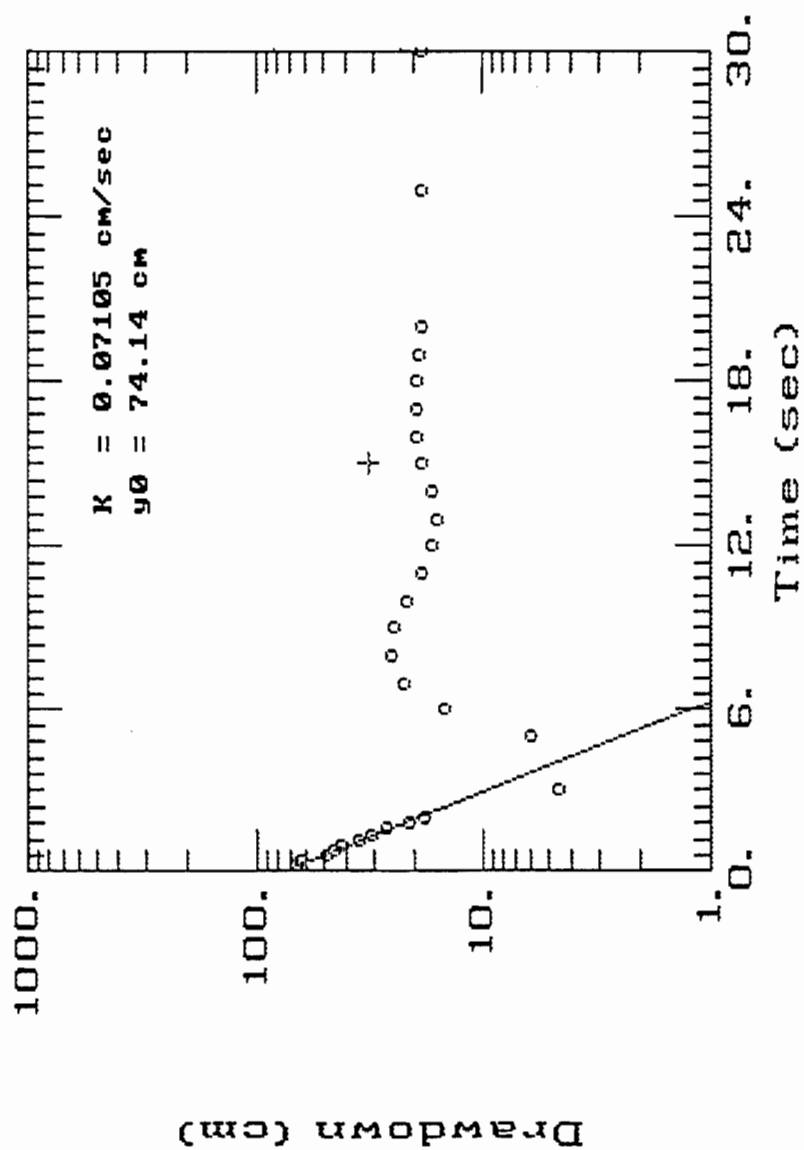
MW-4 RISING HEAD



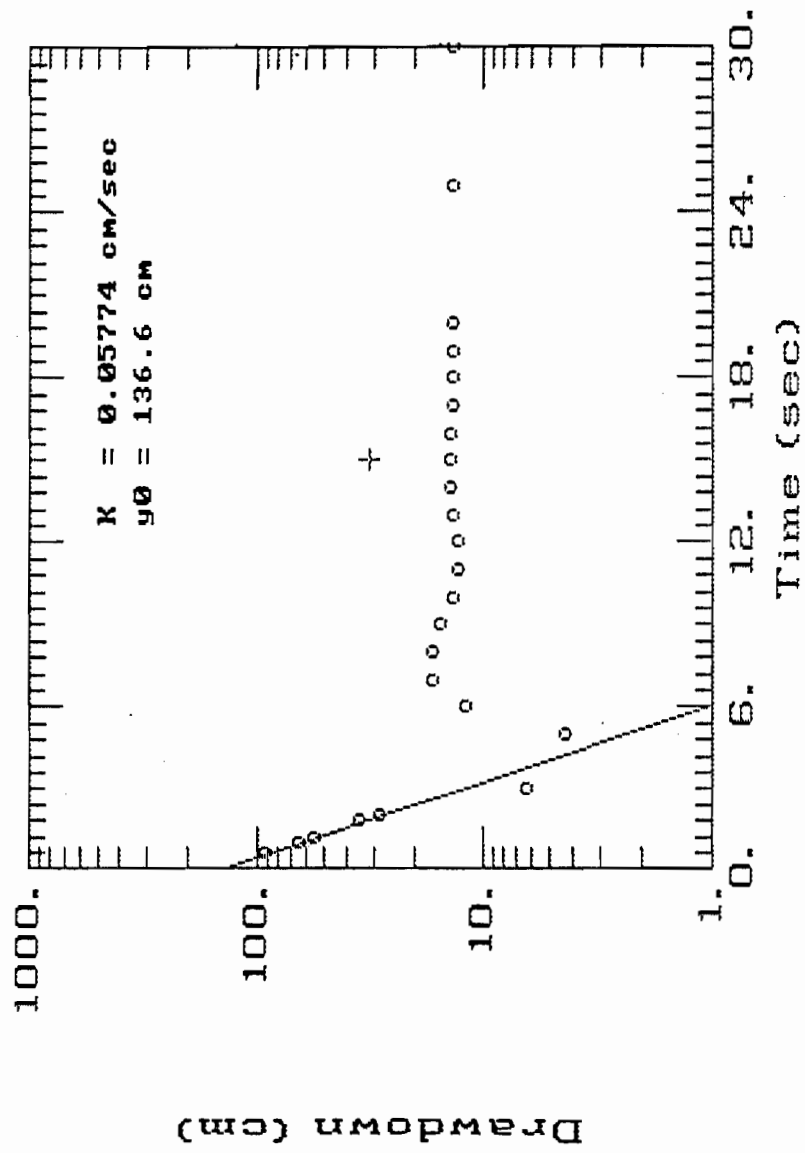
MW-5 FALLING HEAD



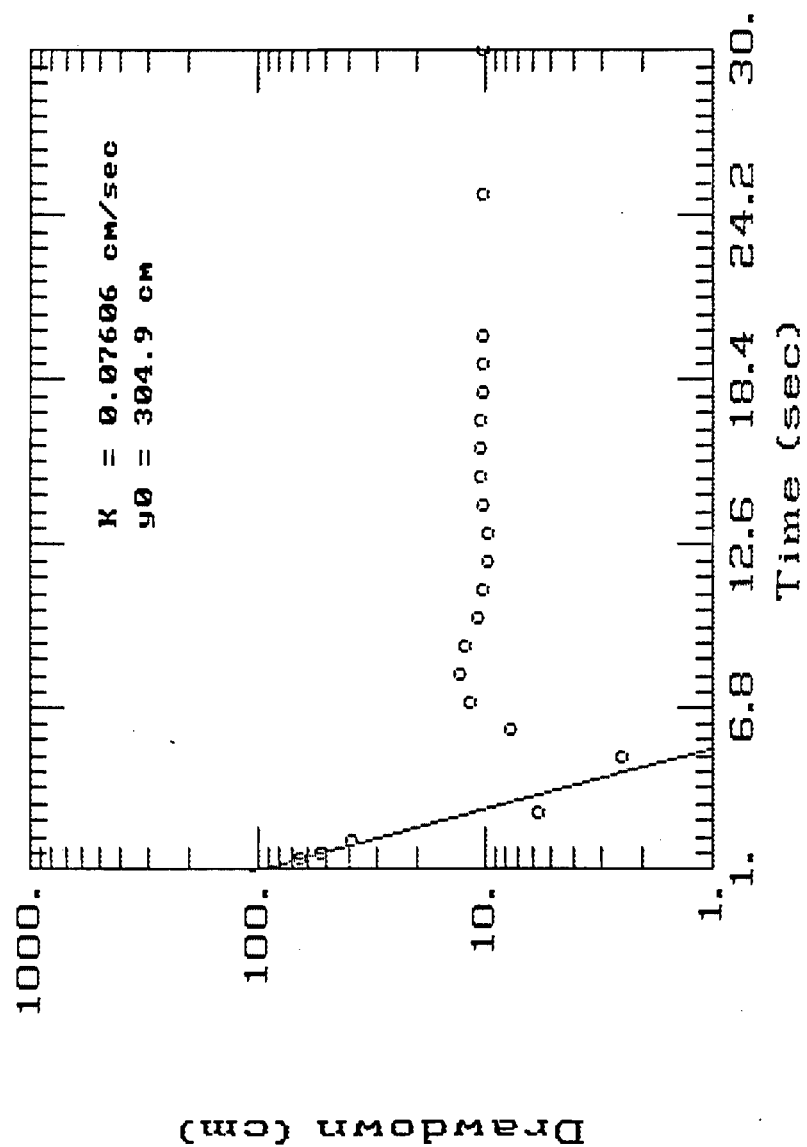
MW-5 RISING HEAD



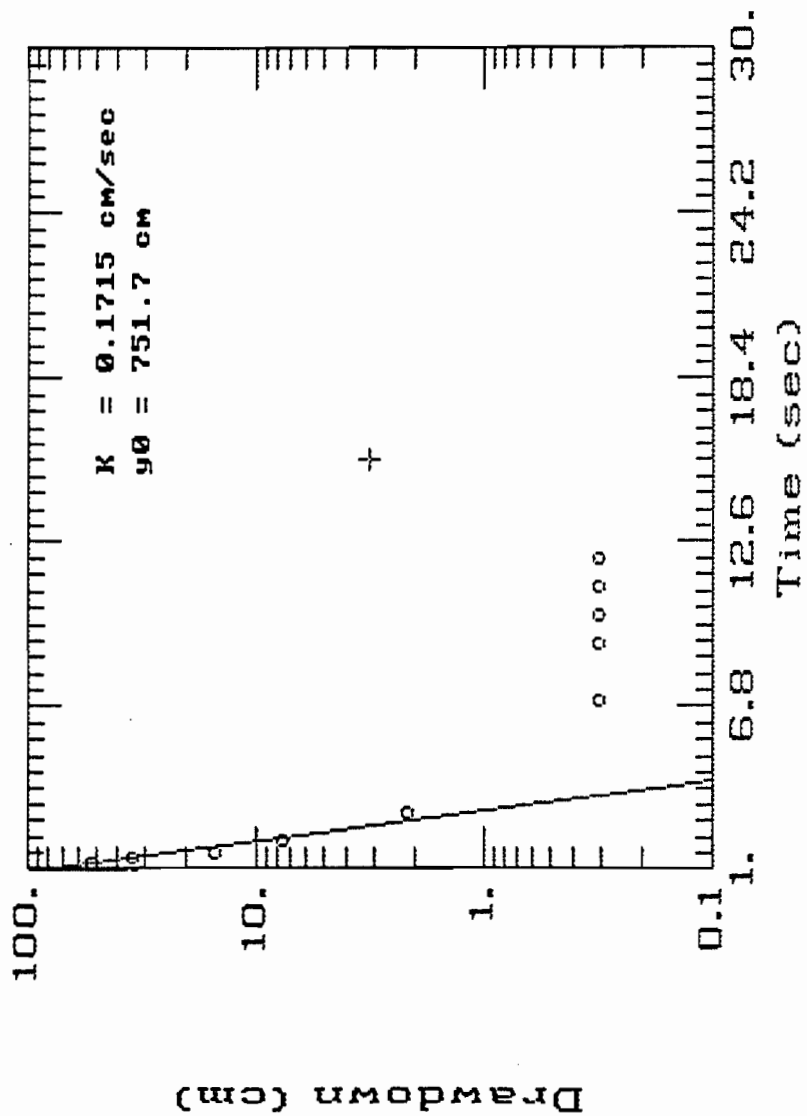
MW-6A RISING HEAD



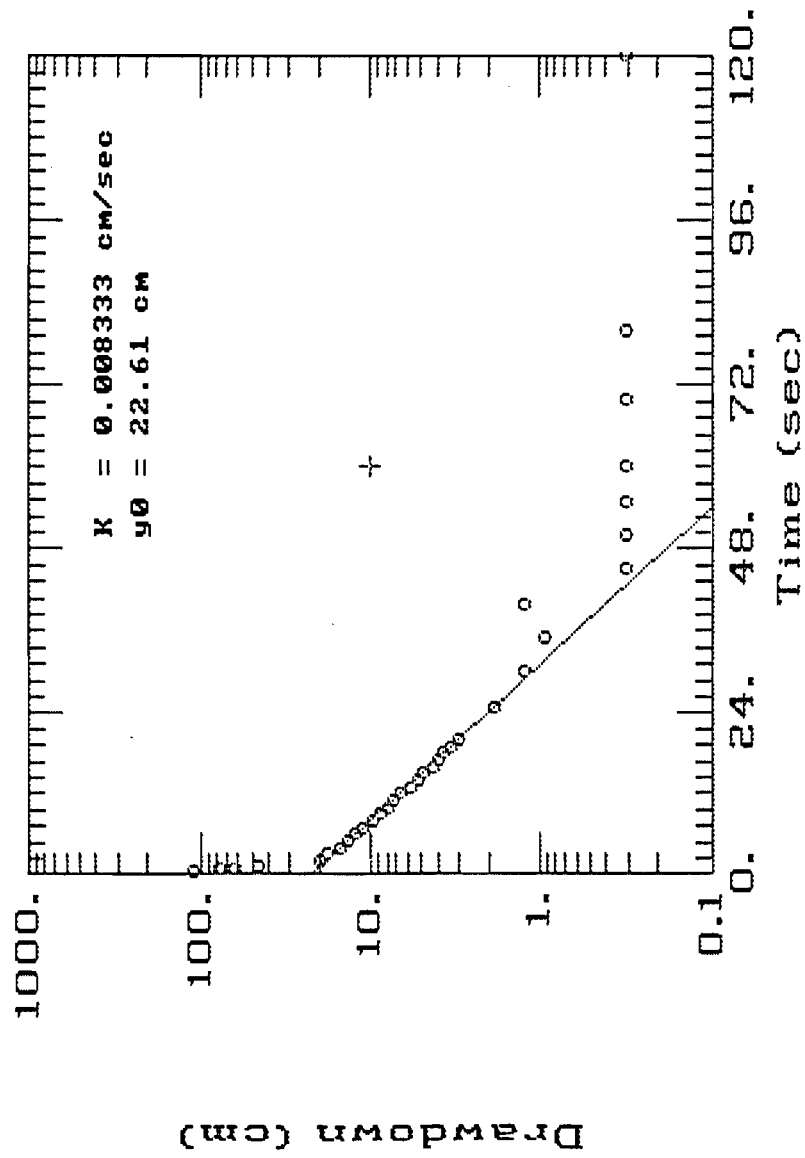
MW-6A FALLING HEAD



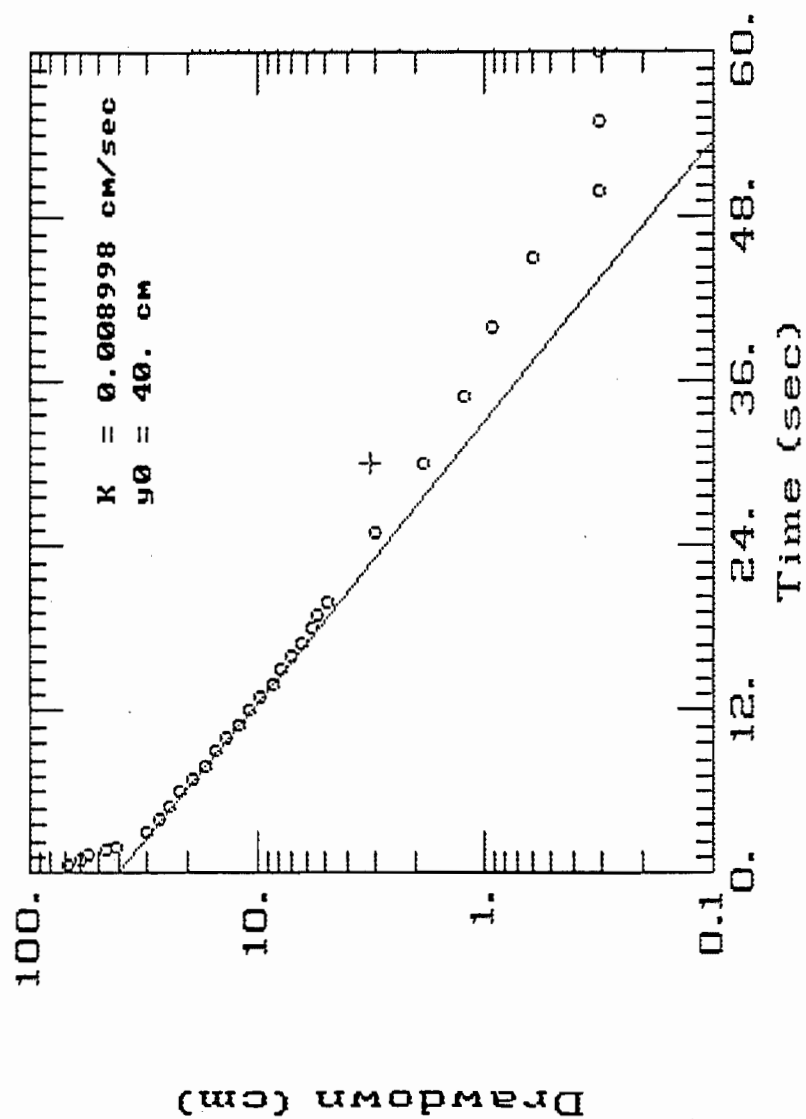
MW-6B RISING HEAD



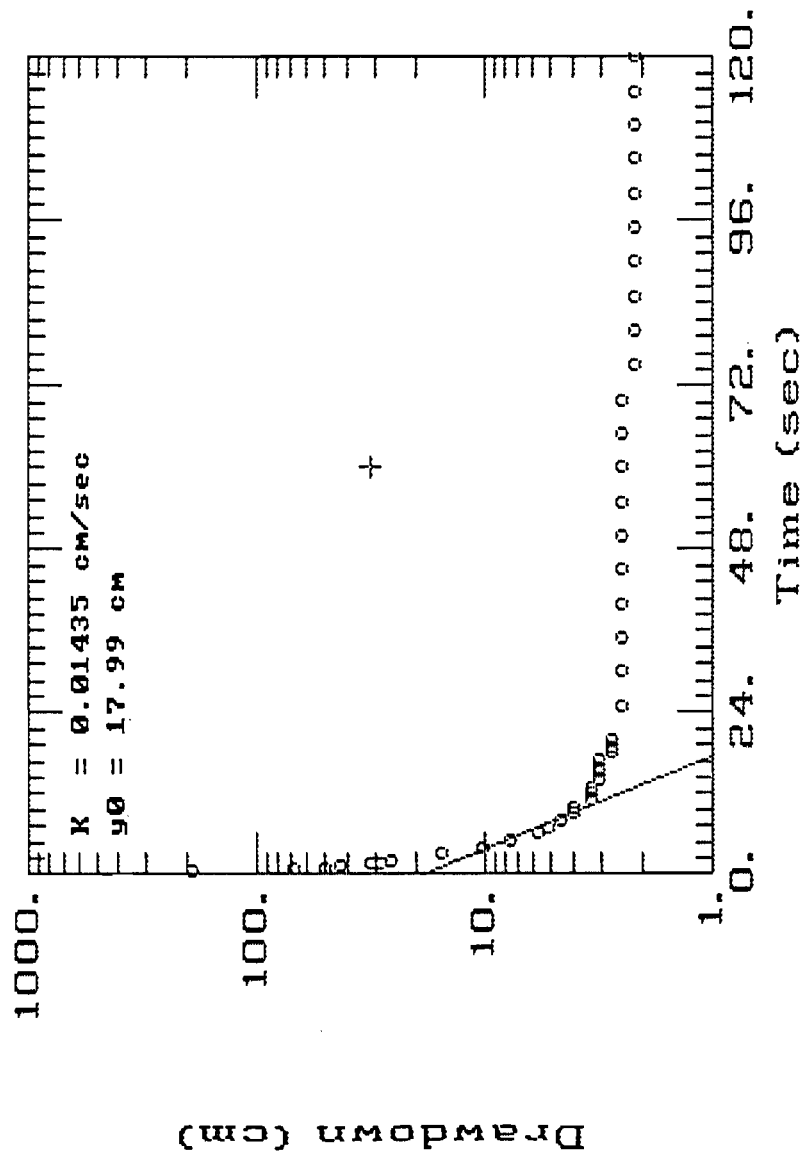
MW-7 FALLING HEAD



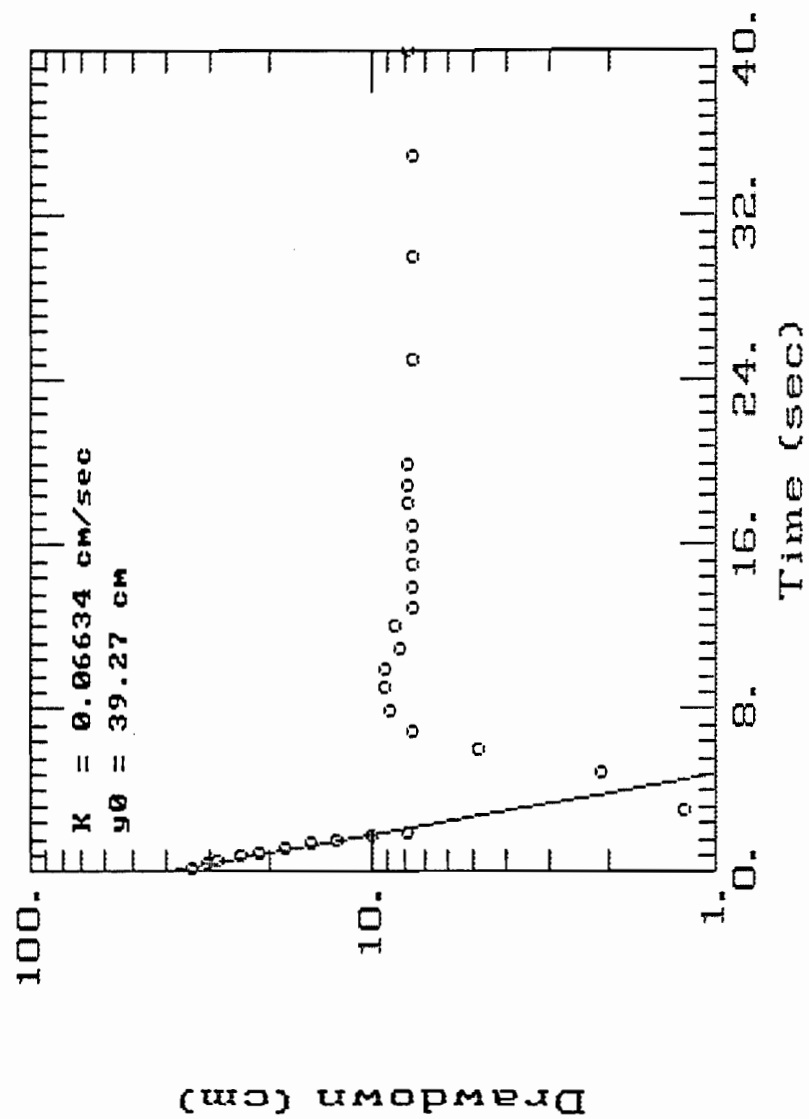
MW-7 RISING HEAD



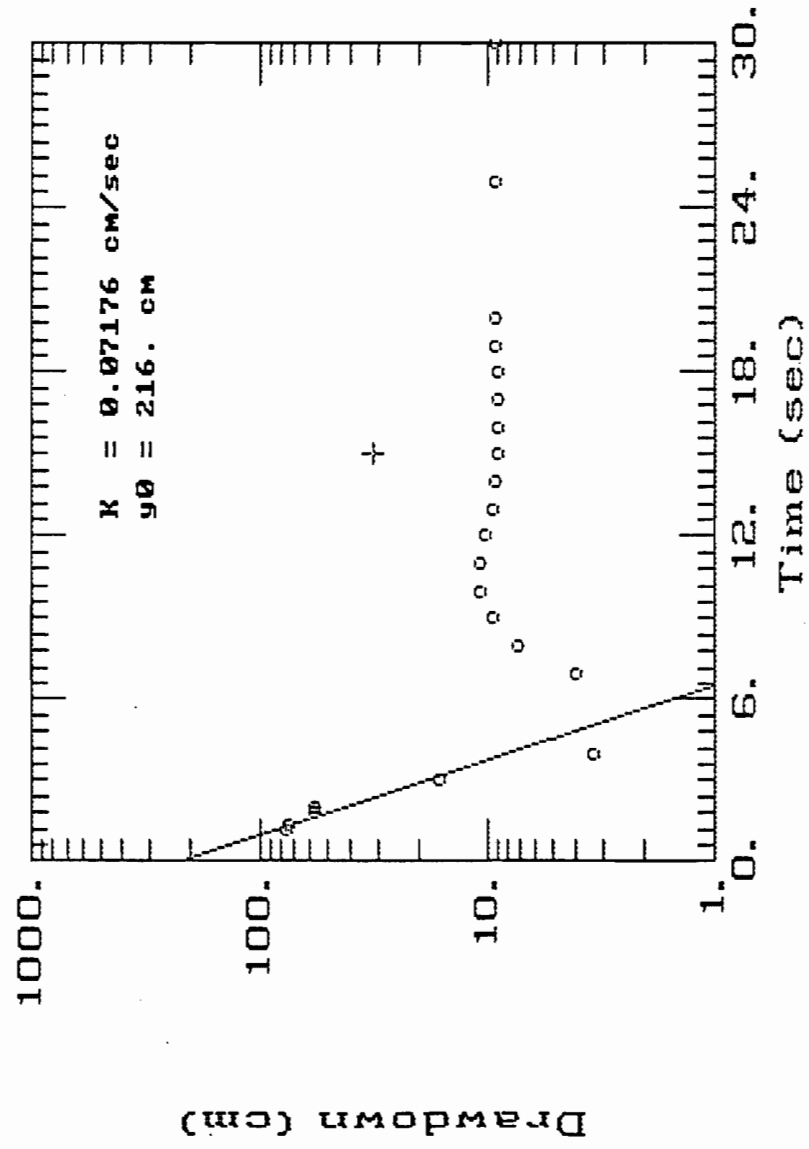
MW-8 RISING HEAD



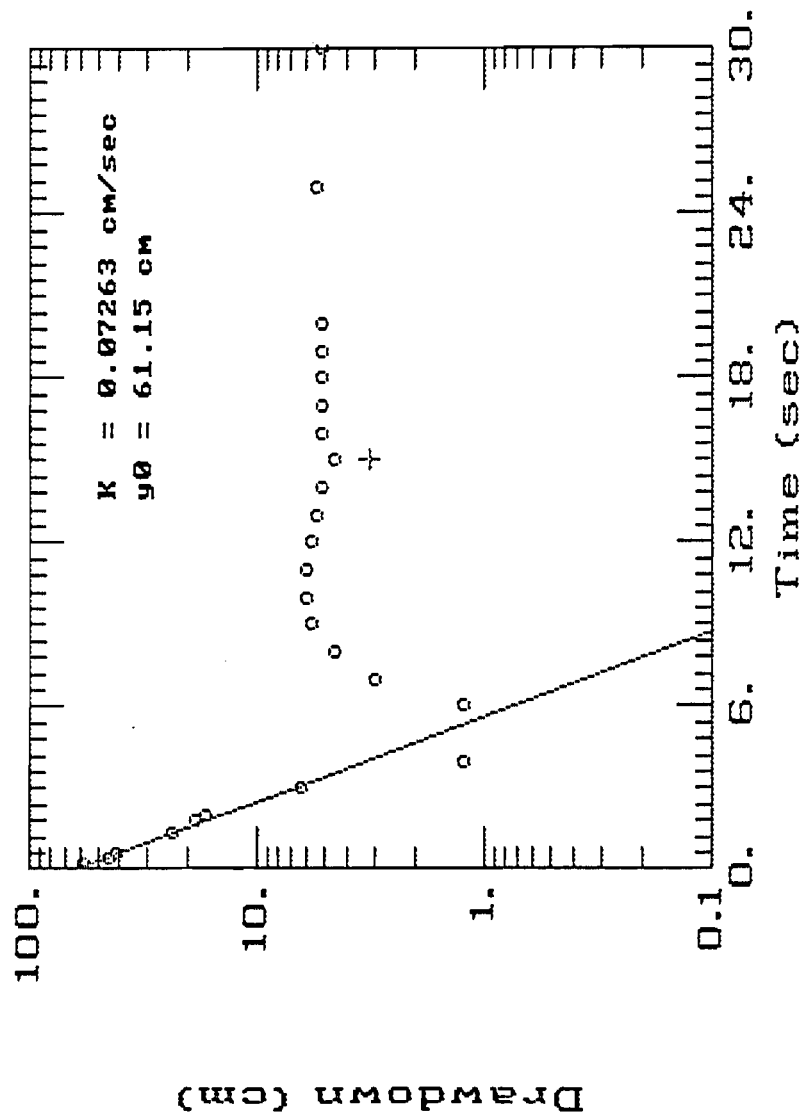
MW-9 RISING HEAD



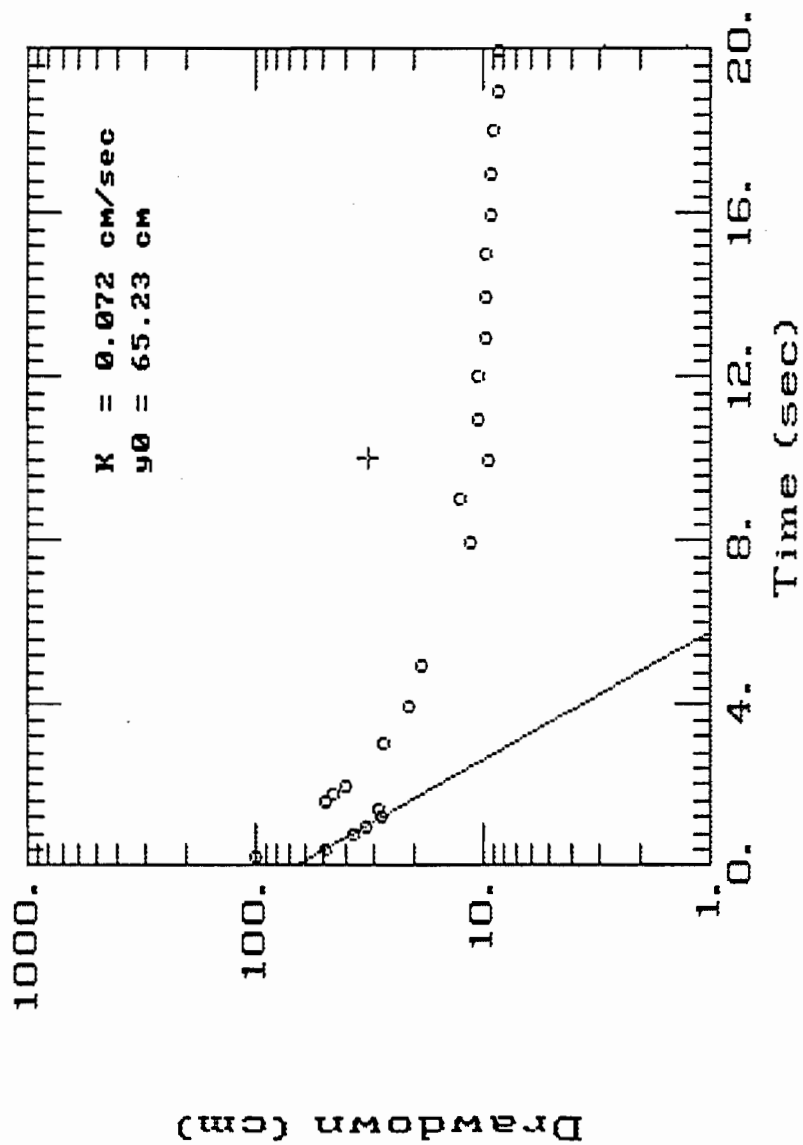
MW-9 FALLING HEAD

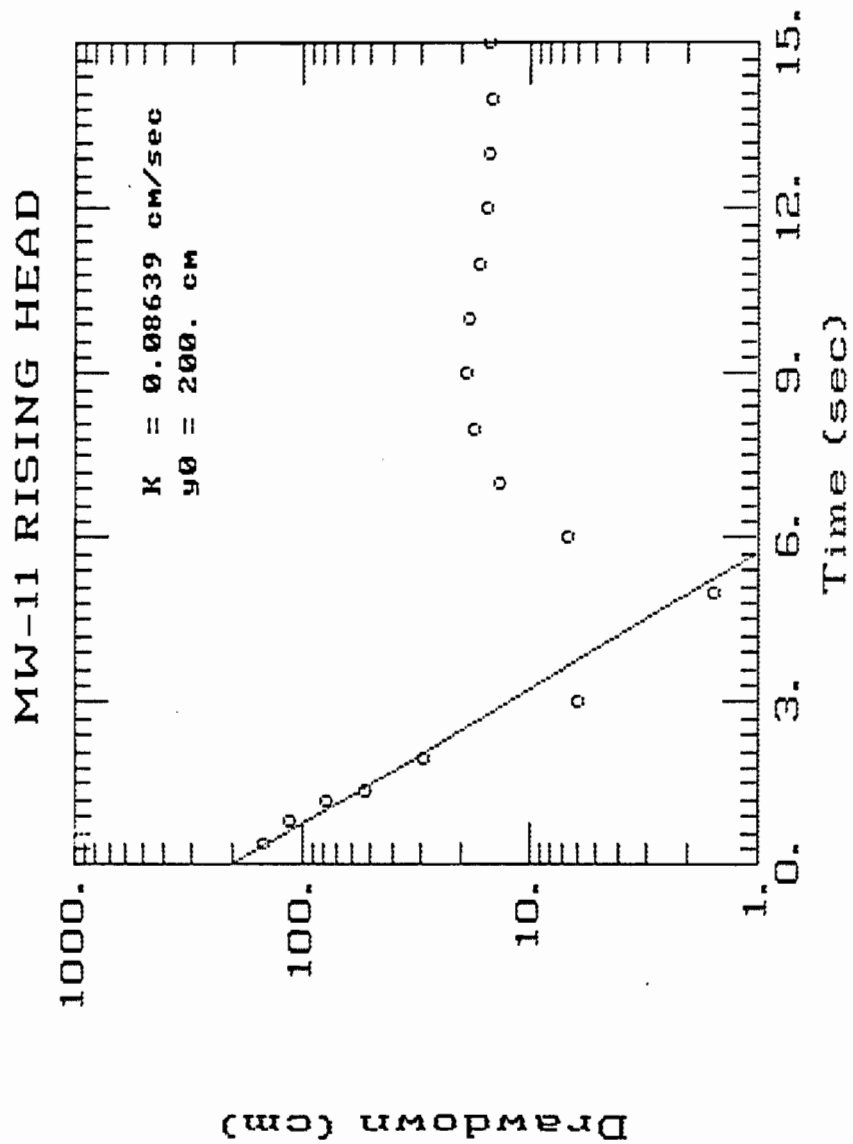


MW-10 FALLING HEAD

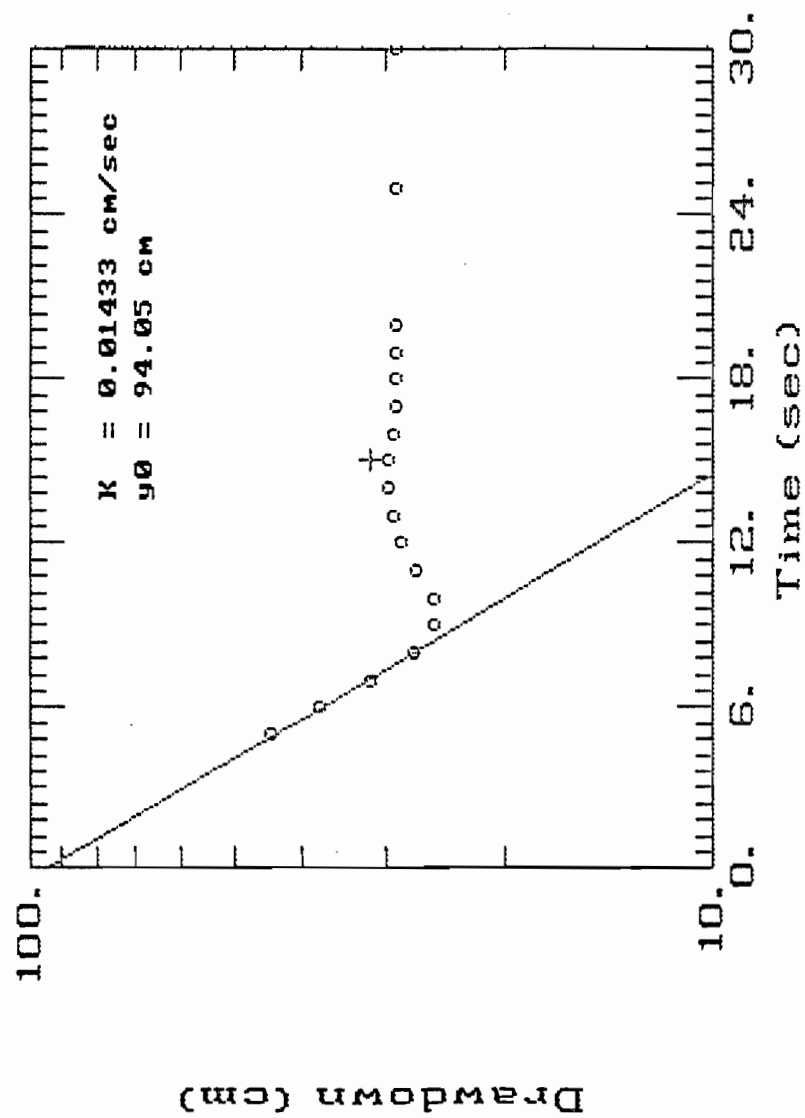


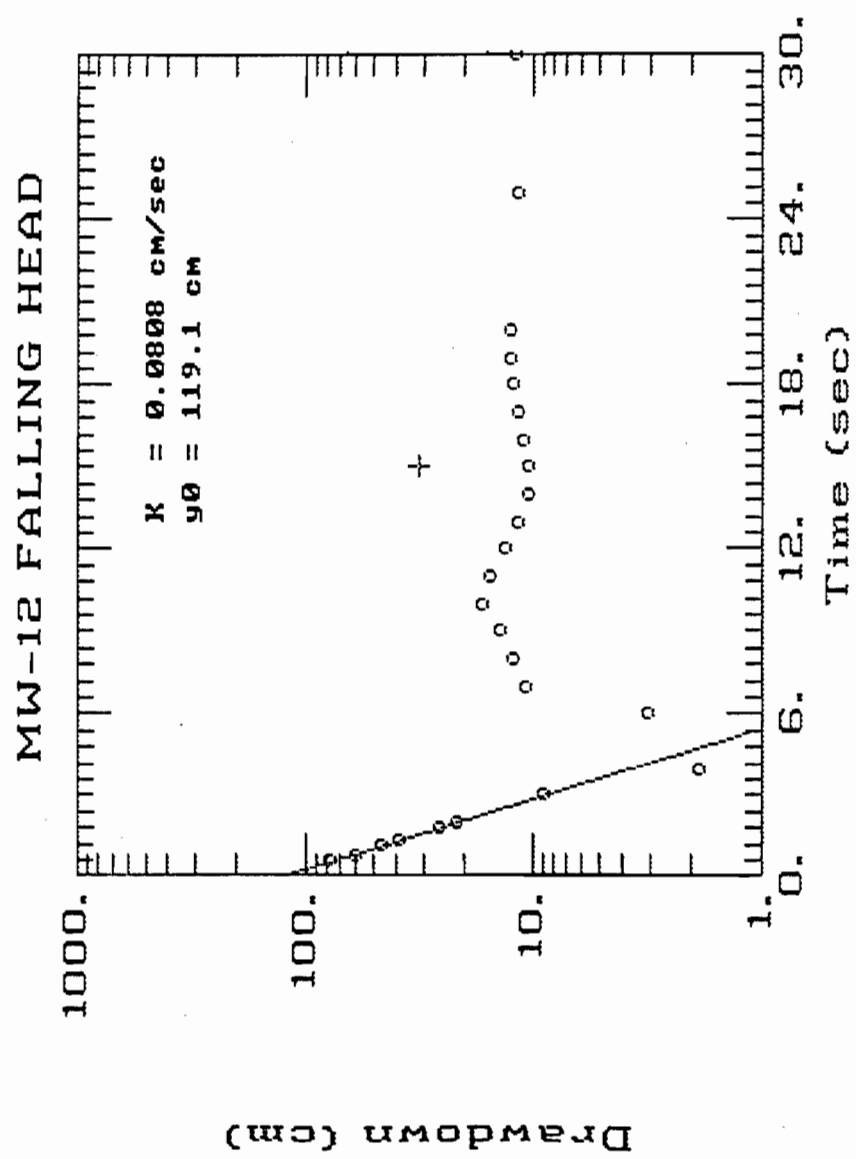
MW-10 RISING HEAD



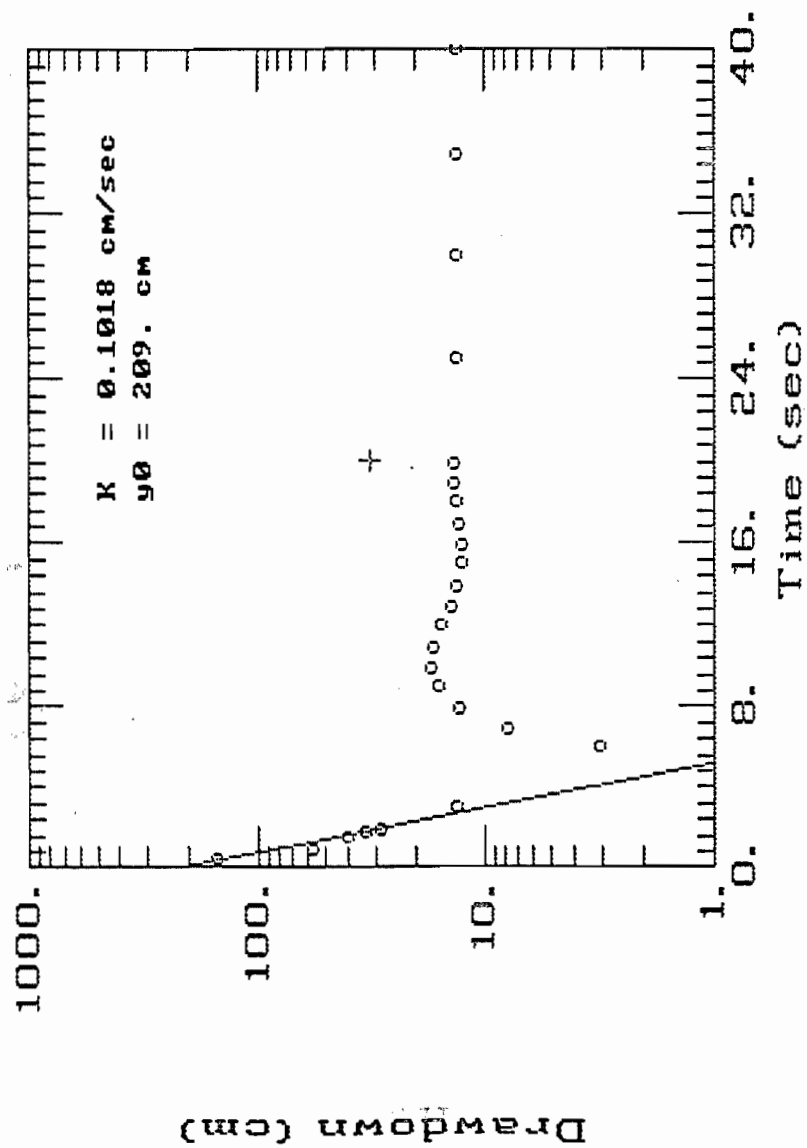


MW-11 FALLING HEAD

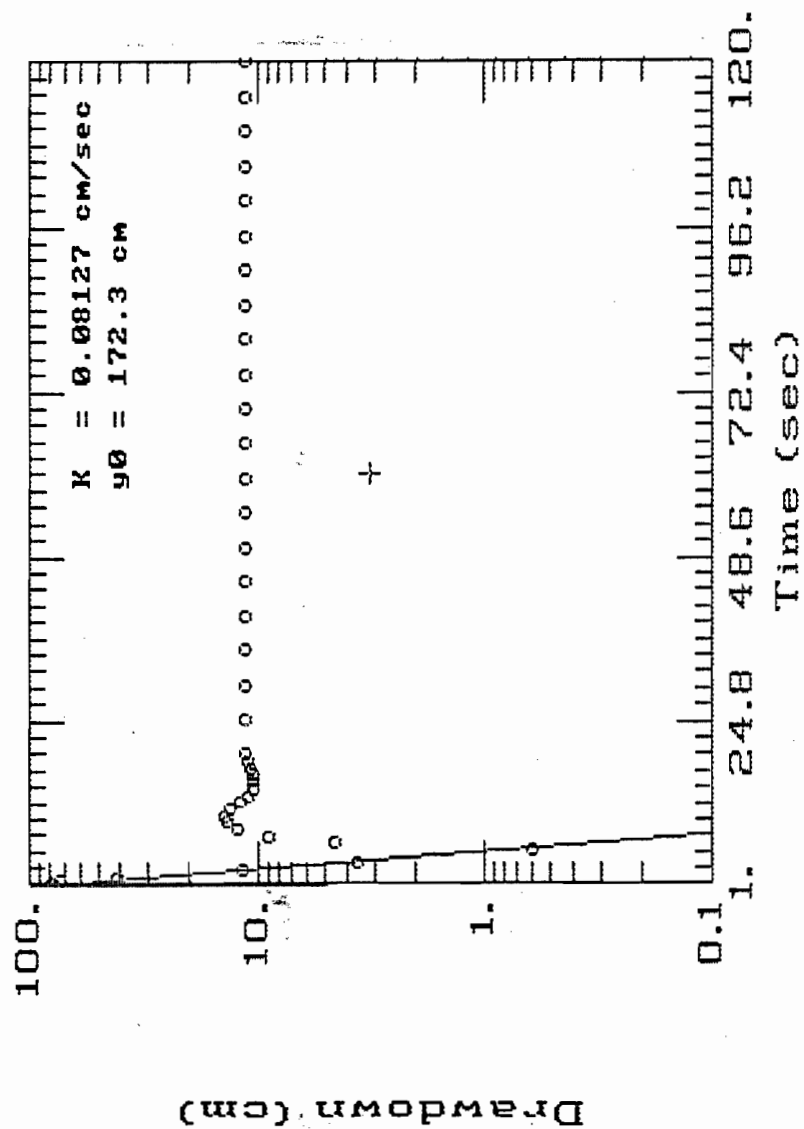




MW-15 RISING HEAD



MW-15 FALLING HEAD



MW-16 FALLING HEAD

