Formerly Utilized Sites
Remedial Action Program
(FUSRAP)

Maywood Chemical Company Superfund Site

ADMINISTRATIVE RECORD

Operable Unit 2 - Groundwater

Document Number

GW-008

US Army Corps
of Engineers®
New York District

GROUNDWATER REMEDIAL INVESTIGATION WORK PLAN
FUSRAP MAYWOOD SUPERFUND SITE
MAYWOOD, NEW JERSEY

SITE-SPECIFIC ENVIRONMENTAL RESTORATION
CONTRACT NO. DACW41-99-D-9001

Submitted to:

Department of the Army
U.S. Army Engineer District, Kansas City
Corps of Engineers
700 Federal Building
Kansas City, Missouri 64106

Department of the Army
U.S. Army Engineer District, New York
Corps of Engineers
FUSRAP Project Office
26 Federal Plaza
New York, New York 10007

Submitted by:

Stone & Webster Environmental Technology & Services
250 West 34th Street
New York, New York 10119-2998

June 2000

Reviewed/ Approved by: [signature] Jay Green, P.E. Project Manager — **Date:** 6/13/00

Reviewed/ Approved by: [signature] Kevin Donnelly, P.E. Project Environmental Engineer — **Date:** 6.13.00

Reviewed/ Approved by: [signature] Daniel Samela, Ph.D., P.E. Task Manager — **Date:** 6/13/00

Prepared by: [signature] Michael Kulbersh, P. HG. Acting Project Hydrogeologist — **Date:** 6/13/00

c:\windows\temp\36503.doc

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

LIST OF ABBREVIATIONS AND ACROYNMS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

LIST OF ABBREVIATIONS AND ACRONYMS

AEC	Atomic Energy Commission
AGST	Above Ground Storage Tank
AHCs	Aromatic Hydrocarbons
AOC	Area of Concern
ARAR	Applicable or Relevant and Appropriate Requirement
Bgs	Below Ground Surface
BNI	Bechtel National, Incorporated
BRA	Baseline Risk Assessment
CDQMP	Chemical Data Quality Management Plan
CERCLA	Comprehensive Environmental Response and Liability Act
CFR	Code of Federal Regulations
CLP	Contract Laboratory Procedure
cm/s	Centimeter Per Second
COCs	Constituents of Concern
CQCP	Contractor Quality Control Plan
CSM	Conceptual Site Model
DCE	Dichloroethylene
DNAPL	Dense non-phase aqueous liquid
DRPSR	Division of Responsible Party Site Remediation
DTW	Depth to Water
EM	Electromagnetic Survey
EMP	Environmental Monitoring Program
EMSA	Environmental Measurements and Site Assessment Section
EPM	Equivalent Porous Medium
EPA	U.S. Environmental Protection Agency
EUF	Earthworm Uptake Factor
FBL	Fixed Based Laboratory
FFA	Federal Facilities Agreement
FID	Flame Ionization Detector
FOC	Field Operations/Quality Assurance Coordinator
FS	Feasibility Study
ft	Feet
FMSS	FUSRAP Maywood Superfund Site
FSP	Field Sampling Plan
FUSRAP	Formerly Utilized Sites Remedial Action Program
gal	Gallon
GEPP	General Environmental Protection Plan
GPR	Ground Penetrating Radar
GSSHP	General Site Safety and Health Plan
GWQC	Groundwater Quality Criteria
GWRI	Groundwater Remedial Investigation
GWRIWP	Groundwater Remedial investigation Work plan

HSA	Hollow Stem Auger
HEAST	Health Effects Assessment Summary Table
IEC	Immediate Environmental Concern
IRIS	Integrated Risk Information system
kg	Kilogram
km	Kilometer
lb	Pound
LMAS	Leaky Multi-unit Aquifer System
LNAPL	Light non-aqueous phase Liquid
LOAEL	Lowest Observed Adverse Effect Level
m	Meters
mg/l	Milligrams per liter
mg/kg	Milligram per Kilogram
MCL	Maximum Contaminant Level
MCW	Maywood Chemical Works
MDA	Minimum Detectable Activity
MHTDP	Material Handling/Transportation and Disposal plan
MISS	Maywood Interim Storage Site
ML	Mobile Laboratory
MSL	Mean Sea Level
MW	Monitoring well
NAD	North American Datum
NC	No Established Criteria
NCEA	National Center for Exposure Assessment
NGVD	National Geodetic Vertical Datum
NJAC	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NJVIS	New Jersey Vehicle Inspection
NESHAPS	Nation Emission Standards for Hazardous Air Pollutants
NPL	National priority List
NRC	Nuclear Regulatory Commission
NTU	Nephelometric Turbidity Units
ORD-TSD	Office of Research and Development-Treatability Study Database
OSHA	Occupational Safety and Health Administration
OVA	Organic Vapor Analyzer
PCBs	Polychlorinated Biphenols
PCE	Perchloroethylene
pCi/g	Picocuries per gram
pCi/l	Picocuries per liter
ppb	Parts per billion
PDI	Preliminary Design Investigation
PID	Photoionization Detector
ppm	Parts per million
PQL	Practical Quantitation Limit
PUF	Plant Uptake Factor

QAP	Quality Assurance Plan
QA/QC	Quality Assurance/Quality Control
Ra	Radium
Rad	Radiological Parameters (total Uranium, Ra-228, Ra-226, Th-230, and Th-232)
RBTLs	Risk-based Target Levels
RCRA	Resource Conservation and Recovery Act
REE	Rare Earth Elements (Cerium, Dysprosium, Lanthanum, Neodymium and Yttrium)
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
ROD	Record of Decision
SAP	Sampling and Analysis Plan
SAS	Special Analytical services
SCC	Soil Cleanup Criteria
SDWA	Safe Drinking Water Act
SD	Sediment
SOW	Statement of Work
SQL	Sample Quantitation Limit
SSLs	Soil screening Levels
SVOCs	Semivolatiles Organic Compounds
SW	Surface Water
TAL Metals	Target Analyte List Metals
TCL	Target Compound List Organics (VOCs, SVOCs, Pesticides/PCBs)
UST	Underground Storage Tank
U	Total Uranium
Th	Thorium
TCE	Trichloroethylene
TCLP	Toxicity Characteristics Leaching Procedure
TSD	Treatment, Storage , Disposal
UR	Urban Land
USACE	U. S. Army Corps of Engineers
USDOE	United States Department of Transportation
USEPA	United States Department of Environmental Protection Agency
USGS	United States Geological Survey
VC	Vinyl Chloride
VOC	Volatile Organic Compound
VLF	Very Low Frequency

1.0 INTRODUCTION

1.1 PROJECT INTRODUCTION

1.1.1 General

This Groundwater Remedial Investigation Work Plan (GWRIWP) has been prepared by the Stone & Webster Team in accordance with the requirements set forth under U.S. Army Corps of Engineers (USACE) Kansas City District Contract No. DACW 41-99-D-9001 and the 1991 Federal Facilities Agreement (FFA) between the U.S. Environmental Protection Agency (USEPA) and the U.S. Department of Energy (USDOE). The GWRIWP identifies the office, field and other investigations and analyses required to complete the environmental characterization of groundwater at the Formerly Utilized Sites Remedial Action Program (FUSRAP) Maywood Superfund Site (FMSS) (Figure 1-1). This GWRIWP has been written in accordance with the USEPA Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (Comprehensive Environmental Response, Compensation and Liability Act of 1980) (USEPA, 1988). Further, this GWRIWP defines the measures/methods to identify the nature and extent of identified Constituents of Concern (COCs) in groundwater, determine the fate and transport of these COCs, and provide a basis to review and prepare a supplement to the 1993 Baseline Risk Assessment (BRA) in terms of current information. This information will also be used to provide a basis for a feasibility study/pre-design investigation (FS/PDI) should such be required for the selection of a remedy as a response action to the release of hazardous substances that are a threat to human health and/or the environment.

1.1.2 FMSS Background Information

The FMSS is comprised of a number of properties in Maywood, Rochelle Park and Lodi, New Jersey. The properties include; the Stepan property; the Sears and immediately adjacent properties; the federally owned Maywood Interim Storage Site (MISS); and, a number of nearby commercial/government properties (Figure 1-2).

In the first half of this century, the Maywood Chemical Works (MCW) processed radioactive thorium ore (i.e., monazite sand) to produce the thorium concentrate for use in industrial products such as mantles for gas lanterns. The residues or tailings from the process operation contained low-level radioactive materials. In addition to thorium materials processing, other processing operations at MCW generated various other types of waste products (such as lanthanum, lithium compounds, detergents, alkaloids, essential oils and products from tea and cocoa leaves). MCW pumped process wastes to diked areas west of the plant and these may have migrated onto adjacent properties in Rochelle Park. Some of the waste materials were excavated and used as fill and mulch for nearby properties in Maywood, Rochelle Park and Lodi. Waste materials were also transported via the old Lodi Brook stream channel (later replaced by a storm water drain system) into Lodi. In 1932, New Jersey Route 17 (Route 17) was built through parts of the disposal area.

The result of these activities was deposition of MCW waste materials over much of the local area. Stepan Chemical Company, which was later referred to as Stepan Company (Stepan), bought MCW in 1959. Stepan is currently the owner/operator of a portion of the original MCW property. Many of MCW's operations were discontinued in the 1960s and much of its original property has been sold and converted to other uses. Stepan currently focuses on the production of specialty chemicals such as ester, lubricants, food ingredients and other specialty products.

Between 1963 and 1968, Stepan undertook several onsite cleanup actions. Contaminated material from west of Route 17 in Rochelle Park and onsite building rubble and debris were buried on the remaining Stepan property. Subsequent to these actions, areas adjacent to Stepan to the west were thought to not pose radiological concerns because the Atomic Energy Commission (AEC) released the areas for unrestricted use. However, in 1980, radiological contamination was discovered by an area resident on property immediately west of Route 17 on the Ballod property, which was formerly owned by Stepan. From 1980 to 1983, radiological testing by the State of New Jersey, USEPA, and USDOE, revealed extensive low-level radiation at several locations. Based on the results of the investigation, the Maywood Site was included on the National Priorities List in 1983. From 1984 through 1986, USDOE, acting under its authority through the 1984 Energy and Water Appropriations Act (PL 98-50), which specifically addressed the FMSS, investigated and removed over 35,000 cubic yards of soil and debris from the Ballod property (the former location of diked disposal areas west of Route 17) and 25 residential properties in Maywood, Lodi, and Rochelle Park. This material was stockpiled and secured at the MISS; the MISS was acquired by USDOE in September 1985 and is still owned by the federal government. The MISS is located on 11.7 acres of land previously owned by Stepan and abuts the Stepan property to the northwest.

In 1986, in conjunction with USDOE's radiological characterization of the Sears and adjacent properties, USEPA performed a preliminary study of chemical, non-radioactive pollutants. In late 1987 through spring 1988, in conjunction with USDOE's studies and investigations, USEPA collected "split" samples of soil and groundwater on the Stepan property. The data indicated the presence of radiological contaminants in soil and non-radiological contaminants in soil and groundwater. In 1991, USEPA and USDOE signed a Federal Facilities Agreement (FFA), which detailed the responsibilities for the FUSRAP waste at the site (see Section 1.3).

USDOE decided to address the FMSS under its FUSRAP program because environmental concerns were similar to those at other FUSRAP sites. The purpose of FUSRAP is to clean up contaminated sites where work has been performed as part of the Nation's early Atomic Energy Program. The Energy and Water Development Appropriations Act of 1998 (PL 105-62) provided appropriations and authority for the USACE to administer and execute the USDOE's FUSRAP program. As a result, responsibility for the remaining cleanup of the FMSS has been transferred from USDOE to the USACE as of October 1997 (date of the Appropriations Act).

Soil cleanup activities for portions of the FMSS (residential properties, municipal properties, and the interim storage pile previously located at the MISS) have been completed. However, the groundwater, surface water, and sediment related cleanup activities at the FMSS will be addressed as part of this Groundwater Remedial Investigation (GWRI). The constituents included in the definition of FUSRAP waste at the FMSS include radionuclides (^{232}Th, U (total), and ^{226}Ra), metals, and rare earth metals. The primary sources identified include: the burial pits on Stepan; the former retention ponds on MISS property; buried drums at the Sears property (if commingled with FUSRAP waste); former stockpiled material at the MISS property; material deposited by stream flow along Lodi Brook; and, contaminated fill material on other industrial/government properties.

1.2 SITE LOCATION

The FMSS is located in a highly developed area of northeastern New Jersey in the boroughs of Maywood and Lodi, and the Township of Rochelle Park, New Jersey. The area consists of residential, municipal, and commercial properties that were contaminated by operations associated with thorium processing at the former MCW. The three municipalities are located approximately (12 miles, 20 kilometers) north-northwest of New York City and (13 miles, 21 km) northeast of Newark, New Jersey (Figures 1-1 and 1-2). The FMSS is listed on the National Priorities List (NPL) as the Maywood Chemical Company Superfund Site.

1.3 DEFINITION OF FUSRAP CONTAMINATION

The USACE is responsible for "FUSRAP Waste" in accordance with the FFA between the USDOE and the USEPA dated April 22, 1991.

In accordance with the FFA:

"FUSRAP Waste" shall mean and be specifically limited to all contamination, both radiological and chemical, whether commingled or not, on the MISS and all the radiological contamination above USDOE's action levels related to past thorium

processing at the MCW site occurring on any Vicinity Properties.[1] *Also included are any chemical or non-radiological contamination on Vicinity Properties that would satisfy either of the following requirements:*

- *The chemical or non-radiological contaminants are mixed or commingled with radiological contamination above USDOE's action levels; or*

- *The chemical or non-radiological contaminants originated in the MISS or were associated with the specific thorium manufacturing or processing activities at the MCW site which resulted in the radiological contamination.*

Therefore, only FUSRAP waste impacted groundwater contamination will be considered in this GWRIWP. A discussion of the COCs related to FUSRAP waste is included in Section 3.0.

1.4 GROUNDWATER AND SURFACE WATER BACKGROUND INFORMATION

Groundwater within the FMSS occurs in the overburden and underlying fractured bedrock. The general direction of groundwater flow in the FMSS area varies seasonally, however, groundwater flow in the overburden tends to flow in a southwesterly to westerly direction across the MISS to the Saddle River (Figure 1-3). A ridge located along Summit Avenue in Hackensack is the regional basin groundwater divide. To the east of this regional divide, groundwater in the overburden drains toward the Hackensack River. To the west, groundwater in the overburden drains toward the Saddle River. To the west of Summit Avenue, a sub-basin exists that also drains to the Hackensack River. This is the sub-basin defined by Coles Brook. Therefore, a sub-basin groundwater divide in the overburden is judged to exist between the bulk of the FMSS and Coles Brook.

[1] MCW Site and Vicinity Properties are the FMSS.

Groundwater from the overburden aquifer is believed to discharge to low lying areas such as Westerly Brook, Coles Brook and the existing wetland near the Sears property and immediately south of the Stepan property. This wetland is the headwaters for the Lodi Brook.

1.4.1 Historical Westerly Brook

Westerly Brook is a continuous stream fed by surface water runoff and groundwater. The brook originates some 3,200 feet north of the FMSS. Historically, Westerly Brook flowed south in a natural open channel towards the MISS. The channel slope is approximately one percent, so flow velocities are typically low. At the MISS, the historic flow of the brook changed course from a southerly direction to a southwesterly direction, which is similar to the direction of shallow groundwater flow in the area. The brook flows in the southwesterly direction, ultimately discharging into the Saddle River. Figures of the current and historic locations of Westerly Brook are provided in Appendix A.

1.4.2 Historical Lodi Brook

Prior to development of the Sears property, shallow groundwater discharged to ground surface forming two separate springs (or seeps) that joined in a low lying area to form the Lodi Brook. From this point, the brook flowed generally south across relatively flat open terrain. The original stream channel split near the present location of Industrial Avenue in Lodi and rejoined at the present day location of Sydney Street in Lodi flowing southward to New Jersey Route 46 (Route 46). The historic flow of the brook south of Route 46 is not known. A 1940's (exact date unknown) aerial photograph of the area shows that at Route 46, the course of Lodi Brook may have been channeled through a culvert to the Saddle River. Aerial photographs of the historic location of Lodi Brook are provided in Appendix A.

1.4.3 Westerly Brook Area Development

Development in the Westerly Brook area north of MISS generally includes commercial and light industrial development and residential developments are located to the east and to the west. Area businesses located to the west of the brook include two auto body/repair shops (immediately next to the brook), and a chemical company (Dixo Co.) that formerly packaged industrial solvents located within one block of the brook. As depicted in Figure 1-2, Maywood Auto Repair located at the intersection of Hergesell Avenue and West Central Avenue is located adjacent to Westerly Brook. Similarly, to the west of this intersection is the Maywood Auto Mall. Businesses at this location includes American Discount Muffler, and Rochelle Radiator.

Residential properties are located to the east of Westerly Brook with the exception of a Public Service Electric & Gas transformer station on West Central Avenue and a municipal swimming pool located off of Duvier Place. It appears that the original location of the brook may have been altered to facilitate the construction of the pool. To the south of the municipal pool is a vacant lot. This property formerly housed several greenhouses and is currently being reviewed by the NJDEP specifically for groundwater contamination. A single monitoring well is visible in the southwest corner of the property adjacent to the Westerly Brook. Six residential wells located on West Magnolia Avenue, refer to Figure 1-2, and the municipal swimming pool have been impacted by tetrachloroethene (PCE) contamination. In May 1987, the six residents and the swimming pool were connected to the United Water Company main for municipal water use. NJDEP is currently assessing the Magnolia Avenue wells to determine a source of the contamination.

Westerly Brook was routed through a 72-inch culvert in the early 1970's starting just north of the MISS. Inside the MISS, the culvert abruptly changes direction (approximately 90°) at three locations before exiting the MISS towards the west. The culvert changes to a 90-inch tunnel beneath Route 17 (Figure 1-2). After passing beneath Route 17, the culvert again changes to a 72-inch by 60-inch elliptical pipeline. Historic drawings of Westerly Brook are included in Appendix A. The culvert runs beneath an assisted living facility to a residential area before surfacing west of St. Anne Place. Westerly Brook then extends as a natural channel for approximately 600 feet ultimately discharging into the Saddle River. A 36-inch diameter storm system line exits the MISS immediately south of, and is tied, to the Westerly Brook culvert (Bechtel National Inc.

(BNI) Drawing No. 138-DD551-C01). This 36-inch diameter pipe within the MISS follows the same north-south orientation (approximately 100 feet to the east) as the Westerly Brook culvert. This segment of the 36-inch line appears to connect with an additional 18-inch diameter pipe running parallel to the pipe immediately to the west of the MISS. The pipes join at a manhole south of the rail spur, which is used to load out material from the MISS. A hole has developed alongside this manhole, which is referred to as a "sinkhole" by BNI field personnel. Flows in this pipe exit the MISS from this manhole through a nominal 65-inch diameter pipe. A headwall is present and a smoke test completed on the 65-inch pipe indicated that this pipe was connected to the 72-inch elliptical pipe (Westerly Brook).

The investigation of this area of Westerly Brook is specifically significant because according to the Bergen County Health Department, volatile organic contamination has been detected in the groundwater in the vicinity north of the MISS. According to a May 10, 1999 letter from the New Jersey Department of Environmental Protection (NJDEP) to the Bergen County Health Department, "Dixo Co. is considered a responsible party for the area-wide groundwater contamination." Dixo's impact to the regional groundwater quality is discussed further in Sections 1.6.1 and 2.5.2, and the location of Dixo Co. Inc., is depicted in Figure 1-2.

1.4.4 Lodi Brook Development

The following summary of development at the Lodi Brook headwaters was taken from aerial photographs of the FMSS included in the USEPA Report entitled "Maywood Chemical Sites, Maywood and Rochelle Park, New Jersey," dated May 1984. Selected historic aerial photographs are provided in Appendix A.

An analysis of the 1940's aerial photograph of the area shows that two reaches located north of Route 17 (on what is now the Sears Property) joined to form the Lodi Brook south of Route 17. Immediately to the north of the easternmost reach are three areas defined as "lagoons" in the report. These lagoons appear in the 1965 aerial photograph (and not in the 1970 aerial photograph).

An aerial photograph dated 1951 shows additional smaller sources of water feeding into the primary reaches of the brook. Several of the sources that appear to be feeding the easternmost reach may be the result of continued development to the east of Maywood Avenue. A coal storage area is identified in a 1940 aerial photograph near an MCW power plant. This coal area was noted in a 1961 aerial photograph and not in the 1965 aerial photograph. This is of particular note in that a 1951 aerial photograph indicates a drainage channel from this area, running to the westernmost reach of the Lodi Brook headwaters.

The 1965 aerial photograph details the continued development adjacent to the Lodi Brook headwaters. The photograph shows the newly constructed buildings currently occupied by the DeSaussure Company, located off Maywood Avenue and both the Federal Express and SWS Realty Building at Route 17. The 1970 aerial photograph shows the Sears warehouse building and associated parking lot as "new construction". All of this construction continued to impact the natural flow of the source waters to Lodi Brook leading potentially to further the development of the wetlands and marshes that currently exist in the area.

Not readily apparent from the aerial photographs included in this report is the construction of the building currently occupied by Myron Manufacturing (Myron) which is located upgradient from the MISS. Prior to Myron, this building was occupied by Pfizer, for the manufacturing of pharmaceutical products (as reported by the current owner).

West and south of Route 17, the Lodi Brook area has also experienced significant urban development over the years. Because of this development, the natural course of Lodi Brook has been straightened and culverted along an alignment, running north to south, on the east side of and parallel to Hancock Street in Lodi. South of the 80 Hancock Street property, Lodi Brook splits into two separate channels. The culvert exits to a drainage conduit at Route 46 that runs in a southwesterly direction and ultimately discharges into the Saddle River through a 48-inch corrugated metal pipe approximately

1,000 feet south of Route 46. Flow in Lodi Brook is supplemented by the drainage swale running along the south of Sears property (entering from the east on East Howcroft Street and from the rear of Federal Express and Uniform Fashions) and area stormwater runoff.

1.5 HISTORICAL OPERATIONS AT THE MCW FACILITIES

Review of the historical process operations that took place at the MCW facilities reveals that these processes can be categorized into two "generations"; these generations being pre- and post-World War II. The initial MCW facilities were constructed around 1895.

1.5.1 Operations Prior to and During World War II

The impact of World War I, from 1914 to 1918, and the cessation of trade with Germany during this period, created a shortage of critical chemicals and strategic materials in this country. Gas mantles were an essential item of American life and industry during this period. Thorium nitrate was an essential component of gas mantles. MCW instituted the manufacture of gas mantles, containing thorium nitrate, some time around 1916. As shown on a 1939 drawing provided by Stepan (Appendix A), the manufacture of thorium was one of several operations. Other operations included: lithium, caffeine, codeine, and cocoa/cocaine products.

As the company expanded and operations continued, much of the wetland area adjacent to the facilities was backfilled with residue from this process containing 1 to 2% of thorium. The thorium extraction process continued until approximately 1956. Prior to World War II, MCW was also manufacturing lithium-based compounds. During the war, MCW manufactured lithium hydroxide for the Navy, which was used in submarines to absorb carbon dioxide.

1.5.2 Post-World War II Process Operations

In addition to the thorium nitrate extraction process, which continued until 1956, MCW continued to manufacture lithium compounds after the war. In 1959, Stepan purchased the MCW and continued to run the operation as a separate division under the continued use of the name MCW. A 1961, AEC Part 40 inspection characterized the operation as primarily engaged in the manufacture of lithium compounds, detergent materials, alkaloids, and essential oils. Examples of alkaloids are caffeine, codeine and strychnine. Essential oils are a volatile oil derived by either solvent extraction or steam distillation from the leaves, stem, flower or twigs of plants such as wintergreen.

The 1961 AEC Part 40 inspection report states that the MCW operations were performed under the name of Stepan. This report also states that the manufacture of essential oils is obtained from glove leather cuttings and waste shavings. The report further states that the essential oils are used in the manufacture of "washing products".

Today, Stepan is primarily involved in the manufacture of surfactants including personal care products, detergents and fabric softeners worldwide. Stepan also produces polyurethane polyols used in the manufacture of laminate board and polyurethane systems used in industrial thermal insulation. Specialty products include emulsifiers and solubilizers for the food industry; specialty formulations for soft drinks; and, esters for jet engine lubricants, fiber finishing lubricants and specialty foamers.

A search of the Stepan's web site revealed that they also produce the following synthetic essential oils: Drewmulse GMO, Neobee M-20, Neobee M-5, Neobee 1053, Amidox L-5, Amidox C-5, and Amidox C-2, used in the manufacture of the above products. It is not known at this time if these essential oils are produced at the Maywood facility.

1.5.3 Summary of Process Operations

Sections 1.5.1 and 1.5.2 indicate that a myriad of processes has been used at the former MCW over the past 10 decades, including thorium extraction and the manufacture of lithium compounds. In all of the processes known to have occurred on the Stepan property, heat requirement for process operations was a common thread. In the early years, a coal burning furnace(s) was the primary heat source. Coal laydown areas were adjacent to the facility power plant as early as 1940. The coal pile was apparent in a 1961 aerial photograph but not in a 1965 aerial photograph. The coal storage area was not covered and was therefore exposed to the elements over time. The burning of coal produces bottom ash and fly ash, which are believed to have been disposed at MCW; the ash was also subject to water runoff and potential groundwater infiltration.

1.6 POTENTIAL CONTAMINATION SOURCES

Thorium waste was deposited in specific areas within the FMSS over the years. Stepan relocated a significant portion of this material from where it had been originally disposed west of Route 17 to three separate burial pits on their own property east of Route 17 in the 1960s. Some of the process wastes were reportedly removed from the MCW for use as mulch and fill on nearby properties. The Westerly Brook and Lodi Brook, along with other natural occurrences, such as surface runoff and groundwater flow all played a role in transporting this specific contamination as well as other contamination within the FMSS.

1.6.1 Westerly Brook Area Contaminant Transport

Notwithstanding the extent of thorium products at the MISS, no off-site occurrence of radionuclides in the Westerly Brook area groundwater has been noted either above federal or state MCLs or NRC limits. However, a concern in the Westerly Brook portion of the FMSS is the presence of metals and VOCs: perchloroethylene (PCE), trichloroethylene (TCE), dichloroethylene (DCE), and vinyl chloride (VC).

Groundwater samples have been obtained from monitoring wells located within the MISS/FMSS and to the west of Rt. 17 as part of the Environmental Monitoring Program (EMP) and previous environmental surveillance activities. A tabulation of analytical data dating back from approximately 1991 through 1999 are presented in Appendix B. The following discussion summarizes the results from the latest groundwater sampling program which occurred in May 1999 as part of the EMP.

Historical results are similar in concentration and distribution to the results presented in Table 1-1.

As indicated in Table 1-1, and depicted in Figure 1-4, the off-site occurrence of radiologic constituents were detected in the two well clusters sampled in May 1999; B38W14S/14D, and B38W17A/17B. Radiological constituents consisted of radium-226 (Ra-226), Ra-228, thorium 230 (Th-230), and total uranium. With respect to the groundwater samples obtained from monitoring well cluster B38W14S/14D, maximum detected concentrations were: 0.40 pCi/L of Ra-228 (B38W14S), 1.02 pCi/L of Th-230 (B38W14D), and 0.96 pCi/L of total uranium (B38W14S). With respect to well cluster B38W17A/17B, no radiologic constituents were detected in the bedrock well (B38W17B), while concentrations of Ra-226 (0.62 pCi/L), Th-230 (1.47 pCi/L), and total uranium (0.21 pCi/L) were detected in the groundwater sample and/or duplicate sample from the overburden monitoring well (B38W17A). The concentrations of these radiologic compounds were present below the Federal MCL of 5 pCi/L for Ra-226 + Ra-228, NRC limit of 100 for Th-230. Total uranium was present at a concentration less than the NRC limit of 300 pCi/L, and NJDEP proposed limit of 30 pCi/L. Due to access restrictions groundwater samples could not be obtained from monitoring well cluster B38W15S/15D in May 1999. However, analytical results from the July 1998 groundwater sampling round from monitoring well cluster B38W15S/15D did not detect the presence of any radiologic constituents. The July 1998 data for this well cluster is presented in Appendix B.

Concentrations of radiologic parameters detected in monitoring wells located within the MISS/FMSS site ranged from non-detect at 0.08 pCi/L of Ra-226 in monitoring wells MISS-7B and B38W25S to 0.68 pCi/L in MISS-5A. Ra-228 was not present in any of the monitoring wells sampled within the MISS/Stepan property, however, as indicated previously, Ra-228 was detected in downgradient monitoring well B38W14S at a concentration of 0.40 pCi/L. Th-230 was detected in nearly half of the samples obtained during the May 1999 sampling round. Concentrations ranged from 0.57 pCi/L (MISS-1B) to 2.26 pCi/L in a duplicate sample obtained from B38W25D.

Th-232 was not detected in any of the monitoring wells located within the MISS/FMSS. Total uranium concentrations were less than average historical values. The one exception was the sample obtained from monitoring well MISS-5A. At this well, 74.78 pCi/L was detected. All concentrations were however less than the Federal/State MCL of 5 pCi/L for total radium (Ra-226 + Ra-228), the NRC limits of 100 pCi/L for Th-230, and the NRC limit of 300 pCi/L and the proposed NJDEP limit of 30 pCi/L for total uranium.

Groundwater analytical results for VOCs in May 1999 are shown in Table 1-2. As previously described, chlorinated VOCs have been detected in off-site monitoring wells at a concentration greater than wells located within the MISS/FMSS. In May 1999, groundwater samples obtained from monitoring well B38W14S contained 2J ug/L 1,1,1-trichloroethene, 3J ug/L 1,1-dichloroethene, 43 ug/L total 1,2-dichloroethene (DCE), 290 ug/L PCE, and 67 ug/L trichloroethene (TCE). The groundwater sample obtained from bedrock monitoring well B38W14D, contained similar concentrations of 1,1,1-trichloroethene, 1,1-dichloroethene, a higher concentration (77 ug/L) of total 1,2-dichloroethene (DCE), and higher concentrations of PCE (630 ug/L) and TCE (160 ug/L). Groundwater samples obtained from well cluster B38W17A/17B did not contain the presence of chlorinated VOCs. Although not sampled in May 1999, monitoring well B38W15S/15D detected the presence of chlorinated VOCs during the July 1998 sampling round. Maximum detected concentrations for the chlorinated VOCs present in this well cluster in July 1998 were: 5 ug/L 1,1,1-trichloroethene (B38W15D), 6 ug/L 1,1-dichloroethene (B38W15D), and 140 ug/L total 1,2-dichloroethene (B38W15D). Tetrachloroethylene and TCE were not detected in the B38W15S/15D well cluster during this sampling round. Although not detected in well clusters B38W14S/14D, and B38W17A/17B, vinyl chloride was detected at 12 ug/L in B38W15S in the sample obtained in July 1998. Many of the chlorinated VOCs exceeded Federal or state standards, refer to Table 1-2.

As a point of reference, the highest concentration of chlorinated VOCs detected in wells sampled on the MISS property was detected in monitoring well MISS-7B. This well is located adjacent to the culverted section of Westerly Brook. The groundwater sample obtained from this monitoring well in May 1999 contained 6 ug/L 1,2-dichloroethene (total), 24 ug/L PCE, and 2J ug/L TCE. No detection of vinyl chloride was noted during the May 1999 sampling round.

Groundwater analytical results for metals in May 1999 are shown on Table 1-3. Of the metals detected in downgradient monitoring wells, lithium was present at its highest concentration of 1460 ug/L in the sample obtained from B38W17B. This concentration is significantly higher than the concentrations detected in B38W14S/14D (38 ug/L/34.3 ug/L). Presently, there is no Federal MCL or state standard for lithium in groundwater. Nickel was detected in B38W17A at a concentration of 118 ug/L. This concentration exceeds the state standard of 100 ug/L. However, these results are consistent with historical nickel results obtained from this well (refer to Table 1-3 and Appendix B). Arsenic was not detected in any of the off-site monitoring wells at concentrations exceeding the state PQL of 8 ug/L. No detections of arsenic in off-site wells exceeded the Federal MCL of 50 ug/L.

Arsenic, chromium and lead were present at a concentration exceeding either Federal MCLs and/or state standards in groundwater samples obtained from monitoring wells located within the MISS/FMSS. Arsenic was detected in many wells above the state PQL of 4 ug/L, but with the exception of 2 wells (MISS-2A and B38W19D, none exceeded the Federal MCL of 50 ug/L. Section 1.6.3, discusses the potential sources of these contaminants. Arsenic was detected at a maximum concentration of 6,350 ug/L in the sample obtained from MISS-2A. Chromium was present at a maximum concentration of 106 ug/L in a groundwater sample obtained from B38W25S. This was the only concentration which exceeded the Federal MCL/state standard of 100 ug/L. Lead was present in a groundwater sample obtained from MISS-2A at 11 ug/L, this concentration is less than the Federal MCL of 15 ug/L, but in excess of the state standard of 5 ug/L. Lithium was detected in all MISS/FMSS wells samples, with a maximum concentration of 12,100 ug/L in the sample obtained from MISS-2B, refer to Table 1-3 and Appendix B.

A Preliminary Assessment and Site Investigation Report completed by the NJDEP on July 29, 1998 for Dixo Co. stated that Dixo is a primary source of PCE contamination in area groundwater (Appendix C). A 5,000 gallon above ground PCE storage tank was formerly located at the facility. Soil samples collected at Dixo contained up to 830 parts per million (ppm) PCE and 120 ppm TCE (the NJDEP Impact to Groundwater Soil Cleanup Criteria for PCE and TCE is 1 ppm). Groundwater samples collected at Dixo contained up to 140,000 parts per billion (ppb) PCE, 69,000 ppb DCE, and 20,000 ppb TCE (the NJDEP Groundwater Quality Criteria for PCE, DCE, and TCE is 1 ppb, 10 ppb and 1 ppb, respectively). The report states that "sample results confirm a release of PCE to groundwater at the location of a 5,000 gallon above ground storage tank which previoulsy held PCE. Significant levels of contamination adjacent to and downgradient from the tank implicate Dixo as a primary source of contamination for the Rochelle Park Swim Club (located 2,000 feet hydraulically downgradient; adjacent to the Saddle River) and, possibly, for the West Magnolia Avenue wells to the northeast." The report also states that a storm sewer catch basin located in the facility's parking lot discharges to the Westerly Brook. A soil and groundwater Remedial Investigation was recommended by the NJDEP to determine the extent of contamination and to evaluate the potential risk to other potable wells in the area. The location of the Magnolia Avenue wells and the Rochelle Park Swim Club are depicted in Figure 1-2.

Diverted flows in the Westerly Brook culvert through the MISS may have seriously impacted the structural performance of the pipe over the years. For example, this may have led to points along the pipe where joints separated, which would result in either groundwater discharge into the pipe (i.e. infiltration), or surface water leakage out of the pipe (i.e. exfiltration) depending on the seasonal groundwater conditions. It would also be expected that this could occur at points of abrupt alignment change (e.g., at the three places of horizontal turns within and near the MISS and near monitoring well cluster B38W14S/D, located about 600 feet west of Route 17, near Park Way where vertical and horizontal alignment changes occur). Structural integrity (e.g. pipe cracks) might also be a concern but generally result in less dramatic culvert flows. The leachate collection sumps for the former stockpile may have leaked if the system was not properly maintained or was poorly constructed.

1.6.2 Lodi Brook Area Contaminant Transport

The transport of FUSRAP waste south down historic Lodi Brook is well documented in previous investigations (BNI, 1992). The proximity of the MCW lagoons (in the vicinity of the current day DeSaussure Property) to the eastern reach of Lodi Brook may have played a key role in the transport of FUSRAP materials down Lodi Brook. (During heavy rains, the lagoons may have over topped or even breached causing waste spills to low lying areas.) During storm events, this material was likely transported down the original Lodi Brook course. One could also expect that bottom ash or other coal-related residues made its way down Lodi Brook as well, given that this material is fine and potentially mobile with surface water flows. The presence of FUSRAP contaminated waste to southern properties outside Lodi Brook is also well documented (i.e. Scanel and Bergen Cable properties). The remaining known suspected pathway for the Lodi Brook area contaminant transport would be the soot fallout from coal combustion outlined in the previous section for the Westerly Brook area.

1.6.3 Other Potential Sources

Other potential sources of PCE contamination in the area include the former Pfizer facility adjacent to Maywood Avenue and Stepan. If Pfizer manufactured pharmaceuticals at the facility, solvents may have been used. Potential VOC spills at the facility directly to groundwater and/or to stormwater catch basins could have contributed to the current groundwater and VOC contamination at the FMSS. The contaminant concerns at Magnolia Avenue are suspected to be groundwater VOC related. However, the NJDEP has attributed the VOC contamination detected at Magnolia Avenue to Dixo. In addition, auto body repair/salvage operations use VOCs to clean greased auto parts. Electric utilities use a PCE process to convert askarel transformers to non-PCB status. Some of these sources may have contributed to the presence of PCE in the FMSS, with Westerly Brook possibly contributing to the transport process. Finally, the Stepan manufacturing of essential oils and pharmaceuticals, may have been a potential source of waste solvents.

It is believed that the heavy metals, such as arsenic, chromium, and lead are not directly related to thorium processing activities, and may be associated with the coal used at the manufacturing facilities. These metals have been detected in monitoring wells at concentrations exceeding either Federal and/or state standards (refer to the previous synopsis of chemical data presented in Section 1.6.1). Given the close proximity of the facility power plant and coal laydown areas to the MISS, refer to Figure 1-4 for the location of the coal laydown areas, and Appendix A for the location of the MCW power plant, bottom ash may have been disposed or used as fill and for other functional purposes. Prior to the 1970's, bottom ash was commonly spread on roads during snowstorms or ice conditions to provide traction for vehicles, similar to sand use today. Soot (i.e. fly ash) from the stack could have contributed to the presence of metals on area soils and in the groundwater. As coal was used over the years at the MCW facilities, for heat and process operations, the wetlands that once abutted MCW, near the Saddle River and adjacent to the Sears property, may have received significant soot fallout before the area was filled. Arsenic was detected in 2 groundwater samples at a concentration exceeding the state PQL of 8 ug/L in May 1999. Arsenic was detected at a maximum concentration of 6350 ug/L in the groundwater sample obtained from MISS-2B, and was present in MISS-7A at a concentration (49.9 ug/L) near the Federal MCL of 50 ug/L. As previously noted, monitoring well MISS-2B is located downgradient of Burial Pit 2, whereas, MISS-7B is located adjacent to Westerly Brook, and downgradient of several Burial/Retention Ponds (refer to Table 1-3 and Appendix B for a summary of the historical data). Chromium was detected in a groundwater sample obtained from B38W25S in May 1999 at a concentration of 106 ug/L. This concentration exceeds the Federal MCL and state standard of 100 ug/L. This sample was obtained from a well located adjacent to one of the former leather tanning hide waste disposal areas located on Stepans property, refer to Figure 1-4. Lead was also detected in monitoring well MISS-2B in May 1999 at a concentration of 11 ug/L. This well is located hydraulically downgradient of Burial Pit 2 located on Stepans property.

An additional source of metals contamination (specifically chromium) is the burial of leather tanning hides on or near the MISS property. Leather hides, which were tanned by Stepan were observed in test pits dug on the MISS and Stepan properties. Analytical results revealed that the leather hides contained up to 117,000 ppm total chromium. As discussed above, the highest concentration of chromium detected in a groundwater sample was obtained adjacent to a tanning hide disposal area.

A final potential source of contamination could be the three burial pits on the Stepan property. During construction, groundwater was reported as "not observed" in the excavations. All of the pits were dug approximately 13 feet to bedrock. However, by overlaying recent potentiometric data from wells in the area, it can be seen that Burial Pits 1 and 3 currently extend approximately 7 feet below the present day groundwater table. Burial Pit 2 currently extends approximately 2 feet below the groundwater table. Historical data indicate that lithium was buried in each of the burial pits. As depicted in Table 1-3, lithium was detected at a maximum detected concentration of 12,100 ug/L in the groundwater sample obtained downgradient of Burial Pit 2.

1.6.4 Overview

All of these potential sources are addressed in the field investigation detailed in Section 8.0 of this GWRIWP. The office, field and other investigations and analyses associated with this GWRIWP will work toward confirming or ruling out these potential contaminant sources and pathways outlined in this section. These investigations will also examine other potential pathways that may further explain the presence and distribution of FMSS contaminants, particularly as related to FUSRAP waste.

1.7 OBJECTIVES OF THE GWRIWP AND GWRI

The overall purpose of this GWRIWP is to address human and ecological risk concerns related to potential groundwater contamination at the FMSS. To achieve this purpose, specific objectives have been established. The first step towards this purpose is establishment of a site-specific conceptual site model that identifies the following: the COCs; physical site characteristics (i.e., geology, geohydrology, hydrology); fate and transport mechanisms specific to the physical site characteristics; and contaminant migration (transport) pathways. The conceptual site model thereby focuses the GWRI activities by identifying data gaps and incomplete contaminant migratory pathways. Implementation of the GWRIWP is primarily focused on the need to collect data and information to address these data and information gaps.

Specific objectives of this GWRIWP are to:

- Further investigate the history of the FMSS, to a greater extent than previous investigations, to develop a more complete understanding of how area development may have provided sources and pathways of FUSRAP contaminant migration (COCs);
- Identify/confirm sources of COCs affecting groundwater;
- Determine how the contamination distribution and/or concentration gradients may have changed and may continue to change with time as a result of surface water flows, groundwater flows, and human activities;
- Characterize the conceptual model of groundwater contamination at the FMSS as related to FUSRAP waste;
- Evaluate the mobility of COCs in unsaturated soil through the performance of Batch Sorption Soil Distribution (k_d) Tests; and
- Identify field, laboratory, office and other work needed to substantiate, refine or otherwise establish a conceptual site model of FUSRAP COCs transport which defines how they may affect the groundwater and related regimes.

During implementation of GWRIWP, the Stone & Webster Team will:

- Collect sufficient data and information to address data gaps identified in the conceptual site model;

- Gather the information required to perform a Feasibility Study, should it be determined that unacceptable risks identified in this investigation exist; and
- Provide the various project elements (schedule, staffing, and management approach) needed to implement the GWRI.
- Use emergent data to review and evaluate the existing BRA in terms of impacts to human health/ecological receptors.

2.0 SITE SETTING AND CONCEPTUAL MODEL

2.1 SITE GEOLOGY

2.1.1 Bedrock

The FMSS is located in the Piedmont Physiographic Province. The Piedmont Province in New Jersey is located within the Newark Basin (Figure 2-1). The Newark Basin extends southwestward from the Hudson River Valley in New York to southeastern Pennsylvania. A cross section of the Newark Basin is provided as Figure 2-2.

The Newark Basin is primarily composed of a sequence of sedimentary rocks, known as the Newark Group. The Newark Group consists of sandstones, shales, mudstones, and conglomerates that represent depositional cycles during the late Triassic and early Jurassic periods. The sedimentary rocks of the Newark Group lie on Paleozoic and Precambrian rocks. The sedimentary rocks represent various non-marine depositional environments. During the Triassic period, the sedimentary sequence was intruded by the igneous basalt sheet lava flows forming the Watchung, Preakness, and Hook Mountains, which resulted in the high topographic points within the rolling plains of the basin (Olsen, 1978). The sedimentary rocks have been covered by glacial, lacustrine, and fluvial unconsolidated deposits.

The sedimentary rocks of the Newark Group are divided into three formations: a lower unit, the Stockton Formation; a middle unit, the Lockatong Formation; and an upper unit, the Passaic Formation (Olsen, 1978). These sediments were deposited in fluvial and lacustrine environments and grade upward from the lower, locally conglomeratic arkose (Stockton Formation) into a reddish-brown mudstone deposit (Passaic Formation).

The Passaic Formation underlies the FMSS. The Passaic Formation consists primarily of interlayered dark to moderate reddish-brown, fine-grained sandstones and siltstones. The Passaic Formation is exposed at several locations within the FMSS. Bedrock outcrops near Spencer Joseph Avenue and Passaic Street; Lawrence Avenue and Passaic Street; and Ramapo Avenue and West Central Avenue. The surface of the bedrock ranges from the above mentioned surface outcrops in Maywood, to approximately 30 feet below grade in the Kennedy Park property in Lodi. The configuration of the bedrock surface developed as a result of differential erosion, which formed elongated ridges and broad valleys. The bedrock surface directly influenced the distribution of the overlying unconsolidated sediments. This surface controlled the courses of streams and affected the distribution of fine-grained interfluvial sediments and coarse stream deposits.

2.1.2 Overburden

The overburden soils at the FMSS were deposited by fluvial and glacial processes. In the lower portion of geologic borings drilled in bedrock valleys, sand and gravel derived from the bedrock were encountered immediately above the weathered surface. The gravel was commonly composed of rounded to subrounded pebbles of Passaic Formation sandstone, indicating stream transport and reworking. Gravel-sized fragments of igneous and metamorphic materials and boulder sized erratics of sedimentary materials were also observed in these deposits, indicating glacial transport into the local area. In the lower portion of the stream channels, much of the material deposited on the bedrock surface cannot be easily distinguished from the weathered bedrock materials.

Unconsolidated materials that overlie the weathered bedrock consist of sand, silt, and clay. The composition and characteristics of these deposits vary widely according to depositional history. These deposits can be divided into three units that interfinger with the underlying and overlying unit. These are identified as a lower unit of more stratified, sorted, fine-grained sand and silt; a middle unit of clayey silt and sand, with varying amounts of organic materials; and an upper unit of poorly stratified sand, silt, and gravel that are in places disturbed by development.

Considerable filling by human activities has occurred in the FMSS region. Fill materials encountered in borings across the area varied from clays to coarse sands containing brick fragments, black and white mottled clay, concrete chips, wood chips, and other miscellaneous materials.

2.2 HYDROGEOLOGY

2.2.1 Regional Hydrogeology

Groundwater in the Newark Basin occurs under confined, semi-confined, and unconfined conditions in the intergranular openings of the unconsolidated deposits and in joints, fractures, and partings of bedding in the consolidated rocks. Groundwater in the Passaic Formation occurs in a network of interconnected joints and fractures. The intervening unfractured rock has negligible capacity to store and transmit groundwater and, as depth increases, the fractures and joints typically decrease in size and number.

The groundwater system typically consists of a series of alternating aquifers and aquitards several tens of feet thick. The water-bearing fractures of each aquifer are more or less continuous, but hydraulic connection between individual aquifers is poor (Carswell, 1976). These aquifers generally dip[1] downward for a few hundred feet and are continuous along the strike[2] for thousands of feet.

Groundwater in the upper Passaic Formation may occur under both confined and unconfined conditions. Where the rock is overlain by permeable materials and in upland areas, the bedrock groundwater generally occurs under unconfined conditions. Where the rock is overlain by low permeability till or stratified deposits, bedrock groundwater may occur under confined conditions.

Virtually all groundwater in the Passaic Formation occurs in interconnecting fractures and joints (Vecchioli and Miller, 1973). Additional void space occurs in the

---

[1] Dip is the angle between bedding planes and a horizontal plane.

[2] Strike is the direction of the intersection between the given plane and the horizontal plane.

sandstone and conglomerate beds where cementing material is lacking, either because it was never deposited or because it has been dissolved by circulating groundwater.

The permeability and storativity of bedrock formations in the Newark Basin are fracture-controlled, with the exception of some sandstone facies (Michalski and Britton, 1997). Several models have been used to conceptualize groundwater flow in fractured bedrock at various sites in the region. A recent study (Michalski and Britton, 1997) documents 5 conceptual groundwater flow models for the Passaic Formation (Figure 2-3). The first conceptual model, the equivalent porous medium (EPM) concept, treats the bedrock as a single aquifer system. The second conceptual model, the 2-aquifer EPM, was developed in view of significant differences in water level elevations between "shallow" and "deep" wells. The third conceptual model, near-vertical joints, postulates that near vertical joints that are positioned near parallel to the strike of the beds provide primary flow pathways (as measured in the field and previously reported, the regional direction of strike is northeast/southwest). In the fourth conceptual model, a leaky multi-unit aquifer system (LMAS), partings along the bedding planes (bedding fractures) having the greatest hydraulic apertures act as major discrete aquifer units of the bedrock system. The fifth conceptual model consists of a weathered zone and overburden superimposed on the LMAS model. Below this weathered zone, the prevailing groundwater flow direction within individual aquifer units tends to be near parallel to the strike of the beds. It is believed that this fifth conceptual model most accurately depicts the site conditions found within the FMSS.

2.2.2 FMSS Specific Hydrogeology

The shallow groundwater flow system in the FMSS is in the unconsolidated sediments and the shallow bedrock. Groundwater occurs under unconfined and partially confined conditions. Previous investigations at the FMSS revealed that groundwater in the shallow bedrock is generally under confined conditions toward the northeastern portions of the site and unconfined conditions exist toward the west and southwest. The variability of fracturing and weathering of the bedrock results in differences in permeabilities in different zones in the bedrock. The water-bearing fractures at different depths below ground surface contain groundwater under different hydraulic heads.

Potentiometric head differences also occur between the unconsolidated sediments and the bedrock. Table 2-1 presents the potentiometric surface elevations for the shallow bedrock aquifer. As indicated in this table, groundwater levels measured during the August 1999 synoptic gauging event ranged from 2.39 m (B38W12B) to 7.84 m (B38W02D) (7.84 to 20.46 ft) bgs. The piezometric surface in the bedrock aquifer in August 1999, ranged from 12.1 m (B38W12B) to 16.19 m (B38W05B) (39.69 to 53.10 ft) above MSL.

Lateral (i.e., horizontal) groundwater flow at the MISS is strongly controlled by the morphology of the bedrock surface. The bedrock slopes westward across the site, flattens, and then rises to a subtle ridge along the Saddle River. Horizontal hydraulic gradients reflect this configuration and flatten offsite, to the west. Bedrock highs exist in the eastern portion of the site within the Stepan property, these bedrock highs form a local groundwater divide, and actively control the direction of groundwater flow in the overburden and bedrock aquifers.

The horizontal hydraulic gradient measured in the bedrock aquifer, ranged between 0.015 to 0.020 ft/ft. The direction of groundwater flow as depicted in Figure 2-4 is dictated by the presence of a groundwater high, which roughly coincides with a bedrock high located in the northeast corner of the site in the vicinity of the Stepan property. This figure depicts a groundwater divide, with groundwater flowing predominantly to the west-southwest, with a component of groundwater flow to the northwest. It is likely that the northwest component of groundwater flow becomes more westerly based on the isopleths presented in Figure 2-4. Previous investigations by CH2M Hill (1994) noted a southwesterly component of bedrock groundwater flow. The average linear groundwater velocity of the bedrock has previously been estimated to range between 0.1 and 0.7 m/day (0.3 to 2 ft/day) (DOE 1992).

The saturated thickness in the unconsolidated sediments at the MISS ranges from 5 to 15 feet, generally increasing to the west. Where the sediments thin on a bedrock high on the Stepan property, groundwater is generally shallower than on the downgradient properties. In the unconsolidated sediments, water level depths ranged ranged from 1.14 m (B38W01S) to 4.59 m (MISS-1AA) (3.74 to 15.05 ft) bgs. The elevation of the water table in August 1999, ranged from 39.64 ft MSL (B38W12A) to 51.61 ft MSL (B38W01S). Table 2-2 presents the synoptic gauging round information for August 1999 for those wells screened in the unconsolidated materials. A water table contour map based on water levels measured in the overburden monitoring wells in August 1999 is presented as Figure 2-5. The direction of groundwater flow in the overburden aquifer is predominantly to the west-southwest, with a component of groundwater flow towards the south. The direction of groundwater flow will be further defined as additional overburden and bedrock monitoring wells are installed as part of the GWRI investigation. As indicated in Figure 2-5, monitoring well MISS-7A was not included in the contouring of the groundwater flow direction for the unconsolidated aquifer. MISS-7A is located adjacent to the culverted section of Westerly Brook, it is presently unknown as to whether exfiltration from the culvert, or potentially from a Stepan water return line that may be accounting for the anomalously high water table at that locality. This will be investigated as part of the GWRI.

In the unconsolidated sediments, the horizontal hydraulic gradient varies spatially from approximately 0.007 ft/ft to 0.012 ft/ft. The average linear groundwater velocity of 0.02 m/day (0.05 ft/day) has previously been estimated for the unconsolidated sediments (DOE 1992).

Based on the August 1999 synoptic gauging round, information regarding the vertical component of groundwater flow may be inferred. Table 2-3 presents the hydraulic heads observed at the 11 well clusters gauged within the MISS/FUSRAP Maywood Superfund Site. Of the 13 clusters that exist, access was not obtained for B38W15S/15D, similarly, a water level was not obtained from B38W14D, therefore, it was not feasible to determine the vertical gradient direction. With the exception of well clusters MISS-3A/3B, B38W12A/B38W12B, B38W17A/B38W17B, and B38W25S/B38W25D, the other well clusters located within the MISS/FMSS property typically depicted a downward component of groundwater flow. The downward component of groundwater flow depicts recharge areas in the unconsolidated/overburden aquifer. With respect to B38W12A/B38W12B, and B38W17A/B38W17B the hydraulic heads measured in the bedrock aquifer are higher than those measured in the unconsolidated overburden aquifer. The hydraulic heads measured in well cluster Well cluster B38W17A/B38W17B was -0.04 ft., whereby, a negative number indicates an upward component of groundwater flow. Although the water level instrument is sensitive to 0.01 ft., it is feasible that the difference in hydraulic heads are close enough to one another that the vertical component of groundwater flow is negligible, and the predominant component of groundwater flow is horizontal.

Based on water levels obtained in August 1999 from well cluster B38W12A/B38W12B, the hydraulic head difference is approximately -0.05 ft. The proximity of this well cluster to Lodi Brook may truly signify an upward component of groundwater flow. An upward component of groundwater flow within the MISS/Stepan property was detected at MISS-3A/3B and B38W25S/B38W25D. At well cluster MISS-3A/3B, the hydraulic head difference between the bedrock well and the overburden well cannot be quantified since the water level in the bedrock aquifer was below the base of the screen, however, based on the elevation of the base of the screen it is feasible to determine that an upward gradient likely exists. With respect to B38W25S/B38W25D the vertical gradient was upward and the hydraulic head difference was -0.35 ft. As indicated in the Remedial Investigation report (DOE 1992), in the vicinity of B38W25S/B38W25D, fracture zones orientated approximately 90 degrees apart have resulted in the gouging out of the bedrock surface. The bedrock surface has been gouged and filled with unconsolidated material. The presence of sand, silt, and clay overlying the weathered bedrock surface may act as a confining layer, and that the hydraulic head in the vicinity of this well cluster may be under confining conditions. As part of the GWRI investigation USACE will investigate the potential reasons for the upward vertical gradients at these well clusters.

A generalized conceptual flow schematic across the MISS site is presented on Figure 2-6. This diagram indicates that the general direction of flow in the groundwater system in the shallow unconsolidated sediment/bedrock is southwest towards the Saddle River. A downward vertical flow component exists from the overburden to the bedrock in the middle of the site. To the west, this vertical component reverses where an upward hydraulic gradient from the bedrock to the overburden persists. An intention of the GWRI investigation is to determine why the potentiometric surface in the vicinity of well clusters MISS-3A/3B, and B38W25S/25D appear higher in the bedrock aquifer than in the unconsolidated overburden aquifer.

An initial phase of the groundwater investigation was completed as part of the Bechtel Remedial Investigation (BNI, 1992). A summary of the major physical characteristics of the overburden and bedrock aquifers as determined from that investigation is provided in Table 2-4. As indicated in this table, the hydraulic conductivity measured in shallow bedrock monitoring wells ranged from 2.2×10^{-5} to 4.0×10^{-3} cm/sec, with a geometric mean of 7.4×10^{-4} cm/sec. The permeability tests in bedrock were performed using a series of in-situ tests ranging from constant head (packer) tests, constant head gravity, falling head and recovery tests. The hydraulic conductivity of the unconsolidated overburden ranged from 2.6×10^{-5} to 2.9×10^{-2} cm/sec with a geometric mean of 3.9×10^{-4} cm/sec. Overburden hydraulic conductivity results were obtained from both falling head and recovery tests.

2.3 TOPOGRAPHY

The FMSS is located in the Piedmont Physiographic Province, which is characterized by low topography and smooth relief. Elevations range from 45 feet to 75 feet above Mean Sea Level (MSL). The highest elevation is found along the border (Ramapo) fault at its western margin and generally slopes southeastward. The rolling plains are covered by glacial and post-glacial deposits. The plains are dissected by rivers of the Passaic Watershed and by the more resistant, flat-topped basaltic Watchung and Hook Mountains. Many ridge and valley features are found in the region resulting partly from pre-glacial stream and drainage channels. The orientation of these features is generally in a northeasterly/southwesterly direction, similar to the orientation of the strike of the bedrock. These channels developed along the less resistant shale and mudstone sequences, while the resistant sandstone complexes formed the ridges. Many of the present day valleys and river basins, including the Hackensack River Basin east of the FMSS and the Saddle River Basin, where the FMSS is located, probably were deepened during the Wisconsin glaciation and later filled with glacial deposits.

2.4 HYDROLOGY

The FMSS lies in the Saddle River Basin (with the exception of the Scanel Property, which lies within the Hackensack River Basin). The Saddle River Basin drains 61 square miles and the river flows 23 miles from its headwaters in Rockland County, New York through Bergen County, to its confluence with the Passaic River at Garfield and Wallington, New Jersey. The Saddle River is the main tributary to the Passaic River in what is referred to as the Lower Valley of the Passaic River. A USGS guaging station is located on the Saddle River in Lodi, 3.2 miles from the mouth of the Saddle River. The daily mean flow of the Saddle River in Lodi (based on 71 years of record), is 145 cfs. Historical aerial photographs have shown that the Saddle River has maintained the same course in the area south of Essex Street since 1940. The river channel north of Essex Street was straightened in the early 1960s during the construction of Interstate 80. The Saddle River is the major body of water into which properties in the FMSS drain, through Westerly Brook and Lodi Brook.

Coles Brook is located adjacent to the Scanel property, approximately 3000 feet east of the MISS. Coles Brook flows to the north and east and ultimately discharges to the Hackensack River. Therefore, it is believed that a groundwater divide exists between the bulk of the FMSS (exclusive of the Scanel Property) and Coles Brook. Additional overburden and bedrock monitoring wells will be installed along Maywood Avenue (refer to Figure 8-3A) in order to define contaminant distribution, and to determine if a groundwater divide exists.

The average precipitation for the area is 43.5 inches (NCDC TD 9641 Climate 81 1961-1990). The average morning and afternoon relative humidity based on a 28-year average are 73 percent and 23 percent respectively.

2.5 CONCEPTUAL SITE MODEL AND GWRI PLAN ELEMENTS

The radiological/chemical hydrogeologic conceptual model for the FMSS is complex and can be best characterized in terms of its two regimes: that related to Lodi Brook; and, that related to Westerly Brook.

2.5.1 Lodi Brook Regime Conceptual Model

Constituents of Concern in the Lodi Brook conceptual model include radioactive material related to past MCW operations, potential buried drum material on the Sears property, and metals.

Radioactive Material

The environmental transport of FUSRAP waste south along Lodi Brook is well documented in previous investigations (BNI, 1992). Two separate modes of contaminant transport are believed to have occurred in this area. First, the waste was transported through surface water flows down the brook. As previously discussed, this contamination most likely originated in the waste lagoons that were located near the headwaters of the historic Lodi Brook. Secondly, the waste was transported as backfill to properties away from Lodi Brook (i.e. Scanel and Bergen Cable properties). The waste was also potentially used as backfill around the existing culvert when the brook was placed underground.

The structural integrity of the Lodi Brook culvert is in question. During a site walkover, while Phase I (i.e. vicinity residential property) remediation was underway, exposed cracked portions of the pipe were observed. Joint leakage may also be a problem with the butt joints used in the culvert. With time, leaks may have developed in areas of differential head (i.e. groundwater levels higher than the flow levels in the culvert). This is considered a potential problem at this time because radioactive contamination tends to adsorb to fine grained material. As leaks develop in the Lodi Brook culvert, the groundwater may have carried soil fines into the culvert. These fines may be present in sediments within the culvert or carried away from the FMSS with culvert flows. As part of the EMP, three sediment samples, SWSD005 through SWSD007 were obtained from the eastern tributary of Lodi Brook. Results of the sample analyses indicated that soil cleanup criteria for Ra-226, Ra-228 and Th-232 were exceeded, refer to Figure 2-7 for sediment sample locations and Table 2-5 for radiological results. The highest concentrations (8.04 pCi/g Ra-226, 7.67 Ra-228, and 8.13 pCi/g Th-232) were detected at the upstream location, at SWSD006. Further downstream, at location SWSD007, detected concentrations of all radionuclides were above background, but below the soil cleanup criteria for Ra-226, Ra-228, and Th-232, and the sum-of-ratios criterion for mixtures.

At SWSD005, at the confluence of the western and eastern branches of Lodi Brook, detected concentrations of all analyzed radionuclides were below the soil cleanup criteria for the individual isotopes but the sum-of-ratios criterion for mixtures was greater than 1.0 (1.09) which is above the soil clean up criteria.

The 1999 analytical results confirm the presence of localized contamination in the streambed sediment of the eastern tributary of Lodi Brook. Although the majority of results for 1999 are lower than previous years, several results were higher during the 1999 sampling event. The sediment sample obtained from SWSD007 in 1999 had the lowest results ever recorded (at that station) for Ra-228, Th-230, and Th-232, upstream station SWSD006 in 1999 had the highest results ever recorded (at any station) for Ra-226 and Total Uranium. Thus, no definite trend is indicated.

As part of the GWRI investigation, the existing condition of the Lodi Brook culvert will be evaluated. Existing cracks and leaking joints will be evaluated and documented with photographs and/or a video-inspection of the culvert. Sediment samples will also be collected inside the culvert as required to determine the possible extent of radioactive contamination.

Metals

The current belief is that arsenic, chromium, and lead are associated with the storage, disposal and use of coal, fly ash and bottom ash at the MCW facilities over decades. It is also believed that the waste from the various processes at the MCW were mixed in retention ponds on the MCW property. With this, and given the fine grained nature of ash residue, it can be reasonably postulated that these metals exist in those southern areas where radioactive waste was deposited by surface water flows in the Lodi Brook. It is also assumed that coal residue was present in the MCW waste that may have been used as fill.

The New Jersey residential, and less stringent nonresidential, proposed soil cleanup standards provide a basis for evaluating metal concentrations in sediment for the mixed land use area around MISS. These proposed standards, as appropriate for the zoning of a given sampling location, are provided in Table 2-6 along with the detected concentrations of metals in sediment.

Of the three sediment samples collected from Lodi Brook, no metal concentrations at any of the sampling locations exceeded proposed New Jersey soil cleanup criteria. At SWSD005, at the confluence of the eastern and western tributaries of Lodi Brook, no metals concentrations exceeded the proposed residential soil guidelines.

At SWSD006, downstream location along Lodi Brook, no metals concentrations exceeded the proposed nonresidential soil guidelines. However, elevated concentrations of arsenic and lead were reported at 18.2 mg/kg and 294 mg/kg, respectively. The concentrations of arsenic and lead were above background concentration, but below the proposed state limit of 20 mg/kg and 600 mg/kg and below respective values recorded in 1998. Upstream of this sampling location and downstream from MISS, there are multiple potential industrial sources for these metals.

At SWSD007, in the eastern tributary of Lodi Brook, arsenic (6.7 mg/kg) and lead (140.0 mg/kg) were present but below the proposed New Jersey nonresidential soil cleanup standards and below respective values recorded in 1998. Upstream of this sampling location and downstream from MISS, there are multiple potential industrial sources for these metals.

Another potential transport mechanism for these metals could have been from the deposition of soot (i.e. fly ash) fallout over the years. As part of this investigation, research will be conducted into coal use at MCW. This research will include an analysis of potential coal sources and the probable composition of the coal. The historic record of wind speed and direction will also be obtained. It is believed that this is critical to a better understanding of the metals contamination that currently exists.

Considering the sediment data obtained as part of the EMP, the sediment samples proposed for collection as part of the GWRI from Lodi Brook will also be evaluated for the presence of these metals.

Potential Buried Drum Material at Sears Property

During investigations by others (CH2M Hill, 1994), buried drums were encountered during test pitting activities conducted on the Sears property. The document states that the condition of the drums varied from "good" to "partially crushed and rusty" to "crushed and/or rusted through". Some drums appeared to contain groundwater or stormwater. Other drums appeared to contain "organic material". The extent of the buried drums is not known. The source of these drums is not completely known either.

The Stone & Webster Team is conducting a PDI which will, in part, serve to determine, by non-intrusive means, the extent of the drums. Data obtained from that investigation will be evaluated to determine the potential impact, if any, on the Lodi Brook regime.

2.5.2 Westerly Brook Regime Conceptual Model

Constituents of Concern in the Westerly Brook regime include radioactive material related to past MCW operations, metals including arsenic, chromium, lead and lithium, and aromatic hydrocarbons. Chlorinated VOCs, such as PCE, TCE, DCE, and VC, are also present in groundwater; however, as described in this section, these contaminants are not considered to be FUSRAP related COCs.

Radioactive Contamination

FUSRAP defined waste COCs include isotopes of thorium, uranium, and radium attached to fine grained soils. In general, these radioactive COCs occurring in soil at the FMSS are not believed to be mobile. Although radioactive contamination has not been observed in the Westerly Brook regime, sediment samples in the Westerly Brook culvert will be tested for radioactive contamination. The reason for this is that surface water flows (i.e. heavy rains) could have washed radioactive contamination down the sinkhole adjacent to monitoring well MISS-7A located on the MISS. The absence of an effective silt fence between the existing soil load-out area (that lacks vegetative cover) and the rail line may have lead to this existing condition. During a recent walkover of the MISS, an accumulation of silt was noted along the railroad tracks in this area.

As part of the sediment samples collected as part of the EMP in May 1999, two sediment samples were obtained from the unculverted section of Westerly Brook, refer to Figure 2-7. As described in Table 2-7, sediment samples from Westerly Brook (SWSD002) did not exhibit elevated concentrations of the tested radionuclides. Results for this sample location are comparable to background measurements obtained from sample location SWSD003. Historical sediment sample results are presented in Appendix B-4.

Metals

Based on a review of existing groundwater monitoring data for wells located in the Westerly Brook area, elevated levels of metals (arsenic, chromium, lead and lithium) have been detected. With the exception of lithium, all of these metals may be attributable to coal, fly ash, and bottom ash residue associated with the burning of coal over the decades. It is believed that this residue was buried with other waste on the MCW property. Figure 2-8 depicts the locations of the geologic cross-sections at the MISS

(BNI, 1992). As indicated in Figure 2-9, transect E-E' is a geologic section through the former retention pond C, refer to Figures 2-4 and 2-5 for the location of the former retention pond C located on the MISS, and includes fill described as "ash and sludge".

Arsenic, chromium, and lead generally occur at high concentrations in the overburden monitoring wells at the MISS. This is consistent with the current belief that coal, fly ash and bottom ash residue is the probable source of this contamination in that the presence of the contamination generally occurs in soils at shallower depths (i.e. at or above the overburden groundwater level). The source of these metals in overburden groundwater may be in response to a fluctuating water table and/or leaching of the metals through infiltration. A summary of the analytical data presented in previous Environmental Monitoring Reports was presented in Section 1. Table 1-3 and Appendix B summarizes the levels of these metals in overburden and bedrock in monitoring wells sampled in May 1999, and from previous sampling rounds, respectively.

Lithium processes were an integral part of the past MCW operations (see Section 1.5). It is also believed that the waste associated with these processes were mixed with the waste from other MCW processes including the thorium extraction process and stored in the retention ponds east of the MISS. MCW retention ponds D and E located west of Route 17 were remediated in the late 1960s and the waste placed in burial pits on the Stepan property east of the MISS. Historical records indicate that waste placed in burial pits 1 and 2 each include 1000 drums of lithium fluoride. It should be noted that the highest lithium concentration was detected in bedrock monitoring well MISS-2B, refer to Figure 2-10. The construction records for the pits indicated that the base of each burial pit extended below the present day groundwater level by as much as seven feet. By contrast, the construction records indicated that each pit was excavated to a depth of 13 feet and that "no groundwater was encountered" in either pit.

As indicated earlier, two sediment samples were collected from the unculverted sections of Westerly Brook. The results presented in Table 2-8 indicates that no metals concentrations exceeded either the proposed residential or nonresidential soil cleanup criteria at the upstream, background location (SWSD003). At SWSD002, the downstream sample, refer to Figure 2-7, no metals were present at a concentration exceeding the proposed residential soil guidelines.

With the possible presence of lithium, a mobile contaminant, below the overburden groundwater level, the extent of lithium contamination will be investigated as a means of confirming the assumptions presented in this conceptual site model. The GWRI investigation will include the analyses of soil and groundwater samples obtained from Geoprobes® that will be drilled in the vicinity of the burial pits. Groundwater samples will also be collected from existing monitoring wells near the burial pits.

VOCs

Previous investigations for the MISS (BNI, 1992, SAIC, 1997) suggest that VOC contamination in groundwater may be attributable to releases from the MISS. Recent data collected and reported by the NJDEP indicate that there is a significant source of VOC contamination located immediately upgradient and off-site of the MISS. This potential upgradient source has been identified as Dixo Co., Inc. Dixo is located on West Central Avenue just east of the Rt. 17 over-pass, refer to Figure 1-2. However, other upgradient sources may consist of the autobody/auto supply shops located off of West Central Avenue. High concentrations (greater than 100 parts per million) of PCE, TCE, 1,1-dichloroethylene DCE, and VC have been detected in both soil and groundwater at the Dixo property. In addition, Dixo has used the culvert of Westerly Brook as a discharge for its storm water and surface water runoff from its parking lot.

It is believed based on these recent data that Dixo may be attributable for the VOC contaminated groundwater beneath and downgradient of the MISS. Tetrachloroethylene, TCE, DCE, and VC have consistently been detected in several wells within the MISS boundary (MISS-1B, MISS-7B and less frequently in MISS-6A) and in off-site hydraulically downgradient monitoring well pairs (B38W14S/D, B38W15S/D, and less frequently in B38W17A/17B). As depicted in Figure 2-10, the location of monitoring wells MISS-1B and MISS-7B approximate the locations of the abrupt changes in alignment of the rerouted Westerly Brook culvert. Monitoring well MISS-6A is located hydraulically downgradient from the southernmost leachate sump associated with the former stockpile of remediated soils from the Stage I residential properties. As discussed in Section 8.0, monitoring well pairs B38W14S/D and B38W15S/D are located hydraulically downgradient of the MISS and upgradient of the Westerly Brook transition to an open stream at the ground surface. Additionally, monitoring well pairs B38W14S/D and B38W15S/D are located along the direction of area bedrock strike with Dixo, and at a location where the Westerly Brook culvert experiences both a horizontal and vertical alignment change.

Volatile organic data have been obtained from selected monitoring wells located throughout the FMSS over the years. The groundwater samples were recently obtained in May 1999 as part of the EMP. This data is presented in Section 1, and summarized in Table 1-2. Similarly, Appendix B presents the historical data in a tabular form, and subsequently, the data has been compiled as a series of graphs depicting concentration over time (Appendix D). The current belief, based on an analysis of the data suggests that the VOC contamination detected in monitoring wells MISS-1B, MISS-7B and in the downgradient well pairs may be coming from the same source. Further, monitoring wells MISS-1B and MISS-7B and monitoring well pairs B38W14S/D and B38W15S/D are located in the vicinity of Westerly Brook. According to the NJDEP Preliminary Assessment Report for Dixo, a storm drain located in the parking lot of Dixo drains to the Westerly Brook. The VOC concentration levels in groundwater also appear to increase with distance along Westerly Brook, from upstream to downstream. However, the ratio of PCE concentrations to TCE, DCE and VC concentrations remains fairly consistent with distance and depth. This suggests that there may be a continuous source of PCE in the area.

As described in Section 2.2.1, the prevailing groundwater flow direction according to the LMAS model presented by Michelski and Britton (1997) is near parallel to strike. Strike measurements obtained from bedrock outcrops behind the Maywood Inn on Spencer Joseph Avenue and along Passaic Street near the Lawrence Avenue intersection revealed a northeast/southwest strike. This is specifically significant since monitoring well pairs B38W14S/D and B38W15S/D and Dixo Co., Inc. are in alignment, parallel to the strike. Although the August 1999 potentiometric and water table contour contour maps (refer to Figures 2-4 and 2-5) depict a westerly component of flow, fractured flow coupled with dispersion may account for the reason that chlorinated VOCs are detected in these wells located south of Dixo Co., Inc., separate from the fact that Westerly Brook is adjacent to B38W14S/D.

Dixo has been identified by the NJDEP as a responsible party for the area-wide VOC groundwater contamination. In fact, groundwater samples collected at Dixo contained up to 150,000 ppb PCE. Because these concentrations exceed the solubility of PCE (approximately 10,000 ppb), it is possible that free-phase PCE is present in the groundwater, and would behave as dense non-phase aqueous liquids (DNAPLs). If present, the free-phase PCE would behave as a continuous source of contamination and could explain the consistent concentration ratios of PCE to TCE, DCE and VC. All of this indicates that an upgradient source, north of the MISS, is a principal cause of the VOC contamination west of Route 17 and along Westerly Brook that is evident in the nearby wells. In order to determine if contamination is migrating from Dixo Co., Inc., a series of Geoprobe and monitoring well groundwater samples will be analyzed for VOCs.

2.5.3 GWRI Plan Elements

Based on the conceptual model information reviewed above, a number of GWRI activities are planned for implementation, including:

- Soil batch sorption distribution tests (K_d) to evaluate the leachability of contaminants from the soil to groundwater;
- Video and sediment inspections for Lodi Brook and Westerly Brook;
- Review of information that results from PDI investigations;
- Literature research on coal and coal residue properties as related to heavy metals generation and leaching and radiation sources; and

- Collection and analysis of soil and groundwater samples from Geoprobes® and monitoring wells located throughout the FMSS.

Additionally, further historical research and fieldwork will be required as described below.

2.5.3.1 Further Background Information Investigation

To further enhance the current understanding of the Westerly and Lodi Brook groundwater regimes, several site background information investigations are required. These investigations include the following items:

i. Dixo Co. Inc.

As previously discussed, the NJDEP has identified Dixo as a responsible party for the area-wide VOC groundwater contamination. Additional available reports will be obtained from the NJDEP and the Bergen County Health Department. Further, attempts will be made to locate the storm sewer system pipe that discharges to the Westerly Brook. Surface water and sediment sample locations within Westerly Brook will be biased towards those locations. In addition, a series of Geoprobe borings and monitoring wells will be located upgradient of the MISS, within the MISS along the culverted section Westerly Brook, west of Rt. 17 on the Ballod property straddling the culverted section of Westerly Brook, and hydraulically downgradient of Dixo Co., Inc. The location of these Geoprobe borings and monitoring wells including sample analyses will be presented in greater detail in Sections 4 and 8.

ii. Photographic Search

The aerial photographs included in the USEPA document used in the development of Section 1.4.4 were useful but of fair visual quality. ERML will be contracted for their complete photo library. Also, resources such as the Museum of Aviation will be investigated for additional aerial photographs of the FMSS.

In addition to the aerial photography mentioned above, historic ground surface photographs will be pursued as well. Photographs such as the pre-1930's view of MCW (showing four stacks on the property) can enhance the overall knowledge of historic operations. The Hackensack Historical Society will be investigated for additional historical photographs.

iii. MCW/Stepan Facility Search

A better understanding of the Stepan facilities is essential. Facilities as old as this can have a myriad of underground utilities. Active and abandoned utilities can create preferential pathways for contaminant migration. The results of this channeling might alter the conclusions through analyzing soil and groundwater test results. An understanding of the underground utility network on the property is essential in the continued refinement of the FMSS conceptual model.

Previous and current air emission permits, as well as the historic record of wind speed and direction, will be analyzed, as available to better understand the impact of coal burning on the surrounding environment. In addition to this, utility databases will be analyzed as a means of determining the probable composition of the coal used at the MCW/Stepan facilities over the years. A mass balance calculation will be performed to determine an estimated volume of waste, both bottom and fly ash, produced over the years of facility operation from burning coal.

Historic and current stormwater discharge permits and yard piping and municipal stormwater piping will be investigated as a means of enhancing the knowledge of processes and the overall FMSS conceptual model.

iv. Myron Facility Search

A similar facility search will be conducted on the Myron Manufacturing property, formerly, it has been suggested, the location of the Pfizer pharmaceutical manufacturing operation. The search will include results from previous sampling done by Myron (when they purchased the property), as well as, the location of underground utilities that might be directed toward the wetlands at Sears or toward the Stepan property, discharge permits and aerial/historic photographs.

v. ***Sanborn Map Investigation***

The Sanborn Map search conducted under the PDI Program will be reviewed to determine its applicability to the MISS, MCW and areas immediately adjacent. This search will be helpful in determining what other entities burned coal had stockpiles and other chemical processes in the vicinity of the FMSS.

vi. ***Magnolia Avenue Vacant Lot***

The status and history of the Magnolia Avenue Vacant Lot will continue to be investigated through the NJDEP and Bergen County Health Department. However, in the Preliminary Assessment and Site Investigation Report, the NJDEP attributed the groundwater contamination detected in the vicinity of the Magnolia Avenue Vacant Lot to Dixo. The Magnolia Avenue wells are located approximately 600 feet northeast of Dixo Co, Inc., refer to Figure 1-2.

vii. ***Transformer PCB Conversion***

Public Service Electric and Gas will be interviewed to determine if a PCB conversion process using PCE occurred at the substation north of the FMSS, and adjacent to Westerly Brook.

viii. ***Auto Body/Repair Yards***

The Auto Salvage/Repair Yards will be investigated to determine if these properties have been included on either the NJDEP or Bergen County Health Department List of Known Contaminated Sites.

2.5.3.2 Field Investigations

A field program is required to further refine the assumptions and judgements made in the development of the radiological/chemical hydrogeological conceptual model and to establish a basis for further site conceptual model refinement. The components of this field investigation include the following items.

i. ***Buried Drum Investigation***

The Stone & Webster Team is conducting a PDI to determine the location and extent of the buried drums beneath the Sears parking lot. A geophysical survey, which will include ground penetrating radar, electromagnetic, terrain conductivity, and magnetometer survey, will be conducted in the vicinity of radiological "hot spots". This information will be used to modify the proposed locations of Geoprobes® in their vicinity, as appropriate.

ii. ***Geophysical Surveys***

Two general types of geophysical surveys have been proposed. The first consists of a surface geophysical survey as part of the buried drum investigation as well as a surface geophysical survey to locate bedrock fractures throughout the FMSS. The second type of survey consists of borehole geophysical logging. Borehole geophysical logging will be completed in existing and newly installed bedrock monitoring wells for the purpose of obtaining information regarding the presence, location, size, frequency, and if possible, orientation of water-transmitting bedrock features. An assemblage of borehole geophysical tests will be performed on existing and proposed bedrock open holes. These tests include acoustic televiewer/borehole imaging photographs, down hole camera, heat pulse flowmeter, and temperature/fluid resistivity. Acoustic/borehole imaging tests in addition to existing lithostratigraphic information (i.e., boring logs) will be used to further describe the geology within the FMSS. Other proposed tests such as heat pulse flowmeter will be useful in determining areas of water bearing units.

iii. ***Surface Water and Sediment Sampling***

Surface water and sediment samples will be collected from the Saddle River, Westerly Brook, Lodi Brook, Coles Brook, and an unnamed drainage swale north of the MISS. The results obtained from these samples will be used to determine if COCs are present at these locations and to evaluate the potential migration and distribution of the

COCs within the surface water bodies. Subsequently, staff gauges will be placed along non-culverted sections of Westerly and Lodi Brook, and along Coles Brook and the Saddle River in order to determine the hydraulic relationships between these water bodies and the underlying groundwater.

iv. Geoprobe® Investigation

A total of 86 Geoprobes® will be advanced throughout the FMSS. Depending upon the saturated thickness, one or two groundwater samples will be collected from each Geoprobe®. These samples will be used as a preliminary screening tool to refine, as necessary, the proposed number, location, and depth of the monitoring wells. In addition soil samples will be collected from 71 of the 86 Geoprobes®. Analytical data from these soil samples will be used to evaluate the presence (if any) of residual COCs and to provide a vertical delineation of the stratigraphy at each of the Geoprobes® locations. At each location, continuous soil cores will be obtained. The soil samples will be characterized in accordance with the Unified Soil Classification System (USCS) in order to define the stratigraphy, and screen for the presence of VOCs and radiologic constituents. In addition, soil samples will be collected from the Geoprobes® and analyzed using batch sorption tests to determine estimates of a contaminants distribution coefficient (K_d). The site specific K_d will subsequently be used in a vadose zone leaching model.

v. Monitoring Well Installation and Sampling

The installation of 20 overburden and 20 bedrock monitoring wells is proposed as part of the GWRI. A soil sample will be collected from each of the 20 overburden soil borings installed and analyzed for chemical, radiological and geotechnical analyses, refer to Sections 4 and 8 for specifics regarding the well installation and sampling program. Groundwater samples will be collected from these newly installed monitoring wells in addition to the 41 existing monitoring wells for a total of 81 groundwater wells. There are an additional 36 monitoring wells owned by Stepan that are currently inaccessible to USACE. Presently, USACE is actively pursuing access to sample these wells from Stepan. As part of the GWRI, a well integrity assessment will be performed in order to verify the existence and the integrity of the existing monitoring wells for sampling purposes. The results obtained from the groundwater samples will be used for several purposes, including:

- Determination of the horizontal and vertical extent of contamination;
- Evaluating the contaminant contribution from potential off-site sources; and
- Assess the migration and distribution of contamination throughout the FMSS.

Monitoring wells will also be used to measure groundwater levels. This information will be used to construct groundwater elevation contour maps.

vi. Monitoring Well Testing

Several types of tests will be conducted using the existing and newly installed monitoring wells. The different types of tests and the objectives of each test is described below and identified in greater detail in Section 8.9. Prior to performing these tests, USACE will submit an Aquifer Testing Work Plan to the regulators for informational purposes:

- Slug tests will be performed on existing and newly installed overburden monitoring wells. The information gathered from these tests will be used to evaluate the condition of the existing wells and to obtain site-wide hydrogeologic information.
- Pumping tests will be performed using an overburden monitoring well and a bedrock monitoring well. The information obtained from these tests will be used to refine the conceptual hydrogeologic model and provide input parameters for the fate and transport model, if the fate and transport model is deemed necessary.
- Packer tests will be performed on existing and newly installed open hole bedrock monitoring wells. The information gathered from these tests will be used to obtain site-wide hydrogeologic information.

3.0 INITIAL EVALUATION

3.1 INTRODUCTION

Included in this section are discussions on the following topics:

- Preliminary Risk Assessment;
- Summary of Additional Data Needs; and
- Identification of Potential Remedial Action Objectives.

The various discussions describe rationale and approaches that are used to:

- Identify a preliminary list of COCs;
- Refine the conceptual site model of potential exposure pathways for human and ecological receptors established in the BRA and which evolves with the GWRI implementation;
- Fill identified data gaps;
- Identify potential remedial action objectives for each contaminated medium; and a preliminary range of potential remedial action alternatives and associated technologies.

3.2 PRELIMINARY RISK ASSESSMENT

This preliminary risk assessment is presented to focus the GWRI on those sources, environmental migration pathways, and chemical and radiological constituents that pose potential risks to human and ecological health. It is based on the current understanding of the FMSS including available historical information, existing data on the extent and magnitude of chemical and radiological contamination, current and potential future land use, demographics, geohydrological characteristics and other data presented in this GWRIWP.

As described in Section 14.0 Risk Assessment, the additional information and data collected during the GWRI will be used in conjunction with the BRA conducted for the FMSS (USDOE, 1993) to determine the need for further action and, if needed, site-specific, risk-based target levels (RBTL) for remedial design purposes.

Groundwater that may be contaminated by FUSRAP wastes is the primary environmental medium of concern; surface water and/or sediment are also environmental media of concern, to the extent that contamination is related to FUSRAP waste. In the following sections, a preliminary list of COCs is presented and the conceptual site model of potential exposure pathways for human and ecological receptors is discussed.

3.2.1 Preliminary Constituents of Concern (COCs)

The preliminary list of chemical and radiological constituents that pose a potential risk to human and/or ecological health via groundwater, surface water, and sediment are listed in Table 3-1. These COCs were selected based upon review of all existing data using the following criteria:

- Chemicals of concern in the BRA (USDOE, 1993);
- Measured concentrations relative to background levels and/or relevant screening concentrations;
- Carcinogenicity/toxicity; and
- Frequency of detection.

As described in Section 14.0 Risk Assessment, this preliminary list of COCs will be updated, as appropriate, based on information and data collected during the GWRI. In updating the preliminary list, consideration will be given to the fate and transport characteristics of the constituents.

3.2.2 Potential Source Areas and Migration Pathways

The thorium processing operation conducted at the former MCW was the primary origin of the contamination. Numerous neighboring properties became contaminated as a result of surface water runoff, waste disposal operations and construction activities, thus providing secondary sources. Interim remedial actions resulted in a stockpile of wastes at the FMSS property that has recently been removed. Thus, the primary sources of groundwater, surface water, and/or sediment contamination are:

- Material deposited by stream flow along Lodi Brook;

- Former retention ponds on the FMSS property;
- Former stockpiled material at the FMSS property;
- Contaminated fill material on residential and other industrial/government properties;
- Buried drums on the Sears property;
- Burial pits on the Stepan property; and
- Other upgradient surface and subsurface sources.

Based on these source areas, environmental migration pathways of concern include:

- Leaching through the soils to groundwater;
- Surface water runoff and/or groundwater discharge/surface water recharge;
- Surface water runoff and discharge through stormwater drains to surface water; and
- Contaminated groundwater infiltration into and contaminated stormwater/groundwater exfiltration out of culverted surface water bodies.

There are a number of potential off-site sources of chemical contamination typical of urban/industrial areas that may be contributing to degradation of groundwater quality at the FMSS. These will be discussed in the GWRI Report as part of the evaluation of the potential site impact on groundwater quality.

3.2.3 Potential Exposure Pathways and Receptors

Groundwater at the FMSS is classified by the State of New Jersey as GWII-A, which is groundwater having a natural total dissolved solids concentration of 500 mg/l or less, is suitable for potable, industrial, and agricultural water supply. However, it is understood that groundwater within the study area is not currently used as a potable supply and therefore, potable use of groundwater in a residential scenario is not considered a current exposure pathway. As indicated in Section 8.0 Field Investigation Tasks, the well survey conducted in 1994 will be updated to determine if water supply wells, for any purpose, exist within a 1-mile radius of the FMSS. Currently, the only human receptors are:

- Children that live near Westerly Brook or the Saddle River who may contact surface water and sediment while playing;

- Workers who may come into contact with sediment in Lodi Brook or Westerly Brook which has been routed through a subsurface storm sewer system along most of its length;
- Those with wells that are used for other than potable purposes (industrial, cooling, lawn sprinkling);
- Those with wells that are either illegal or pre-date current ordinance requirements concerning the creation of water supply wells; and
- Construction and other workers (e.g. utility public works) who come into contact with groundwater.
- Wildlife in and around the water bodies is a potential current receptor that may be affected by contact with surface water and sediment.

Groundwater in the FMSS could be used in the future for potable or industrial purposes. Thus, in the future, resident adults and children may be exposed to constituents in groundwater used as a potable supply and workers in commercial/industrial settings may be exposed to constituents in groundwater used as a potable, process or cooling system supply. In addition, because of the shallow water table, construction/utility workers may also come in contact with overburden groundwater. The exposure potential for human and wildlife receptors would continue into the future.

3.2.4 Risk Assessment Conceptual Site Model

A conceptual model for potential human and ecological receptor exposure to groundwater, surface water, and sediments associated with the FMSS is illustrated in Figure 3-1. As indicated, releases from the primary sources of contamination may occur by leaching through the soil, by stormwater runoff, both overland and through storm sewer drains, and/or groundwater discharge/surface water recharge. In addition, contaminated groundwater may infiltrate into or exfiltrate from the culverted sections of Lodi and Westerly Brooks. Exposure of human receptors to site-related contamination may occur via ingestion, dermal contact, inhalation, and external gamma radiation.

3.3 SUMMARY OF ADDITIONAL GWRI DATA NEEDS

In Section 2.0, various GWRI Plan Elements were identified. Coupling that with an understanding of potential pathways and receptors yields an array of additional data needs that are discussed below.

3.3.1 Calculation of Preliminary Soil Cleanup Levels Protective of Leaching to Groundwater

A sufficient number of samples will be collected and analyzed using batch sorption tests to determine distribution coefficients (K_d). Presently, batch sorption tests will be conducted on differing soil types, and contaminants that will be tested for will include: Ra-226, Th-232, U-238, arsenic, chromium and lithium. The distribution coefficients will be used to calculate the appropriate preliminary soil screening levels (SSLs) protective of leaching to groundwater in accordance with EPA soil screening guidance. Calculated distribution coefficients will also be used as input parameters to a vadose zone leaching model. USACE currently plans on using one of several 1-dimensional vadose zone leaching models, notably VLEACH or SESOIL, in order to determine the contaminants ability to leach from site soils to the underlying water table.

3.3.2 Video Inspection of Lodi and Westerly Brook

The Lodi and Westerly Brook culverts will be video inspected. These inspections will be used to determine the impact of areas of sediment buildup and to evaluate whether groundwater is infiltrating into the culverts or if surface water in the culvert is exfiltrating into the environment.

3.3.3 Results of Pre-Design Investigation

Coordination between the PDI field data sampling activities and the GWRI will be accomplished to take full advantage of all data within the region. Where applicable, Geoprobe® locations have been placed to provide information for both the PDI and the GWRI concurrently.

3.3.4 Literature Research on Coal and Coal Residue Properties

Literature from available utility databases on coal and coal residue properties will be researched to confirm the association of the presence of COCs in the hydrocarbon products resulting from combustion of coal in relation to the impact on the FMSS groundwater.

3.3.5 Literature Survey

Information pertaining to potential off-site sources of contamination will continue to be gathered. This may include information obtained from local and county health departments, NJDEP, USACE, and USEPA. Available data including historic aerial and ground surface photographs will be assembled and reviewed to develop a historic perspective on past area activities that may have influenced the groundwater in the FMSS. In addition, historic Stepan and Myron facility drawings will be researched as available, to determine potential impacts on area groundwater.

3.3.6 Field Hydrogeologic Investigation

The field hydrogeologic investigation will meet the needs identified on Table 3-2 including:

- Obtaining a better understanding of the overburden stratigraphy and bedrock structure throughout the FMSS;
- Determining vertical and horizontal hydraulic gradients in parts of the FMSS where these data are lacking;
- Determining hydraulic parameters such as hydraulic conductivity and transmissivity in order to refine the conceptual groundwater flow regimes of the overburden and bedrock aquifers;
- Evaluating the hydraulic relationship between groundwater and surface water; and
- Providing hydrogeologic data for use in the groundwater flow and fate and transport model, if necessary.

3.3.7 Sampling and Analysis Program

A sampling and analysis program will be conducted to:

- More completely determine the nature and extent of groundwater contamination in the overburden and bedrock aquifers;
- Determine the potential sources of residual contamination in soil;
- Determine potential contaminant impacts to the surface waters and sediments; and
- Provide analytical data (including leaching potential) for use in the groundwater flow and fate and transport model, if fate and transport modeling is necessary, and the risk assessment.

3.3.8 Geophysical Survey

A geophysical survey will be conducted to:

- Identify potential preferential contamination pathways;
- Identify bedrock structures that may be facilitating groundwater flow and contaminant migration.

3.4 IDENTIFICATION OF PRELIMINARY REMEDIAL ACTION OBJECTIVES

Section 121(b) of CERCLA exhibits a preference for remedial actions in which treatment permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances, pollutants, and contaminants. The remedial action must be protective of human health and the environment, cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

The purpose of this section of the GWRIWP is to identify potential remedial action objectives for the contaminated medium (groundwater) and a preliminary range of remedial action alternatives and associated technologies, should remedial action be dictated by the results of the GWRI. It is a general classification of potential remedial actions based upon the initially identified potential routes of exposure and associated receptors.

3.4.1 Preliminary Objectives

The GWRI will address groundwater. Preliminary remedial action objectives for groundwater include the following:

- Prevent the ingestion of water having contaminant concentrations in excess of the risk-based levels developed in the BRA;
- Mitigate further migration of water having contaminants in excess of the risk-based levels developed in the BRA; and
- Clean up groundwater such that appropriate standards are attained at the end of the remedy.

3.4.2 Prospective Response Actions, Remedial Technologies and Alternatives

To meet the above preliminary remedial action objectives, a set of general response actions as follows were identified:

- No action;
- Limited Action;
- Containment;
- Removal;
- Treatment; and
- Institutional Controls.

The USEPA Guidance on Remedial Action for Contaminated Ground Water at Superfund Sites (USEPA, 1988a) provides further information on groundwater remediation strategies and technologies and will be appropriately utilized once the nature of unacceptable groundwater risk is quantified.

4.0 WORK PLAN RATIONALE

4.1 DATA QUALITY

Data quality for the GWRI will be ensured by determination of test parameters with well-defined "error bars". Test data will support determinations on:

- the nature, extent, and source(s) of groundwater contamination (e.g., distribution and transport of specific source(s) of contamination);
- assess potential contributions of off-site sources to the groundwater contamination;
- the risks posed by the contamination (e.g., human health and ecological); and
- potential remedial alternative evaluations.

Data quality for particular GWRI activities must be consistent with the intended use of the data and also ensure precision, accuracy, reproducibility, comparability, and completeness. The purpose of this Section is to identify the level of data quality deemed necessary for this GWRI based upon evaluation of existing site data, human health and ecological risks, and potential remedial alternative objectives, as identified in Section 3.0 of this GWRIWP. Refinements to data quality may become necessary as this GWRI progresses.

The analytical testing levels are defined as follows:

- Field screening analysis using portable instruments. Results are often not compound-specific and not quantitative, but results are available in real-time. It is the least costly of the analytical options.
- Field analysis using more sophisticated portable analytical instruments; in some cases, the instruments may be set up in a mobile laboratory on-site;

there is a wide range in the quality of data that can be generated. It depends on the use of the calibration standards, reference materials, sample preparation equipment, and the training of the operator. Results are available in real-time or several hours.

- Analyses performed in an off-site analytical laboratory. Analytical data is characterized by rigorous QA/QC protocols and documentation.

The field measurements data to be collected include those from field OVA, HNu, or radiation monitoring (with a Geiger Mueller or GM pancake detector) gathered as part of the health and safety monitoring for the field activities. These are real-time data used for the immediate evaluation of field conditions. Field measurements of parameters such as pH, temperature and specific conductance, and turbidity of water samples, as well as borehole and surface geophysical surveys, are also examples of screening level data which will be collected at the FMSS. These real-time data will be collected to permit immediate evaluation of the adequacy of monitoring well purging.

Surface and subsurface soil samples obtained as part of the Geoprobe® program will be analyzed by an in field (mobile) laboratory and analyzed for Ra-226, Th-232, and U-238 and quantified using a gamma spectrophotometer.

Certain analyses will be performed by a fixed based laboratory using standard methods with rigorous QA/QC protocols. For example, SW-846 methods for quantitating levels of volatile and semi-volatile organic compounds, pesticides/PCBs, metals, etc. shall be employed. For radiological constituents, the contractors laboratory(ies) shall employee USACE approved SOPs.

4.2 WORK PLAN APPROACH

The objectives of the GWRIWP were developed based primarily on data available from previous investigations. Information was also compiled from site visits, published reports on regional and local geology, hydrogeology, and various chemicals and processes.

The main objectives of the GWRIWP are to characterize and delineate the nature and extent of contamination; identify potential source(s) of contamination; assess the potential contaminant contributions of off-site sources to the groundwater beneath the FMSS; evaluate distribution and migration pathways; broaden the existing geological, hydrogeological, chemical and radiological database; and provide current information to evaluate in respect to the BRA.

The proposed overall approach to conducting this GWRIWP includes:

- Evaluating of existing data;
- Determining additional data needs;
- Collecting data;
- Analyzing and validating samples;
- Evaluating and interpreting data;
- Determining the need for additional data/treatability studies;
- Contaminant Fate and Transport Modeling;
- Identifying the need for and nature of Potential Remedial Alternatives;
- Reassessing the information in the BRA based on current information; and
- Report

Geophysical Survey

Two types of geophysical surveys will be undertaken throughout the FMSS. The first type of survey, *surficial geophysical survey,* is composed of two elements. The first element includes ground penetrating radar (GPR), electromagnetic (EM) survey, terrain conductivity, and magnetometer survey that will be completed to assist in the location of underground utilities. The second element consists of a Very Low Frequency (VLF) survey. This survey will be completed to assist in the location of bedrock fractures.

The second type of survey, *borehole geophysical survey,* will consist of a downhole geophysical investigation in 6 existing and up to 20 newly installed bedrock monitoring wells. The purpose of the borehole geophysical survey is to locate water-transmitting structures, to assist in determining the appropriate location and depths of the proposed aquifer tests (i.e., packer tests), and to gather information to support contaminant fate and transport modeling, if fate and transport modeling is necessary.

Geoprobe® Investigation

A total of 86 Geoprobes® will be advanced throughout the FMSS in accordance with Soil Probe Investigation SOP 509. The rationale for this portion of the investigation is included in Section 8.0. Depending upon the saturated thickness, one or two groundwater samples will be collected from each Geoprobe®. These samples will be used as a preliminary screening tool to refine, as necessary, the proposed number, location, and depth of the monitoring wells. In addition, soil samples will be collected from 71 of the 86 Geoprobes®, and analyzed for the parameters outlined in Section 8. Analytical data from these soil samples will be used to evaluate the presence (if any) of residual COCs and to provide a vertical delineation of the soil quality at each Geoprobe® location. In addition, 5 discrete soil samples representing differing radiological/chemical concentrations and lithological consistency will be collected from the Geoprobes® and analyzed in accordance with ASTM method D-4646 for 24-h Batch Sorption (soil distribution) tests. Presently, soil samples requiring batch sorption tests will be analyzed for radiological (Ra-226, Th-232, U-238), and chemical (arsenic, chromium, and lithium) parameters.

Hydrogeologic Investigation

A total of 40 proposed new monitoring wells will be installed in the FMSS in accordance with CDQMP SOP-303 of the Maywood CDQMP, Monitoring Well Installation and Development. These include 20 overburden wells and 20 shallow bedrock wells. The rationale for this portion of the investigation is included in Section 8.0. A soil sample obtained from the overburden monitoring well will be analyzed for radiological, chemical and geotechnical analyses, refer to Table 4-1 and Section 8.

Groundwater samples will be collected from each of the existing 41 monitoring wells, if all wells are determined to exist and function properly after the monitoring well integrity assessment is completed, and the 40 newly installed monitoring wells in accordance with SOP-304, Purging and Sampling Monitoring Wells, and analyzed for known or suspected COCs. Monitoring wells owned by Stepan will not be included in the groundwater monitoring program unless USACE is granted access to these wells by Stepan. Analytical parameters proposed for sampling of the existing and proposed monitoring wells are presented in Table 4-1, and discussed in further detail in Section 8. This information will be used to estimate the horizontal and vertical distribution of COCs, assess contaminant mobility, and predict the long-term disposition of COCs. Groundwater and surface water levels will be measured using CDQMP Field SOP-410, Groundwater Level Measurements, to determine the groundwater flow directions and hydraulic gradients. Aquifer pumping tests, slug tests, and packer tests will be performed in accordance with the CDQMP field SOPs 201, 204, and 205, respectively. The aquifer pumping tests will be used to estimate the hydraulic properties of the overburden aquifer, and the hydraulic properties including the interconnectivity of bedrock fractures in the bedrock aquifer throughout the FMSS. Similarly, slug test data obtained as part of the well integrity tests, will be used to estimate the hydraulic properties of the overburden and bedrock aquifer. Borehole geophyical data and surface geophysical data (VLF) will provide information on fracture orientation, and productive water bearing zones throughout the FMSS, and will be used to determine the number, location, and construction depths of proposed monitoring wells. Furthermore, lithostratigraphic data obtained as part of the Geoprobe program will be used to appropriately size the sand pack in order to prevent the influx of fines into the well screen.

Surface Water and Sediment Sampling

Samples will be collected from the Saddle River (6 surface water and 6 sediment samples), Westerly Brook (5 surface water and 5 sediment samples), Lodi Brook (8 surface water and 8 sediment samples), Coles Brook (5 surface water and 5 sediment samples), and an unnamed drainage swale north of the New York Susquehanna and Western Railroad (3 surface water and 3 sediment) in accordance with CDQMP Field

SOPs 301, Sediment Sampling, and 302, Surface Water Sampling. Refer to Section 8 for a list of proposed analytical parameters. In general, the purpose of these samples is to provide analytical data to support the human health and ecological risk assessment. However, these surface water bodies may be local groundwater discharge points. Therefore, analytical results of the surface water and sediment samples will be compared to the analytical results from groundwater samples to evaluate the potential infiltration of groundwater to the surface water.

As part of the Phase I Data Analysis and Interim Report, the Team will evaluate the existing and currently obtained data in light of the Data Quality Objectives (DQO) outlined in the CDQMP. If the DQO's cannot be achieved based on the number of soil, sediment and groundwater samples proposed for collection, the necessity for adding additional samples to the GWRI will be discussed with the USACE.

Risk Assessment

The existing BRA will be reviewed, evaluated and updated in light of current data produced in this GWRI effort. The assessment will focus on human health and ecological receptors.

Table 4-1 presents a summary of the proposed GWRI field sampling and analysis tasks, including the media to be sampled, the types of data to be collected, the analytical testing levels to be achieved, and the analytical parameters.

5.0 PROJECT PLANNING

Project planning involves several subtasks that must be conducted to develop the plans and corresponding schedule necessary to execute the GWRI. These subtasks include conducting an analysis of background data; reviewing available project plans, making site visit(s), developing a preliminary risk assessment strategy, identifying potential preliminary remedial alternatives, determining preliminary data quality levels, and determining preliminary ARARs. All of these activities culminate in the preparation of the final project plans. Several of these subtasks have been done; others require completion.

This GWRIWP will be implemented in accordance with following project plans that include: CDQMP, which consists of the Quality Assurance Plan (QAP), Field Sampling Plan (FSP), and Standard Operating Procedures (SOP); Contractor Quality Control Plan (CQCP); and Site Safety and Health Plan (SSHP). General Environmental Protection Plan (GEPP) and Materials Handling/Transportation and Disposal Plan (MHTDP). These documents have been submitted to the USACE (under separate cover) for review and comment.

5.1 AVAILABLE INFORMATION

The FMSS has been the subject of numerous extensive investigations generating a substantial amount of data. The available data have undergone a review during this project planning stage and have been incorporated into a database.

Given the large volume of available data, it is expected that the review of information will be an on-going task. As new data are generated and other historical data become available, this database will be revised and updated. This updated database will be used to refine the risk assessment and to revise the conceptual site model.

5.2 CHEMICAL DATA QUALITY MANAGEMENT PLAN

The CDQMP provides detailed procedures for each field activity, including, but not limited to:

- Geoprobe soil and groundwater sampling;
- Monitoring well construction and development;
- In-situ permeability testing including slug and pump tests;
- Rock coring;
- Groundwater level monitoring;
- Groundwater sampling; and
- Geophysical surveying (clearance, VLF and borehole)

5.3 SAMPLING AND ANALYSIS PLAN

A task specific sampling and analysis plan (SAP) will address project-specific requirements and will reference specific sections of the CDQMP. The purpose of the SAP will be to ensure that sampling and data collection activities will be comparable to, and compatible with, previous data collection activities performed at the FMSS while providing a mechanism for planning and approving field activities.

5.4 SITE SAFETY AND HEALTH PLAN

The SSHP has been prepared and complies with applicable USACE, OSHA, and NRC guidelines.

5.5 GENERAL ENVIRONMENTAL PROTECTION PLAN

The GEPP addresses controls designed to prevent environmental pollution from soil, air and water emissions resulting from FMSS activities. The GEPP is a guide for use by project staff for environmental regulations to consider for all site related activities.

5.6 MATERIALS HANDLING/TRANSPORTATION AND DISPOSAL PLAN

The MHTDP addresses the necessary actions to ensure compliance for the management of waste generated from FMSS activities. All waste generated from site activities will be disposed off-site in accordance with applicable local, state and federal regulations.

6.0 COMMUNITY RELATIONS

The USACE has a community relations program in place for the entire Maywood FUSRAP investigation. General planning, management, analytical and coordination support will be provided to USACE during this community relations program. This may include coordination meetings with USACE to discuss planning and scheduling of community relations activities, providing information and analysis about concerns expressed by local officials and residents in the area during the GWRI.

7.0 SUBCONTRACTING

The following subcontracts will be required to support the proposed field activities:

- Drilling subcontract for Geoprobes®, soil borings, and well installations;
- Laboratory subcontract;
- Data validation subcontract
- Surface geophysical contract for utilities markout;
- Professional Licensed Surveying (PLS) subcontractor to perform a survey of existing and newly installed monitoring wells, Geoprobes®, surface water and sediment locations, and geophysical transects;
- Borehole geophysical subcontract;
- Specialty firms for stormwater sewer system inspections (e.g., photo/video documentation), and
- Data management subcontract

8.0 INVESTIGATION TASKS

8.1 INVESTIGATION OBJECTIVES AND APPROACH

The purpose of this section is to define the tasks associated with obtaining the necessary data to validate, enhance, and refine the conceptual model. These tasks will include:

- Further evaluation of historical data;
- Supplementing existing data through on-going and proposed field activities;
- Conducting laboratory controlled batch sorption tests (soil distribution) and
- Analyzing and interpreting existing and newly acquired data.

A philosophy of the Stone & Webster Team is to consider the USACE a partner in the GWRI and integral to the decision making process. All data gathered throughout the investigation will be shared with USACE decision makers.

8.1.1 Further Historical Data Review

The on-going review of previous investigations and the collection of relevant supporting information will continue. This information will be gathered prior to the start of the GWRI field investigation and may be used to modify proposed sampling locations. The historical data review information includes:

- Sanborn Maps (for MCW and surrounding properties);
- Stepan and MCW piping drawings;
- Stepan and MCW water discharge and air permits;
- Aerial and other photographs that demonstrate MCW site conditions;
- Mass balance composition and extraction procedures for monazite sands;

- Mass balance of coal utilization at MCW;
- Historical data on ash waste disposal;
- Dielectric fluid conversion procedures for northern transformer substation;
- Identifying potable, municipal and commercial wells within the FMSS; and,
- NJDEP files for the Known Hazardous Waste Site Database.

8.1.2 Supplementing Existing Data through On-going Activities

The refinement of the existing database will also be an on-going task. It is expected that the data generated from on-going groundwater monitoring will complement the historical data and enhance the database.

8.1.3 Field Activities

The GWRI will gather geologic, hydrogeologic, chemical, and radiological information that will be used to enhance, refine, and validate the existing conceptual site model. Field data will be recorded on field log forms included in Appendix E. The new data results will be used to assess migration pathways, determine the extent of contamination, identify potential receptors, and assess risks to human health and to the environment. New data generated in the field will be shared with the USACE to evaluate the progress of the field investigation.

The approach to the GWRI is that the work will be completed in two phases (Table 8-1). Information gathered during the implementation of the first phase of tasks will be used to better define the specific details of the second phase of tasks presented below. This may include, for example, modifying the proposed number and locations of monitoring wells, changing the proposed depths of the monitoring wells, or moving the proposed number and locations of surface water and sediment samples. Upon completion of the first phase (which includes tasks such as surface features survey, utilities survey, well integrity survey, chemical results from the Geoprobe and existing monitoring well sampling, etc.), a Phase I Interim Report will be developed and submitted to the USACE and to the regulators for informational purposes. This report will summarize the findings of the Phase I activities and provide recommendations for the completion of Phase II activities (e.g., modifying the number and location of monitoring wells). These recommendations may include modifications or revisions (including the addition or reduction of sample points) to the Phase II field activities proposed in this GWRIWP.

Each of the GWRI tasks is described in the subsequent Sections. The GWRI tasks and the corresponding phases are identified in Table 8-1 and detailed on the following pages.

8.2 COORDINATION WITH PRE-DESIGN INVESTIGATION FIELD ACTIVITIES

The PDI will be conducted in parallel with this GWRI. The general purpose of the PDI is to address potential FUSRAP contamination in the soil on the 24 commercial and government properties and Phase I Ballod property located within the FMSS. The overall objective of the PDI is to complete the activities necessary to conduct a remedial design and remedial action, addressing the soil contamination. A field investigation is proposed as part of the PDI to meet this objective. Coordination between the GWRI and the PDI is planned to avoid the duplication of similar tasks in the field.

The field investigation tasks described in this section take into consideration the tasks proposed in the PDI Work Plan. The complementary relationship between the investigations will benefit the project in two ways. First, data collected during the implementation of the PDI will be used as appropriate during the completion of the GWRI. Conversely, it is expected that relevant data collected during the implementation of the GWRI will be considered during the completion of the PDI Report. Second, selected sample locations and sample procedures proposed in the PDI Work Plan may be modified in the field so that the information obtained can be used in both the GWRI Report and the PDI Report.

8.3 SITE RECONNAISSANCE

8.3.1 Surface Features Survey

A detailed surface features survey will initiate GWRI. This survey will consist of a thorough walk-over of the FMSS to gather field observations that might provide a rationale for enhancing the GWRI and identify any obstacles that may impede the implementation of the GWRI.

The obstacles that will be identified as part of the GWRI may include:

- Overhead power lines;
- Rights-of-way;
- Heavy traffic areas or unusual traffic patterns;
- Bedrock outcrops;
- Obvious signs of contamination;
- Changes in topography; and
- Heavy tree or vegetation cover.

8.3.2 Utilities Survey

Due to the intrusive subsurface work (i.e., advancement of Geoprobes® and monitoring well installations) that will be completed as part of the GWRI, a utilities survey will be undertaken. Further, it is possible that some underground utilities may be providing preferential pathways for contaminant migration; specifically, water and sewer lines surrounded by backfill material, which could be more permeable than the native soils.

The utilities survey will be conducted by completing each of the following three tasks:

- **Township and County Department of Engineering** – The Engineering Departments of Maywood, Rochelle Park, Lodi, and Bergen County will be contacted to obtain available underground utility drawings for areas in the vicinity of intrusive activities;

- **Garden State Underground Plant Service** – The New Jersey, "Dig Safe", toll free number (800-272-1000) will be contacted; and
- **Surface Geophysical Survey** – A surface geophysical survey will be conducted to obtain two types of information. First, the survey will be conducted to obtain additional information about the location of underground utilities. The specific method will be selected based upon consultation with the geophysical subcontractor, but will include an EM survey, magnetometer, and a GPR survey. Second, as part of PDI field activities, a limited surface geophysical survey will be completed to locate and delineate buried drums in areas exhibiting radiological "hot spots" beneath the Sears parking lot (See Section 8.5.1).

Based on the findings of the utility survey, a number of Geoprobes® may be advanced close to subsurface lines (such as water and sewer) in order to investigate the presence of contamination along these potential migration pathways.

8.3.3 Lodi and Westerly Brook Pipe Video-Inspection

Portions of Lodi Brook and Westerly Brook are routed through concrete culverts. A video-inspection program is proposed to determine the integrity of these pipes. The pipes will be accessed either from manholes or where the pipes begin and/or end and the natural drainage of the brooks begins. If obstructions or debris block the progress of the video camera, confined space entry may be necessary.

The information gained from the video-inspection will be used to modify the proposed locations of the Geoprobes® (Section 8.6). For example if the video-inspection revealed areas where the pipe is broken, it will be desirable to advanced Geoprobes® at those locations for the purposes of obtaining soil and groundwater samples. Analytical results from these samples will be used to evaluate whether COCs could have migrated from the brook pipes to the surrounding environment (exfiltration), or whether contaminated groundwater is entering the culvert via groundwater infiltration.

8.3.4 Monitoring Well Integrity Survey

There are a total of 77 existing monitoring wells located throughout the FMSS. Of these 77 wells, 36 are owned by Stepan and are presently inaccessible. Presently, USACE is attempting to gain entry to these wells through on-going conversations with Stepan. The integrity and existence of the 41 existing monitoring wells will be verified as part of this activity (Figures 8-1A, 8-1B, and 8-1C). This process will involve the completion of several tasks as described below:

- The protective surficial casings (i.e., stickups or flushmounts) will be inspected for signs of damage;
- The condition of the monitoring well locks will be verified;
- The expanding well caps will be inspected;
- The monitoring wells will be sounded with the water level meter probe to determine if there is a buildup of silt and sediment. The depth will be compared to the well construction information summarized in Table 8-2;
- In-situ permeability tests (slug tests) will be performed on selected monitoring wells to evaluate the hydraulic connection between the monitoring wells and the formation. The results of these slug tests will be compared to historical results to determine if the monitoring well(s) need to be redeveloped. Redevelopment of any existing monitoring wells will occur prior to the Phase II groundwater sampling program which will occur after the proposed monitoring wells are installed. Note that slug tests will also be performed as part of the Phase II activities on the newly installed monitoring wells (Section 8.9);
- Monitoring wells found to be damaged will be identified and the degree of repair necessary to re-establish well integrity will be provided to the USACE; and repaired/reconditioned during Phase II activities;

- Monitoring wells found to be damaged beyond repair will be identified. Recommendation will be provided to the USACE if the permanently damaged well(s) should be abandoned or abandoned and replaced with a new monitoring well. All wells will be abandoned in accordance with NJDEP regulations.

8.3.5 Water Level Measurements

As part of the Phase I activities, groundwater levels will be measured in each of the 41 existing DOE/USACE monitoring wells located in the FMSS (Figures 8–1A, 8-1B, and 8-1C).

Groundwater level measurements will be converted to elevations referenced to MSL (the National Geodetic Vertical Datum 1929). These elevations will be used to construct groundwater elevation contour maps for the FMSS as required (previous groundwater elevation contour maps were restricted to specific areas within FMSS). Based on these elevations, the direction of groundwater flow will be estimated. The flow information will be used to modify the proposed Geoprobe® and monitoring well locations, as necessary.

As part of the Phase II activities, groundwater levels will be measured in the existing USACE/DOE existing monitoring wells, as well as the new monitoring wells. Surface water level measurements will be obtained from 7 staff gauges installed in the Saddle River and various other water bodies (Westerly, Lodi Brooks, and Coles Brook, if water is present in these water bodies at the time that gauging is performed) as part of the GWRI. A water table and potentiometric surface contour map will be developed based upon this data.

8.4 MOBILIZATION/DEMOBILIZATION

This subtask will consist of field personnel orientation, equipment mobilization, staking of sampling locations, and demobilization. Prior to the mobilization to the site, each field team member will be required to read and understand the relevant project documents (i.e., RIWP, EPP, CDQMP, SAP, and SSHP). Each field team member will attend an on-site orientation meeting to become familiar with the history of the site, health and safety requirements, and field procedures.

Equipment mobilization will entail the ordering, purchase, and transport of all sampling equipment needed for the field investigation. A complete inventory of available equipment will be prepared before initiating field activities. Any additional required equipment will be obtained.

Locations for the Geoprobe® points, monitoring wells, geophysical grids, surface water sample locations, and staff gauge locations will be staked at the start of the site operations. These locations will be measured from existing landmarks and provisions will be made to accommodate activities in progress. An area for the decontamination pads will also be identified at the MISS.

Equipment will be demobilized at the completion of each phase of field activities as necessary. Demobilization may include (but will not be limited to) removal of sampling equipment, drilling subcontractor equipment, decontamination pad, and health and safety decontamination equipment.

At the time of demobilization, drummed drill cuttings, well development water, decontamination fluids, and used personal protective equipment (that has been brought to the MISS at the conclusion of each day of field work) will be disposed of in accordance with applicable codes and regulations, as described in the CDQMP.

8.5 GEOPHYSICAL SURVEY

8.5.1 Surface Geophysical Survey

A surface geophysical survey will be completed to assist in the location of underground utilities. This task is also being completed as part of the PDI field investigation. Therefore, the geophysical survey proposed in this GWRIWP will be combined as appropriate with the PDI geophysical survey.

The survey transects will be located in the vicinity of the proposed Geoprobes® and monitoring wells. The surface geophysical survey method includes magnetometer, GP and EM.

A limited surface geophysical survey will also be completed to locate buried drums in the vicinity of radiological "hot spots" beneath the Sears parking lot, as part of the PDI field investigation. The buried drum survey will include GPR, EM, magnetometer, and terrain conductivity. In addition, a Very Low Frequency (VLF) surface survey is proposed, as part of this GWRIWP to help identify areas of water bearing fractured bedrock zones which can be developed into three dimensional fracture models to determine monitoring well placement. This information, gathered as part of the PDI field investigation, will be used as part of this GWRIWP to assess potential contaminant source areas, identify areas that have unique health and safety concerns, and modify monitoring well and sample locations proposed in the GWRIWP and will be conducted in accordance with the CDQMP.

8.5.2 Borehole Geophysical Survey

Borehole geophysical surveys will be performed during the field investigation following the procedures described in the CDQMP. The primary purpose of these surveys will be to obtain information regarding the presence, location, size, frequency, and if possible, the orientation of water-transmitting bedrock features. The borehole logging will be conducted during Phases I and Phase II of the GWRI activities. During Phase I GWRI activities, existing open-hole bedrock wells (MISS-1B through MISS-5B, and MISS-7B) located throughout the FMSS will be logged. As part of Preliminary GWRI activities, it became apparent that existing bedrock well MISS-6B had partially collapsed. As a result, this bedrock well was not targeted for borehole geophysical work. Phase I borehole geophysical work is being performed to meet the following objectives:

- test the suitability of the methods for later use (i.e., during Phase II);
- verify previous lithologic information obtained during bedrock coring runs; and
- obtain additional information regarding bedrock fractures and fluid movement within the fractures.
- determine primary permeability of the rock matrix and flow gradients and determine secondary permeability (e.g., solution cavities, discontinuities within the rock).

During Phase II, the 20 proposed shallow bedrock monitoring wells (see Section 8.8) will also be logged. The proposed logging scheme for bedrock/fracture characterization during Phases I and II will be as follows:

- Borehole video camera for those wells for which depth measurements are inconsistent with construction depth;
- Temperature/fluid resistivity (combined run);
- Acoustic televiewer and/or Borehole Imaging Photograph System (BIPS) (depending on borehole fluid conditions);
- Heat pulse flowmeter (under static and pumped conditions)

The information gathered from the borehole geophysical surveys will be used to refine the site conceptual model regarding a description of flow within the underlying leaky, multi-unit fractured bedrock aquifer (Michalski and Britton, 1997). Description of flow gradients (and contaminant movement) through a fractured medium requires information on the primary permeability of the rock matrix and the secondary permeability created by the network of fractures, cracks, joints, solution cavities, and bedding plane discontinuities. Primary permeability of the bedrock lithology will also be determined via in-situ pressure "packer" tests, and through step rate pump and constant rate pumping tests, refer to Section 8.9 for details pertaining to aquifer testing.

The aforementioned suite of borehole geophysical techniques will provide the necessary to determine orientation of fractures and those fractures that produce the greatest amount of water. This information will be used to help determine the appropriate depth for the proposed bedrock monitoring wells.

8.6 GEOPROBE® INVESTIGATION

Groundwater and soil samples will be collected from 86 Geoprobes® located throughout the FMSS (Figures 8-2A, 8-2B, and 8-2C).

Thirty-nine Geoprobes® will be advanced as part of "transects" located in and around the MISS. The soil and groundwater samples collected from these Geoprobes® will be used in combination with existing soil and groundwater data to determine the nature and extent of COCs in the vicinity of the MISS.

The remaining 47 Geoprobes® will be advanced as individual sample points located throughout the FMSS. The samples collected from these Geoprobes® will be used to evaluate the potential presence and concentration of COCs in the soil and groundwater, and for use in developing "cut lines and soil volume calculations" as part of the PDI.

The specific Geoprobe® soil and groundwater sampling procedures are described in the CDQMP. The 39 transect Geoprobes® will be advanced as part of the Phase I activities. The 47 individual Geoprobes® will be conducted concurrent with the PDI field investigation tasks.

The groundwater samples obtained from the Geoprobes® will provide a preliminary screening of the groundwater quality. This information will be used to modify the proposed locations of the monitoring wells to be installed as part of the Phase II activities. In general, the soil samples collected from the Geoprobes® will be used to determine the presence of residual contamination and broaden the stratigraphic record across the FMSS.

Ten Transects (A through J) each consisting from two to six Geoprobes® will be advanced (Figures 8-2A, 8-2B, and 8-2C). The specific objective of each transect is provided below.

- **Transect A** is located on the MISS in the vicinity of Building 76. Soil samples collected from Test Pit 5 located adjacent to Building 76 verified the presence of benzene and toluene at concentrations of 380 mg/kg and 73,000 mg/kg, respectively. Five Geoprobes® are proposed along Transect A for the collection of soil and groundwater samples. Chemical analysis of these samples will provide the information to evaluate the contaminant contribution of these aromatic VOCs, any potential residual contamination, and/or free phase product in the vicinity of Building 76. This information will also be used to determine if a source of aromatic VOCs are present on the MISS.
- **Transect B** is located on Park Way. Four Geoprobes® are included along Transect B. These Geoprobes® cover the portion of Park Way that is aligned perpendicular to the direction of groundwater flow. The Transect B Geoprobes® will be used to evaluate the nature and extent of contamination detected in the hydraulically upgradient monitoring well clusters B38W14 and B38W15.

- **Transect C** is located to the east of the Saddle River. Three Geoprobes® are included along Transect C. The number and spacing of the Geoprobes® at this location provides adequate areal coverage to evaluate the groundwater quality at the most hydraulically downgradient area of the FMSS, as well as the furthest downstream area of Westerly Brook. The samples collected from the Transect C Geoprobes® will be used to evaluate the overburden groundwater quality in the vicinity of the Saddle River and Westerly Brook. Previous investigations have suggested that a vertical upward gradient exists from the bedrock aquifer to the overburden. It is expected that this gradient will be more significant near a regional groundwater discharge point, such as the Saddle River.
- **Transect D** is located on High Street. Four Geoprobes® are located along Transect D. The Transect D Geoprobes®, in combination with the Transect G Geoprobes®, provide effective areal coverage to evaluate the groundwater quality hydraulically downgradient from the Sears parking lot. Current surface gamma survey indicate the presence of radiological contamination in areas of the Sears parking lot. Therefore, it is possible that FUSRAP waste may be commingled with contamination associated with the drums.
- **Transect E** is located adjacent to the western boundary of the MISS. Six Geoprobes® are located along Transect E. The Transect E Geoprobes® will provide appropriate areal coverage to evaluate the groundwater quality at the most hydraulically downgradient portion of the MISS and adjacent to Westerly Brook. Soil samples collected from these Geoprobes® will be used to evaluate the potential presence of residual contamination in the vicinity of the former retention ponds.
- **Transect F** is located within the Sears parking lot. Five Geoprobes® are located along Transect F. The number and spacing of the Geoprobes® at this location provides adequate areal coverage to evaluate the soil and groundwater quality in the vicinity of the Sears parking lot. The Transect

F Geoprobes® will be used to evaluate the groundwater quality in the vicinity of buried drums located beneath the Sears parking lot where current surface gamma survey indicate the presence of radiological contamination. Soil samples will also be collected to evaluate the potential presence of residual contamination in the soil. Current surface gamma survey indicate the presence of radiological contamination in areas of the Sears parking lot. Therefore, it is possible that FUSRAP waste may be commingled with contamination associated with the drums.

- **Transect G** is located on Midland Street. Four Geoprobes® are located along Transect G. The Transect G Geoprobes®, in combination with the Transect D Geoprobes®, provide effective areal coverage to evaluate the groundwater quality hydraulically downgradient from the Sears parking lot. Current surface gamma survey indicates the presence of radiological contamination in areas of the Sears parking lot. Therefore, it is possible that FUSRAP waste may be commingled with contamination associated with the drums.
- **Transects H and I** are located adjacent to the Westerly Brook in the vicinity of the Ballod property. Two Geoprobes® are located along each of these Transects. These Geoprobes® are located on either side of the Westerly Brook pipe. However, their locations may be changed based upon the findings of the video-inspection. The Transects H and I Geoprobes® will be used to evaluate the groundwater quality in the vicinity of the Westerly Brook. Soil samples will also be collected to evaluate the potential presence of residual contamination in the soil.

- **Transect J** is located north of the MISS on the New York Susquehanna and Western Railroad property. Four Geoprobes® are located along Transect J. The Transect J borings provides effective areal coverage to evaluate whether contamination from hydraulically upgradient sources (such as Dixo Co., Inc., or the autobody/auto repair facilities located off of

West Central Avenue, as identified in Section 1) may have impact on the groundwater quality flowing onto the MISS, or via storm water runoff or direct discharges to Westerly Brook, which as noted previously flows through the northern and western portions of the MISS as a culverted brook.

Soil samples will be collected from 24 of the 39 Transect Geoprobes® (i.e., from Geoprobes® along transects A, E, F, H, I, and J). These 24 Geoprobes® are located in areas where there are data gaps in existing data in terms of either stratigraphy or environmental quality in the soil or groundwater. Similarly, there is a lack of chemical data necessary to determine if upgradient sources may be impacting groundwater flowing onto the MISS/FMSS. Two soil samples will be collected based on field screening methods from each of the 24 Geoprobes®. Soil samples will be collected continuously using a four-foot long macro sampler. Soil headspace VOC, radiological, and visual field screening methods will be used to select soil samples for in field (mobile) and fixed base laboratory analyses. Soil core intervals exhibiting elevated VOCs, radiation, and/or unnatural staining will be selected for sampling. Additional soil samples may be collected from an individual boring at the discretion of the field geologist if unusual or significant contamination is observed. This sampling strategy will provide a vertical delineation of the soil quality at each Geoprobe® location.

With the exception of Geoprobes obtained from Transects A, E, H, I, and J, each soil sample will be analyzed for the following: RCRA 8 metals; lithium; boron; and rare earth elements by an off-site laboratory. Similarly, two soil samples from each Geoprobe will be analyzed by the on-site mobile laboratory for radiological parameters (soils/sediment). These analyses will include U^{238}, Th^{232}, and Ra^{226}, which are the isotopes identified as the radiological constituents of concern in the Baseline Risk Assessment (BRA). In accordance with the CDQMP, 10% of all soil samples submitted to the on-site (mobile laboratory) for radiological analysis will be sent to the off-site laboratory for confirmational analysis. Similarly, 10% of all samples submitted to the off-site laboratory for chemical and radiological analyses (waters only) will be submitted to an USACE approved outside laboratory for confirmational analysis. These samples will be analyzed for the following radiological parameters: Total Uranium (U^{238}, U^{235}, U^{234}); Th^{232}; Th^{230}; Ra^{226}; and Ra^{226}. In addition to these analyses, soil samples collected from Transects A, E, H, I, and J will be analyzed for TCL VOCs in order to determine the extent of residual soil contamination associated on the MISS (Transects A and E), Ballod property (Transects H and I) and hydraulically upgradient of the MISS with respect to overburden flow (Transect J).

Temporary microwells (less than 1-inch diameter) will be installed within the Geoprobes® to facilitate the collection of groundwater samples. Two groundwater samples will be collected via peristaltic pump, Waterra inertia pump, or micro-bailer in the case of VOCs from each of the 39 Geoprobes® located within the Transects, if possible. The first sample will be collected from the top of the overburden aquifer, at the water table. The second sample will be collected from the bottom of the overburden aquifer, immediately above the bedrock contact. However, if the top to bedrock is relatively shallow, and the saturated thickness of the overburden aquifer is 10 feet or less, than only only the shallow groundwater sample will be collected. Groundwater samples from each Geoprobe® will be analyzed for filtered RCRA 8 metals, filtered rare earth elements (REE), and unfiltered radiological parameters. Similarly, 10% of the RCRA 8 metals including lithium and boron will be collected in replicate and analyzed for total (unfiltered) metals. All attempts will be made in the field to minimize the suspension of sediments while collecting Geoprobe® groundwater sample. This includes pumping the Geoprobe® sampler at a reduced flow rate. Typical flow rates will be in the 250 mL/min to 500 mL/min range. However, given the potential for a high level of turbidity, samples requiring metals analysis will be filtered in the field using a 0.45 μm filter. If samples are excessively turbid, it may be necessary to place the samples in a centrifuge prior to filtration. In addition to the above mentioned suite of analytical parameters, groundwater samples obtained from Transects A, E, H, I, and J will be analyzed for TCL VOCs.

Forty-seven individual Geoprobe® are located throughout the FMSS (Figures 8-2A, 8-2B, and 8-2C). These Geoprobes® locations are the same as the Geoprobes® identified as "environmental borings" in the PDI. These Geoprobes® are located in areas where there are gaps in the existing database in terms of the environmental quality of the soil and groundwater. Further, these locations provide aerial coverage throughout the FMSS. Approximately five percent of the soil samples collected as part of the PDI investigation will be used for assessing facility disposal requirements. The soil samples with the highest concentration of radiological contamination (determined by on-site analysis) will be submitted to the USACE approved off-site laboratory for the following analyses: Target Compound List (TCL) volatile organic compounds (VOCs); semi-volatile organic compounds (SVOCs); pesticides; polychlorinated biphenols (PCBs); Target Analyte List (TAL) metals including total cyanide; chromium speciation (hexavalent, trivalent); rare earth elements; full RCRA characteristics (ignitability, corrosivity, reactivity); and full TCL/TAL parameters by the toxicity characteristic leaching procedure. In accordance with the CDQMP, 10% of all soil samples submitted for analysis will be sent to an USACE approved outside laboratory for replicate radiological analysis.

One groundwater sample will be collected from each of the 47 Geoprobes® conducted as part of the PDI field investigation. Following soil collection, each Geoprobe® will be advanced to the water table to collect a groundwater sample. Each groundwater sample will be analyzed for filtered RCRA 8 metals including lithium and boron, filtered rare earth elements, and unfiltered radiological parameters. Similarly, 10% of the RCRA 8 metals and lithium and boron will be collected in replicate and analyzed for total (unfiltered) metals. If as a result of field screening, the possibility of volatile organic compounds are present in groundwater, a decision will be made with the USACE to submit a sample for VOC and potentially SVOC analysis. All attempts will be made in the field to minimize the suspension of sediments while collecting the Geoprobe® groundwater sample. This includes pumping the Geoprobe® sampler at a reduced flow rate. Typical flow rates will be in the 250 mL/min to 500 mL/min range.

However, given the potential for a high level of turbidity, samples requiring metals analysis will be filtered in the field using a 0.45 μm filter. If samples are excessively turbid, it may be necessary to place the samples in a centrifuge prior to filtration.

8.7 MONITORING WELL INSTALLATION

Monitoring wells will be installed for the purpose of collecting groundwater samples for chemical analysis, for measuring groundwater elevations to estimate the direction of groundwater flow and velocity; for conducting aquifer testing to estimate aquifer characteristics; and to determine the extent of horizontal and vertical extent of contamination. Forty (40) new monitoring wells are proposed as part of the Phase II field activities.

The 40 new monitoring wells will include 20 overburden wells and 20 shallow bedrock monitoring wells (Figure 8-3A and 8-3B). The actual locations of the monitoring wells will be based upon observations made during the surface features survey (Section 8.3.1), results of the geophysical investigations (VLF and borehole (Section 8.5)), and the Geoprobe® investigation (Section 8.6). Efforts will be made to install the monitoring wells on sidewalks or township streets rather than private property. The rationale for the placement of the 40 new monitoring wells is provided in Table 8-3. Presently, USACE does not have access to existing monitoring wells installed by Stepan, (refer to Figure 8-1A), therefore, proposed monitoring wells may be installed in close proximity to monitoring wells installed by others. If prior to installing the monitoring wells, access is granted by Stepan, consideration will be made to relocate a monitoring well cluster.

8.7.1 Overburden Monitoring Well Installation

The 20 overburden monitoring wells, MW-1 through MW-20, are tentatively located in residential areas of Maywood, Rochelle Park and Lodi (Figures 8-3A and 8-3B)

The actual number, location, and construction of these wells will be determined based upon the results of the Phase I investigation results.

The installation of each overburden monitoring well will occur in three steps. The initial step consists of drilling a soil boring using a truck-mounted auger rig, or potentially a cable tool rig/churn rig. USACE is currently evaluating the best suited drilling method for installing overburden monitoring wells. However, for the purpose of this discussion, it will be assumed that the overburden monitoring wells are being installed using a Hollow Stem Auger (HSA) drilling technique.

Nominal 8 1/4-inch outside diameter continuous-flight HSAs will be used to advance the augers. Continuous soil core samples will be collected while drilling. However, if attempts to obtain continuous soil core samples are not successful, soil samples will be collected at 5-foot intervals using a 2-foot long, 2-inch outside diameter split-spoon sampler.

Following borehole completion, a 2-inch diameter 10-slot polyvinyl chloride (PVC) screen, or material deemed appropriate for site groundwater such as stainless steel will be installed within the borehole. A filter pack of appropriate sand gradation will be emplaced around the well screen and will terminate approximately 2 feet above the top of the well screen. A bentonite seal consisting of granular or pellitized bentonite chips will be emplaced above the sand pack. The bentonite seal will subsequently be hydrated. Above the bentonite seal will be a cement-bentonite slurry. This slurry of appropriate density will be set to within 2 feet of grade where either a road box or protective outer casing will be set into the concrete. Monitoring well installation will be in accordance with the method outlined in the CDQMP. Finally, the installed monitoring well will be developed to prepare the well for measuring water levels and groundwater sampling. Monitoring well development procedures are described in Section 8.7.3 of this GWRIWP. Groundwater sampling procedures are provided in Section 8.9.

One soil sample from each overburden monitoring well boring will be collected from the unsaturated (vadose) zone for analysis of radiological parameters by the mobile laboratory, this consist of analysis for Ra-226, Th-232, and U-238, and TAL metals, lithium and boron. Also, a soil sample obtained from proposed overburden monitoring wells MW-1 through MW-12, MW-19, and MW-20, all located north of Essex Street, refer to Figure 8-3A and 8-3B, will be analyzed for TCL VOCs. The depth for which this sample will be obtained will be based on field screening instruments and visual inspection of the sample. Similarly, a soil sample from the saturated zone of each overburden boring will be collected and analyzed for the following geophysical parameters: grain size distribution including hydrometer analysis, total organic carbon (TOC), soil bulk density, particle density, soil pH, moisture content, and cation exchange capacity (CEC). The results of these analyses will be used in the fate and transport analysis.

8.7.2 Shallow Bedrock Monitoring Well Installation

The installation of 20 bedrock monitoring wells is planned (Figures 8-3A, 8-3B and 8-3C) as outlined in Table 8-3. The 20 shallow bedrock monitoring wells, identified as MW-1D through MW-20D, will be approximately 50 feet deep or will be at depths comparable to the existing bedrock monitoring wells. The actual depths will be determined from the findings of the Phase I borehole geophysical survey. The proposed method for the shallow bedrock well installation will be a combination of HSA and water rotary drilling methods. Anticipated changes in the drilling procedures will be discussed with the USACE prior to implementation. Investigation derived wastes will be containerized and transported to the MISS for temporary storage pending characterization and final disposal at a permitted facility.

The shallow bedrock monitoring well borings will be advanced through the overburden to the top of competent bedrock with a truck-mounted drill rig using nominal 8-inch inside diameter continuous-flight HSAs. Since bedrock monitoring wells are being installed as pairs with overburden monitoring wells, soil samples will not be collected.

A nominal eight-inch diameter steel casing will be installed and seated into the top of the bedrock surface. A nominal eight-inch diameter borehole will be advanced a minimum of 10 feet into competent bedrock using water rotary drilling methods and a six-inch diameter steel casing or casing material compatible with the quality of the groundwater, will be advanced and seated into the competent bedrock. The six-inch diameter casing will be grouted in place and allowed to set for 24 hours. A nominal four-inch diameter borehole will be advanced using water rotary drilling methods to a depth of approximately 50 feet after the casing has set for 24 hours. Upon completion of the drilling, the borehole geophysical survey will be completed as described in Section 8.5.2. The shallow bedrock monitoring wells will be completed as open-hole monitoring wells. However, if the necessity exists for the open-hole to exceed 25 feet, then the bedrock monitoring well will be completed using a well screen and riser, of appropriate slot size and composition. Information regarding bedrock strike and dip, and fracture orientation, as obtained from Phase I activities will be used to determine the appropriate depth for completing the bedrock monitoring well.

8.7.3 Monitoring Well Development

Development of wells will be conducted to remove fines and create optimum hydraulic connection between the well screen and surrounding filter sand pack. Development will be in accordance with procedures outlined in the CDQMP.

Monitoring wells will be developed using a submersible pump. Acids or dispersing agents will not be used. Development will begin no earlier than 24 hours following well completion to allow the bentonite seal and bentonite grout to cure. Development may begin prior to installation of the protective surface casing and concrete pad.

Determination of monitoring well development completion will be dependent upon stabilization of field parameters, removal of water used in well installation, and the turbidity of the discharge water. As monitoring wells are developed, field parameters (i.e., conductivity, pH, and temperature) will be monitored. Development will continue until the water quality parameters have stabilized to within 10 percent and turbidity level of 50 NTUs (nephelometric turbidity units) or less. A minimum of at least three borehole volumes of water plus five times the volume of water lost during drilling, if any, will be removed, containerized, and transported to the MISS for characterization and final disposal at a permitted facility.

8.8 GROUNDWATER SAMPLING

Two rounds of groundwater samples will be obtained. The first round will consist of groundwater samples collected from the 41 existing monitoring wells. The actual number of wells that will be sampled will be dependant on the results of the well integrity investigation (Section 8.3.4). The second round of groundwater samples will consist of collection of groundwater samples from the 41 existing wells and 40 newly installed monitoring wells located within the FMSS to monitor groundwater quality and establish baseline data for potential contaminants. The newly installed monitoring wells will be sampled a minimum of two weeks after the completion of well development. Prior to sample collection, a synoptic round of groundwater level measurements will be obtained. The groundwater samples will be collected following the protocol described in the CDQMP. This procedure follows the guidance provided in the USEPA Region II memo date March 20, 1998 titled *Final USEPA Region II Low Stress (Low Flow) Groundwater Sampling Standard Operating Procedure* (Appendix F).

All attempts will be made in the field to minimize the suspension of sediments while collecting the groundwater samples. This includes minimzing well drawdown and pumping at a reduced flow rate in accordance with the SOP. Typical flow rates will be in the 250 mL/min to 400 mL/min range.

The groundwater samples obtained from the Phase I Groundwater Sampling Program (41 existing monitoring wells) will be analyzed for unfiltered RCRA 8 metals including lithium and boron, unfiltered radiological parameters, and unfiltered rare earth elements. In addition, measurements of the following field parameters will be recorded: pH, turbidity, specific conductance, temperature, dissolved oxygen, Eh, ferrous iron, and alkalinity.

The second round of groundwater samples will consist of sampling the existing 41 monitoring wells, and the 40 proposed monitoring wells. Groundwater samples obtained during this second round will be analyzed for unfiltered TAL metals, lithium and boron, unfiltered radiological parameters, unfiltered rare earth elements and geochemical parameters. In addition, all existing and proposed monitoring wells with the exception of the 5 well clusters located south of Essex Street (MW-14/MW-14D through MW-18/18D) will be analyzed for TCL VOCs. The exclusion of TCL VOCs in these well clusters are due primarily to the westerly component of groundwater flow, and the lack of chlorinated VOCs detected in monitoring wells sampled within the MISS and on Stepans property. However, if while installing these monitoring wells detectable levels of VOCs are detected on field instruments, then USACE will consider collecting groundwater samples from these wells for TCL VOCs. In addition to the radiological/chemical/geochemical parameters, the following field parameters will be recorded: pH, turbidity, specific conductance, temperature, dissolved oxygen, Eh, ferrous iron, and alkalinity.

8.9 AQUIFER TESTING

Three types of aquifer tests will be conducted: In-situ permeability tests (i.e., slug tests), packer tests and aquifer pumping tests. Slug tests will be performed on a selected number of existing and newly installed monitoring wells representative of site conditions. Similarly, packer tests will be performed on a selected number of existing and newly installed open hole bedrock monitoring wells. Aquifer pumping tests will be conducted using one newly installed overburden well and one newly installed bedrock monitoring well. The number of observation wells used during the pumping tests will be based on hydraulic calculations using regional data and data generated from the slug tests. Prior to conducting a full scale pump test, an eight hour aquifer step-drawdown test will be conducted to determine optimum pumping conditions for the full scale pump test. The purpose of the pump tests is to determine aquifer hydraulic characteristics including interconnectivity of bedrock fractures and then input this data into a three dimensional contaminant fate and transport flow model, if fate and transport modeling is necessary. Slug tests and packer tests will provide supplemental data in support of the aquifer tests. The spatial distribution of monitoring wells will allow an order of magnitude estimation of hydraulic properties throughout the FMSS in addition to and in support of the aquifer tests.

The procedures for conducting slug tests, packer tests and aquifer pumping tests are provided in the CDQMP. In general, a 4 to 6 hour step drawdown test will be performed in both the overburden and bedrock aquifers separately. Pumping rates will be increased successively, during each "step" which may run for 1-1.5 hours or until stabilization occurs. Approximately 4 different pumping steps (i.e., pumping rates) will be employed during the test. Information obtained from the step drawdown test will be used to determine general aquifer characteristics such as hydraulic conductivity and transmissivity, however storativity cannot be determined from this test. Furthermore, information obtained from this test will be used to determine the appropriate pumping rate for a full scale 48 to 72 constant rate pumping test which will also be performed in both the overburden and shallow bedrock aquifers.

Appropriate aquifer testing software such as AQUITEST (Waterloo Hydrogeologic, Inc.) or AQTESOLV (Geragphty & Miller, Inc.) which used analyses methods such as Birsoy-Summers or Cooper-Jacobs for analysis of step drawdown data, or the Theis or Newman method for analysis of constant rate pumping test data will be utilized to determine aquifer hydraulic properties. However, prior to initiating the preparation of the aquifer step drawdown/full scale pump test, a pump test work plan will be submitted to the regulators for an informational review.

8.10 SEDIMENT SAMPLING

During Phase II activities, twenty-seven sediment samples will be collected from the four surface water bodies within the FMSS: Saddle River, Westerly Brook, Coles Brook, and Lodi Brook (Figures 8-4A, 8-4B, and 8-4C). In addition, three sediment samples will be collected from an unnamed drainage swale located north of the New York Susquehanna and Western Railroad, north of the MISS and east of Route 17. At certain locations where Westerly Brook and Lodi Brook flow through the subsurface concrete pipes, access to the sediment can only be gained through manholes. The actual sediment sample locations in Westerly Brook may be further biased towards turns in the pipe, since a greater accumulation of sediment is expected at these areas. Therefore, the actual number of the sediment sample locations will be determined based upon the results of the Phase I video inspection activities.

The sediment samples will be collected in accordance with the CDQMP. At each location where the drainage is natural (i.e., there is no pipe present), sediment samples will be obtained using a stainless steel hand-auger assembly (with stainless steel liners) or hand-pushed stainless steel liners. The hand-auger will be decontaminated between each sample location. Samples will be collected from the sediments underlying the surface water to a depth between 0.5 and 1-foot. Either one 12-inch long or two 6-inch long liners will be used per location. The 0 to 0.5-foot portion of the sample will be marked on the outside of the 12-inch long liners for proper sample extraction at the laboratory.

At each location within the drainage pipe, sediment samples will be collected using stainless steel trowels or scoops. The sediment will be transferred into the appropriate sample containers for submittal to the laboratory.

Each sediment sample will be analyzed for TAL metals, lithium and boron, radiological parameters and rare earth elements.

8.11 SURFACE WATER SAMPLING

Twenty-seven surface water samples will be collected from four surface water bodies within the FMSS: Saddle River, Westerly Brook, Coles Brook and Lodi Brook (Figure 8-4A, 8-4B, and 8-4C). In addition, three surface water samples will be collected from an unnamed drainage swale located north of the New York Susquehanna and Western Railroad, north of the MISS and east of Route 17. At certain locations where Westerly Brook and Lodi Brook flow through the subsurface concrete pipe access to the surface water can only be gained through manholes. Therefore, the actual number and location of the surface water samples will be determined based upon the results of the Phase I video inspection activities.

The surface water samples will be collected in accordance with the CDQMP. Surface water samples will be collected before obtaining sediment samples at each location. Samples will be collected by immersing the appropriate sample container into the surface water bodies.

In the smaller streams (Westerly Brook, Coles Brook, Lodi Brook, and the unnamed drainage swale) surface water samples will be collected with the opening of the sample bottle facing upstream, avoiding floating debris. Surface water locations will be sampled in order from the most downstream to the most upstream locations to minimize the impact of sampling-related turbidity and potential cross-contamination from upstream to downstream locations. Each surface water sample will be analyzed for RCRA-8 metals (unfiltered), radiological parameters, lithium, boron, rare earth elements, and hexavalent chromium (Cr^{+6}). In addition, the collected surface water samples will be analyzed in the field for pH, turbidity, specific conductance, temperature, and dissolved oxygen.

8.12 BATCH SORPTION (SOIL DISTRIBUTION) TESTS

Soil samples collected from five locations containing elevated levels of surface or subsurface gamma counts and that represent differing stratigraphic lithologies will be submitted for batch sorption (soil distribution (K_d)) tests. It is presently anticipated that the samples will be collected from locations indicating elevated levels of gamma counts. Sample locations will be determined based on the results of soil samples obtained during the Phase I Geoprobe assessment. The purpose of the batch sorption tests are to determine whether several of the metals (arsenic, chromium and lithium) and radiologic constituents (Ra-226, Th-232, and U-238), identified as contaminants of concern (COCs) have the potential to "sorb" to site soils or are readily leachable.

The batch sorption tests will be conducted in accordance with ASTM Method D-4646, refer to Appendix G. The method will be modified to meet the objective(s) of the project. As outlined in the ASTM method, the soil will be placed in a solution containing a known concentration of the COC, the sample will be shaken and allowed to equilibrate with the soil for approximately 24 hours. The equilibrium extract and soil matrix will subsequently be tested for the contaminants of concern. In order to define the contaminants isotherm, individual soil aliquots will be "spiked" with varying concentrations of a known amount of COC.

A plot of equilibrium concentration (x-axis) versus amount sorbed to the soil matrix (y-axis) is plotted in order to define the isotherm. The slope of the isotherm is the distribution coefficient (K_d).

It is presently anticipated that distribution tests will be conducted with a pH representative of acid rain (pH approximately 4.5). Values of K_d determined from the tests will be compared to literature values. In addition to the chemical tests, selected soil samples will be analyzed for moisture content, bulk density, particle density, grain size distribution and total organic carbon. These parameters in addition to the site-specific K_d values will be used as input parameters to the vadose zone leaching model.

8.13 SURVEY

Each sample point (i.e., new and existing monitoring wells, Geoprobes®, surface water and sediment samples, and geophysical transects) will be surveyed by a New Jersey licensed surveyor. The survey will be tied into the benchmarks and monuments established for the FUSRAP FMSS. These are:

- Benchmark elevation will be based on National Geodetic Vertical Datum (NGVD) 1929; and
- Horizontal controls will be based on the North American Datum (NAD) 1927.

9.0 ON-SITE SAMPLE ANALYSIS

As part of the GWRI investigation, several in-field geochemical parameters will be collected and used in tandem with mobile or fixed base chemical and radiological data in order to determine the behavior and fate/transport of COCs. The in-field parameters will typically be collected during the groundwater and surface water sampling programs. Results of the on-site sample analysis will be recorded in the field logbooks. The proposed field analyses for both of these media are provided below.

9.1 GROUNDWATER

Groundwater samples will be analyzed onsite during several field investigation activities. These activities include Geoprobe® sampling, monitoring well development, and groundwater sampling. During Geoprobe® sampling activities, groundwater samples will be analyzed for pH, specific conductance, temperature, and dissolved oxygen. During monitoring well development, the groundwater discharge will be analyzed for pH, specific conductance, temperature, and turbidity. During groundwater sampling, the groundwater will be analyzed for pH, specific conductance, temperature, turbidity, dissolved oxygen, Eh (redox potential), ferrous iron (Fe^{2+}), and alkalinity (as $CaCO_3$). Similarly, prior to collection of groundwater samples, monitored in-situ parameters will be recorded and upon stabilization of these parameters in accordance with the EPA Region II Low Stress (Low Flow) Purging and Sampling SOP, groundwater samples will be collected.

9.2 SURFACE WATER

Surface water samples will be collected from the Saddle River, Westerly Brook, Lodi Brook, Coles Brook, and an unnamed drainage swale north of the New York Susquehanna and Western Railroad. These samples will be analyzed onsite for pH, turbidity, specific conductance, temperature, dissolved oxygen, Eh (redox potential), ferrous iron (Fe^{2+}), and alkalinity (as $CaCO_3$).

10.0 OFF-SITE SAMPLE ANALYSIS

As part of the GWRI investigation, soil/sediment, surface water and groundwater samples will be collected and submitted to a mobile and fixed base laboratories for chemical and radiological analyses. Presently, Safety and Ecology Corporation (SEC) will provide USACE with mobile laboratory capabilities and testing for radiological parameters (Ra-226, Th-232, and U-238) in soil and sediment media. All other chemical parameters specified in Sections 4 and 8 will be performed by an off site fixed base laboratory. Presently, ThermoNutec, Inc., Oak Ridge, TN., and RECRA Environmental, Inc., Lionsville, PA will perform radiological and chemical analyses, respectively. The procedures will involve the analyses of groundwater, surface water, soil, and sediment. The proposed laboratory analyses for each of these sample media is provided below.

10.1 GROUNDWATER

Groundwater samples will be collected from Geoprobes® and monitoring wells existing and proposed for installation during the field investigation. The groundwater samples collected during the Geoprobe® and sample investigation will be analyzed for the following parameters:

- TCL VOCs (Transects A, B, C, E, H, I and J);
- RCRA 8 Metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver) (field filtered);
- TAL metals Phase II groundwater sampling program;
- Radiological parameters: total uranium, ^{228}Ra, ^{226}Ra, ^{228}Th, ^{230}Th, and ^{232}Th;
- Rare earth elements (REE): cerium (Ce), dysprosium (Dy), lanthanum (La), neodymium (Nd) and Yttrium (Yt);
- Lithium and boron.

Groundwater samples collected during the Phase I groundwater sampling program will be analyzed for the following parameters:

- RCRA 8 Metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver) (unfiltered);
- Radiological parameters: total uranium, ^{228}Ra, ^{226}Ra, ^{228}Th, ^{230}Th, ^{232}Th;
- REE: Ce, La, Dy, Nd, Yt;
- Lithium and boron;

Groundwater samples collected during the Phase II groundwater sampling program will be analyzed for the following parameters:

- TCL VOCs (w/exception of well clusters MW-14/14D through MW-18/18D);
- TAL Metals (unfiltered);
- Radiological parameters: total uranium, ^{228}Ra, ^{226}Ra, ^{228}Th, ^{230}Th, ^{232}Th;
- REE: Ce, La, Dy, Nd, Yt;
- Lithium and boron;
- Geochemical parameters (e.g., silica, calcium, magnesium, sodium, potassium, sulfate, hexavalent chromium [Cr^{6+}], chloride, fluoride, nitrate, phosphate, dissolved organic carbon, methane, and total dissolved solids).

10.2 SURFACE WATER

Surface water samples will be collected from the Saddle River, Westerly Brook, Lodi Brook, Coles Brook, and an unnamed drainage swale north of the New York Susquehanna and Western Railroad. These samples will be analyzed for the following parameters:

- TAL Metals (unfiltered);

- Radiological parameters: total uranium, ^{228}Ra, ^{226}Ra, ^{228Th}, ^{230}Th, and ^{232}Th;
- Rare Earth Elements: Ce, La, Dy, Nd, Yt
- Lithium and boron;
- Cr^{6+}, total dissolved solids.

10.3 SOIL

Soil samples will be collected during Geoprobe® sampling. During Phase I of the Geoprobe® sampling program, selected soil samples will be collected and analyzed for the following parameters:

- TCL VOCs via Encore Sampler (Transects A, E, H, I, and J);
- RCRA 8 Metals;
- Radiological parameters: ^{238}U, ^{226}Ra, and ^{232}Th*;
- Rare Earth Elements: Ce, La, Dy, Nd; Yt.
- Lithium and Boron.

Geoprobes® advanced to support the PDI (i.e., environmental borings) will be analyzed for the following parameters:

- Full TCL parameters, which include VOCs, SVOCs, pesticides/PCBs, TAL metals including chromium speciation, and cyanide;
- RCRA disposal parameters (TCLP for full TCL/TAL parameters, ignitability, corrosivity, and reactivity);
- Radiological parameters: ^{226}Ra, ^{232}Th, ^{238}U;*
- Rare Earth Elements: Ce, La, Dy, Nd; Yt;
- Lithium and Boron.

During the advancement of the 20 monitoring well clusters, a soil sample from the vadose zone will be analyzed for the following chemical/radiological analyses:

- TCL VOCs via Encore Sampler (MW-1 through MW-13, MW-19, and MW-20);
- TAL Metals;
- Radiological parameters: ^{238}U, ^{226}Ra, and ^{232}Th*;
- Lithium and Boron.

Similarly, at each of the proposed monitoring well locations, a soil sample obtained from the vadose (unsaturated) zone will be collected and analyzed for the following physical and chemical parameters to support a vadose zone leaching model:

- Total organic carbon;
- Soil pH;
- Specific Gravity;
- Dry Bulk density;
- Cation exchange capacity (CEC);
- Moisture content; and
- Grain size distribution (including silt/clay content fraction by hydrometer).

Soil samples collected for batch sorption (soil distribution) tests will analyzed for a reduced number of parameters including:

- Arsenic, chromium, lithium;
- Radiological parameters: ^{238}U, ^{226}Ra, and ^{232}Th;
- Moisture content;
- Dry Bulk Density;
- Grain Size Distribution (including hydrometer fraction); and
- Total Organic Carbon.

*Note that 10 percent of all radiologic samples analyzed by the on-site mobile laboratory will be analyzed in replicate by a fixed-based laboratory and analyzed for total uranium, ^{228}Ra, ^{226}Ra, ^{228}Th, ^{230}Th, and ^{232}Th.

10.4 SEDIMENT

Sediment samples will be collected from the Saddle River, Westerly Brook, Lodi Brook, Coles Brook, and an unnamed drainage swale north of the New York Susquehanna and Western Railroad. Sediment samples collected from each of these locations will be analyzed for the following parameters:

- TAL Metals;
- Radiological parameters: ^{226}Ra, ^{232}Th, ^{238}U*;
- Rare Earth Elements: Ce, La, Dy, Nd; Yt;
- Lithium and Boron.
-

*Note that 10 percent of all radiologic samples analyzed by the on-site mobile laboratory will be analyzed in replicate by a fixed-based laboratory and analyzed for total uranium, ^{228}Ra, ^{226}Ra, ^{228}Th, ^{230}Th, and ^{232}Th.

11.0 DATA VALIDATION

Samples collected at the FMSS will be analyzed for selected parameters according to the methods listed in Appendix A of the Maywood CDQMP. USEPA SW-846 protocols. Validation will be accomplished by comparing the contents of the data packages including quality assurance/quality control (QA/QC) results to the requirements contained in the analytical methods and the validation guidelines provided in the USACE Data Quality Evaluation Guidelines (See Appendix G of the CDQMP QAPP) and USACE Radionuclide Data Quality Evaluation Guidance. All validation will be performed by certified data validators in accordance with any applicable protocols.

Several types of samples will be collected for this project including Geoprobe® groundwater samples, monitoring well soil and groundwater samples, surface water samples, and sediment samples. The level of data validation will be as per the USACE guidance cited above.

12.0 DATA EVALUATION

The data collected as part of the field investigations will be organized and analyzed to permit an assessment of the FMSS. The geology and geohydrology of the FMSS and the nature and extent of chemical, non-chemical, and radiological contamination in the media sampled (i.e., groundwater, surface water, soil, and sediment) and exposure pathways will be evaluated. Available historic data will be incorporated into this analysis as appropriate. However, the data evaluation for this GWRI will be conducted independent of any conclusions or interpretations made as part of previous investigations. When possible, and as they become available, the evaluation of new data generated by this investigation will be performed concurrently with field investigations, sample analysis and risk assessment with the goal of more precisely focusing planned GWRI work, potential added work and expeditiously preparing the GWRI. Assessing the data as they are collected will permit early identification of any data gaps and data quality issues that must be addressed prior to completing the GWRI.

The **first phase** of data assessment will be performed to identify potential sources of contamination.

The **second phase**, which is not necessarily sequential, will be performed to evaluate the geology and geohydrology of the FMSS. Data from previous field investigation tasks will be compiled before initiating this second phase assessment. Features such as changes in the topography and surficial preferential pathways identified during the Surface Features Survey will be located on site maps and described to permit correlation with, and impacts to, the geohydrology. Geologic logs from the soil boring and monitoring well installation program and the results of laboratory analyses of the physical characteristics of the soil will be used to construct geologic cross-sections and/or fence diagrams to correlate stratigraphic units across the FMSS.

Water level data collected from monitoring wells and surface water bodies will be entered into a database in tabular format to allow for the comparison of measurements obtained on different dates and calculation of water elevations. Groundwater and surface water elevations will be plotted on site maps and groundwater elevation contours drawn to estimate the direction of horizontal groundwater flow component. Separate contour maps will be constructed for each synoptic water level measurement for overburden and bedrock wells. Flow sections will be constructed to compare shallow and deep water levels and to determine the direction and gradient of vertical groundwater flow transport. The flow sections will be constructed approximately parallel to the flow direction indicated by the potentiometric surface maps.

Pump and slug test data will be downloaded from the data logger used to conduct the tests. The data will then be entered into a computer program to perform one of several accepted analytical methods for pump and slug test data to obtain an order of magnitude estimate of the hydraulic conductivity of the water-bearing interval monitored by each tested well. The computer program used will be subject to approval by the USACE. Data on the hydraulic characteristics of each water bearing zone from each test location will be tabulated and compared to provide an understanding of the average rate of groundwater flow across the FMSS.

The **third phase** of data assessment will be performed to assess the nature and extent of the physical, chemical, and radiological contamination in the various media and exposure pathways at the FMSS. After data validation, groundwater, surface water, sediment and soil analytical results will be entered into the existing database. This will allow comparison of data from samples collected on different dates, at different locations and/or in different media (i.e., groundwater, surface water, soil, and sediment).

Analytical results will also be compared to the USEPA Office of Research and Development Treatability Study Database to determine if a treatability study should be recommended. Contaminant concentrations will be mapped to illustrate their distribution in the groundwater, surface water, soil, and sediment; individual maps will be prepared for discrete stratigraphic units (e.g., overburden, fractured rock, and bedrock). The geochemical properties, including breakdown products of detected contaminants will be considered to help evaluate potential sources and the behavior of contaminants in the environment. Data from the geohydrologic characterization of the FMSS will be integrated with the analytical results of different media to aid in identifying contaminant sources, migration rates and migration routes.

The human population assessment, land use investigation, and environmental assessment will be considered relative to the geohydrologic, radiological and chemical characterization of the FMSS to identify potential receptors. This assessment will permit development of a refined conceptual site model and evaluation in terms of the existing BRA. The results of the data evaluation will be discussed in the GWRI. This information will also be the basis for an FS should the need be indicated which will include development and screening of remedial alternatives, detailed analysis of remedial alternatives, and the feasibility study report.

Compilation of the data collected during each field investigation task in tables, figures, graphs or maps as described above will facilitate review and evaluation. These tables, figures, graphs and maps will be presented in the GWRI. In addition, original data (e.g., validated chemical analyses, geologic boring and well construction logs, physical soil sample analyses and water level and pumping test data) will be presented in appendices to the GWRI.

13.0 CONTAMINANT FATE AND TRANSPORT MODELING

Accurate estimates of groundwater flow and contaminant migration are needed to quantify the human health and ecological risks posed by COCs in groundwater at the Site, and to evaluate remedial alternatives (if warranted). The type of model(s) selected will be predicated on the results of the GWRI and the new Conceptual Site Model (CSM). A three-dimensional numerical model can be developed by the Team to simulate the flow of groundwater and the fate and transport of COCs occurring in groundwater underlying the Site if the hydrogeologic and chemical analytical data warrants such an analysis. An iterative step-wise approach to the modeling will be employed whereby simpler analytical models will be used where appropriate and numerical solutions used only where required to meet the objectives and the data support such an approach. Regardless of the type of model utilized for the fate and transport model, a sensitivity analysis will be performed. The specific objectives of the modeling effort will be to simulate the fate and transport of COCs with sufficient accuracy to:

- Evaluate natural attenuation as a remedial alternative at the Site; and
- Support the full risk assessment.

Although natural attenuation is considered applicable typically to organic based compounds, remediation through natural attenuation (RNA) also considers in a broader sense those compounds that can be retarded (sorption) and reduced in concentration via dispersion/dilution. Therefore, although the mass of the contamination may not be reduced, sorption mechanisms act to keep the contaminant from migrating further, and dispersion/dilution acts to reduce the concentration of the contaminant laterally away from the plumes centerline. Therefore, assessing natural attenuation for radiological constituents and metals is appropriate for this site.

A number of desktop calculations will be made in order to evaluate contaminant fate and transport, and may in several situations suffice as final calculations. These calculations would also be completed prior to implementation of a numerical solute fate and transport model, if a numerical model is deemed appropriate. Typically, the calculations include (but are not limited to) sorption and retardation calculations, solubility calculations, organic-water partitioning calculations, groundwater flow velocity calculations, biodegradation rate-constant calculations, and derivation of dilution factors.

It is anticipated that several analytical codes will be investigated for potential use to perform some of the preliminary calculations. These codes essentially serve as tools for efficiently performing very complex calculations.

Supporting the fate and transport analysis will involve performing an exposure pathways analysis, which is linked to the baseline risk assessment. This analysis includes identifying potential human and ecological receptors at points of exposure under current and future land and groundwater use scenarios. The results of the fate and transport analysis will be central to the exposure pathways analysis. If conservative assumptions are used, then the fate and transport analysis should provide conservative estimates of contaminant migration. From this information, the potential for impacts on human health and the environment from contamination present at the site can be estimated.

The type(s) of model(s) selected for estimating contaminant flow and transport will depend on the specific objectives and the quality and quantity of available site-specific data. Depending on the type of model solution selected, a fate and transport model can predict contaminant concentrations at different locations in the aquifer under different hydrogeologic conditions as a function of time. Therefore, estimates of contaminant mass loading to the rivers and brooks will be possible for enhancing the risk assessment and information on the effectiveness of natural attenuation will be available.

14.0 RISK ASSESSMENT

14.1 INTRODUCTION

Baseline risks have already been established for groundwater, surface water, and sediment in the existing BRA (USDOE, 1993). Thus, the existing BRA will be used as a basis for deriving site-specific, risk-based target levels (RBTLs). RBTLs will be derived for those constituents where either appropriate standards are not available or appropriate standards are not adequately protective of exposure from multiple pathways or to multiple constituents. The Feasibility Study will evaluate laws, regulations, and guidance to determine the ARARs and TBCs that will be used to establish cleanup levels at the Maywood FUSRAP Site. In deriving the RBTLs, the list of COCs and other risk assessment aspects in the BRA will be re-evaluated and updated, as necessary, based on new environmental quality data, new information on potential receptors, and current exposure parameters and toxicological criteria.

The primary focus of this effort will be on groundwater. However, as limited surface water and sediment data will also be collected during the GWRI, consideration will be given to these media as well. All constituents detected in groundwater, surface water, and sediment will be considered for selection as COCs whether they are commingled or not. However, chemicals found not to be site-related may be excluded from further consideration.

14.2 HUMAN HEALTH EVALUATION

The BRA (USDOE, 1993) indicated that worker and resident exposure to groundwater via ingestion resulted in carcinogenic and non-carcinogenic health risks in excess of the USEPA acceptable levels. Therefore, site-specific human-RBTLs will be derived for potential exposure to groundwater. As previously discussed in Section 3.2.3, groundwater exposure scenarios will also include wells used for other than potable purposes (e.g., industrial cooling and lawn care). Exposure of a child to surface water and sediment did not result in carcinogenic or non-carcinogenic health risks in excess of the USEPA acceptable levels.

As a result of the GWRI, potential exposure pathways associated with surface water and sediment will be re-evaluated to determine if other receptors and/or other exposure routes are plausible, which may warrant derivation of human-RBTLs for these media as well.

The derivation of the human-RBTLs will follow guidance contained in the USEPA's Risk Assessment Guidance for Superfund: Volume I Human Health Evaluation Manual (Part B, Development of Preliminary Remediation Goals) (USEPA, 1991a) and other related USEPA guidance.

In order to derive human-RBTLs the following components of the BRA need to be re-evaluated and, as necessary, updated:

- The data evaluation, in which COCs are identified;
- The exposure assessment, in which potential receptors, exposure pathways, and exposure parameters are identified and evaluated; and
- The toxicity assessment, in which toxicological criteria are presented for use in characterizing risks.

14.2.1 Data Evaluation

COCs will be selected based on the existing BRA (USDOE, 1993), historical radiological and chemical data deemed usable and appropriate, and radiological and chemical data collected during the GWRI.

COCs in groundwater, surface water, and sediment will be selected based on: comparison to background levels, nutrient screening concentrations, frequency of detection (i.e., in greater than 5 percent of the samples, with sample sizes of 20 or more); environmental fate, transport, and availability; and carcinogenicity/toxicity.

14.2.2 Exposure Assessment

Potential receptors and exposure pathways have been preliminarily identified in Section 3.2.3. However, these potential receptors and exposure pathways will be revised or eliminated, as necessary, based on new information obtained during the GWRI. The well survey conducted in 1994 will be updated to determine if water supply wells, for any purpose, exist within a 1-mile radius of the FMSS. In addition, exposure parameters such as exposure rates, frequencies, and durations will be re-evaluated and updated, as necessary, based on current guidance and any new information obtained during the GWRI.

Potentially exposed populations will be characterized with the intent of determining whether there is potential for casual contact with or intake of the COCs. This characterization will include profiles of the population demographics at potential points of exposure and identification of human activity patterns that may influence exposure. Under current and future conditions, potential receptors may include construction/utility workers and residents.

All potential exposure pathways will be identified and a rationale will be provided for inclusion or exclusion of each pathway. The potential for incidental contact with groundwater or potential exposure to groundwater during potable, industrial or other uses will be evaluated.

Actual or potential exposure pathways, identified by a source and mechanism of radionuclide/chemical release, an environmental transport medium, a point of potential contact, and an exposure route, will be included in the derivation of the human-RBTLs.

Human-RBTLs that are protective of potential current and future receptors will be derived based on currently available standard assumptions and parameters used to estimate reasonable maximum exposure (RME). These values will provide reasonable estimates of exposure and yet not underestimate exposure. All parameters and assumptions will be documented, where possible, by reference to USEPA guidance and/or the scientific literature.

14.2.3 Toxicity Assessment

The toxicity assessment will be updated to include the most recent toxicological criteria (e.g., slope factors for assessing potential cancer risks and reference doses for assessing the potential for noncarcinogenic health effects) in the derivation of the human-RBTLs. Toxicological information for the COCs will be presented to indicate the intrinsic toxicity of the constituent (i.e., its ability to pose potential hazards to human health). Sources of toxicological information include:

- The USEPA Integrated Risk Information System (IRIS), a database of chemical toxicological information;
- The USEPA Health Effects Assessment Summary Tables (HEAST), which are tabular presentations of radionuclide- and pathway-specific carcinogenic slope factors and chemical toxicological information;
- The USEPA National Center for Exposure Assessment (NCEA), which may provide provisional toxicological information, where available, when such information is not is not published in IRIS or HEAST;
- USEPA Federal Guidance Report No. 11, which contains radionuclide-specific dose conversion factors (USEPA, 1988d);
- USEPA Federal Guidance Report No. 12, which provides radionculide-specific dose conversion factors for external radiation exposure (USEPA, 1993);
- USEPA Federal Guidance No. 13, which contains ingestion slope factors and methods for estimation of indoor air radon concentrations (USEPA, 1998); and
- USNRC NUREG/CR-5512, which contains methodology to translate contamination levels to annual total effective dose equivalent values to site occupants (USNRC, 1992).

Currently available toxicological criteria and information are presented in Table 14-1. Brief toxicity profiles will be prepared for those COCs for which human-RBTLs cannot be derived, if any, to support qualitative evaluation of risk.

14.2.4 Derivation of Risk-Based Target Levels

Based on the re-evaluated/updated exposure assessment and toxicity assessment, human-RBTLs will be derived for the COCs identified in the data evaluation where appropriate standards are not available or appropriate standards are not adequately protective of exposure from multiple pathways or to multiple constituents. The following items will be communicated to the USEPA for concurrence before proceeding with the derivation of the human-RBTLs:

- the rationale and selection of COCs;
- a potential exposure pathway matrix and inclusion/exclusion analysis;
- the exposure equations and input variables; and
- the toxicological criteria.

14.3 ECOLOGICAL EVALUATION

There were no COCs identified for sediments of Coles, Westerly and Lodi Brooks or the Saddle River. Since additional surface water and sediment sampling will be conducted at the site, the results of this sampling will be screened against applicable standards, guidelines and toxicity data to develop an updated list of COCs for surface water and sediment.

If COCs are chosen for sediment through the screening process, eco-RBTLs will be calculated for sediment for several wildlife receptors known to inhabit the site vicinity. Eco-RBTLs will be calculated for the COCs from available Lowest Observed Adverse Effect Levels (LOAELs) for several ecological receptors, to result in a range of values which can be used in determining target cleanup goals for the water bodies at the site. LOAELs are the lowest concentration of COCs at which adverse effects were observed in test species. Concentrations of COCs that are lower than the LOAELs should be protective of receptors using the site. Eco-RBTLs will also include toxicity values for sediment invertebrates, where available.

Two wildlife receptors, the mallard and the raccoon, will be used as representative species for the eco-RBTL calculations. The mallard will represent the waterfowl population in the area and the raccoon will represent the small mammal population. In calculating the eco-RBTLs, the LOAEL (in mg/kg-day) for each COC is set equal to the total exposure each receptor receives from the site, in the form of sediment ingestion and ingestion of vegetation and prey (e.g. sediment invertebrates), as follows:

$$LOAEL = Ps(EE_{sed}) + Pv(EE_{veg}) + Pp(EE_{prey})$$

where:

EE_{sed} = estimated exposure through ingestion of sediment (mg/kg)
EE_{veg} = estimated exposure through ingestion of vegetation (mg/kg)
EE_{prey} = estimated exposure through ingestion of prey (mg/kg)
Ps, Pv and Pp = the percentage of the total exposure from sediment, vegetation and prey.

The EE_{sed} is further defined as:

$$EE_{sed} = Cs \times FS \times IR \times FR / BW$$

where:

Cs = the concentration of a COC in sediment at the site (mg/kg)
FS = the percentage of diet which consists of sediment (%)
IR = the total ingestion rate of the receptor species (kg/day)
FR = foraging frequency of the receptor at the site (%)
BW = body weight of the receptor (kg)

EE_{veg} is further defined as:

$$EE_{veg} = Cv \times FRv \times NIRv$$

where:

Cv = the concentration of a COC in vegetation at the site (mg/kg)
FRv = the foraging frequency of the receptor at the site %
NIRv = the ingestion rate of the receptor, normalized to body weight (g/g-day)

EE_{prey} is further defined as:

$$EE_{prey} = Cp \times FRp \times NIRp$$

where:

Cp = the concentration of a COC in prey at the site (mg/kg)
FRp = the foraging frequency of the receptor at the site (%)
NIRp = the ingestion rate of the receptor, normalized to body weight (g/g-day)

Substituting these equations into the first equation gives:

$$LOAEL = Ps(Cs \times FS \times IR \times FR/BW) + Pv(Cv \times FRv \times NIRv) + Pp(Cp \times FRp \times NIRp)$$

Solving for Cs, Cv and Cp in this equation results in the concentration of a COC in sediment, vegetation and prey that would result in a total exposure for a receptor that is equal to the LOAEL. Dividing Cv and Cp by a COC-specific plant uptake factor (PUF) or earthworm uptake factor (EUF) gives the concentrations of a COC in sediment which would provide an exposure to the receptor (through ingestion) that is equal to the LOAEL.

Since the BRA (1993) did not calculate exposure values for specific receptors, this will be completed prior to calculation of the eco-RBTLs. Exposure calculations will follow the same equations shown above for EE_{sed}, EE_{veg}, and EE_{prey}.

15.0 TREATABILITY STUDIES/PILOT TESTING

Existing site data do not suggest at this time that treatability studies will be required to allow full development and evaluation of treatment alternatives during the detailed analysis portion of any potential FS. As site data are collected, however, it may be determined that existing technologies may not be able to treat the particular contaminants, levels of contaminants and/or mixtures of contaminants in various media. A treatability study may be warranted under these circumstances.

To evaluate the need for a treatability study, validated chemical quality data from soil, sediment, surface water and groundwater samples will be compared to the USEPA Office of Research and Development - Treatability Study Database (ORD-TSD) after collection. If review of the ORD-TSD identifies the need for a treatability study, a proposal will be prepared and submitted to the USACE. The proposal will utilize the treatability guidance document (USEPA, 1989d); and Chapter 5 of the RI/FS guidance document (USEPA, 1988a).

16.0 GROUNDWATER REMEDIAL INVESTIGATION REPORT

A Draft GWRI Report will be prepared concurrently with field investigations, sample analysis, data evaluation and risk assessment, and submitted to the USACE for review after the completion of risk assessment. The report will follow the latest guidance documents (USEPA, 1988). The report will include discussion of the data from the previous sampling programs as well as the data and analyses performed as part of this RI. Following receipt of all USACE written comments, the report will be revised and resubmitted to the USACE. Revisions will be completed within four weeks. Upon concurrence of the revised GWRI by the USACE, the GWRI report will be submitted to the USEPA for review and comment. When the USACE determines that the Draft GWRI Report is acceptable, it will be deemed the "Final GWRI Report".

17.0 PROJECT SCHEDULE

The proposed project schedule is provided on Figure 17-1. The schedule may be modified pending USACE approval of this GWRIWP. In an effort to shorten the schedule as much as possible, several tasks may be completed during the regulatory review period. These tasks, subject to USACE authorization, may include:

- Historical data survey;
- Surface features survey;
- Well integrity survey;
- Surface geophysical survey;
- Westerly and Lodi Brook video-inspection; and
- Geoprobe survey.

18.0 PROJECT MANAGEMENT APPROACH

18.1 ORGANIZATION AND APPROACH

This section describes the management approach and plan for the GWRI. Specifically, the approach to project management organization, project procedures, quality management, and subcontractor management are described in this section.

18.2 PROJECT MANAGEMENT ORGANIZATION

The project management organization is shown in Figure 18-1. Responsibilities for each of the identified individuals are provided below.

Stone & Webster Task Manager – The Stone & Webster Task Manager is responsible for directing staff working on the GWRI, coordinating resources required to complete the project, ensuring the technical quality of the work (in consultation with S&W Consultant Hydrogeologist), and approving deliverables submitted to the USACE. The Task Manager is also responsible for assuring the project is completed on time and within budget.

Stone & Webster Field Operations/Quality Assurance Coordinator (FOC) - The Stone & Webster FOC prepares for, directs, and carries out the activities in the field investigation. The FOC directs daily activities of Subcontractors on site in coordination with the Malcolm Pirnie's Project Hydrogeologist and Field Operations Leader.

Stone & Webster Consultant Hydrogeologist - The Stone & Webster Consultant Hydrogeologist is responsible for tracking hydrogeologic field activities and serving as liaison on specific technical issues between the S&W Task Manager and Malcolm Pirnie's Project Hydrogeologist and Field Operations Leader.

Malcolm Pirnie Project Hydrogeologist – The Malcolm Pirnie Hydrogeologist is responsible for technical direction and implementation of the GWRI in accordance with the USACE Statement of Work (SOW) and this Work Plan. The Project Hydrogeologist is directly responsible for the preparation of the draft GWRI Report. At times the Project Hydrogeologist may direct the activities of subconsultants. The Malcolm Pirnie Hydrogeologist is accountable to the S&W Task Manager and is responsible for keeping the Task Manager informed of all the GWRI activities.

Malcolm Pirnie Field Operations Leader – The Malcolm Pirnie Field Operations Leader at times, at the direction of Task Manager, during the investigation may act as or assume certain responsibilities of the S&W FOC. The Field Operations Leader is responsible to the Project Hydrogeologist and Task Manager. The Field Operations Leader directs and tracks the GWRI field activities and associated subcontractors and ensures adherence to the USACE SOW and GWRI Work Plan. On a daily basis the Field Operations Leader assembles the QA/QC daily logs and provides them to the Task Manager. Any deviations from the SOW and or the Work Plan are conveyed to the Project Hydrogeologist and Task Manager. At times during the project, the Field Operations Leader may consult with the S&W Consultant Hydrogeologist.

Stone & Webster Site Safety & Health Officer (SSHO) - The Stone & Webster SSHO is responsible for the health and safety of personnel working on the site. The SSHO enforces all health and safety standards and protocols during the implementation of field work, provides daily tailgate meetings to discuss health and safety related issues, controls personal protection equipment use and distribution, and monitors all health and safety related site conditions. The SSHO has the authority to upgrade or downgrade personal protection equipment in accordance with the SSHP or to modify the Site Safety & Health Plan if site conditions vary significantly from those anticipated.

18.3 PROJECT PROCEDURES

Project procedures and methods are based on the general guidelines and procedures presented in the CDQMP, developed by Stone & Webster, and approved by the USACE. Standard investigation procedures for the GWRI are referenced to the

CDQMP. However, some of the procedures presented in the CDQMP may have been tailored to meet the specific conditions and requirements of this GWRI. These modifications are presented in the various sections of this GWRIWP.

The General Site Safety & Health Plan (GSSHP) has been submitted to USACE as a separate document. The GSSHP presents safety and health procedures designed to minimize potential health risks to personnel performing activities associated with this GWRI. The GSSHP was developed based on knowledge of potential hazards that may be encountered during activities proposed in this GWRIWP.

18.4 QUALITY MANAGEMENT

All quality-related activities for this project will be performed in accordance with the Contractor Quality Control Plan (CQCP). The CQCP was developed for the USACE to ensure that work performed under the contract meets the quality assurance commitments, responsibilities and authorities for all quality-related interfaces with the USACE, suppliers, regulatory agencies, and subcontractors. The Quality Assurance (QA) program is implemented by a system of department procedures, which assure activities are accomplished in a timely, controlled, and quality manner. Persons performing quality functions will be provided with sufficient and well-defined responsibilities and authorities to enforce quality requirements, to identify, initiate, recommend, and provide solutions to quality problems, and verify the effectiveness of the solutions.

18.5 SUBCONTRACT MANAGEMENT

Stone & Webster will direct and control subcontracts for work performed under the Maywood Environmental Remediation Contract. Contractual agreements between Stone & Webster and its subcontractors contain flow-down clauses that ensure subcontractors meet appropriate USACE requirements. During the field portion of the work, subcontractors will be required to coordinate their activities through the FOC.

Subcontractors will also be required to submit daily logs documenting their activities. Daily subcontractor logs will be reviewed for accuracy by the FOC.

19.0 REFERENCES

Allison, J.D., D.S. Brown, and K.J. Novo-Gradac, 1991. MINTEQA2/PRODEFA2 – A Geochemical Assessment Model for Environmental Systems: Version 3.0. USEPA Environmental Research Laboratory, Athens, Georgia. EPA/600/3-91/021.

Anderson, M.P. And W.W. Woessner, 1992. Applied Groundwater Modeling: Simulation of Flow And Advective Transport. Academic Press.

BNI, 1992. Remedial Investigation Report for the Maywood Site, New Jersey, prepared for US Department of Energy, Oak Ridge Operations, Oak Ridge, TN. December.

Bouwer, H.H. and R.C. Rice, 1976. A slug test for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells. Water Resources Res. V. 12, pp. 423-428.

Carswell, L.D., 1976. "Appraisal of Water Resources in the Hackensack River Basin, New Jersey." US Geological Survey Water Resources Investigation 76-74.

CH2M Hill, 1994. Final Remediation Investigation Report: Stepan Property, Sears and Adjacent Properties. November.

CH_2M Hill, 1994. Final Remedial Investigation Report, Stepan. November.

Davis, J.A. and D.B. Kent, 1990. Surface Complexation Modeling in Aqueous Geochemistry. In *Mineral-Water Interface Geochemistry*, Reviews in Mineralogy, Vol. 23. Mineralogical Society of America.

Dragun, J., 1988. The Soil Chemistry Of Hazardous Materials. The Hazardous Materials Control Resources Institute. Greenbelt, Maryland.

Dzombak, D.A. and Morel, F.M.M., 1990. Surface Complexation Modeling: Hydrous Ferric Oxide. Wiley-Interscience Publication, John Wiley & Sons, Inc.

Huling, S.G., 1989. Facilitated Transport. USEPA Ground Water Issue, Kerr Environmental Research Laboratory. EPA/540/4-89/003.

Langmuir, D. And J.S. Herman, 1980. The Mobility Of Thorium In Natural Waters At Low Temperatures. *Geochimica Et Cosmochimica Acta*, Vol. 44, Pp. 1753 – 1766.

MacKinnon, R.J., Sullivan, T. M., Simonson, and Suen, C.J., 1995. BLT-EC (Breach, Leach, Transport, and Equilibrium Chemistry) - A Finite-Element Model for Assessing the Release of Radionuclides from Low-Level Waste Disposal Units: Background, Theory, and Model Description, U.S. Nuclear Regulatory Commission. NUREG/CR-6305 (BNL-NUREG-52446).

McLean, J.E. and Bledsoe, B.E., 1992. Behavior of Metals in Soils. USEPA Ground Water Issue, Kerr Environmental Research Laboratory. EPA/540/S-92/018.

Michalski, A. and Britton, R., 1997. The Role of Bedding Fractures in the Hydrogeology of Sedimentary Bedrock-Evidence from the Newark Basin, New Jersey. Groundwater. V.35, no. 2, pp 318-327.

New Jersey Administrative Code (N.J.A.C.), 7 Sept 99, Technical Requirements for Site Remediation 7:26E ("Tech Rule").

New Jersey Department of Environmental Protection, 1992. Field Sampling Procedures Manual.

OECD Nuclear Energy Agency, 1982. Geological Disposal Of Radioactive Waste: Geochemical Processes. Organization For Economic Co-Operation And Development, Nuclear Energy Agency, France.

Olsen, Paul E, 1978. On the use of the term Newark for Triassic and Early Jurassic rocks in Eastern North American: Newsletters on Stratigraphy, v. 7, p. 90-95.

Schwarzenbach, R.P., Gschwend, P.M., and Imboden, D.M., 1993. Environmental Organic Chemistry. John Wiley & Sons, Inc.

Stumm, W., 1992. Chemistry of the Solid-Water Interface, Wiley-Interscience Publication, John Wiley & Sons, Inc.

Suthersan, S.S., 1997. Remediation Engineering. CRC Press, Inc., Lewis Publishers.

Thornton, I. (Ed.), 1983. Applied Environmental Geochemistry, Academic Press.

USDOE, 1993. Baseline Risk Assessment for the Maywood Site, Prepared for the Former Sites Restoration Division. April.

USEPA, 1998. Final USEPA Region II Low Stress (Low Flow) Groundwater Sampling Standard Operating Procedures.

USEPA, 1998a. Health Risks from Low Level Environmental Exposure to Radionuclides. Federal Guidance Report No. 13-1. January.

USEPA, 1996. Soil Screening Guidance: Technical Background Document. Office of Emergency and Remedial Response, Washington, DC. EPA/540/R-96/128, NTIS PB96-963502.

USEPA, 1993. External Exposure to Radionuclides in Air, Water, and Soil. Federal Guidance Report No. 12. EPA-502-R-93-081. Washington, DC: Office of Radiation and Indoor Air.

USEPA, 1991a. Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual, Supplemental Guidance "Standard Default Exposure Factors", Interim Final, OSWER Directive: 9285.6-03, Washington, DC: Office of Emergency and Remedial Response.

USEPA, 1989d. Guide for Conducting Treatability Studies Under CERCLA (Interim Final). EPA/540/2-89/058, December 1989, 138 pages.

U.S.EPA, 1988. Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion. Federal Guidance Report No. 11. EPA-520/1-88-020. Washington, DC: Office of Radiation and Indoor Air.

EPA, 1988a. Guidance for conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final, EPA/540/G-89/004, Office of Emergency and Remedial Response, Washington, D.C. October.

USEPA, 1988a. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final. EPA/540/G-89/004, OSWER Directive 9355.3-01, Office of Solid Waste, Washington, D.C. October.

USEPA, 1988d. Technology Screening Guide for Treatment of CERCLA Soils and Sludges. EPA/540/G-88/. September.

USEPA, 1988e. USEPA Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites. EPA/540/G-88/003, OSWER Directive 9283.1-2, December.

USEPA, 1984. Maywood Chemical Sites, Maywood of Rochelle Park, New Jersey.

Vecchioli, J., and Miller, E.G., 1973. Water Resources of the New Jersey Part of the Ramapo River Basin, U.S. Geological Survey Water Supply Paper 1974, pp.77.

Wiedemeier, T.H., Wilson, J.T., Kampbell, D.H., Miller, R.N., and Hansen, J.E., 1995. Technical Protocol for Implementing Intrinsic Remediation with Long-Term Monitoring for Natural Attenuation of Fuel Contamination Dissolved in Groundwater, Revision 0. Air Force Center for Environmental Excellence.

Yeh, G.T. and V.S. Tripathi, 1990. HYDROGEOCHEM: A Coupled Model of Hydrological and Geochemical Equilibrium of Multicomponent Systems. ORNL-6371, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

TABLE 1-1
1999 Groundwater Analytical Results - Radioactive Constituents
FUSRAP Maywood Interim Storage Site
Maywood, NJ

Sampling Location	Date Collected	Analyte	Result[a] (pCi/L)			BNI Flag[b]	MDA[c] (pCi/L)	NRC Limit[d] (pCi/L)	Federal MCL[e] (pCi/L)
Monitoring wells completed in unconsolidated sediment:									
B38W14S	17-May-99	Radium-226	0.16	±	0.16	UJ	0.50	60	5[f]
	17-May-99	Radium-228	0.40	±	0.38		0.50	60	5[f]
	17-May-99	Thorium-230	0.2	±	0.29	UJ	0.50	100	N/A[h]
	17-May-99	Thorium-232	0.07	±	0.17	UJ	0.50	30	N/A
	17-May-99	Total uranium	0.96	±	0.03		0.02	300	N/A
B38W17A	13-May-99	Radium-226	0.62	±	0.41	J	0.50	60	5
	13-May-99	Radium-228	1.06	±	0.31	UJ	0.50	60	5
	13-May-99	Thorium-230	1.47	±	0.83	J	0.50	100	N/A
	13-May-99	Thorium-232	0.44	±	0.03	UJ	0.50	30	N/A
	13-May-99	Total uranium	0.09	±	0.01		0.02	300	N/A
Duplicate[g]	13-May-99	Radium-226	0.62	±	0.39		0.50	60	5
	13-May-99	Radium-228	0.4	±	0.54	UJ	0.50	60	5
	13-May-99	Thorium-230	0.81	±	0.67	J	0.50	100	N/A
	13-May-99	Thorium-232	0.26	±	0.4	UJ	0.50	30	N/A
	13-May-99	Total uranium	0.21	±	0.06		0.02	300	N/A
B38W19S	14-May-99	Radium-226	0.35	±	0.3	UJ	0.50	60	5
	14-May-99	Radium-228	0.48	±	0.15	U	0.50	60	5
	14-May-99	Thorium-230	0.07	±	0.17	UJ	0.50	100	N/A
	14-May-99	Thorium-232	0.02	±	0.1	UJ	0.50	30	N/A
	14-May-99	Total uranium	0.27	±	0		0.02	300	N/A
B38W24S	13-May-99	Radium-226	0.23	±	0.24	UJ	0.50	60	5
	13-May-99	Radium-228	0.1	±	0.25	UJ	0.50	60	5
	13-May-99	Thorium-230	0.6	±	0.43		0.50	100	N/A
	13-May-99	Thorium-232	0.09	±	0.2	UJ	0.50	30	N/A
	13-May-99	Total uranium	0.02	±	0	UJ	0.02	300	N/A
Duplicate[g]	13-May-99	Radium-226	0.09	±	0.15		0.02	300	5
	13-May-99	Radium-228	0.13	±	0.19	UJ	0.50	60	5
	13-May-99	Thorium-230	0.53	±	0.34		0.50	60	N/A
	13-May-99	Thorium-232	0.09	±	0.13	UJ	0.50	100	N/A
	13-May-99	Total uranium	0.02	±	0	UJ	0.50	30	N/A
B38W25S	17-May-99	Radium-226	0.08	±	0.13	UJ	0.50	300	5
	17-May-99	Radium-228	0.12	±	0.22	UJ	0.50	60	5
	17-May-99	Thorium-230	0.26	±	0.26	UJ	0.50	100	N/A
	17-May-99	Thorium-232	0.13	±	0.18	UJ	0.50	30	N/A
	17-May-99	Total uranium	0.12	±	0		0.02	300	N/A
MISS01AA	17-May-99	Radium-226	0.26	±	0.24	UJ	0.50	60	5
	17-May-99	Radium-228	0.08	±	0.24	UJ	0.50	60	5
	17-May-99	Thorium-230	0.25	±	0.29	UJ	0.50	100	N/A
	17-May-99	Thorium-232	0.25	±	0.26	UJ	0.50	30	N/A
	17-May-99	Total uranium	0.54	±	0.01		0.02	300	N/A
MISS02A	18-May-99	Radium-226	0.29	±	0.22	J	0.50	60	5
	18-May-99	Radium-228	0.17	±	0.35	UJ	0.50	60	5
	18-May-99	Thorium-230	1.2	±	0.73		0.50	100	N/A
	18-May-99	Thorium-232	0.12	±	0.28	UJ	0.50	30	N/A
	18-May-99	Total uranium	0.58	±	0.03		0.02	300	N/A
MISS05A	14-May-99	Radium-226	0.68	±	0.48		0.50	60	5
	14-May-99	Radium-228	0.16	±	0.31	UJ	0.50	60	5
	14-May-99	Thorium-230	0.69	±	0.48		0.50	100	N/A
	14-May-99	Thorium-232	0.17	±	0.26	UJ	0.50	30	N/A
	14-May-99	Total uranium	74.78	±	1.70		0.02	300	N/A
MISS06A	17-May-99	Radium-226	0.32	±	0.27	UJ	0.50	60	5
	17-May-99	Radium-228	0.99	±	0.31	U	0.50	60	5
	17-May-99	Thorium-230	0.21	±	0.34	UJ	0.50	100	N/A
	17-May-99	Thorium-232	0.08	±	0.19	UJ	0.50	30	N/A
	17-May-99	Total uranium	3.92	±	0.09		0.02	300	N/A
Duplicate[g]	17-May-99	Radium-226	0.7	±	0.43	J	0.50	60	5
	17-May-99	Radium-228	0.02	±	0.14	UJ	0.50	60	5
	17-May-99	Thorium-230	0.22	±	0.21		0.50	100	N/A

TABLE 1-1
1999 Groundwater Analytical Results - Radioactive Constituents
FUSRAP Maywood Interim Storage Site
Maywood, NJ

Sampling Location	Date Collected	Analyte	Result[a] (pCi/L)			BNI Flag[b]	MDA[c] (pCi/L)	NRC Limit[d] (pCi/L)	Federal MCL[e] (pCi/L)
	17-May-99	Thorium-232	0.06	±	0.13	UJ	0.50	30	N/A
	17-May-99	Total uranium	4.07	±	0.09		0.02	300	N/A
MISS07B	27-May-99	Radium-226	0.08	±	0.19	UJ	0.50	60	5
	27-May-99	Radium-228	0.21	±	0.31	UJ	0.50	60	5
	27-May-99	Thorium-230	1.06	±	0.58		0.50	100	N/A
	27-May-99	Thorium-232	0.39	±	0.04	U	0.50	30	N/A
	27-May-99	Total uranium	4.23	±	0.09		0.02	300	N/A
Duplicate[g]	27-May-99	Radium-226	0.13	±	0.17	UJ	0.50	60	5
	27-May-99	Radium-228	0.05	±	0.19	UJ	0.50	60	5
	27-May-99	Thorium-230	2.26	±	0.88		0.50	100	N/A
	27-May-99	Thorium-232	0.06	±	0.13	UJ	0.50	30	N/A
	27-May-99	Total uranium	4.21	±	0.09		0.02	300	N/A
Monitoring wells completed in bedrock:									
B38W02D	20-May-99	Radium-226	0.2	±	0.21	UJ	0.50	60	5
	20-May-99	Radium-228	0.09	±	0.4	UJ	0.50	60	5
	20-May-99	Thorium-230	0.97	±	0.71		0.50	100	N/A
	20-May-99	Thorium-232	0.05	±	0.32	UJ	0.50	30	N/A
	20-May-99	Total uranium	0.21	±	0.01		0.03	300	N/A
B38W14D	17-May-99	Radium-226	0.34	±	0.08	U	0.50	60	5
	17-May-99	Radium-228	0.02	±	0.23	UJ	0.50	60	5
	17-May-99	Thorium-230	1.02	±	0.61		0.50	100	N/A
	17-May-99	Thorium-232	0.1	±	0.22	UJ	0.50	30	N/A
	17-May-99	Total uranium	0.7	±	0.02		0.03	300	N/A
B38W17B	13-May-99	Radium-226	0.46	±	0.4	UJ	0.50	60	5
	13-May-99	Radium-228	0.26	±	0.53	UJ	0.50	60	5
	13-May-99	Thorium-230	0.51	±	0.56	UJ	0.50	100	N/A
	13-May-99	Thorium-232	0.16	±	0.32	UJ	0.50	30	N/A
	13-May-99	Total uranium	0.02	±	0	UJ	0.03	300	N/A
B38W18D	20-May-99	Radium-226	0.28	±	0.23	UJ	0.50	60	5
	20-May-99	Radium-228	0.19	±	0.37	UJ	0.50	60	5
	20-May-99	Thorium-230	0.29	±	0.36	UJ	0.50	100	N/A
	20-May-99	Thorium-232	0.71	±	0.08	U	0.50	30	N/A
	20-May-99	Total uranium	2.76	±	0.08		0.03	300	N/A
Duplicate[g]	20-May-99	Radium-226	0.26	±	0.02	U	0.50	60	5
	20-May-99	Radium-228	0.60	±	0.15	U	0.50	60	5
	20-May-99	Thorium-230	0.32	±	0.3	UJ	0.50	100	N/A
	20-May-99	Thorium-232	0.20	±	0.25	UJ	0.50	30	N/A
	20-May-99	Total uranium	2.88	±	0.07		0.03	300	N/A
B38W19D	27-May-99	Radium-226	0.33	±	0.26	UJ	0.50	60	5
	27-May-99	Radium-228	0.13	±	0.39	UJ	0.50	60	5
	27-May-99	Thorium-230	0.67	±	0.57	UJ	0.50	100	N/A
	27-May-99	Thorium-232	0.22	±	0.32	UJ	0.50	30	N/A
	27-May-99	Total uranium	0.18	±	0.01		0.03	300	N/A
B38W24D	13-May-99	Radium-226	0.19	±	0.26	UJ	0.50	60	5
	13-May-99	Radium-228	0.06	±	0.23	UJ	0.50	60	5
	13-May-99	Thorium-230	0.17	±	0.28	UJ	0.50	100	N/A
	13-May-99	Thorium-232	0.19	±	0.25	UJ	0.50	30	N/A
	13-May-99	Total uranium	0.02	±	0	UJ	0.03	300	N/A
B38W25D	26-May-99	Radium-226	0.34	±	0.22	J	0.50	60	5
	26-May-99	Radium-228	0.07	±	0.26	UJ	0.50	60	5
	26-May-99	Thorium-230	1.67	±	0.73		0.50	100	N/A
	26-May-99	Thorium-232	0.5	±	0.14	U	0.50	30	N/A
	26-May-99	Total uranium	0.02	±	0	UJ	0.03	300	N/A
Duplicate[g]	26-May-99	Radium-226	0.24	±	0.25	UJ	0.50	60	5
	26-May-99	Radium-228	0.14	±	0.29	UJ	0.50	60	5
	26-May-99	Thorium-230	2.26	±	0.87		0.50	100	N/A
	26-May-99	Thorium-232	0.21	±	0.25	UJ	0.50	30	N/A
	26-May-99	Total uranium	0.02	±	0	UJ	0.03	300	N/A

TABLE 1-1
1999 Groundwater Analytical Results - Radioactive Constituents
FUSRAP Maywood Interim Storage Site
Maywood, NJ

Sampling Location	Date Collected	Analyte	Result[a] (pCi/L)			BNI Flag[b]	MDA[c] (pCi/L)	NRC Limit[d] (pCi/L)	Federal MCL[e] (pCi/L)
MISS01B	25-May-99	Radium-226	0.14	±	0.18	UJ	0.50	60	5
	25-May-99	Radium-228	0.38	±	0.35	UJ	0.50	60	5
	25-May-99	Thorium-230	0.57	±	0.41		0.50	100	N/A
	25-May-99	Thorium-232	0.12	±	0.22	UJ	0.50	30	N/A
	25-May-99	Total uranium	0.86	±	0.02		0.03	300	N/A
MISS02B	18-May-99	Radium-226	0.46	±	0.31		0.50	60	5
	18-May-99	Radium-228	0.02	±	0.17	UJ	0.50	60	5
	18-May-99	Thorium-230	0.59	±	0.4		0.50	100	N/A
	18-May-99	Thorium-232	0.04	±	0.11	UJ	0.50	30	N/A
	18-May-99	Total uranium	0.12	±	0		0.03	300	N/A
Duplicate[g]	18-May-99	Radium-226	0.46	±	0.27		0.50	60	5
	18-May-99	Radium-228	0.45	±	0.05	U	0.50	60	5
	18-May-99	Thorium-230	0.68	±	0.44		0.50	100	N/A
	18-May-99	Thorium-232	0.15	±	0.21	UJ	0.50	30	N/A
	18-May-99	Total uranium	0.19	±	0.01		0.03	300	N/A

[a] Results reported with (±) radiological error quoted at 2 sigma (95 percent confidence level).

[b] BNI data qualifier flags:
U = The analyte was not detected.
UJ = Analyte was not detected; estimated value reported. The result is below the MDA or less than the associated error term.
J= Reported as an estimated value.

[c] Minimum Detectable Activity (MDA).

[d] NRC limits for water from 10 CFR 20, Appendix B, Table 2.

[e] Federal SDWA MCLs, 40 CFR 141 (October 1999).

[f] Federal MCL is combined Ra-226 + Ra-228

[g] A quality control duplicate is collected at the same time and location, and is analyzed by the same method in order to evaluate precision in sampling and analysis.

[h] N/A - Not Applicable Federal MCL does not exist

Table 1-2
1999 Groundwater Analytical Results - Detected Volatile Organic Compounds
FUSRAP Maywood Interim Storage Site
Maywood, NJ

Sampling Location	Date Collected	Detected Analyte[a]	Result (µg/L)	Data Qualifiers[b] BNI	Data Qualifiers[b] Lab	Reporting Limit (µg/L)	Related Regulations Federal[c] (µg/L)	Related Regulations State[d] (µg/L)
Monitoring wells completed in unconsolidated sediment:								
B38W14S	17-May-99	1,1,1-TRICHLOROETHANE	2	J	J	5	200	30
		1,1-DICHLOROETHENE	3	J	J	5	7	1
		1,2-DICHLOROETHENE (TOTAL)	43			5	70 / 100	10 / 100[g]
		2-BUTANONE	13	J		10		
		ACETONE	3	UJ	JB	10		
		CHLOROFORM	2	J	J	5	NE	1/6
		DICHLOROMETHANE	3	UJ	JB	5		
		TETRACHLOROETHENE	290		D	5	5	0.4 / 1
		TOLUENE	1	J	J	5		
		TRICHLOROETHENE	67			5	5	1
B38W17A	13-May-99	ACETONE	2	UJ	JB	10		
		BROMOMETHANE	10	UJ	U	10		
		CHLOROETHANE	10	UJ	U	10		
		CHLOROMETHANE	10	UJ	U	10		
		DICHLOROMETHANE	3	UJ	U	5		
		VINYL CHLORIDE	10	UJ	U	2	2	.8/5
B38W19S	14-May-99	2-BUTANONE	16			10		
		ACETONE	6	UJ	JB	10		
		BROMOMETHANE	10	UJ	U	10		
		CHLOROETHANE	10	UJ	U	10		
		CHLOROMETHANE	10	UJ	U	10		
		DICHLOROMETHANE	3	UJ	JB	5		
		TOLUENE	3	J	J	5		
		VINYL CHLORIDE	10	UJ	U	10	2	.8/5
B38W24S	13-May-99	2-BUTANONE	18			10		
		ACETONE	7	UJ	JB	10		
		TOLUENE	2	J	J	5		
B38W25S	17-May-99	2-BUTANONE	5	J	J	10		
		ACETONE	2	UJ	JB	10	NE	700
		DICHLOROMETHANE	3	UJ	JB	5		
MISS01AA	12-May-99	ACETONE	6	UJ	JB	10		
MISS05A	14-May-99	1,1-DICHLOROETHENE	5	UJ	U	5		
		ACETONE	5	UJ	JB	10		
		BROMOMETHANE	10	UJ	U	10		
		CHLOROETHANE	10	UJ	U	10		
		CHLOROMETHANE	3	UJ	JB	10		
		TOLUENE	2	J	J	5		
		VINYL CHLORIDE	10	UJ	U	10	2	.8/5
MISS06A	17-May-99	2-BUTANONE	3	J	J	10		
		ACETONE	3	UJ	BJ	10		
		DICHLOROMETHANE	3	UJ	BJ	5		

Table 1-2
1999 Groundwater Analytical Results - Detected Volatile Organic Compounds
FUSRAP Maywood Interim Storage Site
Maywood, NJ

				Data		Reporting	Related Regulations	
Sampling	Date	Detected	Result	Qualifiers[b]		Limit	Federal[c]	State[d]
Location	Collected	Analyte[a]	(µg/L)	BNI	Lab	(µg/L)	(µg/L)	(µg/L)
Monitoring wells completed in bedrock:								
B38W02D	20-May-99	BROMOMETHANE	10	UJ	U	10		
		CHLOROETHANE	10	UJ	U	10		
		CHLOROMETHANE	10	UJ	U	10		
		DICHLOROMETHANE	4	UJ	BJ	5		
		VINYL CHLORIDE	10	UJ	U	10	2	.8/5
Background[e]								
B38W14D	17-May-99	1,1,1-TRICHLOROETHANE	3	J	J	5	200	30
		1,1-DICHLOROETHANE	2	J	J	5	7	1
		1,1-DICHLOROETHENE	3	J	J	5		
		1,2-DICHLOROETHENE (TOTAL)	77			5	70 / 100	10 / 100[g]
		ACETONE	2	UJ	JB	10		
		CHLOROFORM	2	J	J	5		
		DICHLOROMETHANE	3	UJ	JB	5		
		TETRACHLOROETHENE	630		D	5	5	0.4 / 1
		TRICHLOROETHENE	160			5	5	1
B38W17B	13-May-99	1,1-DICHLOROETHENE	5	UJ	U	5	7	1
		ACETONE	10	UJ	JB	10		
		BROMOMETHANE	10	UJ	U	10		
		CHLOROETHANE	10	UJ	U	10		
		CHLOROMETHANE	10	UJ	U	10		
		DICHLOROMETHANE	3	UJ	JB	10		
		VINYL CHLORIDE	10	UJ	U	10	2	.8/5
B38W18D	20-May-99	2-BUTANONE	7	J	J	10		
		ACETONE	5	UJ	JB	10		
		BROMOMETHANE	10	UJ	U	10		
		CHLOROETHANE	10	UJ	U	10		
		TOLUENE	1	J	J	5		
		VINYL CHLORIDE	10	UJ	U	10	2	.8/5
B38W19D	27-May-99	DICHLOROMETHANE	4	UJ	BJ	5		
B38W24D	13-May-99	2-BUTANONE	13			10		
		ACETONE	7	UJ	JB	10		
B38W25D	26-May-99	1,1-DICHLOROETHENE	5	UJ	U	5		
		2-BUTANONE	6	J	J	10		
		ACETONE	4	UJ	BJ	10		
		BROMOMETHANE	10	UJ	U	10		
		CHLOROETHANE	10	UJ	U	10		
		CHLOROMETHANE	10	UJ	U	10		
		DICHLOROMETHANE	6	UJ	B	5		
		TOLUENE	1	J	J	5		
		VINYL CHLORIDE	10	UJ	U	10	2	.8/5

Table 1-2
1999 Groundwater Analytical Results - Detected Volatile Organic Compounds
FUSRAP Maywood Interim Storage Site
Maywood, NJ

Sampling Location	Date Collected	Detected Analyte[a]	Result (µg/L)	Data Qualifiers[b] BNI	Data Qualifiers[b] Lab	Reporting Limit (µg/L)	Related Regulations Federal[c] (µg/L)	Related Regulations State[d] (µg/L)
MISS01B	25-May-99	1,1-DICHLOROETHENE	5	UJ	U	5	7	1
		1,2-DICHLOROETHENE (TOTAL)	2	J	J	5	70 / 100	10 / 100[g]
		2-BUTANONE	2	J	J	10		
		ACETONE	5	UJ	BJ	10		
		BROMOMETHANE	10	UJ	U	10		
		CHLOROETHANE	10	UJ	U	10		
		CHLOROMETHANE	10	UJ	U	10		
		DICHLOROMETHANE	6	UJ	B	5		
		VINYL CHLORIDE	10	UJ	U	10	2	.8/5
MISS02B		ACETONE	8	UJ	JB	10		
MISS07B	27-May-99	1,2-DICHLOROETHENE (TOTAL)	6			5	70 / 100	10 / 100[g]
		DICHLOROMETHANE	4	UJ	BJ	5		
		TETRACHLOROETHENE	24			5	5	0.4 / 1
		TRICHLOROETHENE	2	J	J	5	5	1

[a] Only the analytes that were detected are reported.

[b] BNI and laboratory data qualifier flags:

U= Analyte was analyzed for but not detected.
J = Reported as an estimated value. Data quality evaluation indicates that the analytical result is an estimate of the actual value.
D = Diluted out. Value is estimated to be non-detect (NJ).
B= The analyte is found in the associated blank as well as in the sample. It indicates possible blank contaminatuion
UJ= Analyte was analyzed for but not detected, it must be estimated due to quality control consideration.

[c] Federal SDWA MCLs, 40 CFR 141 (October 1999).

[d] New Jersey Class IIA Groundwater Quality Standards, NJAC 7:9-6 (October 1999). Analytes for which the published PQL is greater than the GWQC are noted as such: GWQC / PQL.

[e] Monitoring well B38W01S is the background location for wells that are completed in unconsolidated sediment. Monitoring well B38W02D is the background location for wells that are completed in bedrock.

[f] No VOCs were detected during 1999 sampling of this monitoring well.

[g] Limits for cis-isomer/trans-isomer; PQL is 2 µg/L.

Table 1-3
1999 Groundwater Analytical Results - Detected Metals
FUSRAP Maywood Interim Storage Site
Maywood, NJ

Sampling Location	Date Collected	Detected Analyte[a]	Result (µg/L)	Data Qualifiers[b] BNI	Lab	Reporting Limit (µg/L)	Related Regulations Federal[c] (µg/L)	State[d] (µg/L)
Monitoring wells completed in unconsolidated sediment:								
B38W14S	17-May-99	Aluminum	241			20.1	NE	200
	17-May-99	Arsenic	0.52			0.3	50	0.02/8
	17-May-99	Barium	86.6			0.2	2000	2000
	17-May-99	Boron	38.6			2.0	NE	NE
	17-May-99	Cadmium	0.97			0.3	5	4
	17-May-99	Calcium	95600			16.4	NE	NE
	17-May-99	Chromium	67.2			0.6	100	100
	17-May-99	Cobalt	1.5			0.7	NE	NE
	17-May-99	Copper	4.9			1.0	1300	1000
	17-May-99	Iron	528	J		19.4	NE	300
	17-May-99	Lead	2.5			0.4	15	5 / 10
	17-May-99	Lithium	38			0.2	NE	NE
	17-May-99	Magnesium	27400			2.8	NE	NE
	17-May-99	Manganese	32.1	J		0.2	NE	50
	17-May-99	Molybdenum	9.4			1.2	NE	NE
	17-May-99	Nickel	23.5			1.2	NE	100
	17-May-99	Potassium	4810			27.9	NE	NE
	17-May-99	Selenium	1.1	U		1.1	50	50
	17-May-99	Sodium	22800			4.1	NE	50000
	17-May-99	Vanadium	2.9			0.8	NE	NE
	17-May-99	Zinc	6.9			0.5	NE	5000
B38W17A	13-May-99	Aluminum	32.4			20.1	NE	200
	13-May-99	Barium	63.1			0.2	2000	2000
	13-May-99	Boron	66.2			2.0	NE	NE
	13-May-99	Calcium	87100			16.4	NE	NE
	13-May-99	Chromium	66.3			0.6	100	100
	13-May-99	Cobalt	1.1			0.7	NE	NE
	13-May-99	Copper	2.9			1.0	1300	1000
	13-May-99	Iron	377			19.4	NE	300
	13-May-99	Lithium	359			0.2	NE	NE
	13-May-99	Magnesium	9190			2.8	NE	NE
	13-May-99	Manganese	38			0.2	NE	50
	13-May-99	Molybdenum	2.6			1.2	NE	NE
	13-May-99	Nickel	118			1.2	NE	100
	13-May-99	Potassium	24900			27.9	NE	NE
	13-May-99	Sodium	50100			4.1	NE	50000
	13-May-99	Vanadium	0.8			0.8	NE	NE
	13-May-99	Zinc	5.4			0.5	NE	5000
B38W19S	14-May-99	Arsenic	17.8			0.6	50	0.02 / 8
	14-May-99	Barium	43.2			0.2	2000	2000
	14-May-99	Boron	756			2.0	NE	NE
	14-May-99	Calcium	654000			58.5	NE	NE
	14-May-99	Chromium	2.6			0.6	100	100
B38W19S	14-May-99	Iron	6600			19.4	NE	300
	14-May-99	Lithium	1400	J		0.2	NE	NE
	14-May-99	Magnesium	46100			2.8	NE	NE
	14-May-99	Manganese	841			0.2	NE	50
	14-May-99	Nickel	4.2			1.2	NE	100
	14-May-99	Potassium	35500			27.9	NE	NE
	14-May-99	Sodium	21700	J		4.1	NE	50000
	14-May-99	Vanadium	2			0.8	NE	NE
	14-May-99	Zinc	1.7			0.5	NE	5000
B38W24S	13-May-99	Aluminum	46.1			20.1	NE	200
	13-May-99	Barium	38.1			0.2	2000	2000
	13-May-99	Beryllium	1.1			0.1	4	0.008 / 20
	13-May-99	Boron	104			2.0	NE	NE

Table 1-3
1999 Groundwater Analytical Results - Detected Metals
FUSRAP Maywood Interim Storage Site
Maywood, NJ

				Data Qualifiers[b]		Reporting	Related Regulations	
Sampling Location	**Date Collected**	**Detected Analyte[a]**	**Result (µg/L)**	**BNI**	**Lab**	**Limit (µg/L)**	**Federal[c] (µg/L)**	**State[d] (µg/L)**
	13-May-99	Calcium	67100			16.4	NE	NE
	13-May-99	Copper	9.4			1.0	1300	1000
	13-May-99	Iron	35100			19.4	NE	300
	13-May-99	Lithium	32.1			0.2	NE	NE
	13-May-99	Magnesium	9110	J		1.2	NE	NE
	13-May-99	Manganese	4910			0.2	NE	50
	13-May-99	Potassium	7600			27.9	NE	NE
	13-May-99	Sodium	15200	J		4.1	NE	50000
	13-May-99	Vanadium	0.89			0.8	NE	NE
	13-May-99	Zinc	30.4			0.5	NE	5000
B38W25S	17-May-99	Aluminum	146			20.1	NE	200
	17-May-99	Arsenic	23			0.6	50	0.02 / 8
	17-May-99	Barium	73.6			0.2	2000	2000
	17-May-99	Boron	79.6			2.0	NE	NE
	17-May-99	Calcium	185000			16.4	NE	NE
	17-May-99	Chromium	106			0.6	100	100
	17-May-99	Cobalt	3.2			0.7	NE	NE
	17-May-99	Copper	2.8			1.0	1300	1000
	17-May-99	Iron	10400	J		19.4	NE	300
	17-May-99	Lead	0.66			0.4	15	5 / 10
	17-May-99	Lithium	793			0.2	NE	NE
	17-May-99	Magnesium	6150			2.8	NE	NE
	17-May-99	Manganese	2670	J		0.2	NE	50
	17-May-99	Molybdenum	16.6			1.2	NE	NE
	17-May-99	Nickel	78.1			1.2	NE	100
	17-May-99	Potassium	74400			27.9	NE	NE
	17-May-99	Sodium	29900			4.1	NE	50000
	17-May-99	Vanadium	1.7			0.8	NE	NE
	17-May-99	Zinc	29.7			0.5	NE	5000
MISS01AA	12-May-99	Aluminum	43			20.1	NE	200
	12-May-99	Antimony	0.7			0.7	6	2/20
	12-May-99	Arsenic	65			0.6	50	0.02 / 8
	12-May-99	Barium	8.7			0.2	2000	2000
	12-May-99	Boron	278			2.0	NE	NE
	12-May-99	Calcium	645000			58.5	NE	NE
	12-May-99	Chromium	1			0.6	100	100
	12-May-99	Iron	2790			19.4	NE	300
	12-May-99	Lead	1.6			0.4	15	5 / 10
	12-May-99	Lithium	224	J		0.2	NE	NE
	12-May-99	Magnesium	31700			2.8	NE	NE
	12-May-99	Manganese	118			0.2	NE	50
	12-May-99	Nickel	3.6			1.2	NE	100
	12-May-99	Potassium	1590			27.9	NE	NE
	12-May-99	Sodium	5140			4.1	NE	50000
	12-May-99	Vanadium	2.8			0.8	NE	NE
MISS02A	18-May-99	Aluminum	1660			20.1	NE	200
	18-May-99	Antimony	3.9			1.4	6	2 / 20
	18-May-99	Arsenic	6350			275.0	50	0.02 / 8
	18-May-99	Barium	21			0.2	2000	2000
	18-May-99	Boron	1680			2.0	NE	NE
	18-May-99	Calcium	116000			16.4	NE	NE
	18-May-99	Chromium	94.1			0.6	100	100
	18-May-99	Cobalt	2.2			0.7	NE	NE
	18-May-99	Copper	366			1.0	1300	1000
	18-May-99	Iron	1010			19.4	NE	300
	18-May-99	Lead	11			0.4	15	5 / 10
	18-May-99	Lithium	9300			0.2	NE	NE

Table 1-3
1999 Groundwater Analytical Results - Detected Metals
FUSRAP Maywood Interim Storage Site
Maywood, NJ

Sampling Location	Date Collected	Detected Analyte[a]	Result (µg/L)	Data Qualifiers[b] BNI	Lab	Reporting Limit (µg/L)	Related Regulations Federal[c] (µg/L)	State[d] (µg/L)
	18-May-99	Magnesium	5700			2.8	NE	NE
	18-May-99	Manganese	71			0.2	NE	50
	18-May-99	Molybdenum	11.2			1.2	NE	NE
	18-May-99	Nickel	31.1			1.2	NE	100
	18-May-99	Potassium	12500			27.9	NE	NE
	18-May-99	Silver	1.4			1.4	NE	NE
	18-May-99	Sodium	1520000			350.0	NE	50000
	18-May-99	Thallium	0.36			0.3	2	0.5/10
	18-May-99	Vanadium	9.7			0.8	NE	NE
	18-May-99	Zinc	36			0.5	NE	5000
MISS05A	14-May-99	Aluminum	28.9			20.1	NE	200
	14-May-99	Antimony	0.7			0.7	6	2 / 20
	14-May-99	Arsenic	2			0.6	50	0.02 / 8
	14-May-99	Barium	20.3			0.2	2000	2000
	14-May-99	Boron	352			2.0	NE	NE
	14-May-99	Calcium	677000			58.5	NE	NE
	14-May-99	Cobalt	14.1			0.7	NE	NE
MISS05A	14-May-99	Copper	1.7			1.0	1300	1000
	14-May-99	Iron	2190			19.4	NE	300
	14-May-99	Lead	0.35			0.4	15	5 / 10
	14-May-99	Lithium	863	J		0.2	NE	NE
	14-May-99	Magnesium	47700			2.8	NE	NE
	14-May-99	Manganese	688			0.2	NE	50
	14-May-99	Molybdenum	1.9			1.2	NE	NE
	14-May-99	Nickel	22.8			1.2	NE	100
	14-May-99	Potassium	58300			27.9	NE	NE
	14-May-99	Selenium	1.1			1.1	50	50
	14-May-99	Silver	1.5			1.4	NE	NE
	14-May-99	Sodium	18000			4.1	NE	50000
	14-May-99	Thallium	0.3			0.3	2	0.5/10
	14-May-99	Vanadium	1.6			0.8	NE	NE
	14-May-99	Zinc	74.5			0.5	NE	5000
MISS06A	17-May-99	Aluminum	47.9			20.1	NE	200
	17-May-99	Antimony	0.81			0.7	6	2 / 20
	17-May-99	Arsenic	2.2			0.6	50	0.02 / 8
	17-May-99	Barium	48			0.2	2000	2000
	17-May-99	Boron	352			2.0	NE	NE
	17-May-99	Cadmium	2.2			0.3	5	4
	17-May-99	Calcium	250000			16.4	NE	NE
	17-May-99	Copper	29.4			1.0	1300	1000
	17-May-99	Iron	370			19.4	NE	300
	17-May-99	Lead	2.9			0.4	15	5 / 10
	17-May-99	Lithium	2130			0.2	NE	NE
	17-May-99	Magnesium	12300			2.8	NE	NE
	17-May-99	Manganese	58.6	J		0.2	NE	50
	17-May-99	Nickel	8.5			1.2	NE	100
	17-May-99	Potassium	15800			27.9	NE	NE
	17-May-99	Selenium	1.3			1.1	50	50
	17-May-99	Sodium	21200	J		4.1	NE	50000
	17-May-99	Vanadium	1.2			0.8	NE	NE
	17-May-99	Zinc	928			0.5	NE	5000
Monitoring wells completed in bedrock								
B38W02D[e]	20-May-99	Aluminum	22.4			20.1	NE	200
	20-May-99	Arsenic	0.61			0.6	50	0.02 / 8
Background	20-May-99	Barium	342			0.2	2000	2000
	20-May-99	Boron	24.2			2.0	NE	NE
	20-May-99	Calcium	96500			16.4	NE	NE

Table 1-3
1999 Groundwater Analytical Results - Detected Metals
FUSRAP Maywood Interim Storage Site
Maywood, NJ

Sampling Location	Date Collected	Detected Analyte[a]	Result (µg/L)	Data Qualifiers[b] BNI	Data Qualifiers[b] Lab	Reporting Limit (µg/L)	Related Regulations Federal[c] (µg/L)	Related Regulations State[d] (µg/L)
	20-May-99	Chromium	9.7			0.6	100	100
	20-May-99	Copper	2.9			1.0	1300	1000
	20-May-99	Iron	28.8			19.4	NE	300
B38W02D[e]	20-May-99	Lithium	11.7			0.2	NE	NE
	20-May-99	Magnesium	4020			2.8	NE	NE
	20-May-99	Manganese	1130			0.2	NE	50
	20-May-99	Nickel	5.7			1.2	NE	100
	20-May-99	Potassium	777			27.9	NE	NE
	20-May-99	Silver	1.4			1.4	NE	NE
	20-May-99	Sodium	8350			4.1	NE	50000
	20-May-99	Vanadium	1			0.8	NE	NE
	20-May-99	Zinc	2.5			0.5	NE	5000
B38W14D	20-May-99	Aluminum	56.3			20.1	NE	200
	20-May-99	Arsenic	0.81			0.6	50	0.02 / 8
	20-May-99	Barium	116			0.2	2000	2000
	20-May-99	Boron	47.5			2.0	NE	NE
	20-May-99	Calcium	119000			16.4	NE	NE
	20-May-99	Chromium	1			0.6	100	100
	20-May-99	Copper	3.6			1.0	1300	1000
	20-May-99	Iron	64.2	J		19.4	NE	300
	20-May-99	Lead	0.86			0.4	15	5 / 10
	20-May-99	Lithium	34.3	J		0.2	NE	NE
	20-May-99	Magnesium	30000			2.0	NE	NE
	20-May-99	Manganese	6.1	J		0.2	NE	50
	20-May-99	Nickel	3.3			1.2	NE	100
	20-May-99	Potassium	4140			27.9	NE	NE
	20-May-99	Sodium	38800			4.1	NE	50000
	20-May-99	Vanadium	1.1			0.8	NE	NE
B38W14D	20-May-99	Zinc	4.7	U		0.5	NE	5000
B38W17B	13-May-99	Aluminum	32			20.1	NE	200
	13-May-99	Arsenic	0.76			0.6	50	0.02 / 8
	13-May-99	Barium	89.1			0.2	2000	2000
	13-May-99	Boron	317			2.0	NE	NE
	13-May-99	Calcium	303000			16.4	NE	NE
	13-May-99	Chromium	1.4			0.6	100	100
	13-May-99	Copper	1.2			1.0	1300	1000
	13-May-99	Iron	8350			19.4	NE	300
	13-May-99	Lithium	1460	J		0.2	NE	NE
	13-May-99	Magnesium	25200			2.0	NE	NE
	13-May-99	Manganese	4920			0.2	NE	50
	13-May-99	Nickel	1.6			1.2	NE	100
	13-May-99	Potassium	98900			395.0	NE	NE
	13-May-99	Silver	1.4			1.4	NE	NE
	13-May-99	Sodium	197000			17.5	NE	50000
	13-May-99	Vanadium	2.1			0.8	NE	NE
B38W18D	20-May-99	Aluminum	130			20.1	NE	200
	20-May-99	Arsenic	2.3			0.6	50	0.02 / 8
	20-May-99	Barium	20.8			0.2	2000	2000
	20-May-99	Beryllium	0.98			0.1	4	0.008 / 20
	20-May-99	Boron	366			2.0	NE	NE
	20-May-99	Calcium	161000			16.4	NE	NE
	20-May-99	Chromium	39.5			0.6	100	100
	20-May-99	Cobalt	15.7			0.7	NE	NE
	20-May-99	Iron	14800			19.4	NE	300
	20-May-99	Lead	1.1			0.4	15	5 / 10
	20-May-99	Lithium	2850			0.2	NE	NE
	20-May-99	Magnesium	14500			2.8	NE	NE

Table 1-3
1999 Groundwater Analytical Results - Detected Metals
FUSRAP Maywood Interim Storage Site
Maywood, NJ

Sampling Location	Date Collected	Detected Analyte[a]	Result (µg/L)	Data Qualifiers[b] BNI	Lab	Reporting Limit (µg/L)	Related Regulations Federal[c] (µg/L)	State[d] (µg/L)
	20-May-99	Manganese	4590			0.2	NE	50
	20-May-99	Nickel	24.9			1.2	NE	100
	20-May-99	Potassium	7360			27.9	NE	NE
	20-May-99	Sodium	34300			4.1	NE	50000
	20-May-99	Zinc	78			0.5	NE	5000
B38W19D	27-May-99	Arsenic	55.1	J		5.5	50	0.02 / 8
	27-May-99	Barium	31			0.2	2000	2000
	27-May-99	Boron	1120			2.0	NE	NE
	27-May-99	Cadmium	0.3	J		0.3	5	4
	27-May-99	Calcium	258000			16.4	NE	NE
	27-May-99	Iron	3670			19.4	NE	300
	27-May-99	Lead	0.6	J		0.4	15	5/10
	27-May-99	Lithium	6350	J		0.2	NE	NE
	27-May-99	Magnesium	42000			2.8	NE	NE
	27-May-99	Manganese	2820			0.2	NE	50
	27-May-99	Nickel	1.7			1.2	NE	100
	27-May-99	Potassium	408000	J		69.8	NE	NE
	27-May-99	Silver	1.4			1.4	NE	NE
	27-May-99	Sodium	383000			43.8	NE	50000
	27-May-99	Vanadium	8.2			0.8	NE	NE
	27-May-99	Zinc	2.1			0.5	NE	5000
B38W24D	13-May-99	Aluminum	93.7			20.1	NE	200
	13-May-99	Barium	45.6			0.2	2000	2000
	13-May-99	Beryllium	0.42			0.1	4	0.008 / 20
	13-May-99	Boron	98.3			2.0	NE	NE
	13-May-99	Cadmium	2.5	U		0.3	5	4
	13-May-99	Calcium	98800			16.4	NE	NE
	13-May-99	Chromium	6.4			0.6	100	100
	13-May-99	Copper	3			1.0	1300	1000
	13-May-99	Iron	27000			19.4	NE	300
	13-May-99	Lead	1.2			0.4	15	5 / 10
	13-May-99	Lithium	50.4			0.2	NE	NE
B38W24D	13-May-99	Magnesium	11400			2.8	NE	NE
	13-May-99	Manganese	5860			0.2	NE	50
	13-May-99	Nickel	4.4			1.2	NE	100
	13-May-99	Potassium	12800			27.9	NE	NE
	13-May-99	Sodium	40000			4.1	NE	50000
	13-May-99	Vanadium	0.8			0.8	NE	NE
	13-May-99	Zinc	5.9			0.5	NE	5000
B38W25D	26-May-99	Aluminum	20.1			20.1	NE	200
	26-May-99	Antimony	0.35	UJ		0.4	6	2 / 20
	26-May-99	Arsenic	0.55	UJ		0.6	50	0.02 / 8
	26-May-99	Barium	58.4			0.2	2000	2000
	26-May-99	Boron	146			2.0	NE	NE
	26-May-99	Calcium	109000			16.4	NE	NE
	26-May-99	Iron	4980			19.4	NE	300
	26-May-99	Lithium	1290	J		0.2	NE	NE
	26-May-99	Magnesium	5290			2.8	NE	NE
	26-May-99	Manganese	1390			0.2	NE	50
	26-May-99	Nickel	2.7	J		1.2	NE	100
	26-May-99	Potassium	56100			27.9	NE	NE
	26-May-99	Sodium	27700	J		4.1	NE	50000
	26-May-99	Zinc	4.5			0.5	NE	5000
MISS01B[g]	25-May-99	Antimony	0.35	UJ		0.4	6	2/20
	25-May-99	Arsenic	1.1	J		0.6	50	0.02 / 8
	25-May-99	Barium	73.5			0.2	2000	2000
	25-May-99	Boron	61.6			2.0	NE	NE

Table 1-3
1999 Groundwater Analytical Results - Detected Metals
FUSRAP Maywood Interim Storage Site

Maywood, NJ

Sampling Location	Date Collected	Detected Analyte[a]	Result (µg/L)	Data Qualifiers[b] BNI	Data Qualifiers[b] Lab	Reporting Limit (µg/L)	Related Regulations Federal[c] (µg/L)	Related Regulations State[d] (µg/L)
	25-May-99	Cadmium	0.3	UJ		0.3	5	4
	25-May-99	Calcium	96600	J		16.4	NE	NE
	25-May-99	Iron	1060			19.4	NE	300
	25-May-99	Lithium	95.6	J		0.2	NE	NE
	25-May-99	Magnesium	18800			2.8	NE	NE
	25-May-99	Manganese	359			0.2	NE	50
	25-May-99	Molybdenum	1.2			1.2	NE	NE
	25-May-99	Nickel	1.8			1.2	NE	100
	25-May-99	Potassium	11900			27.9	NE	NE
	25-May-99	Selenium	1.7	J		1.1	50	50
	25-May-99	Silver	1.4			1.4	NE	NE
	25-May-99	Sodium	51500			4.1	NE	50000
	25-May-99	Vanadium	3.4			0.8	NE	NE
	25-May-99	Zinc	2.9			0.5	NE	5000
MISS02B	18-May-99	Aluminum	53.4			20.1	NE	200
	18-May-99	Barium	11			0.2	2000	2000
	18-May-99	Beryllium	0.84			0.1	4	0.008 / 20
	18-May-99	Boron	1580			2.0	NE	NE
	18-May-99	Calcium	302000			16.4	NE	NE
MISS02B	18-May-99	Chromium	7.5			0.6	100	100
	18-May-99	Cobalt	3			0.7	NE	NE
	18-May-99	Iron	8620			19.4	NE	300
	18-May-99	Lithium	12100			0.2	NE	NE
	18-May-99	Magnesium	40100			2.8	NE	NE
	18-May-99	Manganese	5600			0.2	NE	50
	18-May-99	Nickel	9.6			1.2	NE	100
	18-May-99	Potassium	70700	J		27.9	NE	NE
	18-May-99	Silver	1.4			1.4	NE	NE
	18-May-99	Sodium	1000000			350.0	NE	50000
	18-May-99	Vanadium	3.8			0.8	NE	NE
MISS07B	27-May-99	Arsenic	49.9	J		2.8	50	0.02 / 8
	27-May-99	Antimony	2	J		0.7	6	2/20
	27-May-99	Barium	21.4			0.2	2000	2000
	27-May-99	Beryllium	0.1	U		0.1	4	0.008 / 20
	27-May-99	Boron	1670			2.0	NE	NE
	27-May-99	Calcium	244000			16.4	NE	NE
	27-May-99	Chromium	3.1			0.6	100	100
	27-May-99	Cobalt	3.7			0.7	NE	NE
	27-May-99	Copper	1			1.0	1300	1000
	27-May-99	Iron	5920			19.4	NE	300
	27-May-99	Lithium	6870			0.2	NE	NE
	27-May-99	Magnesium	85400			2.8	NE	NE
	27-May-99	Manganese	3950			0.2	NE	50
	27-May-99	Nickel	5.9			1.2	NE	100
	27-May-99	Potassium	43700		J	27.9	NE	NE
	27-May-99	Silver	1.9		J	1.4	NE	NE
	27-May-99	Sodium	1290000			87.5	NE	50000
	27-May-99	Vanadium	18.8			0.8	NE	NE
	27-May-99	Zinc	4.6		J	0.5	NE	5000

[a] Only the analytes that were detected are reported. Shaded result indicates value exceeds criteria.

[b] BNI and laboratory data qualifier flags: J = Reported as an estimated value, U= analyte was not detected.

[c] Federal SDWA MCLs, 40 CFR 141. Regulations pertain to drinking water quality and are listed for comparison purposes only. Not established (NE).

Table 1-3
1999 Groundwater Analytical Results - Detected Metals
FUSRAP Maywood Interim Storage Site
Maywood, NJ

				Data		Reporting	Related Regulations	
Sampling	Date	Detected	Result	Qualifiers[b]		Limit	Federal[c]	State[d]
Location	Collected	Analyte[a]	(µg/L)	BNI	Lab	(µg/L)	(µg/L)	(µg/L)

[d] New Jersey Class IIA Groundwater Quality Standards NJAC 7:9-6. Analytes for which the PQL is greater than the GWQC are noted as such: GWQC/PQL.

[e] Monitoring well B38W01S is the background location for wells completed in unconsolidated sediment. Monitoring well B38W02D is the background location for wells completed in bedrock.

TABLE 2-1

DEPTH TO GROUNDWATER AND GROUNDWATER ELEVATION FOR BEDROCK MONITORING WELLS
AUGUST 1999

MAYWOOD FUSRAP SUPERFUND SITE
MAYWOOD, NJ

							8/10-8/12/1999		
Well	Northing	Easting		Elevation TOR (ft MSL)		Ground Surface Elevation (ft MSL)	DTW Below Ground Surface (ft)	DTW Below TOR (ft)	Groundwater Elevation (ft MSL)
MISS01B	752,964.86	2,164,092.32		61.98		60.42	17.23	18.79	43.19
MISS02B	752,771.91	2,164,709.45		61.64		61.15	13.56	14.05	47.59
MISS03B	752,296.78	2,164,451.46		57.66		56.78	11.93	12.81	44.85
MISS04B	752,096.08	2,164,353.55		56.42		55.38	12.32	13.36	43.06
MISS05B	752,371.68	2,164,044.40		59.76		58.09	16.28	17.95	41.81
MISS07B	752,652.98	2,164,048.77		55.77		53.99	11.37	13.15	42.62
B38W02D	752,558.00	2,165,243.20		67.70		64.75	20.46	23.41	44.29
B38W03B	752,253.19	2,164,513.81		58.27		56.93	12.02	13.36	44.91
B38W04B	752,093.44	2,164,950.21		65.85		63.02	10.63	13.46	52.39
B38W05B	752,175.06	2,165,367.58		71.05		68.18	15.08	17.95	53.10
B38W06B	752,016.47	2,164,670.94		54.41		51.70	NG	NG	NA
B38W07B	751,974.49	2,164,168.36		54.63		52.25	10.09	12.47	42.16
B38W12B	750,766.38	2,165,393.46		49.78		47.53	7.84	10.09	39.69
B38W14D	752,600.00	2,163,400.00	(1)	44.88	(2)	45.38	NG	NG	NA
B38W15D	752,370.00	2,164,700.00	(1)	46.99	(2)	47.49	NG	NG	NA
B38W17B	752,021.78	2,163,927.32		53.28		50.68	9.39	11.99	41.29
B38W18D	752,505.39	2,164,783.97		57.85		58.02	6.37	6.20	51.65
B38W19D	752,522.83	2,164,045.10		59.98		57.49	15.99	18.48	41.50
B38W24D	752,193.57	2,164,291.33		54.91		55.29	11.88	11.50	43.41
B38W25D	752,520.38	2,164,353.79		58.24		56.13	9.44	11.55	46.69

Legend

TOR - Top of Riser
DTW - Depth to Water
BGS - Below Ground Surface
ft - feet
MSL - Mean Sea Level
N/A - Not Applicable
(1) - Due to access restrictions northing and eastings for these well clusters are approximate
(2) - Due to access restrictions elevation of top of riser (TOR) was determined based on surveyed information of top of casing (TOC) and the difference in elevation between casing and riser reported in well construction log

TABLE 2-2

DEPTH TO GROUNDWATER AND GROUNDWATER ELEVATIONS FOR OVERBURDEN MONITORING WELLS
JUNE AND AUGUST 1999

MAYWOOD FUSRAP SUPERFUND SITE
MAYWOOD, NJ

							8/10-8/12/1999		
Well Name	Northing	Easting		Elevation TOR (ft MSL)		Ground Surface Elevation (ft MSL)	DTW Below Ground Surface (ft)	DTW Below TOR (ft)	Groundwater Elevation (ft MSL)
MISS01AA	752,963.64	2,164,101.98		62.7		60.50	17.01	19.21	43.49
MISS02A	752,788.00	2,164,706.13		61.47		60.56	12.47	13.38	48.09
MISS03A	752,302.00	2,164,437.77		58.52		56.56	Dry	Dry	<44.86(1)
MISS04A	752,109.73	2,164,349.46		57.17		55.36	Dry	Dry	<45.66(1)
MISS05A	752,360.40	2,164,044.20		58.65		57.86	15.08	15.87	42.78
MISS06A	752,645.21	2,164,224.78		58.26		57.07	12.61	13.8	44.46
MISS07A	752,657.57	2,164,053.10		55.6		53.52	7.47	9.55	46.05
B38W01S	752,836.02	2,164,805.24		60.72		57.55	5.94	9.11	51.61
B38W12A	750,774.61	2,165,389.50		50.1		47.23	7.59	10.46	39.64
B38W14S	752,600.00	2,163,400.00	(2)	45.07	(3)	45.47	5.61	5.21	39.86
B38W15S	752,370.00	2,164,700.00	(2)	46.92	(3)	47.42	NG	NG	NA
B38W17A	752,019.80	2,163,922.90		53.24		50.70	9.45	11.99	41.25
B38W19S	752,513.62	2,164,049.13		59.91		57.48	15.31	17.74	42.17
B38W24S	752,193.57	2,164,291.43		55.04		55.38	11.84	11.5	43.54
B38W25S	752,512.97	2,164,346.37		57.44		55.67	9.33	11.1	46.34

Legend

TOR - Top of Riser
DTW - Depth to Water
BGS - Below Ground Surface
ft - feet
MSL - Mean Sea Level
N/A - Not Applicable
(1) - Denotes that water level elevation was determined using elevation of the bottom of the screen
(2) - Due to access restrictions northing and eastings for these well clusters are approximate
(3) - Due to access restrictions elevation of top of riser (TOR) was determined based on surveyed information of top of casing (TOC) and the difference in elevation between casing and riser reported in well construction log

TABLE 2-3

VERTICAL GRADIENT CALCULATIONS
FOR MONITORING WELL CLUSTERS
AUGUST 1999

MAYWOOD FUSRAP SUPERFUND SITE
MAYWOOD, NJ

	8/10-8/12/1999	
Well Cluster	DTW referenced to TOR/Well Casing (ft)	Groundwater Elevation (ft MSL)
MISS01AA	19.21	43.49
MISS01B	18.79	43.19
Hydraulic Head Difference (ft)		0.30
Gradient Direction		Downward
MISS02A	13.38	48.09
MISS02B	14.05	47.59
Hydraulic Head Difference (ft)		0.50
Gradient Direction		Downward
MISS03A	Dry	<44.86
MISS03B	12.81	44.85
Hydraulic Head Difference (ft)		N/A
Gradient Direction		Likely Upward
MISS04A	Dry	<45.66
MISS04B	13.36	43.06
Hydraulic Head Difference		N/A
Gradient Direction		Unknown
MISS05A	15.87	42.78
MISS05B	17.95	41.81
Hydraulic Head Difference (ft)		0.97
Gradient Direction		Downward
MISS07A	9.55	46.05
MISS07B	13.15	42.62
Hydraulic Head Difference (ft)		3.43
Gradient Direction		Downward
B38W12A	10.46	39.64
B38W12B	10.09	39.69
Hydraulic Head Difference (ft)		-0.05
Gradient Direction		Upward
B38W14S	5.21	39.86
B38W14D	NG	N/A
Hydraulic Head Difference (ft)		N/A
B38W15S	NG	N/A
B38W15D	NG	N/A
Hydraulic Head Difference (ft)		N/A
B38W17A	11.99	41.25
B38W17B	11.99	41.29
Hydraulic Head Difference (ft)		-0.04
Gradient Direction		Upward
B38W19S	17.74	42.17
B38W19D	18.48	41.50
Hydraulic Head Difference (ft)		0.67
Gradient Direction		Downward
B38W24S	11.50	43.54
B38W24D	11.50	43.41
Hydraulic Head Difference (ft)		0.13
Gradient Direction		Downward
B38W25S	11.10	46.34
B38W25D	11.55	46.69
Hydraulic Head Difference (ft)		-0.35
Gradient Direction		Upward

Legend

DTW - Depth to Water
TOR - Top of Riser
N/A - Not Applicable

TABLE 2-4
PHYSICAL CHARACTERISTICS OF THE OVERBURDEN AND BEDROCK AQUIFERS

FUSRAP MAYWOOD SUPERFUND SITE
MAYWOOD, NJ

	Groundwater Elevation* (feet MSL)	Hydraulic Gradient* (feet/feet)	Hydraulic Conductivity (cm/s)	Hydraulic Conductivity Geo. Mean (cm/s)
Bedrock	37 to 55	0.004 to 0.02	2.2 x 10-5 to 4.0 x 10-3	7.4 x 10-4
Overburden	40 to 57	0.01	2.6 x 10-5 to 2. 9 x 10-2	3.9 x 10-4

*Measurements obtained in March 1992. Source: BNI, 1992.

Table 2-5
1999 Sediment Analytical Results - Radioactive Constituents
Lodi Brook
Maywood Interim Storage Site

Sampling Location	Date Collected	Analyte	Result[a] (pCi/g)			BNI Flag[b]	MDA[c] (pCi/g)	Cleanup Criteria[d] (pCi/g)
SWSD005	21-May-99	Radium-226	1.44	±	0.34		0.50	5
	21-May-99	Radium-228	3.13	±	0.78		0.50	5
	21-May-99	Thorium-230	1.81	±	0.52		0.50	5
	21-May-99	Thorium-232	3.56	±	0.85		0.50	5
	21-May-99	Total uranium	1.18	±	0.04		0.07	100
SWSD006	21-May-99	Radium-226	8.04	±	1.33		0.50	5
	21-May-99	Radium-228	7.67	±	1.64		0.50	5
	21-May-99	Thorium-230	1.62	±	0.50		0.50	5
	21-May-99	Thorium-232	8.13	±	1.71		0.50	5
	21-May-99	Total uranium	12.41	±	0.9		0.07	100
SWSD007	21-May-99	Radium-226	1.07	±	0.30		0.50	5
	21-May-99	Radium-228	1.79	±	0.49		0.50	5
	21-May-99	Thorium-230	1.18	±	0.37		0.50	5
	21-May-99	Thorium-232	1.9	±	0.51		0.50	5
	21-May-99	Total uranium	2.0	±	0.05		0.07	100

[a]Results reported with ± radiological error equal at 2 sigma (95% confidence level), Shaded results indicate reported value exceeds criteria.

[b] BNI data qualifier flags:
U = The analyte was not detected.
J = Reported as an estimated value.

[c] Minimum Detectable Activity (MDA)

[d] DOE/EPA soil criteria (DOE 1994a) and DOE site-specific criterion (DOE 1994b).

[e] A quality control duplicate is collected at the same time and location and is analyzed by the same method in order to evaluate precision in sampling and analysis.

Table 2-6
1999 Sediment Analytical Results - Detected Metals in Lodi Brook
Maywood Interim Storage Site, Maywood, NJ

Sampling Location	Date Collected	Detected Analyte[a]	Result (mg/kg)	Data Qualifiers[b] BNI	Lab	Reporting Limits (mg/kg)	State Proposed Criteria[c] (mg/kg)
SWSD005	21-May-99	Aluminum	2,090.00			1.4	NE
(non-residential)	21-May-99	Antimony	0.28	J		0.13	340
	21-May-99	Arsenic	2.70			0.16	20
	21-May-99	Barium	48.70			0.01	47,000
	21-May-99	Beryllium	0.19			0.007	1
	21-May-99	Boron	8.70			0.14	NE
	21-May-99	Cadmium	0.55			0.02	100
	21-May-99	Calcium	6,440.00	J		1.1	NE
	21-May-99	Chromium	16.40			0.04	NE
	21-May-99	Cobalt	2.80			0.05	NE
	21-May-99	Copper	82.60	J		0.07	600
	21-May-99	Iron	9,480.00			1.3	NE
	21-May-99	Lead	26.20			0.2	600
	21-May-99	Lithium	4.20			0.01	NE
	21-May-99	Magnesium	2,500.00	J		0.19	NE
	21-May-99	Manganese	360.00			0.01	NE
	21-May-99	Molybdenum	4.80			0.08	NE
	21-May-99	Nickel	8.10			0.08	2,400
	21-May-99	Potassium	228.00			1.9	NE
	21-May-99	Sodium	130.00			0.28	NE
	21-May-99	Thallium	0.32			0.24	
	21-May-99	Vanadium	8.30			0.06	7,100
	21-May-99	Zinc	105.0	J		0.03	1,500
SWSD006	21-May-99	Aluminum	6,250.0	J		0.19	NE
(non-residential)	21-May-99	Antimony	2.2	J		0.26	340
	21-May-99	Arsenic	18.2	J		0.31	20
	21-May-99	Barium	274.0	J		0.03	47,000
	21-May-99	Beryllium	0.61	J		0.01	1
	21-May-99	Boron	7.1	J		0.27	NE
	21-May-99	Cadmium	2.9	J		0.04	100
	21-May-99	Calcium	12,900.0	J		2.2	NE
	21-May-99	Chromium	260.0	J		0.08	NE
	21-May-99	Cobalt	4.6	J		0.1	NE
	21-May-99	Copper	109.0	J		0.14	600
	21-May-99	Iron	11,200.0	J		2.6	NE
	21-May-99	Lead	294.0	J		0.39	600
	21-May-99	Lithium	40.2	J		0.03	NE
	21-May-99	Magnesium	2,060.0	J		0.38	NE
	21-May-99	Manganese	259.0	J		0.03	NE
	21-May-99	Molybdenum	2.4	J		0.16	NE
	21-May-99	Nickel	19.8	J		0.16	2,400
	21-May-99	Potassium	446.0	J		3.8	NE
	21-May-99	Selenium	1.5	J		0.64	3,100
	21-May-99	Sodium	750.0	J		0.56	NE
	21-May-99	Vanadium	36.9	J		0.11	7,100

Table 2-6
1999 Sediment Analytical Results - Detected Metals in Lodi Brook
Maywood Interim Storage Site, Maywood, NJ

Sampling Location	Date Collected	Detected Analyte[a]	Result (mg/kg)	Data Qualifiers[b] BNI	Lab	Reporting Limits (mg/kg)	State Proposed Criteria[c] (mg/kg)
	21-May-99	Zinc	498.0	J		0.07	1,500
SWSD007	21-May-99	Aluminum	3,450.0			1.2	NE
(non-residential)	21-May-99	Antimony	0.6	J		0.12	340
	21-May-99	Arsenic	6.7			0.14	20
	21-May-99	Barium	114.0			0.01	47,000
	21-May-99	Beryllium	0.28			0.006	1
	21-May-99	Boron	2.9			0.12	NE
	21-May-99	Cadmium	0.49			0.02	100
	21-May-99	Calcium	2,460.0	J		1	NE
	21-May-99	Chromium	122.0			0.04	NE
	21-May-99	Cobalt	3.4			0.04	NE
	21-May-99	Copper	24.5	J		0.06	600
	21-May-99	Iron	8,480.0			1.2	NE
	21-May-99	Lead	140.0			0.18	600
	21-May-99	Lithium	7.8			0.01	NE
	21-May-99	Magnesium	1,240.0	J		0.17	NE
	21-May-99	Manganese	134.0			0.01	NE
	21-May-99	Molybdenum	1.0			0.07	NE
	21-May-99	Nickel	8.7			0.07	2,400
	21-May-99	Potassium	351.0			1.7	NE
	21-May-99	Selenium	0.44			0.29	3,100
	21-May-99	Sodium	212.0			0.25	NE
	21-May-99	Thallium	0.28			0.21	
	21-May-99	Vanadium	17.7			0.05	7,100
	21-May-99	Zinc	94.9			0.03	1,500

[a] Only the analytes that were detected are reported. Shaded results indicate reported value exceeds criteria.

[b] BNI and laboratory data qualifier flags:

U= The analyte was not detected

J= Reported as estimated value

[c] New Jersey Proposed Cleanup Standards for Contaminated Sites: Residential and Non-residential Soil Cleanup Standards (N.J.A.C. 7:26). Residential or non-residential limits are presented, depending upon the zoning of the sampling location.

[d] A quality control duplicate is collected at the same time and location, and is analyzed by the same method in order to evaluate precision in sampling and analysis.

Table 2-7
1999 Sediment Analytical Results - Radioactive Constituents - Westerly Brook
Maywood Interim Storage Site, Maywood, NJ

Sampling Location	Date Collected	Analyte	Result[a] (pCi/g)			BNI Flag[b]	MDA[c] (pCi/g)	Cleanup Criteria[d] (pCi/g)
SWSD003	21-May-99	Radium-226	0.3	±	0.18		0.50	5
Background	21-May-99	Radium-228	0.35	±	0.18		0.50	5
	21-May-99	Thorium-230	0.96	±	0.31		0.50	5
	21-May-99	Thorium-232	0.2	±	0.13	U	0.50	5
	21-May-99	Total uranium	1.06	±	0.03		0.07	100
Duplicate	21-May-99	Radium-226	0.66	±	0.31		0.50	5
	21-May-99	Radium-228	0.3	±	0.18		0.50	5
	21-May-99	Thorium-230	0.73	±	0.27		0.50	5
	21-May-99	Thorium-232	0.48	±	0.21	U	0.50	5
	21-May-99	Total uranium	1.19	±	0.03	U	0.07	100
SWSD002	21-May-99	Radium-226	0.36	±	0.17		0.50	5
	21-May-99	Radium-228	0.74	±	0.27		0.50	5
	21-May-99	Thorium-230	0.55	±	0.22		0.50	5
	21-May-99	Thorium-232	0.39	±	0.18		0.50	5
	21-May-99	Total uranium	1.27	±	0.03		0.07	100

[a]Results
Shaded results indicate reported value exceeds criteria.

[b] BNI data qualifier flags:
U = The analyte was not detected.
J = Reported as an estimated value.

[c] Minimum Detectable Activity (MDA)

[d] DOE/EPA soil criteria (DOE 1994a) and DOE site-specific criterion (DOE 1994b).

[e] A quality control duplicate is collected at the same time and location and is analyzed by the same method in order to evaluate precision in sampling and analysis.

Table 2-8
1999 Sediment Analytical Results - Detected Metals in Westerly Brook
Maywood Interim Storage Site

Sampling Location	Date Collected	Detected Analyte[a]	Result (mg/kg)	Data Qualifiers[b] BNI	Lab	Reporting Limits (mg/kg)	State Proposed Criteria[c] (mg/kg)
SWSD003	21-May-99	Aluminum	2,090.0			1.4	NE
Background	21-May-99	Antimony	0.4	J		0.13	340
	21-May-99	Arsenic	2.8			0.16	20
	21-May-99	Barium	35.00			0.01	47000
	21-May-99	Beryllium	0.30			0.007	1
	21-May-99	Boron	3.4			0.14	NE
	21-May-99	Cadmium	0.69			0.02	100
	21-May-99	Calcium	3,030.00	J		1.1	NE
	21-May-99	Chromium	14.00			0.04	NE
	21-May-99	Cobalt	3.2			0.05	NE
	21-May-99	Copper	54.9	J		0.07	600
	21-May-99	Iron	8,550.00			1.3	NE
	21-May-99	Lead	91.60			0.2	600
	21-May-99	Lithium	3.2			0.01	NE
	21-May-99	Magnesium	1,600.00	J		0.19	NE
	21-May-99	Manganese	82.00			0.01	NE
	21-May-99	Molybdenum	1.10			0.08	NE
	21-May-99	Nickel	13.3			0.08	2400
	21-May-99	Potassium	206.0			1.9	NE
	21-May-99	Sodium	166.0			0.28	NE
	21-May-99	Vanadium	9.2			0.05	7100
	21-May-99	Zinc	184.0	J		0.03	1500
SWSD003	21-May-99	Aluminum	2,670.00			1.4	NE
Duplicate[d]	21-May-99	Antimony	0.55	J		0.13	340
	21-May-99	Arsenic	3.60			0.16	20
	21-May-99	Barium	50.80			0.01	47000
	21-May-99	Beryllium	0.22			0.007	1
	21-May-99	Boron	4.20			0.14	NE
	21-May-99	Cadmium	0.59			0.02	100
	21-May-99	Calcium	3,150.00	J		1.1	NE
	21-May-99	Chromium	17.20			0.04	NE
	21-May-99	Cobalt	3.00			0.05	NE
	21-May-99	Copper	38.10	J		0.07	600
	21-May-99	Iron	7,410.00			1.3	NE
	21-May-99	Lead	96.80			0.2	600
	21-May-99	Lithium	3.90			0.01	NE
	21-May-99	Magnesium	1,670.00			0.19	NE
	21-May-99	Manganese	74.20	J		0.01	NE
	21-May-99	Molybdenum	0.90			0.08	NE
	21-May-99	Nickel	10.90			0.08	2400
	21-May-99	Potassium	213.00			1.9	NE
	21-May-99	Sodium	183.00			0.28	NE
	21-May-99	Vanadium	10.10			0.05	7100
	21-May-99	Zinc	165.00			0.03	1500

Table 2-8
1999 Sediment Analytical Results - Detected Metals in Westerly Brook
Maywood Interim Storage Site

Sampling Location	Date Collected	Detected Analyte[a]	Result (mg/kg)	Data Qualifiers[b] BNI	Lab	Reporting Limits (mg/kg)	State Proposed Criteria[c] (mg/kg)
SWSD002	21-May-99	Aluminum	2,800.0			1.3	NE
	21-May-99	Antimony	0.70	J		0.13	14
	21-May-99	Arsenic	6.2			0.15	20
	21-May-99	Barium	46.2			0.01	700
	21-May-99	Beryllium	0.29			0.007	1
	21-May-99	Boron	4.7			0.13	NE
	21-May-99	Cadmium	0.75			0.02	1
	21-May-99	Calcium	4,120.0	J		1.1	NE
	21-May-99	Chromium	18.5			0.04	NE
	21-May-99	Cobalt	3.8			0.05	NE
	21-May-99	Copper	61.9	J		0.07	600
	21-May-99	Iron	10,900.0			1.3	NE
	21-May-99	Lead	102.0			0.19	400
	21-May-99	Lithium	4.9			0.01	NE
	21-May-99	Magnesium	2,140.0	J		0.18	NE
	21-May-99	Manganese	182.0			0.01	NE
	21-May-99	Molybdenum	0.96			0.08	NE
	21-May-99	Nickel	13.2			0.08	250
	21-May-99	Potassium	271.0			1.8	NE
	21-May-99	Sodium	124.0			0.27	NE
	21-May-99	Vanadium	12.8			0.05	370
	21-May-99	Zinc	212.0	J		0.03	1500

[a] Only the analytes that were detected are reported. Shaded results indicate reported value exceeds criteria.

[b] BNI and laboratory data qualifier flags:

U= The analyte was not detected

J= Reported as estimated value

[c] New Jersey Proposed Cleanup Standards for Contaminated Sites: Residential and Non-residential Soil Cleanup Standards (N.J.A.C. 7:26). Residential or non-residential limits are presented, depending upon the zoning of the sampling location.

[d] A quality control duplicate is collected at the same time and location, and is analyzed by the same method in order to evaluate precision in sampling and analysis.

TABLE 3-1
PRELIMINARY CONSTITUENTS OF CONCERN
FUSRAP MAYWOOD SUPERFUND SITE
MAYWOOD, NJ

	GROUNDWATER		SURFACE	
CONSTITUENT	**OVERBURDEN**	**BEDROCK**	**WATER**	**SEDIMENT**
RADIONUCLIDES				
Uranium-238	X	X	X	X
Total Uranium (Uranium-235, 238)	X	X	X	X
Thorium-232	X	X	X	X
Thorium-230				
Radium-226	X	X	X	X
Radium-228	X	X		
VOLATILE ORGANIC COMPOUNDS				
Benzene		X		
Ethylbenzene		X		
Toluene	X	X	X	
Xylenes		X		X
METALS AND RARE EARTH ELEMENTS				
Arsenic	X	X	X	X
Barium	X			X
Boron	X	X	X	X
Cadium	X		X	X
Cerium	X	X	X	X
Chromium	X	X	X	X
Erbium	X	X	X	X
Lanthanum	X	X	X	X
Lead	X	X	X	X
Lithium	X	X	X	X
Mercury	X		X	X
Neodymium	X	X	X	X
Selenium	X			
Silver	X			

X = Preliminary constituent of potential concern

Table 3-2
Current Hydrogeologic Data Gaps
FUSRAP Maywood Superfund Site, Maywood, NJ

Data Gap Category	Specific Data Gap
Groundwater Quality	• The extent of groundwater contamination north of monitoring well cluster B38W14; • The extent of groundwater contamination south of monitoring well cluster B38W15; • The downgradient extent of groundwater contamination; • The groundwater quality near the Scannel, 80 and 100 Hancock Street, 170 Gregg Street, 80 Industrial Road, NJVIS, Fireman's Park, Kennedy Park, and 72 Sidney Street properties; and • The groundwater quality north and east of the MISS.
Soil Quality	• Assess preliminary soil screening levels (SSLs) protective of leaching to groundwater and compare these levels to proposed soil cleanup levels for radium, thorium, and total uranium in residential (5/5/50 pCi/g) and commercial settings (15/15/50 pCi/g), respectively.
Surface Water	• Assess potential contaminant impacts to the surface water in the Saddle River, Lodi Brook, Coles Brook, and Westerly Brook.
Sediment Quality	• Assess potential contaminant impacts to the sediments in the Saddle River, Lodi Brook, Coles Brook, and Westerly Brook.
Culvert Integrity	• Assess the integrity of both the Westerly Brook and Lodi Brook Culverts via a video inspection. Results of video inspection will assist in determining impacts on contaminant migration (groundwater/surface), and affects on potentiometric surfaces.
Geology	• Assess and infer the depth to bedrock throughout the Study Area; • Determine stratigraphic variations and depositional environments in the overburden throughout the Study Area; and • Evaluate the presence, location, and potential interconnection of bedrock fractures and joints via the performance of borehole geophysical techniques, aquifer pumping tests, and a VLF

Table 3-2 (continued)
Current Hydrogeologic Data Gaps
FUSRAP Maywood Superfund Site

Data Gap Category	Specific Data Gap
	survey.
Vertical Hydraulic Gradients	• Adjacent to the Saddle River, Lodi Brook, and Westerly Brook; • Between the overburden and bedrock.
Horizontal Hydraulic Gradients	• Adjacent to the Saddle River, Lodi Brook, and Westerly Brook.
Aquifer Properties	• Determine aquifer properties for the overburden and shallow bedrock units throughout the Study Area by performing in-situ slug, packer, and step/constant rate pump tests.

Ta[illegible] 4-1
Summary of GWRI Sampling and Analysis Program
FUSRAP Maywood Superfund Site
Maywood, NJ

Medium	Type of Investigation	Location of Investigation	Data Uses	Analyses Performed By	Analysis	MaximumNumber Of Samples
Groundwater	Geoprobe® Sampling	Throughout FMSS	Preliminary Site Characterization	FBL	VOCs (transects A, B, C, E, H, I, J), filtered RCRA 8 metals, filtered Lithium and Boron, filtered REE, and unfiltered RAD (transects A-J)	125
Groundwater	Monitoring Well Sampling	Throughout FMSS	Site Characterization,Alternatives Evaluation, and Risk Assessment	FBL	Existing Monitoring Wells: Unfiltered RCRA 8 metals, unfiltered Lithium and Boron, unfiltered Rad, and unfiltered REE	41
				FBL	Existing and Proposed Monitoring Wells: TCL VOCs (MW-1/1D through MW-13/13D, MW-19/19D, MW-20/20D), Unfiltered TAL metals, unfiltered Lithium and Boron, unfiltered Rad, unfiltered REE, and geochemical parameters	81
				FS	pH, specific conductance, temperature, turbidity, dissolved oxygen, Eh, Ferrous Iron, and Alkalinity	

Ta… 4-1
Summary of GWRI Sampling and Analysis Program
FUSRAP Maywood Superfund Site
Maywood, NJ

Medium	Type of Investigation	Location of Investigation	Data Uses	Analyses Performed By	Analysis	MaximumNumber Of Samples
Soils	Geoprobe® Sampling	Throughout FMSS	Site Characterization, Alternatives Evaluation	FBL and ML	PDI Soil Borings Full TCL/TAL, RCRA disposal parameters, Full TCL/TAL TCLP, REE, Rad, hexavalent chromium	47
				FBL and ML	GWRI Transects TCL VOCs (transects A, E, H, I, and J), RCRA 8 metals Lithium/Boron, Rad, and REE (transects A, E, F, H, I, and J)	48
Soils	Preliminary Soil Cleanup Levels Study	Throughout FMSS	Evaluation of COC mobility through soil	FBL	Rad (Ra-226, Th-228, U-238), Arsenic, Chromium, and Lithium	50

Ta 4-1
Summary of GWRI Sampling and Analysis Program
FUSRAP Maywood Superfund Site
Maywood, NJ

Medium	Type of Investigation	Location of Investigation	Data Uses	Analyses Performed By	Analysis	MaximumNumber Of Samples
Soils	Overburden Monitoring Wells	Monitoring Wells MW-1 through MW-19	Radiological, Chemical and Geophysical Characteristics		Chemical/Radiological Analyses	
				FBL And ML	TCL VOCs (w/exception of MW-14 through MW-18), TAL metals, Lithium/Boron, RAD	20
					Geophysical Characteristics	
				FBL	Standard Penetration Tests*, Total Organic Carbon, Soil pH, Specific Gravity (particle density), Bulk Density, Cation Exchange Capacity (CEC), Moisture Content, Grain Size Distribution including Hydrometer Analysis	20
Bedrock	Bedrock Monitoring Wells	Monitoring Wells MW-1D through MW-19D	Strat. Evaluation, bedrock fracture analysis	NA	Rock Quality Designation, Visual Classifications, and Geophysical Logging	20
Surface Water	Surface Water Sampling	Saddle River, Westerly Brook, Lodi Brook, Coles Brook, drainage swale north of MISS	Ecological Risk Assessment, Site Characterization	FBL	Unfiltered TAL metals, Lithium and Boron, Rad, REE, and TDS	27
				FS	PH, specific conductance, temperature, turbidity, dissolved oxygen, Eh, Ferrous Iron, and Alkalinity	27

Ta. 4-1
Summary of GWRI Sampling and Analysis Program
FUSRAP Maywood Superfund Site
Maywood, NJ

Medium	Type of Investigation	Location of Investigation	Data Uses	Analyses Performed By	Analysis	MaximumNumber Of Samples
Sediment	Sediment Sampling	Saddle River, Lodi, Westerly, and Coles Brook, drainage swale north of MISS	Ecological Risk Assessment, Site Characterization	FBL	TAL Metals, Lithium and Boron, REE	27
				ML	RAD	27

Notes:

Refer to Section 8.0 for appropriate analyses to be performed at specific locations.
The number of samples shown does not include QA/QC samples (e.g., field, trip, or rinsate blanks, duplicates, MS/MSD). The frequency of QA/QC sample collection is provided in the CDQMP.
All fixed based laboratory analyses to be performed by an appropriate test method.
VOCs = Volatile Organic Compounds
TCL = Target Compound List Organics (VOCs, SVOCs, pesticides/PCBs)
TAL Metals = Target Analyte List Metals
RCRA 8 Metals = Arsenic, Barium, Cadmium, Chromium, Mercury, Lead, Selenium and Silver
Rad = Radiological parameters Waters/Soil Fixed Base Laboratory (total Uranium, ^{228}Ra, ^{226}RA, ^{230}Th, and ^{232}Th), Mobile laboratory (^{238}U, ^{226}RA, ^{232}Th)
REE = Rare Earth Elements (Cerium, Dysprosium, Lanthanum, Neodymium and Yttrium)
Geochemical Parameters = Cl^-, sulfate, silica, Ca, nitrate, Mg, Na, K, Cr^{+6}, F, phosphate, dissolved organic carbon, methane, and TDS
RCRA Disposal Parameters = Full TCLP analysis (VOCs, SVOCs, pesticides/PCBs, metals), ignitability, corrosivity, and reactivity.
FBL = Fixed Based Laboratory; FS = Field Screening; ML = Mobile Laboratory
*In-Field Measurement

Ta. ,-1

GWRI Tasks and their Corresponding Phases

FUSRAP Maywood Superfund Site
Maywood, NJ

GWRI Task	Phase I	Phase II
Surface Features Survey	X	
Utilities Survey	X	
Westerly Brook and Lodi Brook Pipe Video-Inspection	X	
Monitoring Well Integrity Survey	X	
Phase I Groundwater Sampling and Water Level Measurements	X	
Geophysical Survey (surface and borehole)	X	X
Geoprobe® Investigation	X	
Batch Sorption Tests (soil distribution)		X
Overburden Monitoring Well Installation		X
Bedrock Monitoring Well Installation		X
Monitoring Well Development		X
Phase II Groundwater Sampling and Water Level Measurements		X
Aquifer Testing	X	X
Sediment Sampling		X
Surface Water Sampling		X
Surveying of investigation locations	X	X

Table 8-2
Monitoring Well Construction Summary for USACE Gauged Monitoring Wells

FUSRAP Maywood Superfund Site

Well Location	Total Well Depth (ft BGS)	Ground Elevation (ft MSL)	Top of Riser Elevation (ft MSL)	Screen Interval (ft MSL)		Screen Interval (ft BGS)		Sump length (feet)
B38W01S[b]	23.0	57.55	60.72	40.6	35.6	17.0	22.0	1.0
B38W02D[b]	43.0	64.75	67.70	27.8	22.8	37.0	42.0	1.0
B38W03B[b]	40.5	56.93	58.27	27.1	17.4	29.8	39.5	1.0
B38W04B[b]	36.3	63.02	65.85	40.3	35.3	22.7	27.7	8.6
B38W05B[b]	44.5	68.18	71.05	45.5	35.2	22.7	33.0	11.5
B38W06B[b]	36.4	51.70	54.41	35.8	30.8	15.9	20.9	15.5
B38W07B[b]	39.2	52.25	54.63	33.8	23.5	18.5	28.8	10.4
B38W12A[b]	14.8	47.23	50.10	39.8	34.8	7.4	12.4	2.4
B38W12B[b]	50.3	47.53	49.78	13.0	2.6	34.5	44.9	5.4
B38W14S[b]	13.0	45.47	45.07	37.5	32.5	8.0	13.0	0.5
B38W14D[b]	51.5	45.38	44.88	-0.6	-6.1	46.0	51.5	NA
B38W15S[b]	16.5	47.42	46.92	36.9	31.9	10.5	15.5	1.0
B38W15D[b]	46.0	47.49	46.99	7.5	2.5	40.0	45.0	1.5
B38W17A[b]	14.1	50.70	53.24	43.1	38.1	7.6	12.6	1.5
B38W17B[b]	44.4	50.68	53.28	32.0	21.7	18.7	29.0	15.4
B38W18D[b]	41.0	58.02	57.85	23.0	18.0	35.0	40.0	1.0
B38W19S[b]	15.8	57.48	59.91	44.6	42.6	12.9	14.9	0.9
B38W19D[b]	47.9	57.49	59.98	35.8	25.6	21.7	31.9	16.0
B38W24S[c]	15.6	55.38	55.04	45.0	40.2	10.4	15.2	0.4
B38W24D[c]	28.0	55.29	54.91	33.3	28.3	22.0	27.0	1.0
B38W25S[c]	12.7	55.67	57.44	49.0	44.0	6.7	11.7	1.0
B38W25D[c]	27.6	56.13	58.24	34.5	29.5	21.6	26.6	1.0
MISS 1AA[b]	19.4	60.50	62.70	47.5	42.5	13.0	18.0	1.0
MISS 1B[b]	53.5	60.42	61.98	37.4	6.9	23.0	53.5	NA
MISS 2A[b]	18.9	60.56	61.47	53.7	43.7	6.9	16.9	2.0
MISS 2B[b]	58.5	61.15	61.64***	32.7	2.7	28.5	58.5	NA
MISS 3A[b]	12.7	56.56	58.52	49.9	43.9	6.7	12.7	1.0
MISS 3B[b]	50.0	56.78	57.66	36.8	6.8	20.0	50.0	NA
MISS 4A[b]	9.7	55.36	57.17	50.7	45.7	4.7	9.7	NA
MISS 4B[b]	47.0	55.38	56.42	38.4	8.4	17.0	47.0	NA
MISS 5A[b]	14.6	57.86	58.65	47.2	43.3	10.7	14.6	0.2
MISS 5B[b]	55.0	58.09	59.76	33.1	3.1	25.0	55.0	NA
MISS 6A[b]	15.2	57.07	58.26	49.9	43.9	7.2	13.2	2.2
MISS 7A[b]	9.6	53.52	55.60	48.9	43.9	4.6	9.6	NA
MISS 7B[b]	49.0	53.99	55.77	35.0	5.0	19.0	49.0	NA

[a] Information was obtained from Stepan RI Report, 1994.
[b] Information was obtained from Maywood RI Report, 1992.
[c] Information was obtained from BNI, April 1993 monitoring well as-built diagrams.
Shaded areas indicate an open hole well construction.
NA-not applicable

Table 8-2 (continued)
Monitoring Well Construction Summary for Stepan Monitoring Wells

FUSRAP Maywood Superfund Site

Well Location	Total Well Depth (ft BGS)	Ground Elevation (ft MSL)	Top of Riser Elevation (ft MSL)	Screen Interval (ft MSL)		Screen Interval (ft BGS)	
OBMW1[a]	10.0	49.4	48.82	46.4	39.4	3.0	10.0
BRMW1[a]	47.0	49.5	49.08	12.5	2.5	37.0	47.0
OBMW2[a]	13.0	54.9	54.40	51.9	41.9	3.0	13.0
BRMW2	13.0	54.9	54.61	23.4	13.4	31.5	41.5
OBMW3[a]	12.0	47.2	46.80	42.2	35.2	5.0	12.0
BRMW3[a]	30.0	46.9	46.67	26.9	16.9	20.0	30.0
OBMW4[a]	14.0	46.2	45.96	42.2	32.2	4.0	14.0
BRMW4[a]	36.0	46.6	46.33	20.6	10.6	26.0	36.0
OBMW5[a]	10.0	46.4	46.13	43.4	36.4	3.0	10.0
BRMW5[a]	29.0	46.4	45.97	27.4	17.4	19.0	29.0
OBMW6[a]	8.0	48.8	48.94	45.8	40.8	3.0	8.0
BRMW6[a]	27.0	49.3	49.06	32.3	22.3	17.0	27.0
OBMW7[a]	15.0	45.6	44.95	40.6	30.6	5.0	15.0
BRMW7[a]	38.0	45.6	45.11	17.6	7.6	28.0	38.0
OBMW8[a]	12.5	45.7	45.55	40.2	33.2	5.5	12.5
BRMW8[a]	42.0	45.7	45.17	13.7	3.7	32.0	42.0
BRMW9[a]	23.5	53.3	54.34	39.8	29.8	13.5	23.5
OBMW10[a]	8.0	48.5	48.09	45.5	40.5	3.0	8.0
BRMW10[a]	40.0	59.4	58.95	29.4	19.4	30.0	40.0
OBMW11[a]	10.0	45.6	48.23	40.6	35.6	5.0	10.0
BRMW11[a]	33.0	45.7	47.79	22.7	12.7	23.0	33.0
OBMW12[a]	15.0	47.5	47.27	42.5	32.5	5.0	15.0
BRMW12[a]	48.0	47.6	47.23	9.6	-0.4	38.0	48.0
OBMW13[a]	14.0	47.7	47.26	43.7	33.7	4.0	14.0
BRMW13[a]	33.0	47.6	47.21	24.6	14.6	23.0	33.0
OBMW14[a]	14.0	46.5	46.02	42.5	32.5	4.0	14.0
BRMW14[a]	37.0	46.6	46.22	19.6	9.6	27.0	37.0
OBMW15[a]	17.0	70.1	72.27	58.1	53.1	12.0	17.0
BRMW15[a]	30.0	70.2	71.63	50.2	40.2	20.0	30.0
BRMW16[a]	30.0	66.9	67.69	46.9	36.9	20.0	30.0
OBMW17[a]	15.0	60.5	63.02	55.5	45.5	5.0	15.0
BRMW17[a]	35.0	60.3	62.04	35.3	25.3	25.0	35.0
WELL 1[a]	16.0	58.3	58.82	53.3	43.3	5.0	15.0
WELL 2[a]	20.0	58.7	59.28	49.7	39.7	9.0	19.0
WELL 5[a]	13.0	62.1	62.17	57.1	50.1	5.0	12.0
WELL 8[a]	17.0	73.3	75.08	66.3	56.3	7.0	17.0
MW-1[d]							
OBMW18[d]							
OBMW19[d]							
BRTW2[d]							

[a] Information was obtained from Stepan RI Report, 1994.
[b] Information was obtained from Maywood RI Report, 1992.
[c] Information was obtained from BNI, April 1993 monitoring well as-built diagrams.
[d]Well was shown in the Stepan RI sampling locations but not in the tables listing well construction summary.
* Indicates an open hole well construction.

Table 8-3 Monitoring Well Placement Location and Rationale		
Well	**Location**	**Rationale**
MW-1 through MW-7 and MW-1D through MW-7D (except MW-3 and MW-3D)	FMSS/Ballod	Assist in determining the lateral extent of groundwater contamination in overburden and bedrock aquifers in the vicinity of Westerly Brook; supplement sample results from well clusters B38W14 and B38W15. Similarly, several of these well clusters are located downgradient of Dixo Co., Inc./auto body shops and may show dispersional effects from these potential source areas. Similarly, well cluster MW-7 is located on the Ballod property, and these wells will assist to characterizing the groundwater quality on this property.
MW-3 and MW-3D MW-8 and MW-8D MW-19 and MW-19D MW-20 and MW-20D	W. Central Ave.	Well clusters are located hydraulically upgradient of the MISS with respect to groundwater flow in the overburden. With respect to bedrock groundwater flow, wells MW-3D /MW-20D are located cross-gradient to the MISS, and potentially downgradient of Stepan's burial pit 2. Also, well clusters MW-8 and MW-19 are located cross and downgradient from Dixo Co., Inc., respectively. The spatial location of these wells will assist in determining background quality with respect to overburden flow, and in some instances also characterize if contamination is moving off the MISS/FMSS.
MW-9 through MW-13 and MW-9D through MW-13D	FMSS	Assist in characterizing the horizontal and vertical extent of groundwater contamination in overburden and bedrock aquifers, and if the presence of a bedrock groundwater divide exists along the eastern side of the FMSS in the vicinity of Maywood Avenue.
MW-14 through MW-18 and MW-14D through MW-18D	FMSS	Assist in characterizing the horizontal and vertical extent of groundwater contamination in overburden and bedrock aquifers at Site Clusters 1 through 4, located south of Essex Street, and in characterizing the infiltration/exfiltration relationship along the culverted section of Lodi Brook and the overburden/bedrock discharge relationship to the Saddle River.

TABLE 14-1
TOXICITY VALUES: POTENTIAL NONCARCINOGENIC EFFECTS - ORAL EXPOSURE
MAYWOOD SUPERFUND SITE

Chemical	Chronic RfD (mg/kg-day)	Critical Effect	RfD Basis	Confidence Level	Uncertainty Factor	Modifying Factor	RfD Source
RADIONUCLIDES							
Uranium-235	--	--	--	--	--	--	--
Uranium-238	--	--	--	--	--	--	--
Thorium-232	--	--	--	--	--	--	--
Radium-226	--	--	--	--	--	--	--
Radon and Thoron	--	--	--	--	--	--	--
VOLATILE ORGANICS							
Benzene	--	--	--	--	--	--	IRIS; HEAST
Ethylbenzene	1.00E-01	Liver and kidney toxicity	Oral	Low	1000 for H,A,S	1	IRIS
Toluene	2E-01	Changes in liver and kidney weights	Gavage	Medium	1000 for H,A,S	1	IRIS
o-Xylene	2.00E+00	Hyperactivity, decreased body weight	Gavage	--	100	--	HEAST
m-Xylene	2.00E+00	Hyperactivity, decreased body weight	Gavage	--	100	--	HEAST
Xylenes (total)	2.00E+00	Hyperactivity, decreased body weight and increased mortality	Gavage	Medium	100 for H,A	1	IRIS
PESTICIDES							
Dieldrin	5.00E-05	Liver, hepatic lesions	Oral, diet	Medium	100	1	IRIS
INORGANICS and RARE EARTH ELEMENTS							
Aluminum	1E+00	Minimal neurotoxicity	Diet	Low	100 for H,A,S	1	NCEA
Antimony	4.00E-04	Longevity, blood glucose, and cholesterol	Oral	Low	1000 for H,O,S	1	IRIS
Arsenic	3E-04	Hyperpigmentation, keratosis and possible vascular complications	Oral	Medium	3 for O	1	IRIS
Barium	7E-02	Increased blood pressure	Oral	Medium	3 for H,O	1	IRIS
Beryllium	2E-03	Small intestine lesions	Diet	Low to Medium	300 for H,A,O	1	IRIS
Boron	9.00E-02	Testicular atrophy, spermatogenic arrest	Diet	Medium	--	1	IRIS
Calcium	--						IRIS; HEAST
Cerium	--	--	--	--	--	--	
Chromium III	1.5E+00	No effects observed	Oral	Low	100 for H,A	10	IRIS
Chromium VI	3.00E-03	No effects reported	Oral	Low	500	1	IRIS
Copper	3.7E-02	Gastrointestinal irritation	Oral	--	--	--	HEAST
Gadolinium	--	--	--	--	--	--	
Iron	3.00E-01	--	Oral	Medium	1 for O	1	NCEA
Lanthanum	--	--	--	--	--	--	
Lead	--	--	--	--	--	--	IRIS; HEAST
Lithium	--	--	--	--	--	--	
Magnesium	--	--	--	--	--	--	IRIS; HEAST
Manganese	1.40E-01	CNS effects	Oral	Medium	1 for O	1 (3 nondiet)	IRIS
Nickel (soluble salts)	2E-02	Decreased body and organ weights	Oral	Medium	300 H,A,O	1	IRIS
Potassium	--						IRIS; HEAST
Selenium	5.00E-03	Clinical selenosis	Epidemiology study	High	3 for O	1	IRIS
Sodium	--				3 for O		IRIS; HEAST
Thallium	--	--	--	--	--	--	IRIS; HEAST
Thallium(I)sulfate	8.00E-05	No observed adverse effects	Oral	Low	3,000 for H,A,C,O	1	IRIS
Vanadium	7E-03	--	Drinking Water	--	100	--	HEAST
Zinc	3E-01	Decrease in erythrocyte superoxide	Diet	Medium	3 for O	1	IRIS

TABLE 14-1
TOXICITY VALUES: POTENTIAL NONCARCINOGENIC EFFECTS - INHALATION EXPOSURE
MAYWOOD SUPERFUND SITE

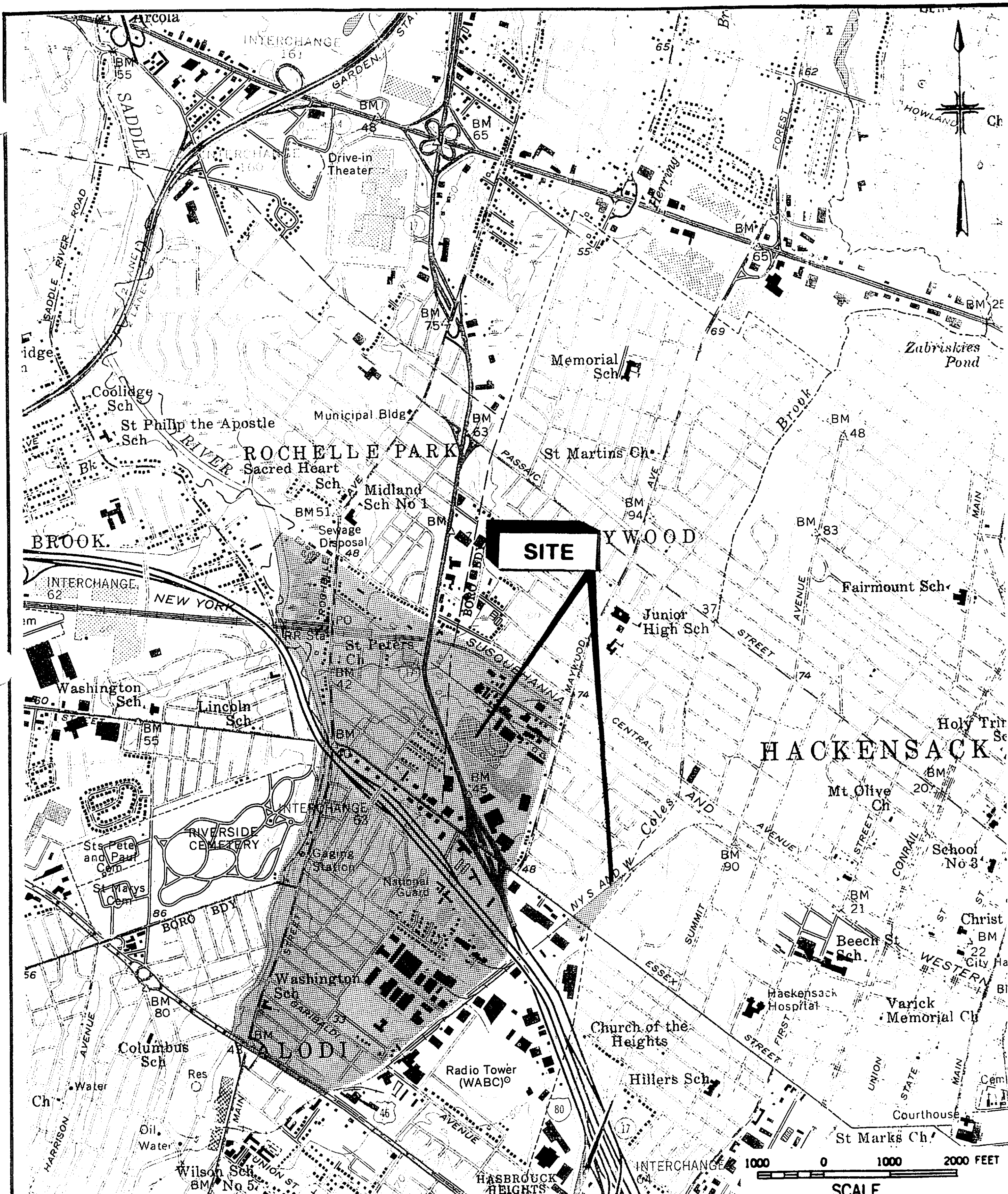
Chemical	Chronic RfC (mg/m3)	Chronic RfD (mg/kg-day)	Critical Effect	RfD Basis	Confidence Level	Uncertainty Factor	Modifying Factor	RfD Source
RADIONUCLIDES								
Uranium-235	--	--	--	--	--	--	--	--
Uranium-238	--	--	--	--	--	--	--	--
Thorium-232	--	--	--	--	--	--	--	--
Radium-226	--	--	--	--	--	--	--	--
Radon and Thoron	--	--	--	--	--	--	--	--
VOLATILE ORGANICS								
Benzene	--	--	--	--	--	--	--	IRIS; HEAST
Ethylbenzene	1.00E+00	2.9E-01	Developmental toxicity	Inhalation	Low	300	1	IRIS
Toluene	4E-01	1E-01	Neurological effects	Inhalation	Medium	300 for H,S,O	1	IRIS
o-Xylene	--	--						IRIS; HEAST
m-Xylene	--	--						IRIS; HEAST
Xylenes (total)	--	--	--	--	--	--	--	IRIS; HEAST
PESTICIDES								
Dieldrin	--	--	--	--	--	--	--	IRIS; HEAST
INORGANICS and RARE EARTH ELEMENTS								
Aluminum	5E-03	1E-03	Psychomotor and cognitive impairment	Oral	Medium	300 for H, S,O	1	NCEA
Antimony	--	--	--	--	--	--	--	IRIS; HEAST
Arsenic	--	--	--	--	--	--	--	IRIS; HEAST
Barium	5E-04	1E-04	Fetotoxicity	Inhalation	--	1000	--	HEAST
Beryllium	2.00E-02	5.7E-03	Sensitization and progression to chronic beryllium disease	Inhalation	Medium	10 H,S	1	IRIS
Boron (for anhydrous borax)	2.00E-02	5.7E-03	Respiratory irritation	Inhalation	--	100	--	HEAST
Calcium	--	--	--	--	--	--	--	IRIS; HEAST
Cerium	--	--	--	--	--	--	--	
Chromium III	--	--	--	--	--	--	--	IRIS; HEAST
Chromium VI	8.00E-06	2.3E-06	--	--	--	--	--	IRIS
Copper	--	--	--	--	--	--	--	IRIS; HEAST
Gadolinium	--	--	--	--	--	--	--	
Iron	--	--	--	--	--	--	--	IRIS; HEAST
Lanthanum	--	--	--	--	--	--	--	
Lead	--	--	--	--	--	--	--	IRIS; HEAST
Lithium	--	--	--	--	--	--	--	
Magnesium	--	--	--	--	--	--	--	IRIS; HEAST
Manganese	5E-05	1E-05	Impairment of neurobehavioral function	Inhalation	Medium	1000 for H,S,O	1	IRIS
Nickel (soluble salts)	--	--	--	--	--	--	--	IRIS; HEAST
Potassium	--	--	--	--	--	--	--	IRIS; HEAST
Selenium	--	--	--	--	--	--	--	IRIS; HEAST
Sodium	--	--	--	--	--	--	--	IRIS; HEAST
Thallium	--	--	--	--	--	--	--	
Thallium(I)sulfate	--	--	--	--	--	--	--	IRIS; HEAST
Vanadium	--	--	--	--	--	--	--	IRIS; HEAST
Zinc	--	--	--	--	--	--	--	IRIS; HEAST

TABLE 14-1
TOXICITY VALUES: POTENTIAL NONCARCINOGENIC EFFECTS - ORAL EXPOSURE
MAYWOOD SUPERFUND SITE

Chemical	Slope Factor (SF) (mg/kg-day)-1	SF Basis	Type of Cancer	Weight-of-Evidence Classification	SF Source
RADIONUCLIDES					
Uranium-235+D	4.70E-11				HEAST[1]
Uranium-238+D	6.20E-11				HEAST[1]
Thorium-232	3.28E-11				HEAST[1]
Radium-226+D	2.96E-10				HEAST[1]
Radon 222+D	--				HEAST[1]
Thoron	--				HEAST[1]
VOLATILE ORGANICS					
Benzene	2.9E-02	Inhalation	Leukemia	A	IRIS
Ethylbenzene	--	--	--	D	IRIS; HEAST
Toluene	--	--	--	D	IRIS; HEAST
o-Xylene	--			--	IRIS; HEAST
m-Xylene	--			--	IRIS; HEAST
Xylenes (total)	--	--	--	D	IRIS; HEAST
PESTICIDES					
Dieldrin	1.60E+01	Oral	Liver carcinomas	B2	IRIS
INORGANICS and RARE EARTH ELEMENTS					
Aluminum	--	--	--	D	IRIS; HEAST
Antimony	--	--	--	B1	IRIS; HEAST
Arsenic	1.5E+00	Oral	Skin	A	IRIS
Barium	--	--	--	D	IRIS; HEAST
Beryllium	--	--	--	B1	IRIS
Boron	--	--	--	--	IRIS; HEAST
Calcium	--	--	--	--	IRIS; HEAST
Cerium	--	--	--	--	IRIS; HEAST
Chromium III	--	--	--	D	IRIS; HEAST
Chromium VI	--			A	IRIS; HEAST
Copper	--	--	--	D	IRIS; HEAST
Gadolinium	--	--	--	--	IRIS; HEAST
Iron	--	--	--	--	IRIS; HEAST
Lanthanum	--	--	--	--	IRIS; HEAST
Lead	--	--	--	B2	IRIS; HEAST
Lithium	--	--	--	--	
Magnesium	--	--	--	--	IRIS; HEAST
Manganese	--			D	IRIS; HEAST
Nickel (soluble salts)	--	--	--	--	IRIS; HEAST
Potassium	--	--	--	--	IRIS; HEAST
Selenium	--	--	--	D	IRIS; HEAST
Sodium	--	--	--	--	IRIS; HEAST
Thallium	--	--	--	ND	IRIS; HEAST
Thallium(I)sulfate	--			D	IRIS; HEAST
Vanadium	--	--	--	ND	IRIS; HEAST
Zinc	--	--	--	D	IRIS; HEAST

TABLE 14-1
TOXICITY VALUES: POTENTIAL NONCARCINOGENIC EFFECTS - INHALATION EXPOSURE
MAYWOOD SUPERFUND SITE

Chemical	Unit Risk (mg/m3)	Slope Factor (SF) (mg/kg-day)-1	SF Basis	Type of Cancer	Weight-of-Evidence Classification	SF Source
RADIONUCLIDES						
Uranium-235+D	1.30E-08					HEAST[1]
Uranium-238+D	1.24E-08					HEAST[1]
Thorium-232	1.93E-08					HEAST[1]
Radium-226+D	2.75E-09					HEAST[1]
Radon 222+D	7.57E-12					HEAST[1]
Thoron	--					HEAST[1]
VOLATILE ORGANICS						
Benzene	7.8E-06	2.7E-02	Inhalation	Leukemia	A	IRIS
Ethylbenzene	--	--	--	--	D	IRIS; HEAST
Toluene	--	--	--	--	D	IRIS; HEAST
o-Xylene	--	--			--	IRIS; HEAST
m-Xylene	--	--			--	IRIS; HEAST
Xylenes (total)	--	--	--	--	D	IRIS; HEAST
PESTICIDES						
Dieldrin	4.60E-03	1.61E+01	Oral	Liver carcinomas	B2	IRIS
INORGANICS and RARE EARTH ELEMENTS						
Aluminum	--	--			D	IRIS; HEAST
Antimony	--	--	--	--	B1	IRIS; HEAST
Arsenic	4.3E-03	1.5E+01	Inhalation	Respiratory	A	IRIS
Barium	--	--	--	--	D	IRIS; HEAST
Beryllium	2.4E-03	8.4E+00	Inhalation	Lung tumors	B1	IRIS
Boron	--	--	--	--	--	IRIS; HEAST
Calcium	--	--			--	IRIS; HEAST
Cerium	--	--	--	--	--	IRIS; HEAST
Chromium III	--	--	--	--	D	IRIS; HEAST
Chromium VI	1.2E-02	4.2E+01	Inhalation	Lung tumors	A	IRIS
Copper	--	--	--	--	D	IRIS; HEAST
Gadolinium	--	--	--	--	--	IRIS; HEAST
Iron	--	--			--	IRIS; HEAST
Lanthanum	--	--	--	--	--	IRIS; HEAST
Lead	--	--	--	--	B2	IRIS; HEAST
Lithium	--	--	--	--	--	IRIS; HEAST
Magnesium	--	--	--	--	--	IRIS; HEAST
Manganese	--	--	--	--	D	IRIS; HEAST
Nickel (soluble salts)	--	--	--	--	--	IRIS; HEAST
Potassium	--	--	Inhalation	Respiratory	--	IRIS; HEAST



SOURCE: HACKENSACK, NJ USGS QUADRANGLE DATED 1955, PHOTOREVISED 1981

U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
NEW YORK DISTRICT

US ARMY CORPS OF ENGINEERS
FUSRAP
FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM

STONE & WEBSTER ENVIRONMENTAL TECHNOLOGY & SERVICES

Prepared by: MALCOLM PIRNIE
Reviewed by: XXXX
Date: XXXX
Drawn by: XXXX
Date: XXXX
File Name: XXXX

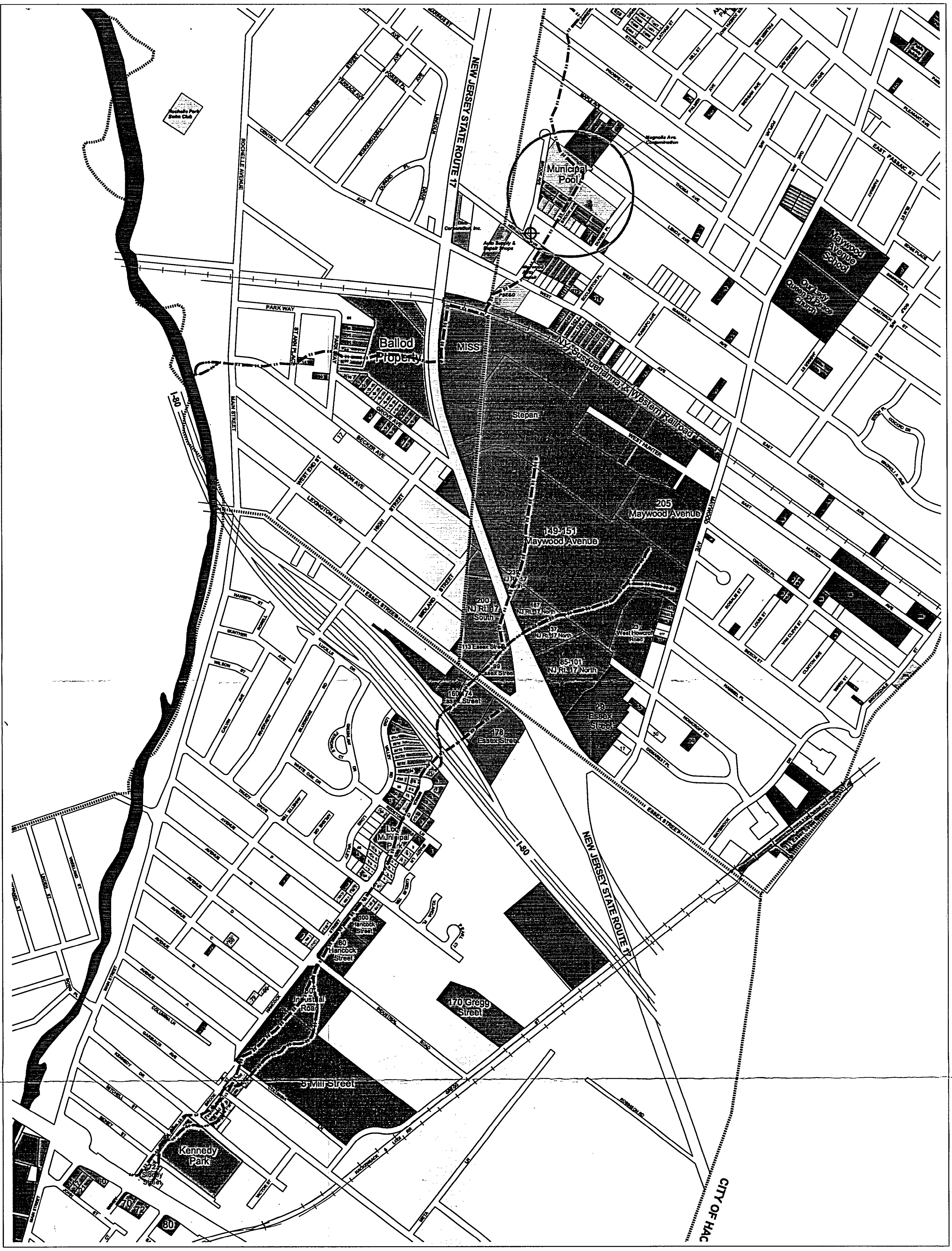
GROUNDWATER REMEDIAL INVESTIGATION WORK PLAN

SITE MAP

FUSRAP MAYWOOD SUPERFUND SITE

Contract Number: DACW41-98-R-0034
Job Number 08575
WAD# 1
WBS# 14
Figure Number:
FIGURE 1-1

FUSRAP MAYWOOD CHEMICAL COMPANY
ADDITIONAL AREAS OF INTEREST



Note: The location and status of the vicinity properties shown on this map are for general reference only. The USACE is reviewing historical archives to confirm the accuracy of the property locations and status depicted on the map. If you have specific questions about a particular property, please contact the USACE Public Information Center at 75A West Pleasant Avenue, Maywood, New Jersey or call 201-843-7466. Or, visit the FUSRAP Maywood Chemical Company Superfund Site website at <www.fusrapmaywood.com>.

Figure 1-2
Location of FMSS Properties

Areas of Additional Interest

Phase 1.shp
- *Remaining Phase I - Scheduled for remediation*
- *Remediated*
- *Surveyed - Not contaminated*

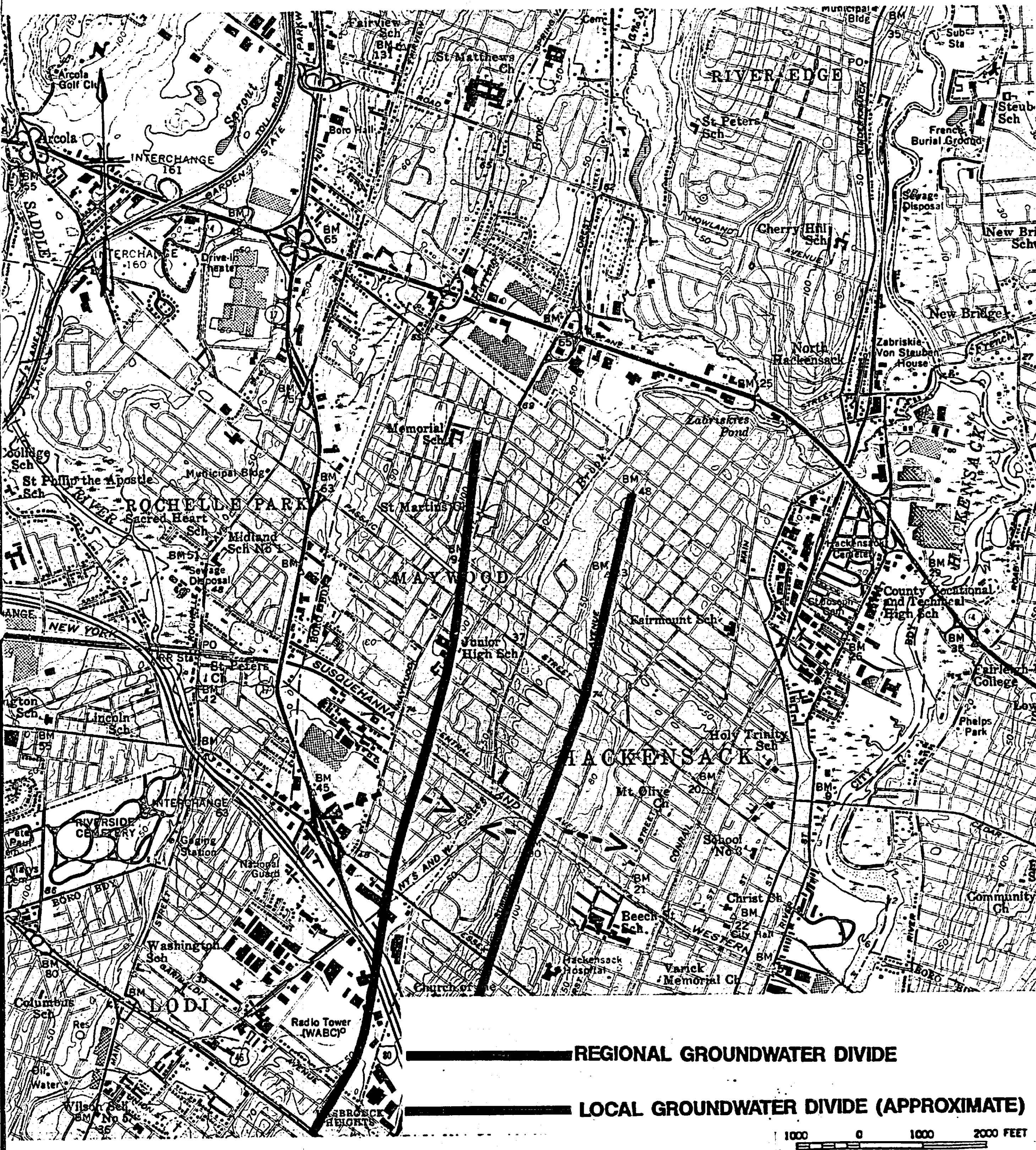
Phase II Properties
- *Scheduled for remediation*
- *Surveyed - Not contaminated*

US Army Corps of Engineers — FUSRAP Maywood Superfund Site — Stone & Webster

N / W / E / S

0 600 1200 Feet

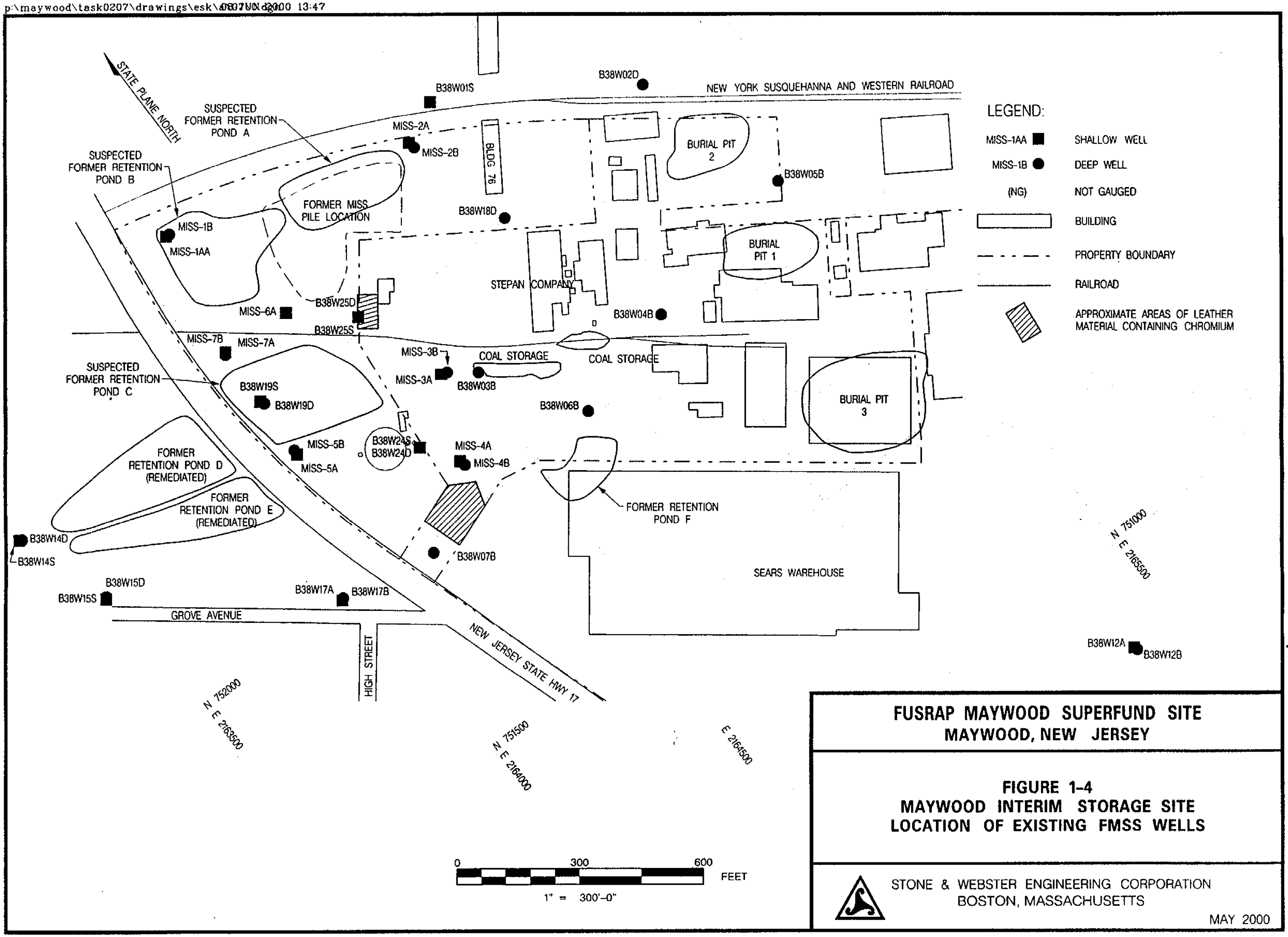
Additional Interest - June 8, 2000



SOURCE: HACKENSACK USGS QUADRANGLE

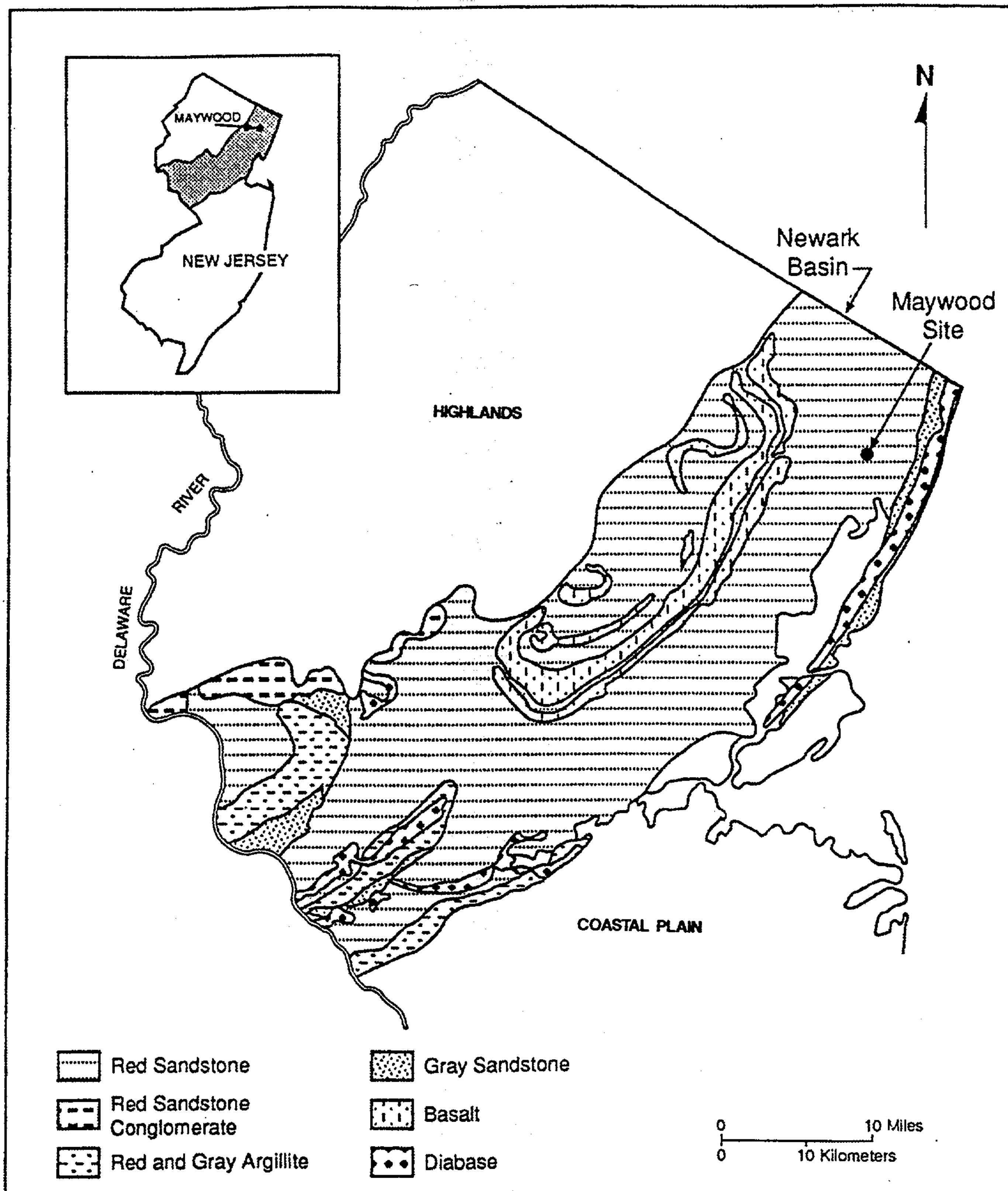
U.S. ARMY ENGINEER DIVISION CORPS OF ENGINEERS NEW YORK DISTRICT	STONE & WEBSTER ENVIRONMENTAL TECHNOLOGY & SERVICES		GROUNDWATER REMEDIAL INVESTIGATION WORK PLAN	Contract Number: DACW41-98-R-0034
US ARMY CORPS OF ENGINEERS FUSRAP FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM	Prepared by: MALCOLM PIRNIE	Reviewed by: XXXX / Date: XXXX	SADDLE RIVER/ HACKENSACK RIVER WATERSHED DELINEATION MAP FUSRAP MAYWOOD SUPERFUND SITE	Job Number 08575 WAD/ 1
	Drawn by: XXXX / Date: XXXX	File Name: XXXX		WBS/ 14
				Figure Number: FIGURE 1-3

p:\maywood\task0207\drawings\esk\ 08 JUN 2000 13:47



FUSRAP MAYWOOD SUPERFUND SITE
MAYWOOD, NEW JERSEY

FIGURE 1-4
MAYWOOD INTERIM STORAGE SITE
LOCATION OF EXISTING FMSS WELLS



SOURCE: TAKEN FROM TEDROW, 1986

U.S. ARMY ENGINEER DIVISION CORPS OF ENGINEERS NEW YORK DISTRICT US ARMY CORPS OF ENGINEERS FUSRAP FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM	STONE & WEBSTER ENVIRONMENTAL TECHNOLOGY & SERVICES Prepared by: MALCOLM PIRNIE; Reviewed by: XXXX; Date: XXXX Drawn by: XXXX; Date: XXXX; File Name: XXXX	GROUNDWATER REMEDIAL INVESTIGATION WORK PLAN REGIONAL GEOLOGY FUSRAP MAYWOOD SUPERFUND SITE	Contract Number: DACW41-98-R-0034 Job Number 08575 WAD# 1 WBS# 14 Figure Number: FIGURE 2-1

AGE	Stratigraphic Divisions		Symbol	Thickness (feet)
LOWER JURASSIC	Brunswick Group	Boonton Formation	Jb	1,500
		Hook Mountain Basalt	Jh	330
		Towaco Formation	Jt	1,020
		Preakness Basalt	Jp	750
		Feltville Formation	Jf	510
		Orange Mountain Basalt	Jo	450
LOWER JURASSIC / UPPER TRIASSIC		Passaic Formation	JTp Tp	10,000
UPPER TRIASSIC		Lockatong Formation	Tl	3,300
		Stockton Formation	Ts	5,400

Compiled from Olsen, 1980 and other sources.

U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
NEW YORK DISTRICT

US ARMY CORPS OF ENGINEERS
FUSRAP
FORMERLY UTILIZED SITES
REMEDIAL ACTION PROGRAM

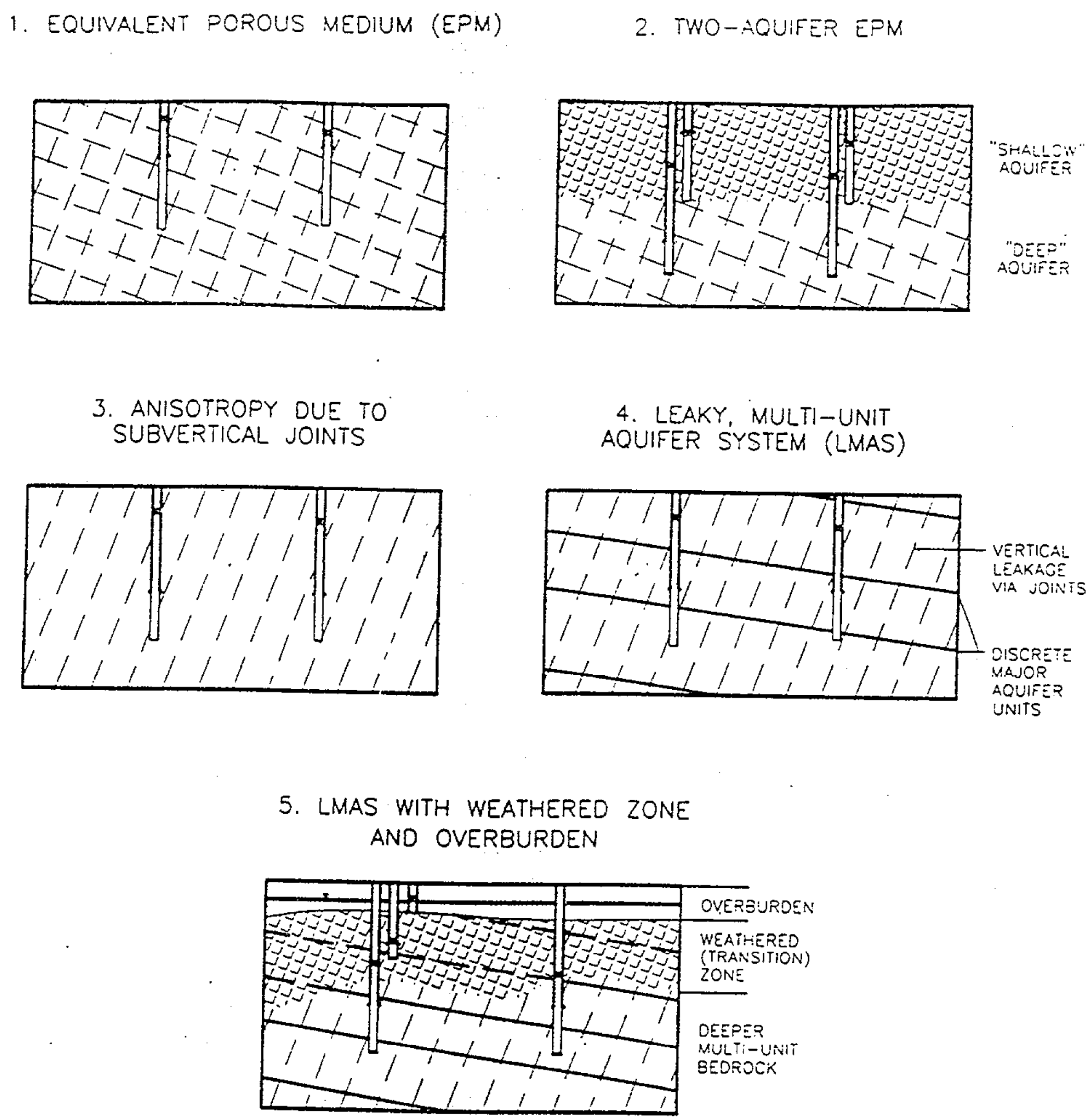
STONE & WEBSTER ENVIRONMENTAL TECHNOLOGY & SERVICES

Prepared by: MALCOLM PIRNIE
Reviewed by: XXXX
Date: XXXX
Drawn by: XXXX
Date: XXXX
File Name: XXXX

GROUNDWATER REMEDIAL INVESTIGATION WORK PLAN

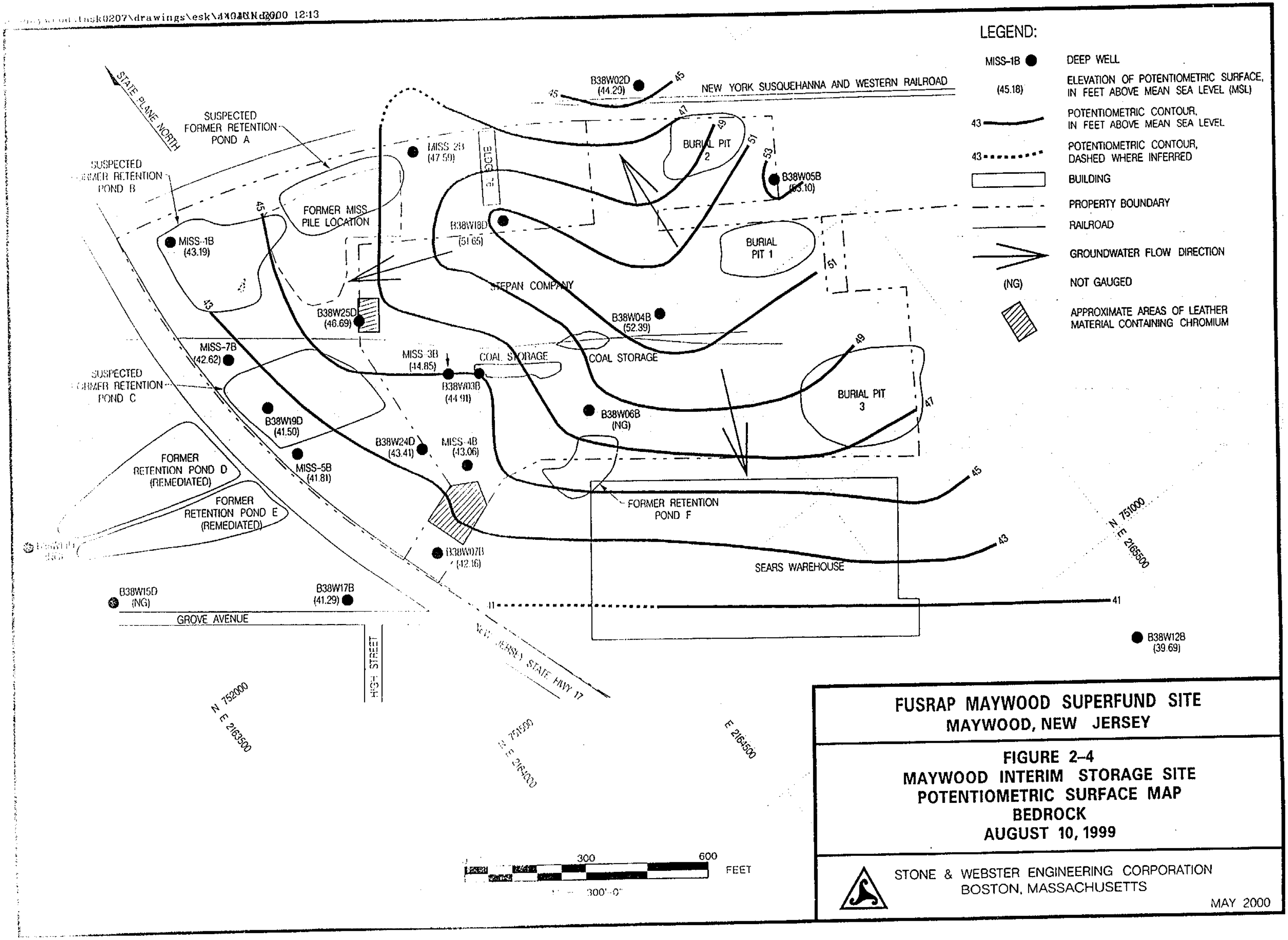
NEWARK BASIN STRATIGRAPHY (NEW JERSEY PORTION)
FUSRAP MAYWOOD SUPERFUND SITE

Contract Number: DACW41-98-R-0034
Job Number 08575
WAO# 1
WBS# 14
Figure Number:
FIGURE 2-2



SOURCE: MICHALSKI & BRITTON, 1997

U.S. ARMY ENGINEER DIVISION CORPS OF ENGINEERS NEW YORK DISTRICT US ARMY CORPS OF ENGINEERS FUSRAP FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM	STONE & WEBSTER ENVIRONMENTAL TECHNOLOGY & SERVICES Prepared by: MALCOLM PIRNIE Reviewed by: XXXX Date: XXXX Drawn by: XXXX Date: XXXX File Name: XXXX	GROUNDWATER REMEDIAL INVESTIGATION WORK PLAN **NEWARK BASIN CONCEPTUAL GROUNDWATER FLOW MODELS** FUSRAP MAYWOOD SUPERFUND SITE	Contract Number: DACW41-98-R-0034 Job Number 08575 WAD# 1 WBS# 14 Figure Number: **FIGURE 2-3**



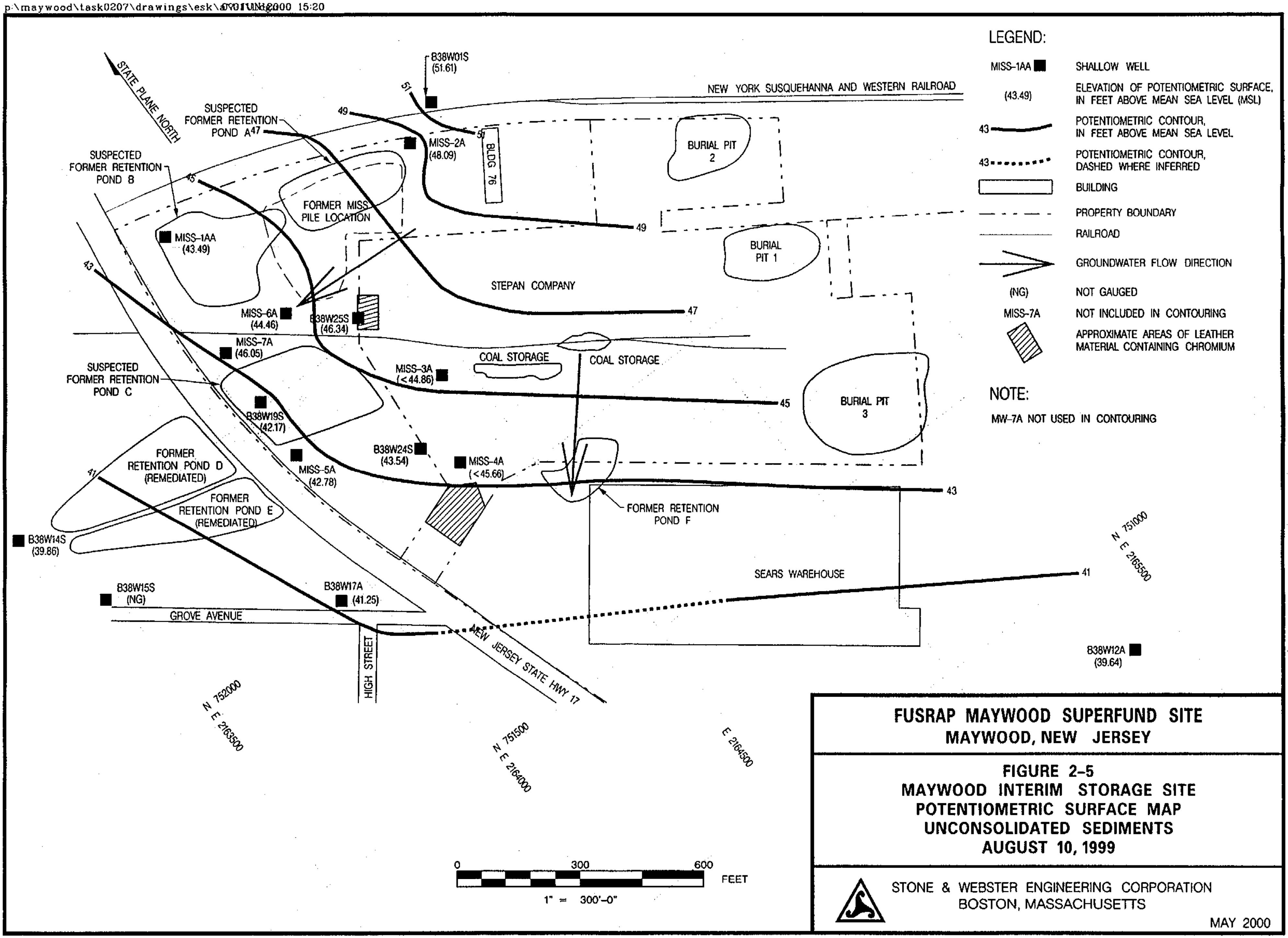
FUSRAP MAYWOOD SUPERFUND SITE
MAYWOOD, NEW JERSEY

FIGURE 2-4
MAYWOOD INTERIM STORAGE SITE
POTENTIOMETRIC SURFACE MAP
BEDROCK
AUGUST 10, 1999

STONE & WEBSTER ENGINEERING CORPORATION
BOSTON, MASSACHUSETTS

MAY 2000

p:\maywood\task0207\drawings\esk\ [illegible] 2000 15:20

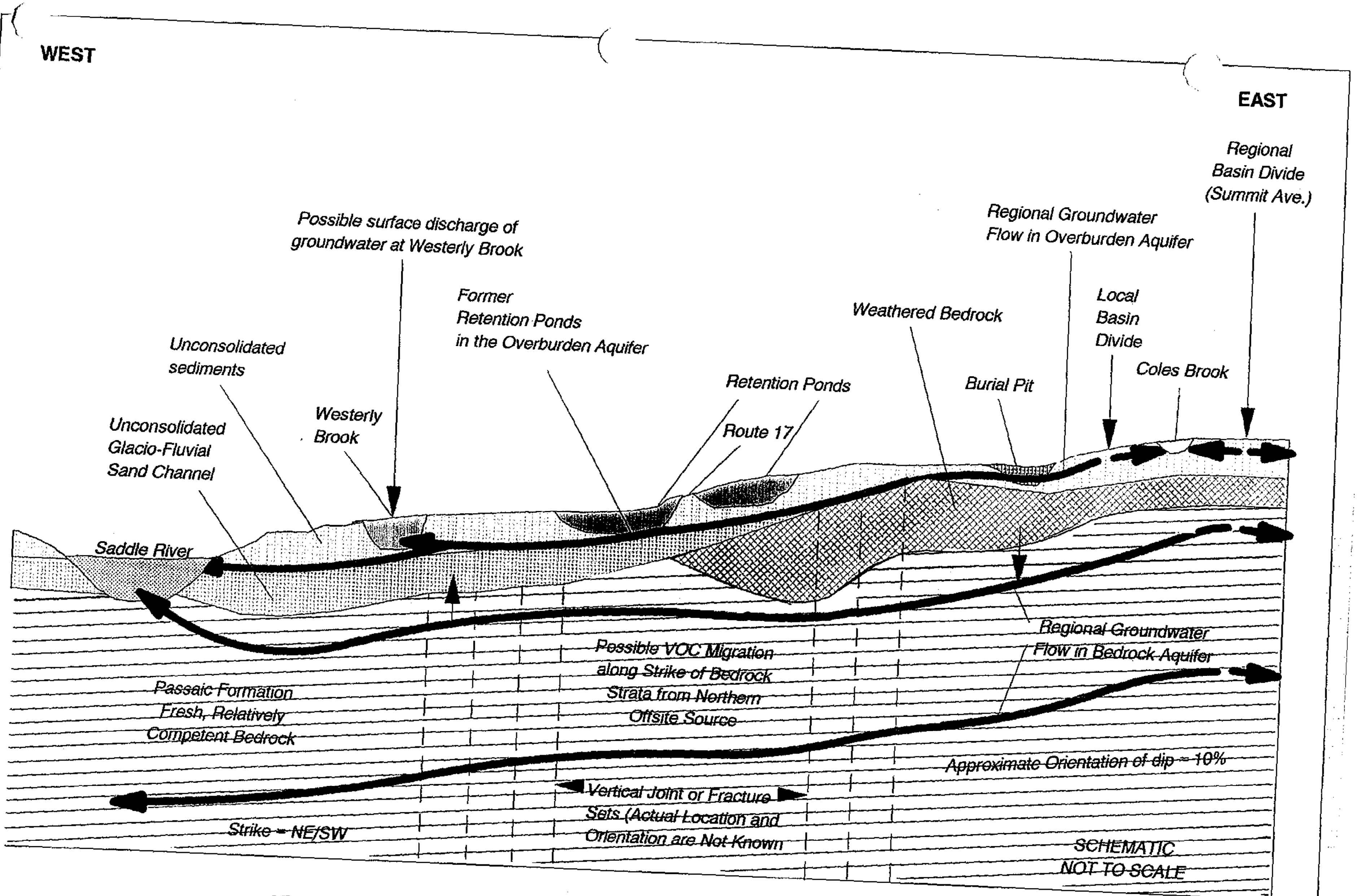


FUSRAP MAYWOOD SUPERFUND SITE
MAYWOOD, NEW JERSEY

FIGURE 2-5
MAYWOOD INTERIM STORAGE SITE
POTENTIOMETRIC SURFACE MAP
UNCONSOLIDATED SEDIMENTS
AUGUST 10, 1999

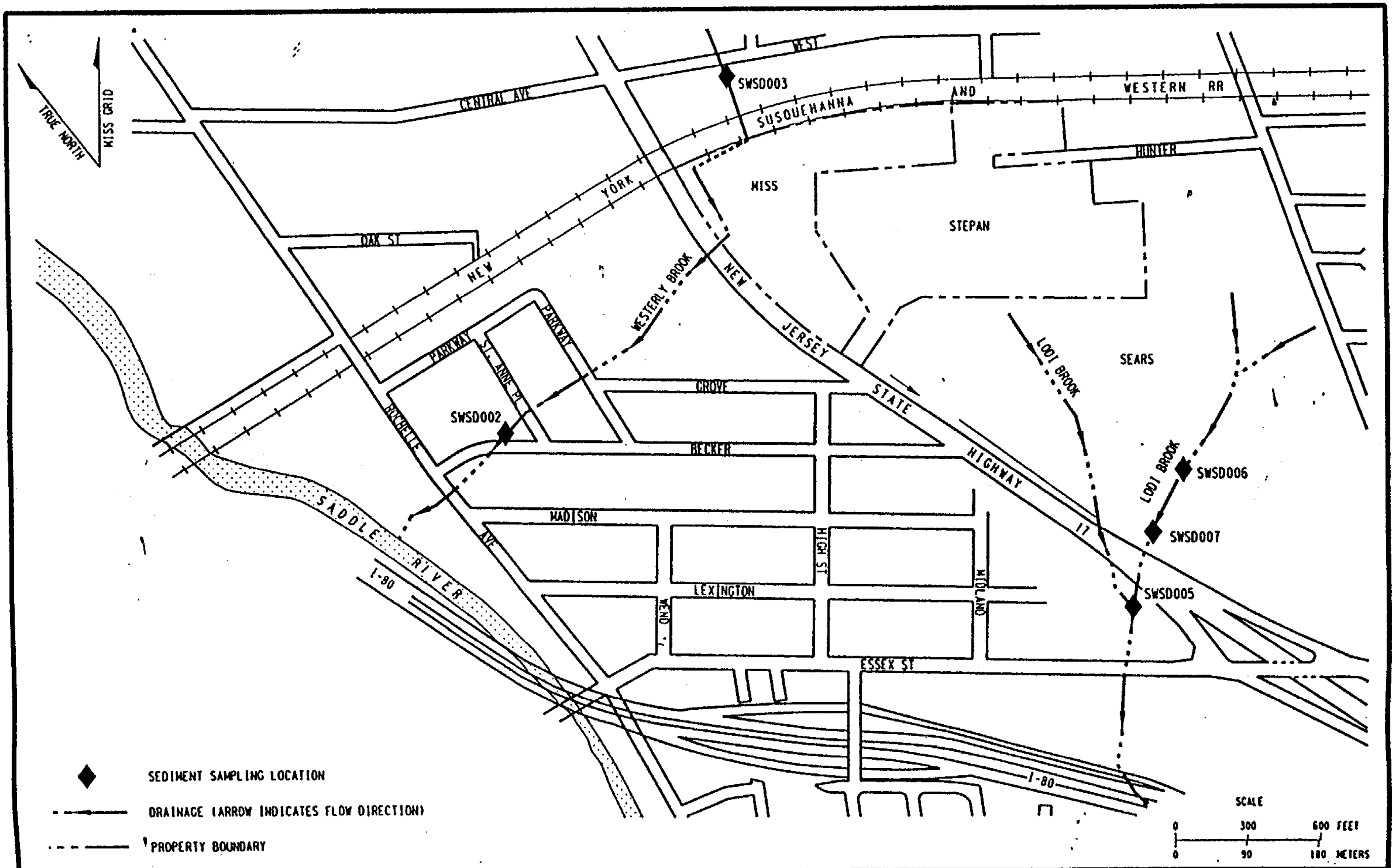
STONE & WEBSTER ENGINEERING CORPORATION
BOSTON, MASSACHUSETTS

MAY 2000



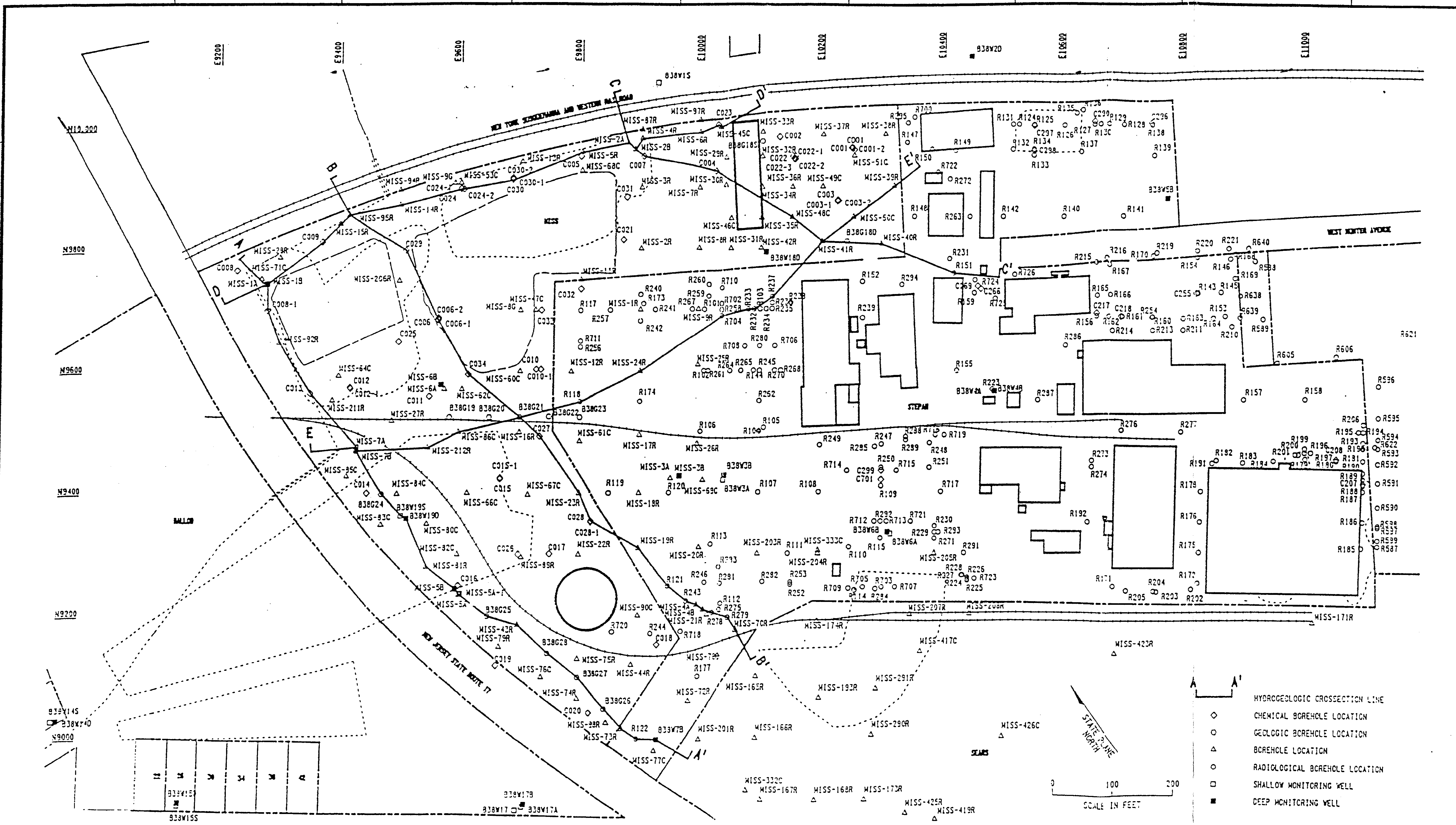
U.S. ARMY ENGINEER DIVISION CORPS OF ENGINEERS NEW YORK DISTRICT US ARMY CORPS OF ENGINEERS FUSRAP FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM	STONE & WEBSTER ENVIRONMENTAL TECHNOLOGY & SERVICES Prepared by: MALCOLM PIRNIE Reviewed by: XXXX Date: XXXX Drawn by: XXXX Date: XXXX File Name: XXXX	GROUNDWATER REMEDIAL INVESTIGATION WORK PLAN CONCEPTUAL MODEL FOR CHEMICAL AND RADIOLOGICAL CONTAMINATION IN GROUNDWATER AT THE MAYWOOD SITE FUSRAP MAYWOOD SUPERFUND SITE	Contract Number: DACW41-98-R-0034 Job Number 08575 WAD# 1 WBS# 14 Figure Number: FIGURE 2-6

G:maywd.prz



R94F006.DGN

Figure 2-7
Surface Water and Sediment Sampling Locations



SOURCE: BNI, RI REPORT FOR THE MAYWOOD SITE, 1992

U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
NEW YORK DISTRICT

US ARMY CORPS OF ENGINEERS
FUSRAP
FORMERLY UTILIZED SITES
REMEDIAL ACTION PROGRAM

STONE & WEBSTER ENVIRONMENTAL TECHNOLOGY & SERVICES

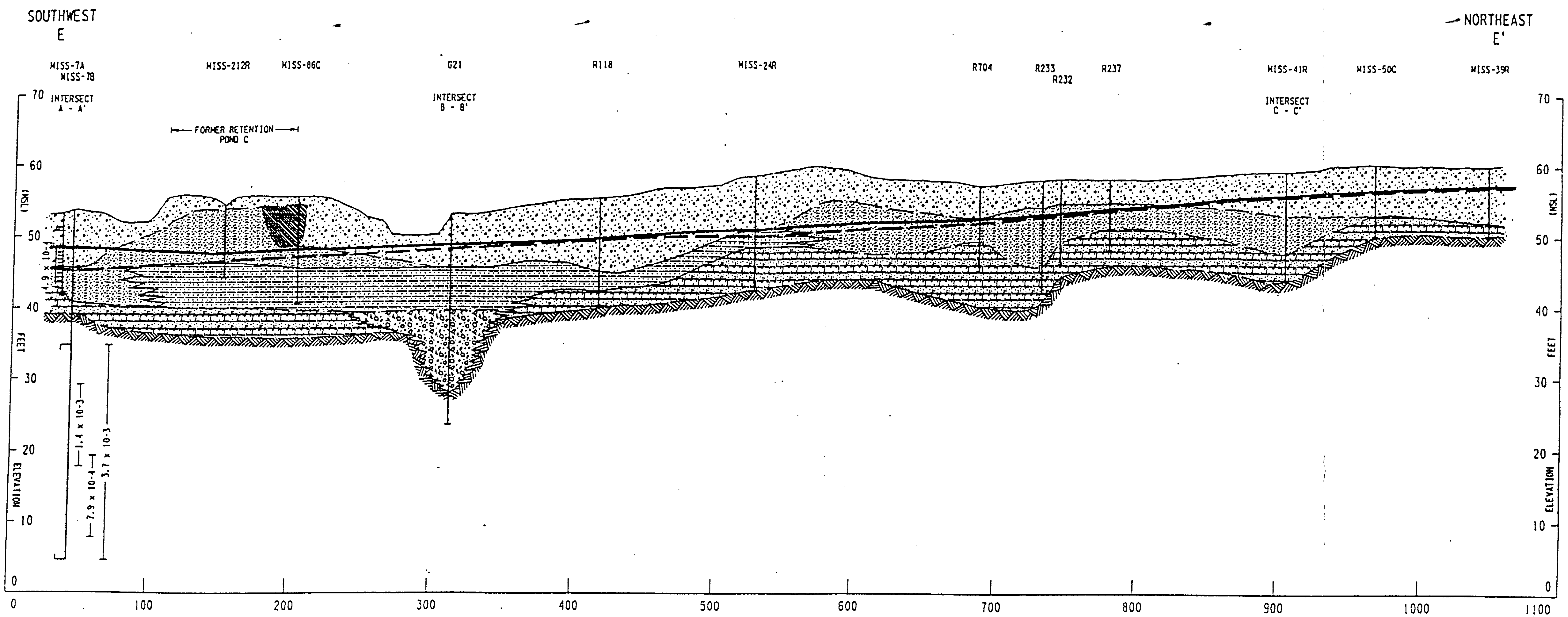
Prepared by: MALCOLM PIRNIE
Reviewed by: XXXX
Date: XXXX
Drawn by: XXXX
Date: XXXX
File Name: XXXX

GROUNDWATER REMEDIAL INVESTIGATION WORK PLAN

LOCATIONS OF GEOLOGIC CROSS SECTIONS AT MISS

FUSRAP MAYWOOD SUPERFUND SITE
MAYWOOD-LODI, NEW JERSEY

Contract Number: DACW41-98-R-0034
Job Number 08575
WAD# 1
WBS# 14
Figure Number: FIGURE 2-8



MONITORING WELL

OPEN HOLE INTERVAL

HYDRAULIC CONDUCTIVITY

7.9 x 10-4

HYDRAULIC CONDUCTIVITY TEST INTERVAL IN BEDROCK RESULT IN CM/SEC

BOREHOLE

- FILL - ASH & SLUDGE
- FILL - UNDIFFERENTIATED
- UNDIFFERENTIATED SAND, SILT, CLAY
- BLACK SAND, SILT, CLAY
- SAND AND GRAVEL
- WEATHERED BEDROCK
- BEDROCK
- WATER TABLE SURFACE (UNCONSOLIDATED SEDIMENTS)
- POTENTIOMETRIC SURFACE IN BEDROCK

DATE OF MEASUREMENT: 3/30/92

HORIZONTAL SCALE
0 37.5 75 FEET
0 11.25 22.5 METERS
VERTICAL EXAGGERATION 5X

SOURCE: BNI, RI REPORT FOR THE MAYWOOD SITE, 1992

U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
NEW YORK DISTRICT

US ARMY CORPS OF ENGINEERS
FUSRAP
FORMERLY UTILIZED SITES
REMEDIAL ACTION PROGRAM

STONE & WEBSTER ENVIRONMENTAL TECHNOLOGY & SERVICES

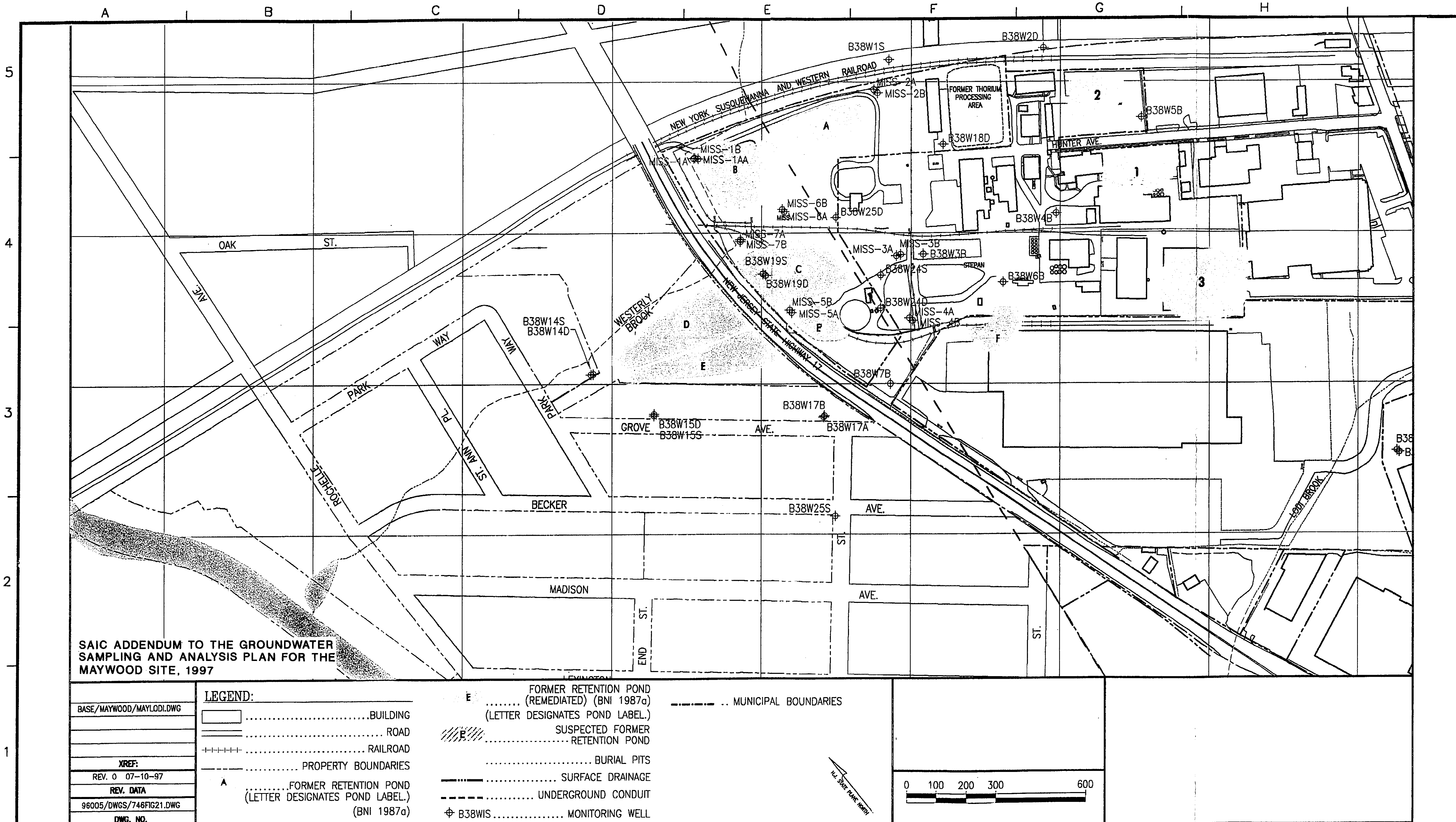
Prepared by: MALCOLM PIRNIE	Reviewed by: XXXX	Date: XXXX
Drawn by: XXXX / Date: XXXX	File Name: XXXX	

GROUNDWATER REMEDIAL INVESTIGATION WORK PLAN

GEOLOGIC CROSS SECTION E-E' AT MISS

FUSRAP MAYWOOD SUPERFUND SITE

Contract Number: DACW41-98-R-0034
Job Number 08575
WAD# 1
WBS# 14
Figure Number:
FIGURE 2-9



U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
NEW YORK DISTRICT

US ARMY CORPS OF ENGINEERS
FUSRAP
FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM

STONE & WEBSTER ENVIRONMENTAL TECHNOLOGY & SERVICES

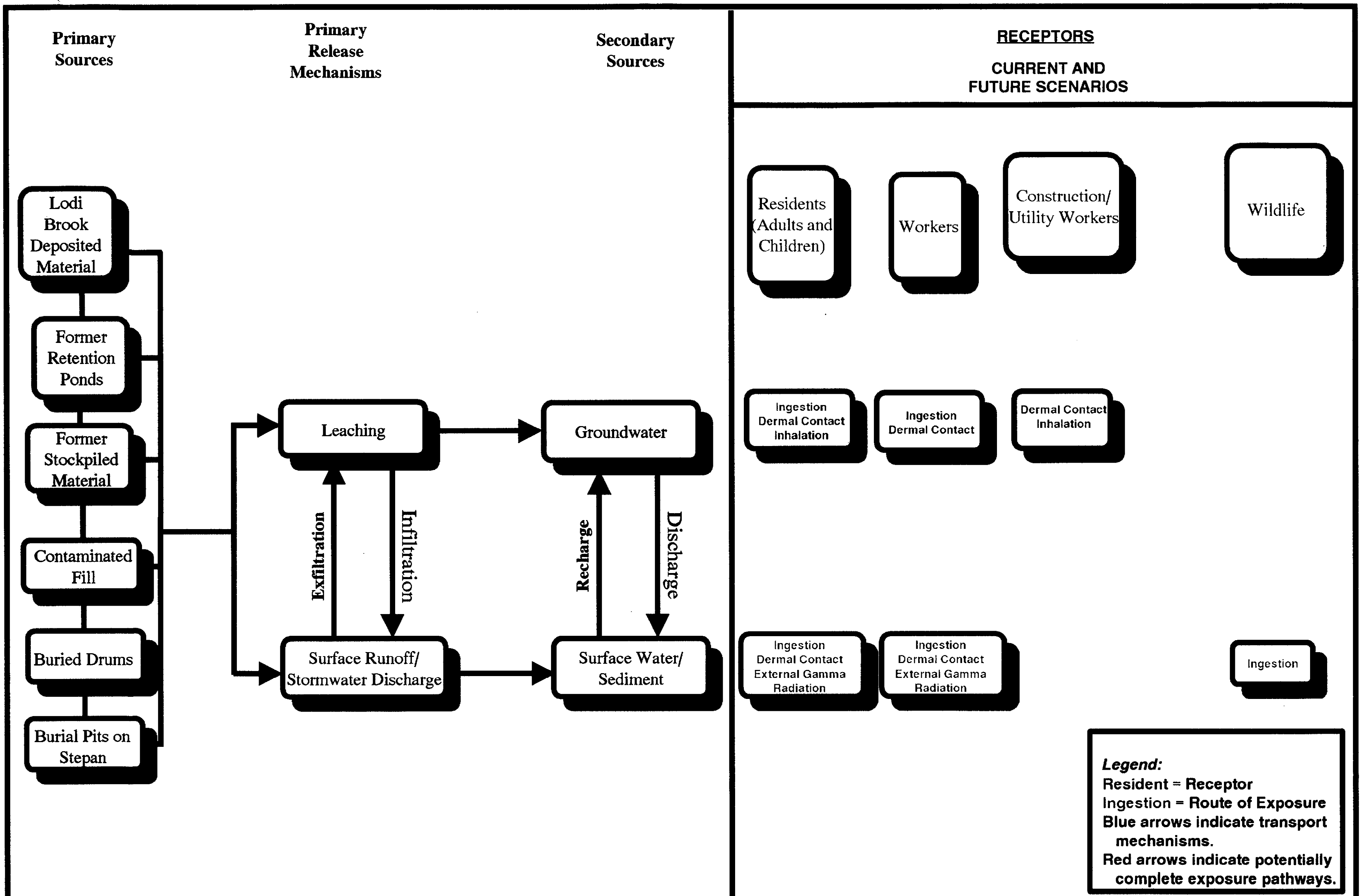
Prepared by: MALCOLM PIRNIE
Reviewed by: XXXX
Date: XXXX
Drawn by: XXXX
Date: XXXX
File Name: XXXX

GROUNDWATER REMEDIAL INVESTIGATION WORK PLAN

LOCATION OF FORMER RETENTION PONDS AND BURIAL PITS AT THE MAYWOOD SITE

FUSRAP MAYWOOD SUPERFUND SITE

Contract Number: DACW41-98-R-0034
Job Number 08575
WAD# 1
WBS# 14
Figure Number:
FIGURE 2-10



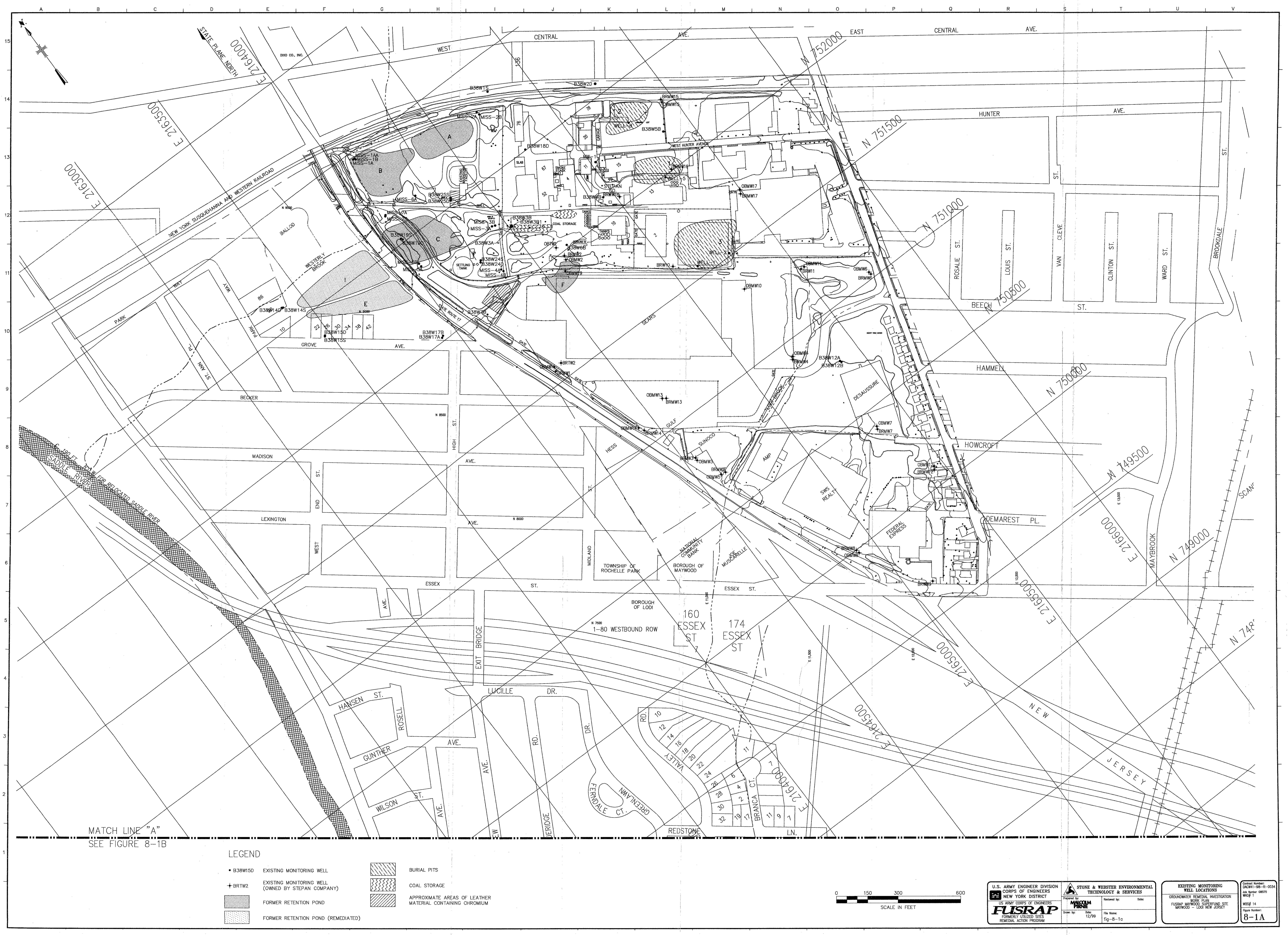
MALCOLM PIRNIE

FUSRAP MAYWOOD SUPERFUND SITE

RISK ASSESSMENT CONCEPTUAL SITE MODEL

MALCOLM PIRNIE, INC.

FIGURE 3-1



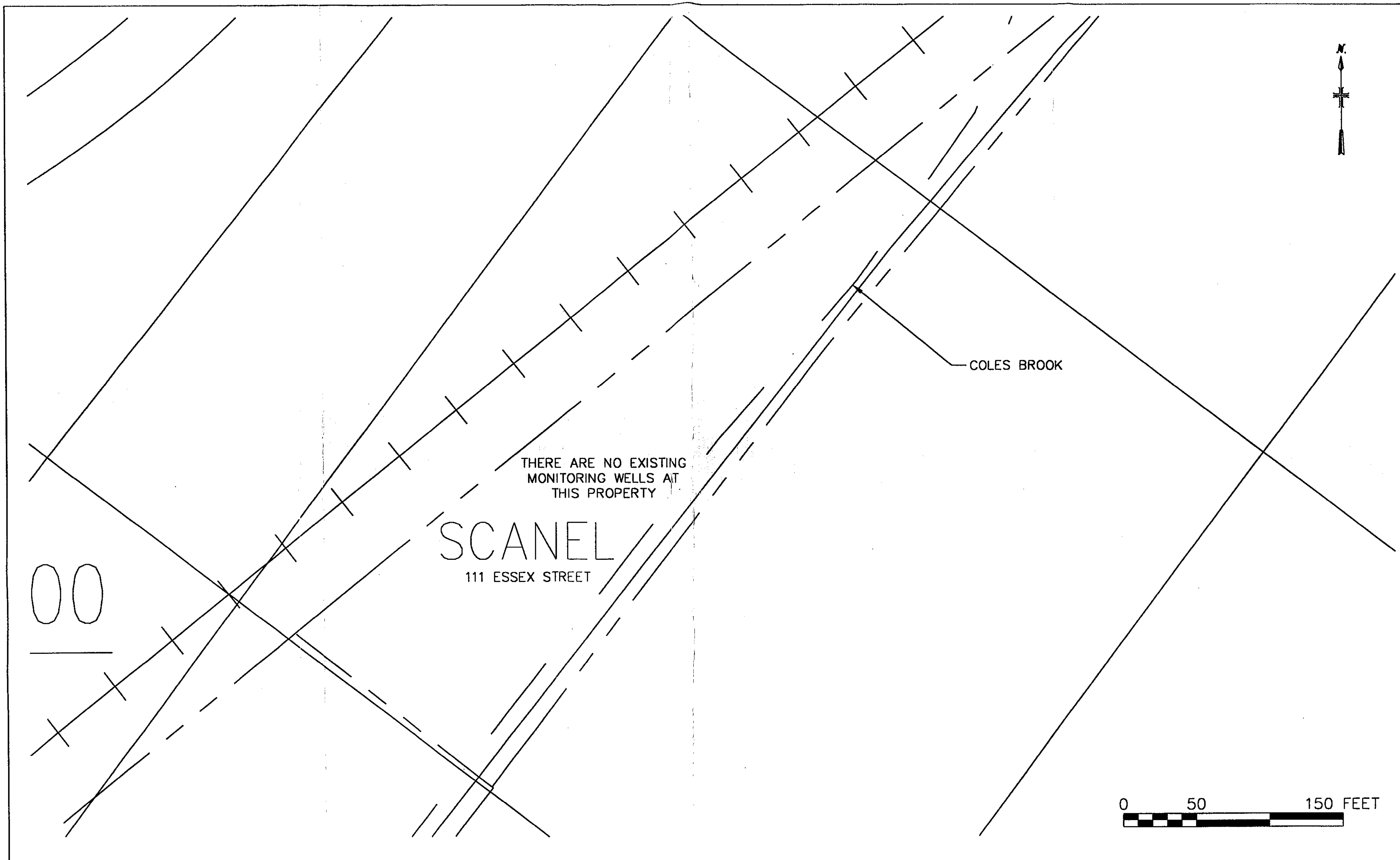
P:\Bosfs01\Maywood\Tas0501\drawings\esk\#\01\fig-8-1a.dwg 8-June-2000 11:00 AM

NOTE:
NO PREVIOUSLY EXISTING MONITORING WELLS IN THIS REGION OF THE STUDY AREA WILL BE USED DURING THIS INVESTIGATION.

0 150 300 600
SCALE IN FEET

U.S. ARMY ENGINEER DIVISION CORPS OF ENGINEERS NEW YORK DISTRICT US ARMY CORPS OF ENGINEERS FUSRAP FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM	STONE & WEBSTER ENVIRONMENTAL TECHNOLOGY & SERVICES Prepared by: MALCOLM PIRNIE Reviewed by: Date: Drawn by: Date: 12/99 File Name: fig-8-1b	EXISTING MONITORING WELL LOCATIONS GROUNDWATER REMEDIAL INVESTIGATION WORK PLAN FUSRAP MAYWOOD SUPERFUND SITE MAYWOOD – LODI NEW JERSEY	Contract Number: DACW41-98-R-0034 Job Number 08575 WAD# 1 WBS# 14 Figure Number: 8-1B

3897 ADMIN I:\ACAD\PROJ\3874002\FIG-8-1B Scale: 1:1 Date: 09/09/1999 Time: 08:32



Symbol	Revisions Descriptions	Date	Approved

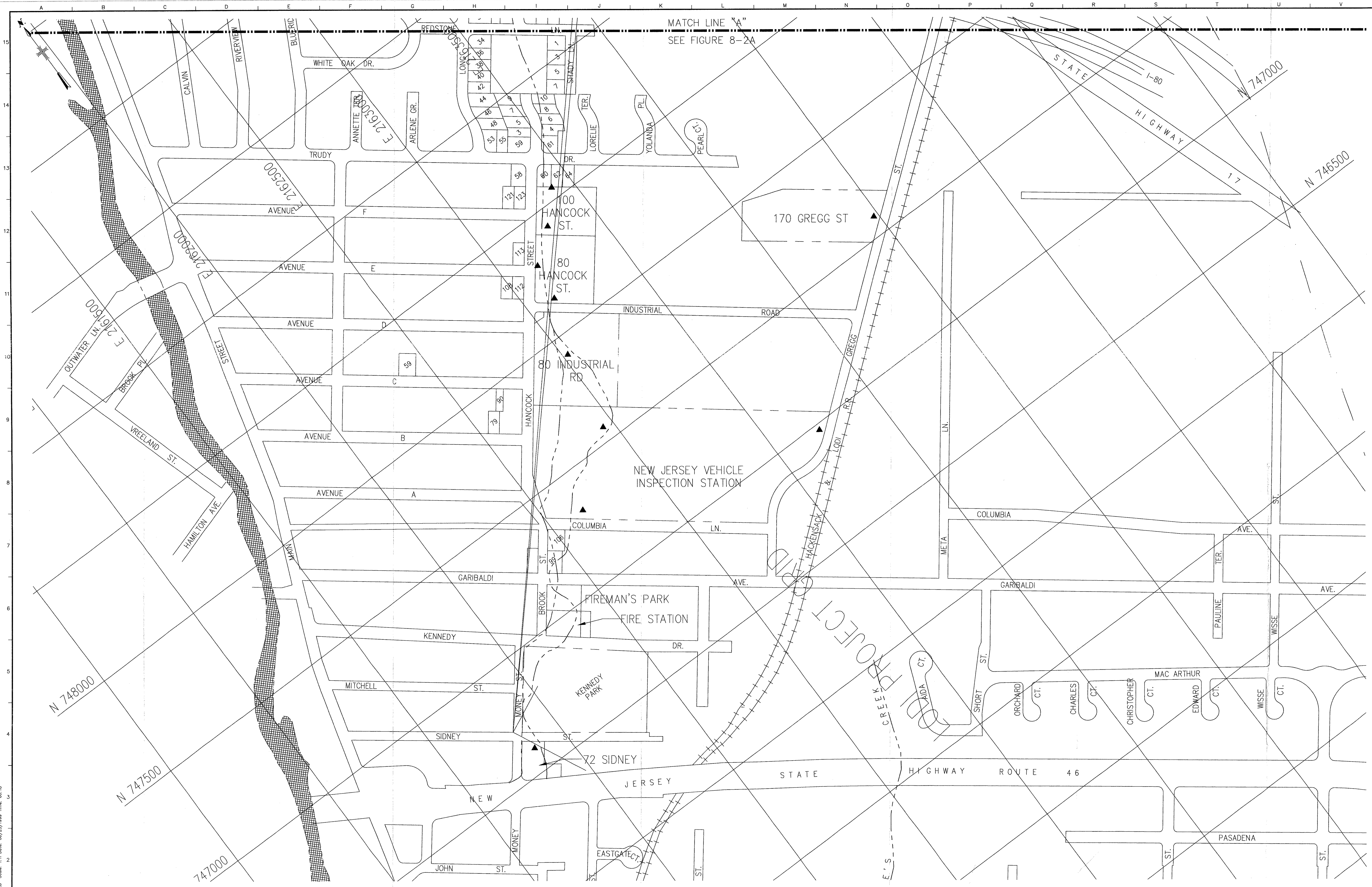
US Army Corps of Engineers

US Army Corps of Engineers FUSRAP FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM

FUSRAP MAYWOOD SUPERFUND SITE
MAYWOOD-LODI, NEW JERSEY
EXISTING MONITORING WELL LOCATIONS

MALCOLM PIRNIE, INC.
DECEMBER, 1999
FIG 8-1C

[Bosfs01\Maywood\Task0501\drawings\esk\e\02\fig-8-2a.dwg 8-June-2000 1:15 PM



LEGEND

▲ PROPOSED GEOPROBE LOCATION

0 150 300 600
SCALE IN FEET

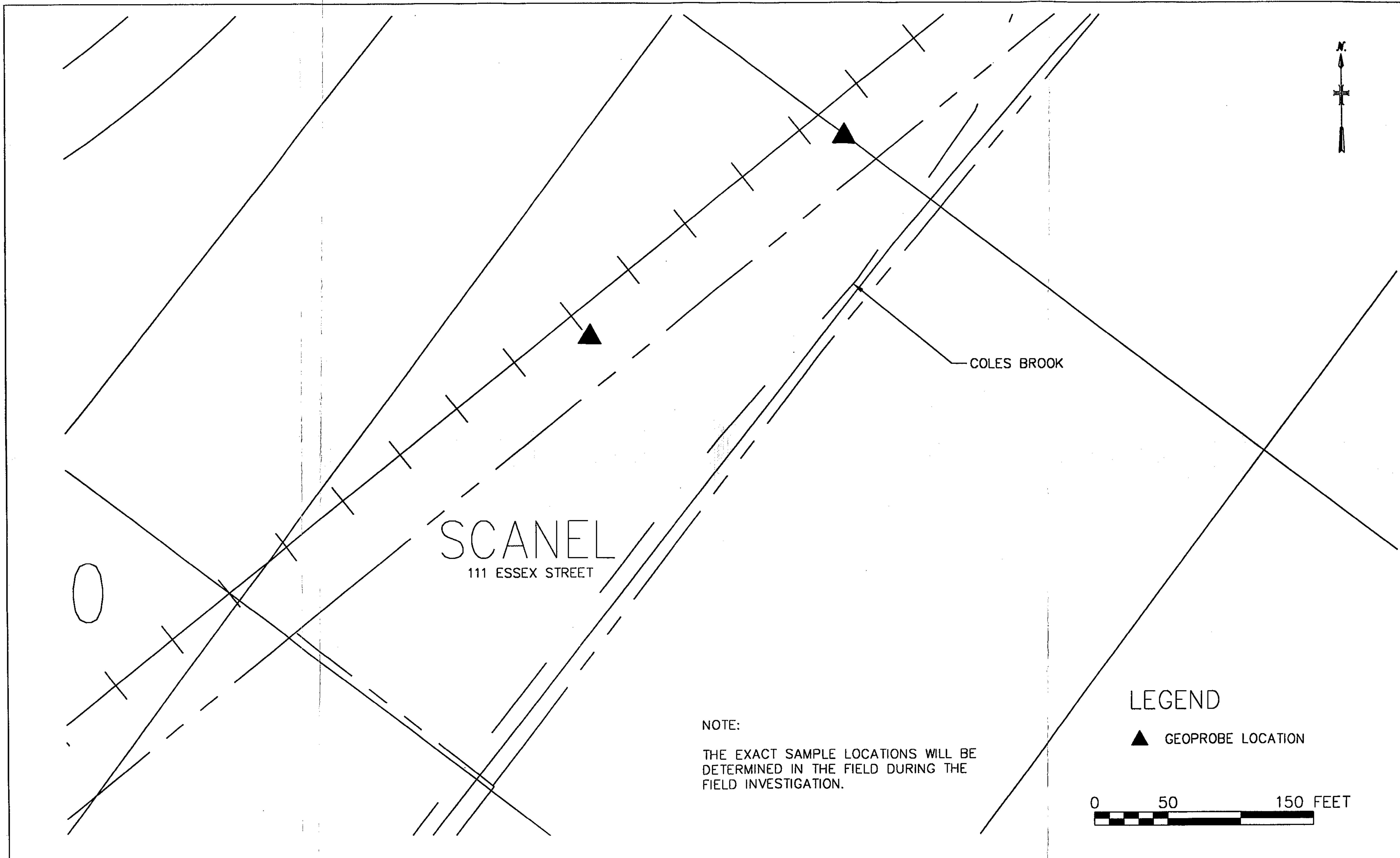
U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
NEW YORK DISTRICT
US ARMY CORPS OF ENGINEERS
FUSRAP
FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM

STONE & WEBSTER ENVIRONMENTAL TECHNOLOGY & SERVICES
Prepared by: MALCOLM PIRNIE
Reviewed by: Date:
Drawn by: Date: 12/99
File Name: fig-8-2b

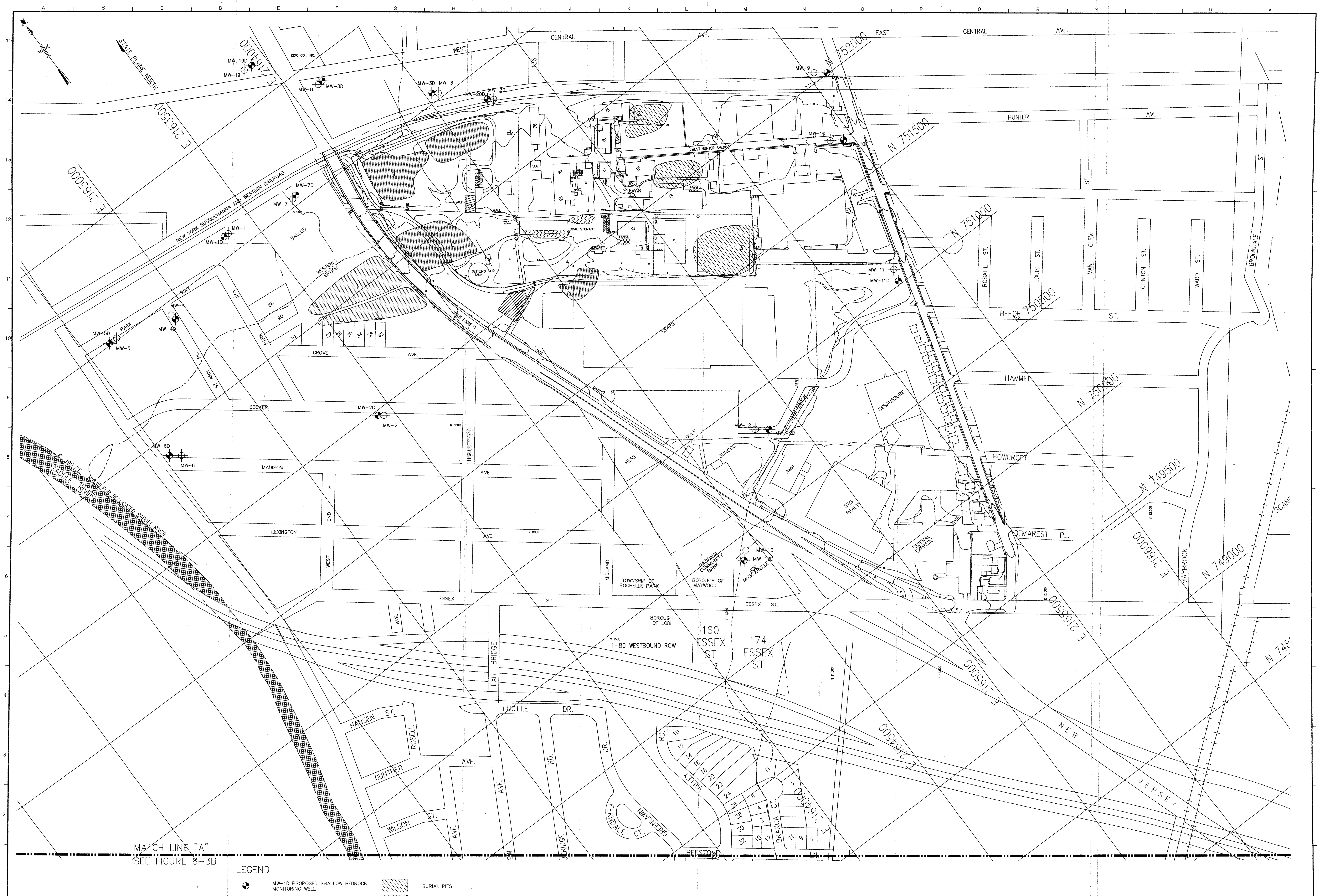
PROPOSED GEOPROBE LOCATIONS

GROUNDWATER REMEDIAL INVESTIGATION
WORK PLAN
FUSRAP MAYWOOD SUPERFUND SITE
MAYWOOD – LODI NEW JERSEY

Contract Number: DACW41-98-R-0034
Job Number 08575
WAD# 1
WBS# 14
Figure Number: 8-2B



Symbol	Revisions Descriptions	Date	Approved	US Army Corps of Engineers FUSRAP (US Army Corps of Engineers; FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM)		FUSRAP MAYWOOD SUPERFUND SITE MAYWOOD–LODI, NEW JERSEY PROPOSED GEOPROBE LOCATIONS	MALCOLM PIRNIE, INC. DECEMBER, 1999 FIG 8–2C



U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
NEW YORK DISTRICT

US ARMY CORPS OF ENGINEERS
FUSRAP
FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM

STONE & WEBSTER ENVIRONMENTAL TECHNOLOGY & SERVICES

Prepared by: MALCOLM PIRNIE | Reviewed by: | Date:
Drawn by: | Date: 12/99 | File Name: fig-8-3a

PROPOSED MONITORING WELL LOCATIONS

GROUNDWATER REMEDIAL INVESTIGATION WORK PLAN
FUSRAP MAYWOOD SUPERFUND SITE
MAYWOOD – LODI NEW JERSEY

Contract Number: DACW41-98-R-0034
Job Number 08575
WAD# 1
WBS# 14
Figure Number: 8-3A

P:[Bosfs01\Maywood\Task0501\drawings\esk\e\03\fig-8-3a.dwg 8-June-2000 1:15 PM

U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
NEW YORK DISTRICT

US ARMY CORPS OF ENGINEERS
FUSRAP
FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM

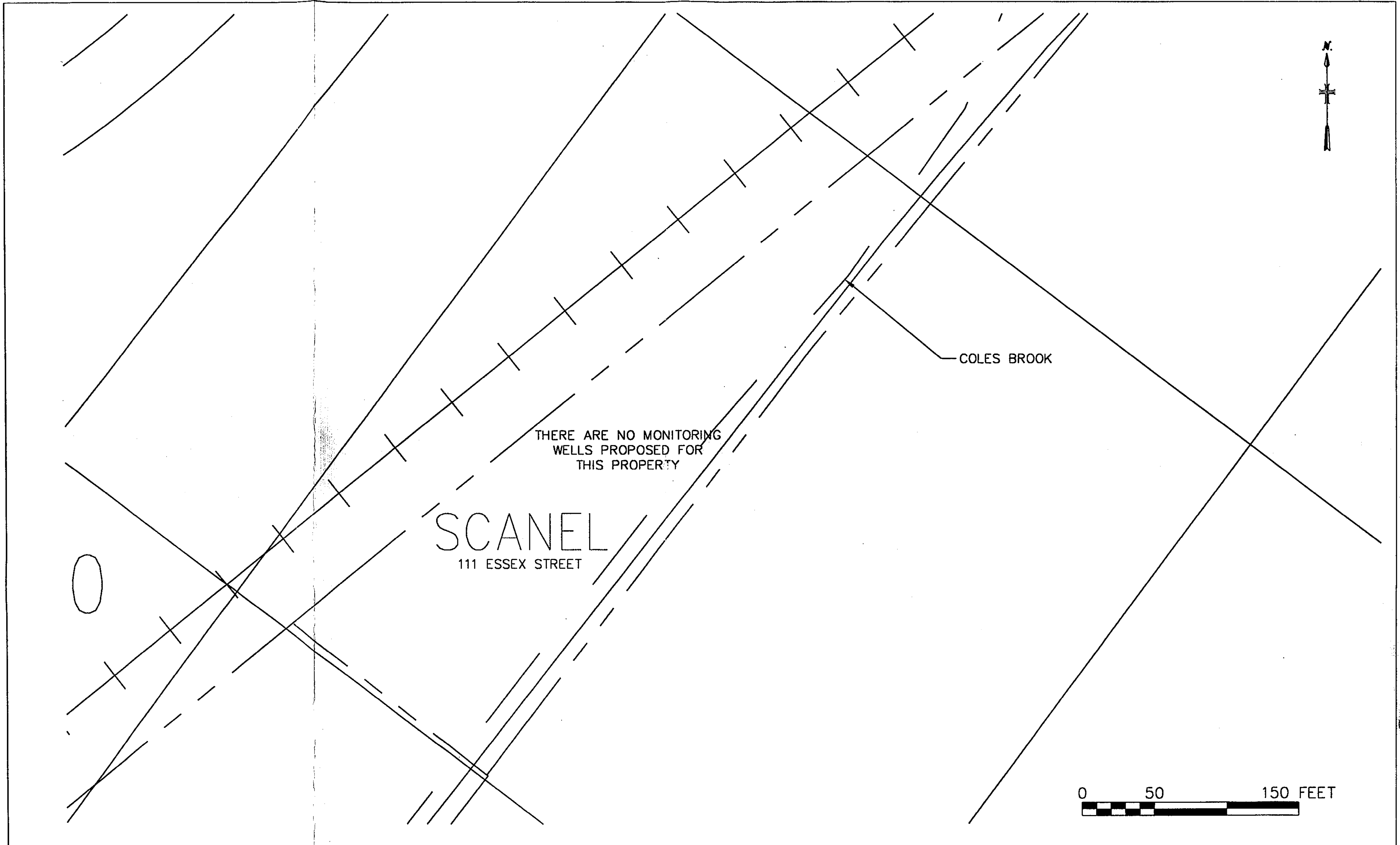
STONE & WEBSTER ENVIRONMENTAL TECHNOLOGY & SERVICES

Prepared by: MALCOLM PIRNIE
Reviewed by: Date:
Drawn by: Date: 12/99
File Name: fig-8-3b

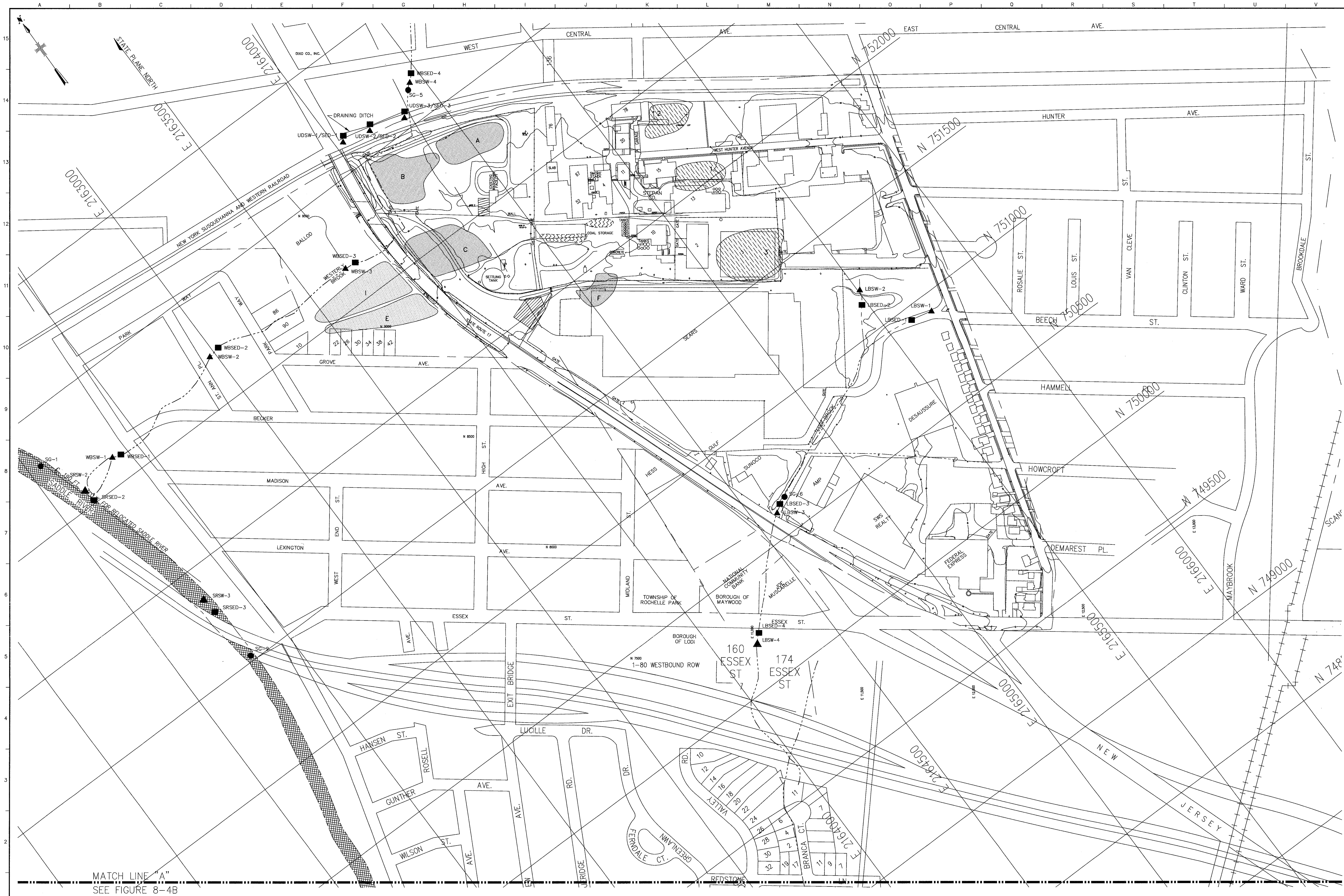
PROPOSED MONITORING WELL LOCATIONS

GROUNDWATER REMEDIAL INVESTIGATION WORK PLAN
FUSRAP MAYWOOD SUPERFUND SITE
MAYWOOD – LODI NEW JERSEY

Contract Number: DACW41-98-R-0034
Job Number 08575
WAD# 1
WBS# 14
Figure Number: 8-3B



Symbol	Revisions Descriptions	Date	Approved	US Army Corps of Engineers FUSRAP		FUSRAP MAYWOOD SUPERFUND SITE MAYWOOD–LODI, NEW JERSEY PROPOSED MONITORING WELL LOCATIONS	MALCOLM PIRNIE, INC. DECEMBER, 1999 FIG 8–3C



LEGEND

- ▲ SRSW-1 PROPOSED SURFACE WATER SAMPLE LOCATION
- ■ SRSED-1 PROPOSED SEDIMENT SAMPLE LOCATION
- ● SG-1 PROPOSED STAFF GAGE LOCATION
- FORMER RETENTION POND
- FORMER RETENTION POND (REMEDIATED)
- BURIAL PITS
- COAL STORAGE
- APPROXIMATE AREAS OF LEATHER MATERIAL CONTAINING CHROMIUM

NOTES

1. SAMPLE LOCATIONS SRSW-1 AND SRSED-1 ARE NOT SHOWN ON THIS FIGURE. THESE SAMPLES WILL BE COLLECTED FROM THE SADDLE RIVER NEAR WEST CENTRAL AVENUE.
2. SAMPLE LOCATIONS WBSED-5 AND WBSW-5 ARE NOT SHOWN ON THIS FIGURE. THESE SAMPLES WILL BE COLLECTED FROM THE WESTERLY BROOK APPROXIMATELY 500 FT NORTH OF WEST CENTRAL AVENUE.

0 150 300 600
SCALE IN FEET

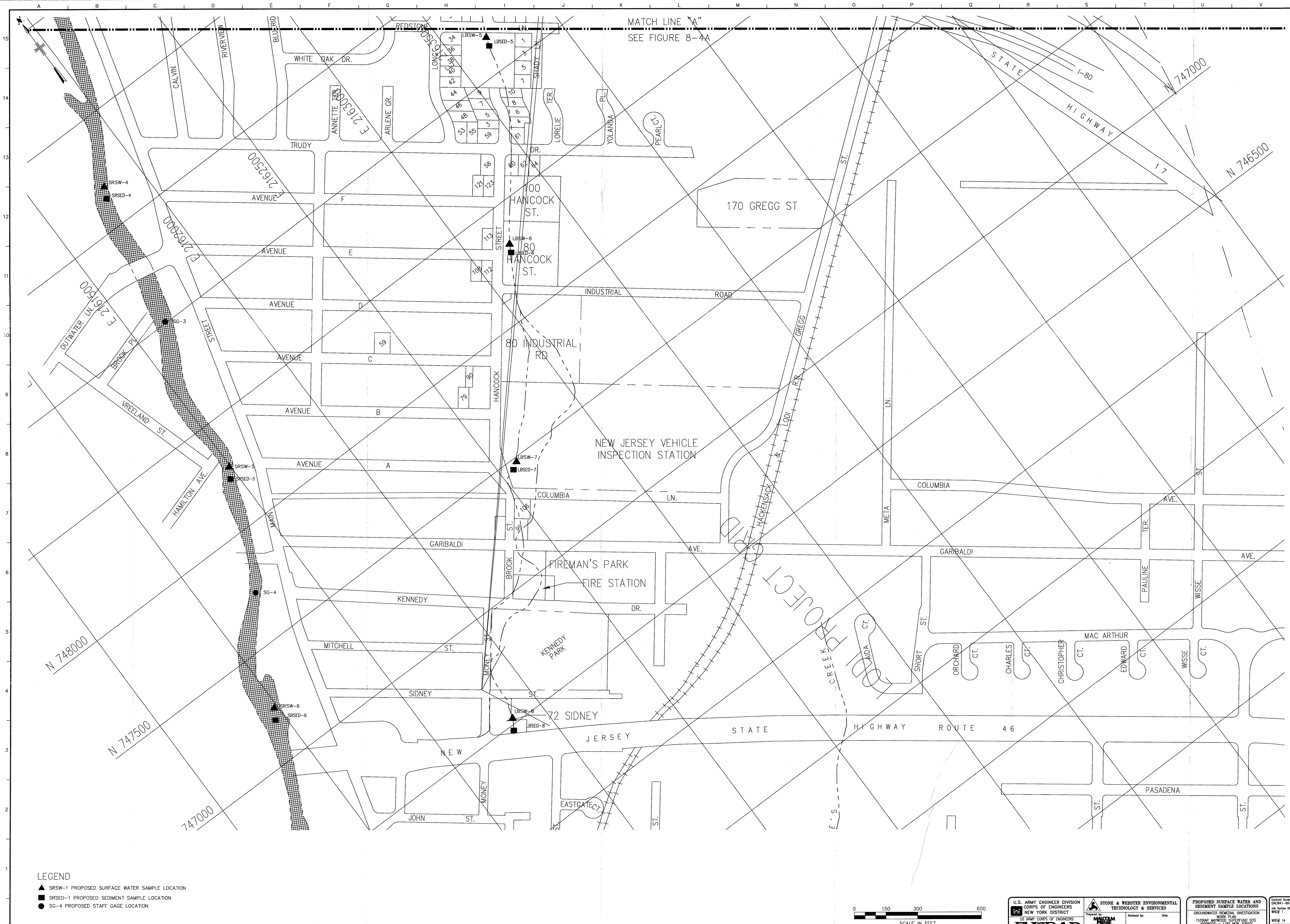
U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
NEW YORK DISTRICT
US ARMY CORPS OF ENGINEERS
FUSRAP
FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM

STONE & WEBSTER ENVIRONMENTAL TECHNOLOGY & SERVICES
Prepared by: MALCOLM PIRNIE
Reviewed by: Date:
Drawn by: Date: 12/99
File Name: fig-8-4a

PROPOSED SURFACE WATER AND SEDIMENT SAMPLE LOCATIONS
GROUNDWATER REMEDIAL INVESTIGATION WORK PLAN
FUSRAP MAYWOOD SUPERFUND SITE
MAYWOOD – LODI NEW JERSEY

Contract Number: DACW41-98-R-0034
Job Number 08575
WAD# 1
WBS# 14
Figure Number: 8-4A

P:\Boston\Maywood\Maywood\Task0501\drawings\esk\a\04\fig-8-4a.dwg 8-June-2000 11:00 AM



LEGEND

▲ SRSW-1 PROPOSED SURFACE WATER SAMPLE LOCATION
■ SRSED-1 PROPOSED SEDIMENT SAMPLE LOCATION
● SG-4 PROPOSED STAFF GAGE LOCATION

U.S. ARMY ENGINEER DIVISION
CORPS OF ENGINEERS
NEW YORK DISTRICT
US ARMY CORPS OF ENGINEERS
FUSRAP
FORMERLY UTILIZED SITES
REMEDIAL ACTION PROGRAM

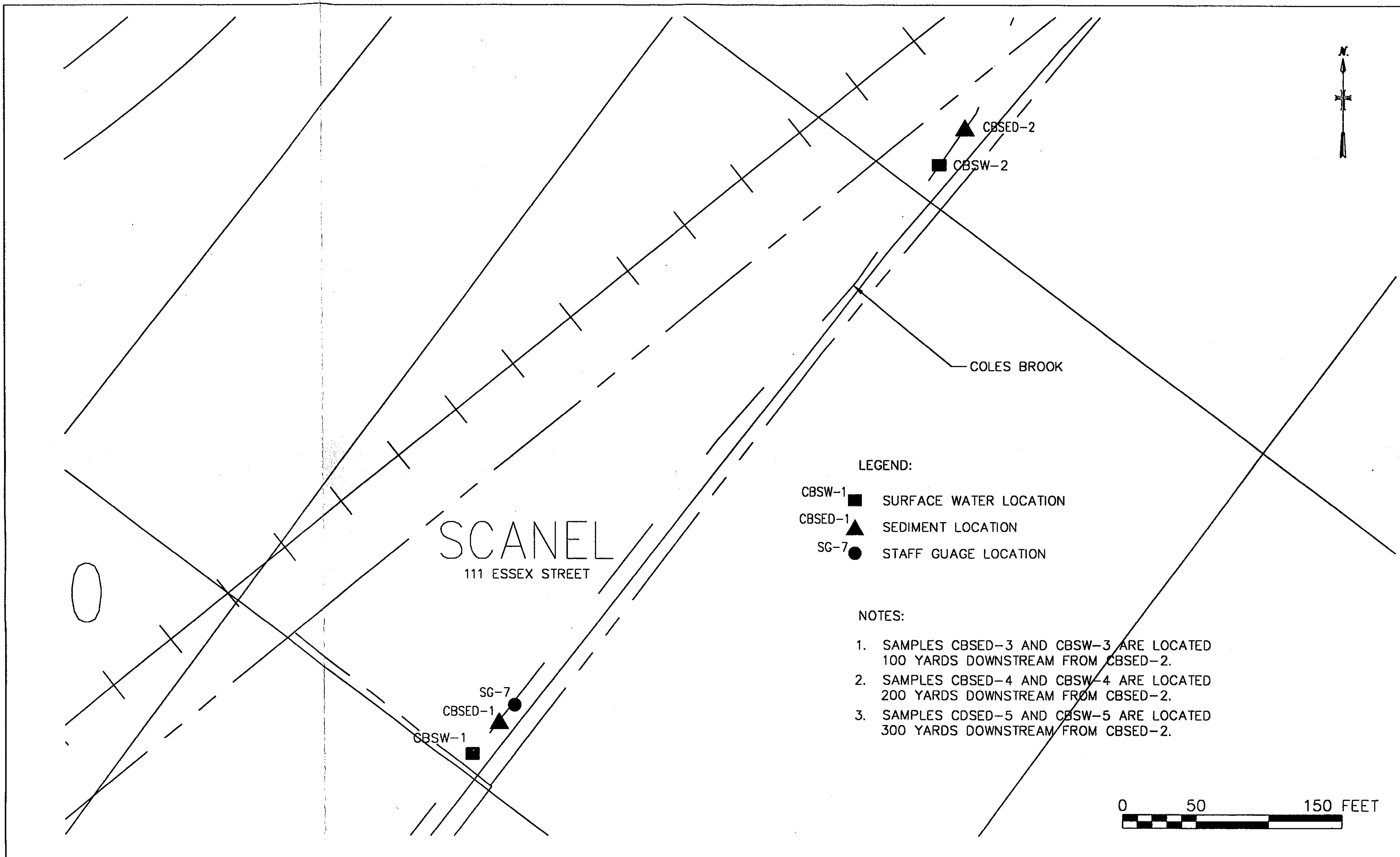
STONE & WEBSTER ENVIRONMENTAL TECHNOLOGY & SERVICES

Prepared by: MALCOLM PIRNIE
Reviewed by:
Date:
Drawn by:
Date: 12/99
File Name: fig-8-4a

PROPOSED SURFACE WATER AND SEDIMENT SAMPLE LOCATIONS

GROUNDWATER REMEDIAL INVESTIGATION
WORK PLAN
FUSRAP MAYWOOD SUPERFUND SITE
MAYWOOD – LODI NEW JERSEY

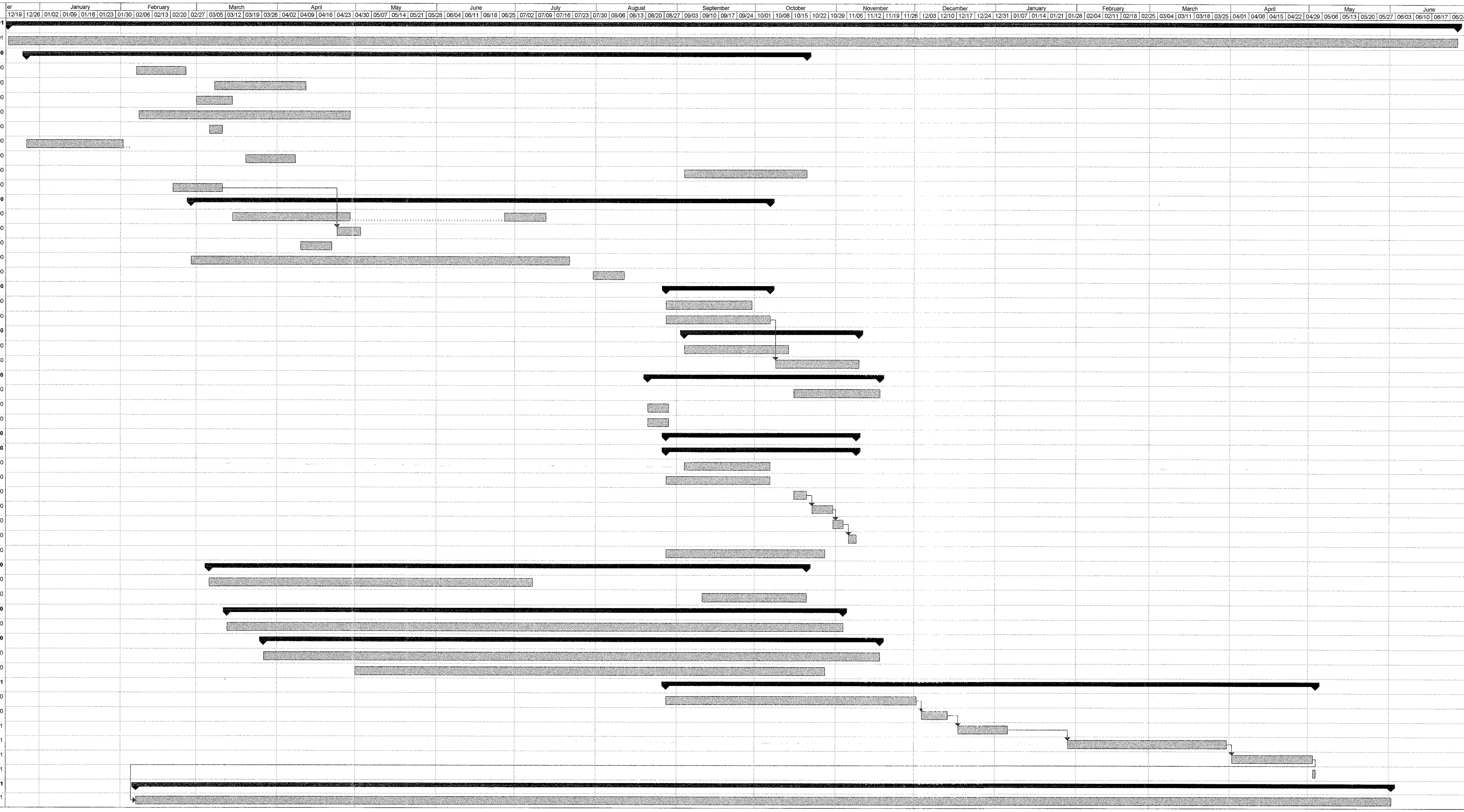
Contract Number: DACW41-98-R-0034
Job Number 08575
WAD# 1
WBS# 14
Figure Number: 8-4B



Symbol	Revisions Descriptions	Date	Approved	US Army Corps of Engineers FUSRAP — US Army Corps of Engineers — FORMERLY UTILIZED SITES REMEDIAL ACTION PROGRAM	FUSRAP MAYWOOD SUPERFUND SITE MAYWOOD-LODI, NEW JERSEY PROPOSED SURFACE WATER & SEDIMENT LOCATIONS	MALCOLM PIRNIE, INC. DECEMBER, 1999 FIG 8-4C

FIGURE 17-1
Groundwater Remedial Investigation Schedule
FUSRAP Maywood Superfund Site

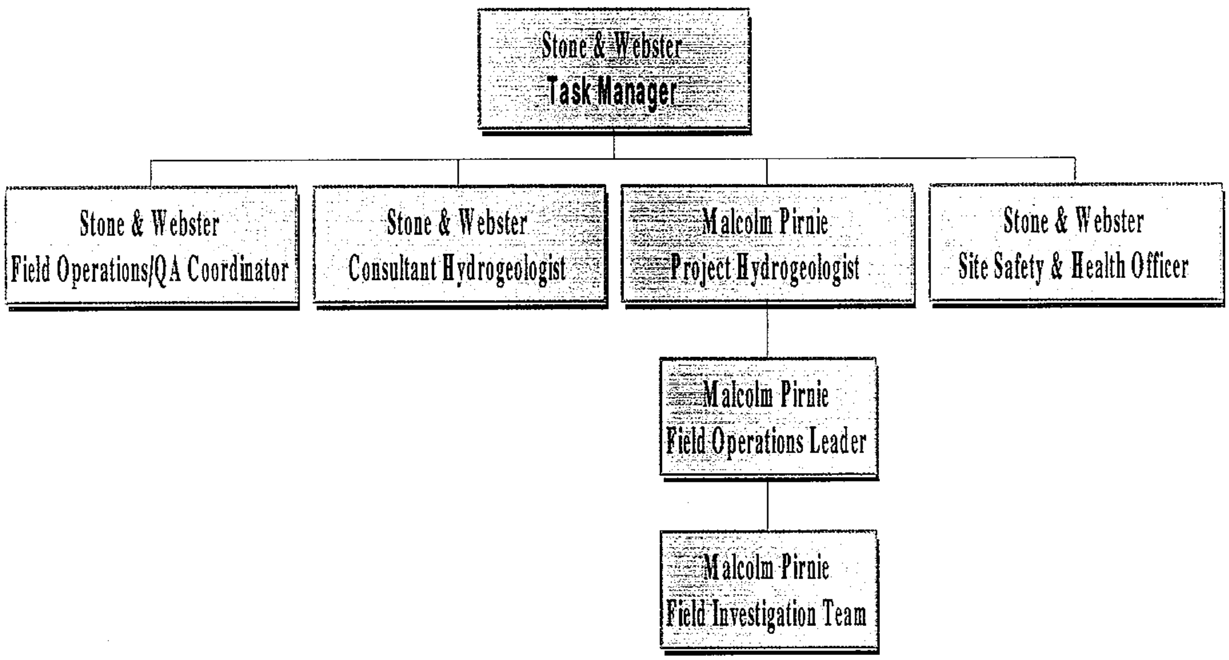
Task Name	Duration	Start	Finish
WBS 1.0 Project Management	**397 days**	**Mon 12/20/99**	**Tue 06/26/01**
Project Management	397 days	Mon 12/20/99	Tue 06/26/01
WBS 2.0 Initial Activities	**215 days**	**Mon 12/27/99**	**Fri 10/20/00**
Training	15 days	Mon 02/07/00	Fri 02/25/00
Utility Survey	25 days	Wed 03/08/00	Tue 04/11/00
Field Mobilization and Demobilization	10 days	Wed 03/01/00	Tue 03/14/00
Historical Data Survey	59 days	Tue 02/08/00	Fri 04/28/00
Surface Features Survey	5 days	Mon 03/06/00	Fri 03/10/00
Westerly Brook/Lodi Brook Survey	30 days	Mon 12/27/99	Fri 02/04/00
Phase I Water Level and Round I GW Sampling	15 days	Mon 03/20/00	Fri 04/07/00
Batch - Sorption Test	35 days	Mon 09/04/00	Fri 10/20/00
Well Integrity	15 days	Mon 02/21/00	Fri 03/10/00
WBS 3.0 Field Activities Phase I	**160 days**	**Mon 02/28/00**	**Fri 10/06/00**
Geoprobe	86 days	Wed 03/15/00	Wed 07/12/00
Phase I Borehole Geophysics	7 days	Mon 04/24/00	Tue 05/02/00
Surface Geophysics	10 days	Mon 04/10/00	Fri 04/21/00
Phase I Data Analysis and Interim Report	105 days	Mon 02/28/00	Fri 07/21/00
USACE Review	10 days	Mon 07/31/00	Fri 08/11/00
Monitoring Well Installation	**30 days**	**Mon 08/28/00**	**Fri 10/06/00**
Overburden Wells	25 days	Mon 08/28/00	Fri 09/29/00
Shallow Bedrock	30 days	Mon 08/28/00	Fri 10/06/00
WBS 4.0 Field Activities Phase II	**49 days**	**Mon 09/04/00**	**Thu 11/09/00**
Well Development	30 days	Mon 09/04/00	Fri 10/13/00
Phase II Borehole Geophysics	24 days	Mon 10/09/00	Thu 11/09/00
WBS 5.0 Sampling and Measurements	**65 days**	**Mon 08/21/00**	**Fri 11/17/00**
Phase II Water Level Measurements/GW Sampling	25 days	Mon 10/16/00	Fri 11/17/00
Sediment Sampling	6 days	Mon 08/21/00	Mon 08/28/00
Surface Water Sampling	6 days	Mon 08/21/00	Mon 08/28/00
WBS 6.0 Aquifer and Related Testing	**53 days**	**Mon 08/28/00**	**Wed 11/08/00**
Aquifer Tests	**53 days**	**Mon 08/28/00**	**Wed 11/08/00**
slug tests	25 days	Mon 09/04/00	Fri 10/06/00
Packer Tests	30 days	Mon 08/28/00	Fri 10/06/00
Antecedent Trends	5 days	Mon 10/16/00	Fri 10/20/00
Step Drawdown Tests	6 days	Mon 10/23/00	Mon 10/30/00
Pumping Test 1	4 days	Tue 10/31/00	Fri 11/03/00
Pumping Test 2	3 days	Mon 11/06/00	Wed 11/08/00
Treatability Study Assessment	45 days	Mon 08/28/00	Fri 10/27/00
WBS 7.0 Data Evaluation	**165 days**	**Mon 03/06/00**	**Fri 10/20/00**
Data Validation	90 days	Mon 03/06/00	Fri 07/07/00
Data Validation for Rnd 2 GW	30 days	Mon 09/11/00	Fri 10/20/00
WBS 8.0 Data Management	**170 days**	**Mon 03/13/00**	**Fri 11/03/00**
Data Management	170 days	Mon 03/13/00	Fri 11/03/00
WBS 9.0 Fate and Transport Modeling/Risk Assessment	**170 days**	**Mon 03/27/00**	**Fri 11/17/00**
Fate & Transport Model	170 days	Mon 03/27/00	Fri 11/17/00
Risk Assessment	130 days	Mon 05/01/00	Fri 10/27/00
WBS 10.0 Report Preparation	**179 days**	**Mon 08/28/00**	**Thu 05/03/01**
Pre-Draft RI Report	70 days	Mon 08/28/00	Fri 12/01/00
Stone & Webster Review of Pre-Draft	8 days	Mon 12/04/00	Wed 12/13/00
USACE Draft RI Report Review	15 days	Mon 12/18/00	Fri 01/05/01
Regulatory Agency Review of Draft RI	45 days	Mon 01/29/01	Fri 03/30/01
Revise RI Report based on Agency Review	23 days	Mon 04/02/01	Wed 05/02/01
Final RI Report to USACE	1 day	Thu 05/03/01	Thu 05/03/01
WBS 11.0 QA/QC	**345 days**	**Mon 02/07/00**	**Fri 06/01/01**
QA/QC	345 days	Mon 02/07/00	Fri 06/01/01



Project: Scheduel-1
Date: Tue 06/13/00

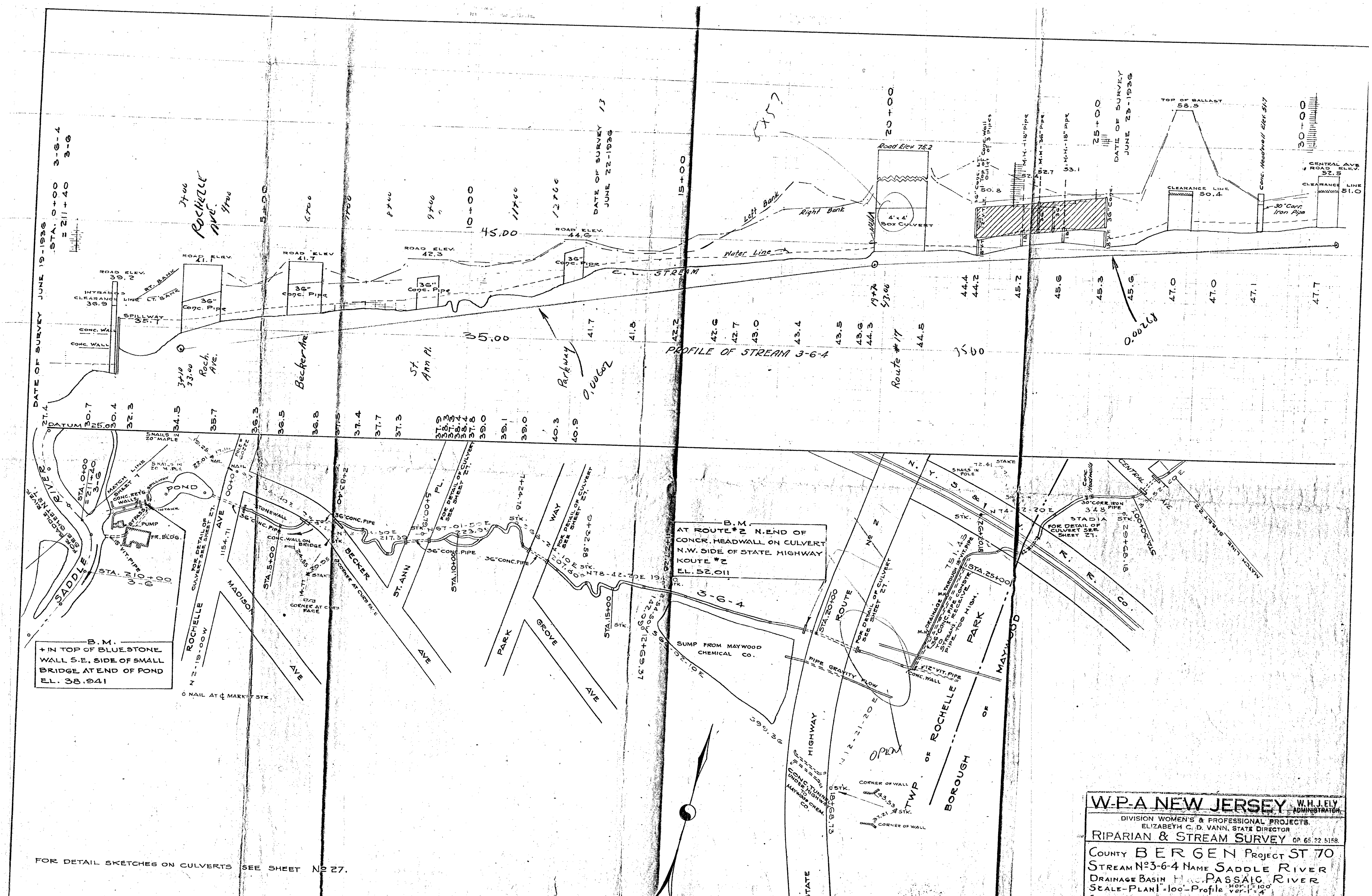
Task | Split | Progress | Milestone | Summary | Rolled Up Task | Rolled Up Split | Rolled Up Milestone | Rolled Up Progress | External Tasks | Project Summary

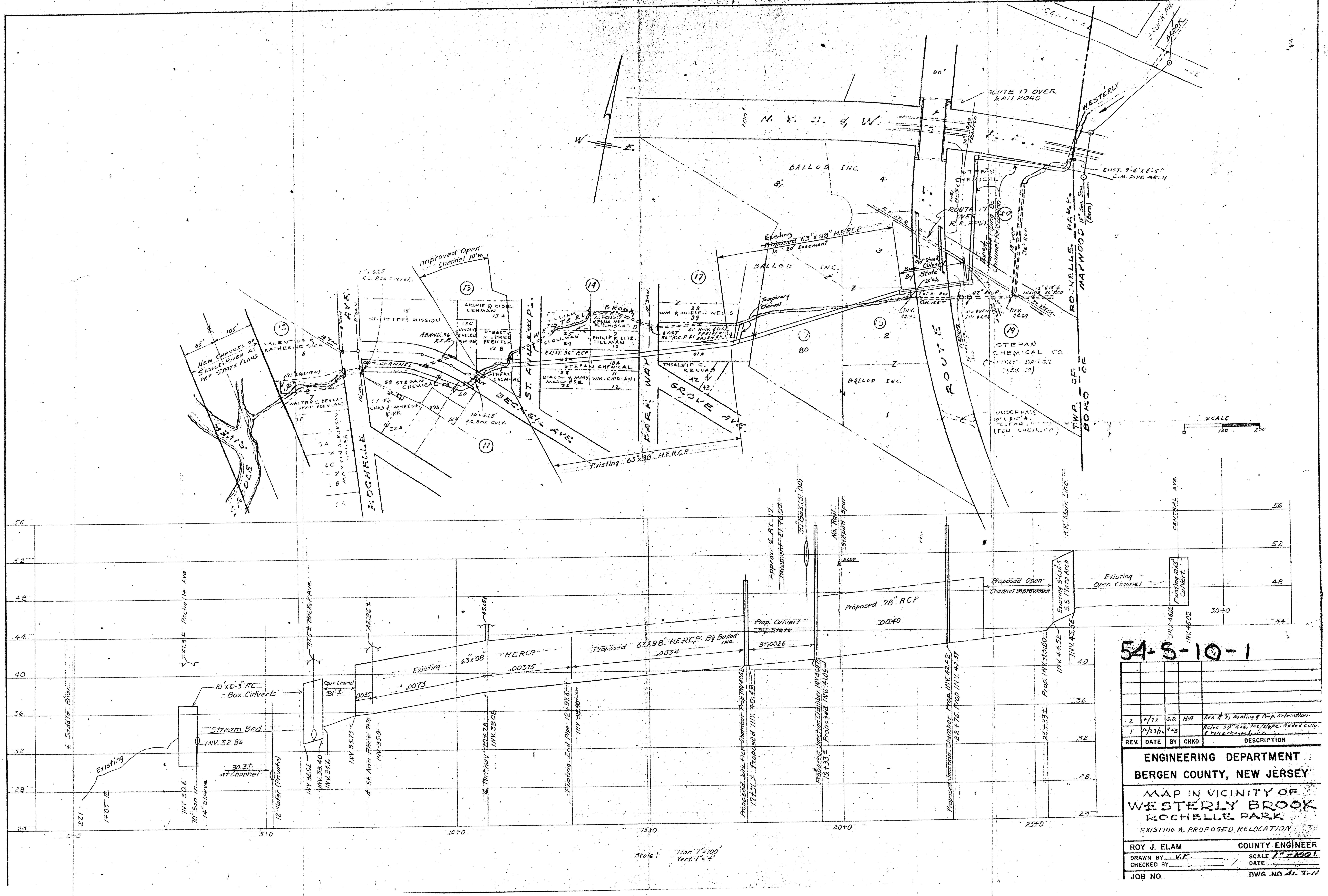
Figure 18-1
Project Management Organization
FUSRAP Maywood Superfund Site



APPENDIX A

Historic Figures


PROFILE OF STREAM 3-6-4
C. L. STREAM
Water Line
Left Bank
Right Bank
DATUM 25.00
DATE OF SURVEY JUNE 19-1936
DATE OF SURVEY JUNE 22-1936
DATE OF SURVEY JUNE 23-1936
4'x4' BOX CULVERT
TOP OF BALLAST 58.5
CLEARANCE LINE
SADDLE RIVER
POND
ROCHELLE AVE
MADISON AVE
BECKER AVE
ST. ANN PL.
PARK WAY
GROVE AVE
ROUTE Nº 2
STATE HIGHWAY
TWP. OF ROCHELLE PARK
BOROUGH OF MAYWOOD
N. Y. S. & W. R. R. CO.
CENTRAL AVE
SUMP FROM MAYWOOD CHEMICAL CO.
PIPE GRAVITY FLOW
B.M. AT ROUTE #2 N. END OF CONCR. HEADWALL ON CULVERT N.W. SIDE OF STATE HIGHWAY ROUTE #2 EL. 52.011
B.M. + IN TOP OF BLUESTONE WALL S.E. SIDE OF SMALL BRIDGE AT END OF POND EL. 38.941
FOR DETAIL SKETCHES ON CULVERTS SEE SHEET Nº 27.
W-P-A NEW JERSEY W. H. J. ELY ADMINISTRATOR.
DIVISION WOMEN'S & PROFESSIONAL PROJECTS.
ELIZABETH C. D. VANN, STATE DIRECTOR
RIPARIAN & STREAM SURVEY OP. 65.22.5158.
COUNTY BERGEN PROJECT ST 70
STREAM Nº 3-6-4 NAME SADDLE RIVER
DRAINAGE BASIN PASSAIC RIVER
SCALE-PLAN 1"=100'-Profile Hor-1"=100' ver-1"=4'
SHEET Nº 21 OF 27 FIELD BOOK 3-6-9
Drawn by R.L. Checked by W.S.
DATE 9.15.'36 APPROVED Frank R. McGuire Field Supervisor
COUNTY FILE Nº HDQRS FILE Nº



54-S-10-1

REV.	DATE	BY	CHKD.	DESCRIPTION
2	6/72	S.D.	H&B	Rev. ℄'s; Existing & Prop. Relocation.
1	10/27/70	H&B		Reloc. 30" San., Inc./slope. Added culv. & reloc. channel inv.

ENGINEERING DEPARTMENT
BERGEN COUNTY, NEW JERSEY

MAP IN VICINITY OF
WESTERLY BROOK
ROCHELLE PARK
EXISTING & PROPOSED RELOCATION

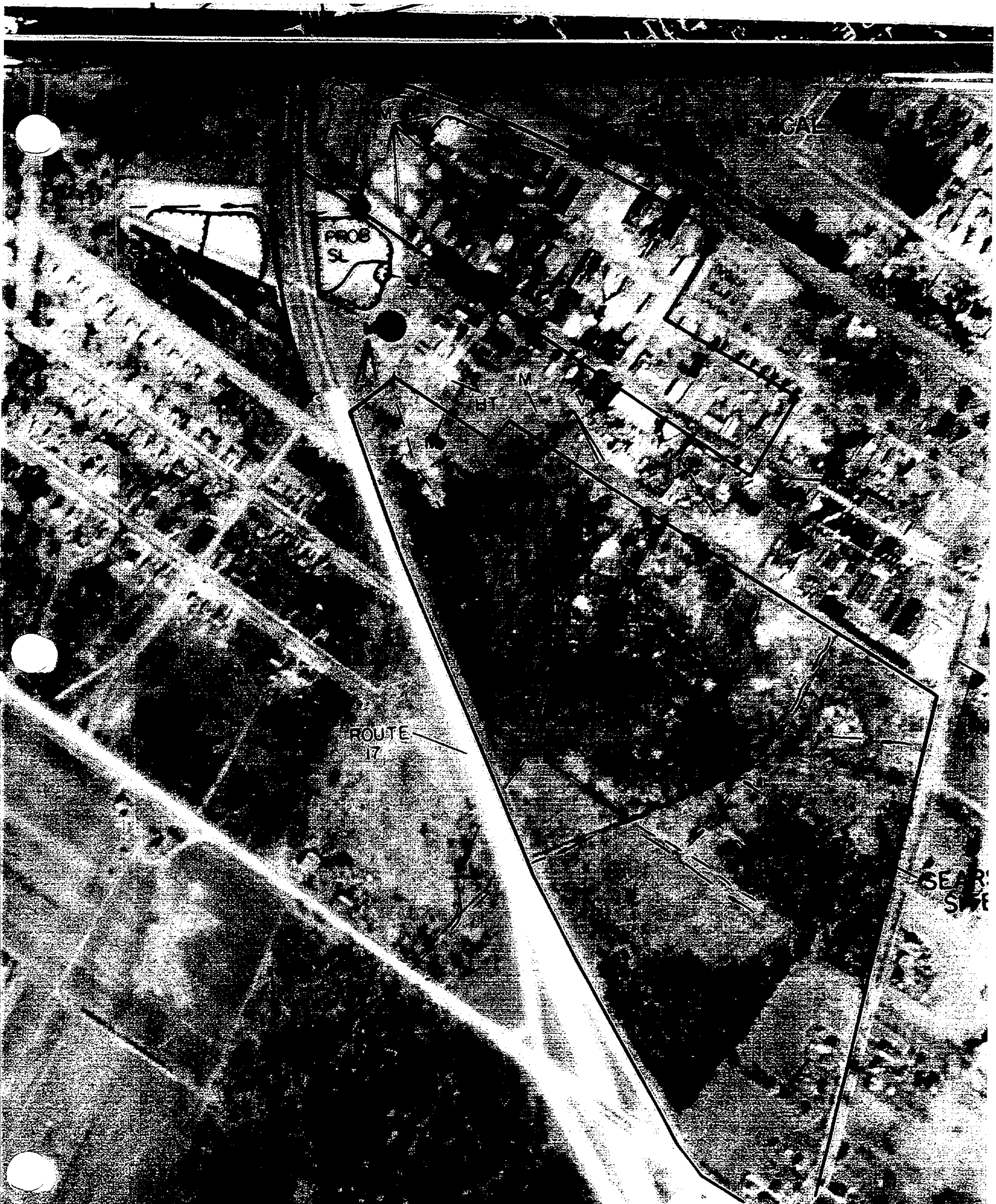
ROY J. ELAM — COUNTY ENGINEER

DRAWN BY V.K. — SCALE 1"=100'
CHECKED BY — DATE
JOB NO. — DWG. NO. 41-3-11

BOOK ___ PAGE ___
FIELD ___ DATE ___
OFFICE ___ DATE ___

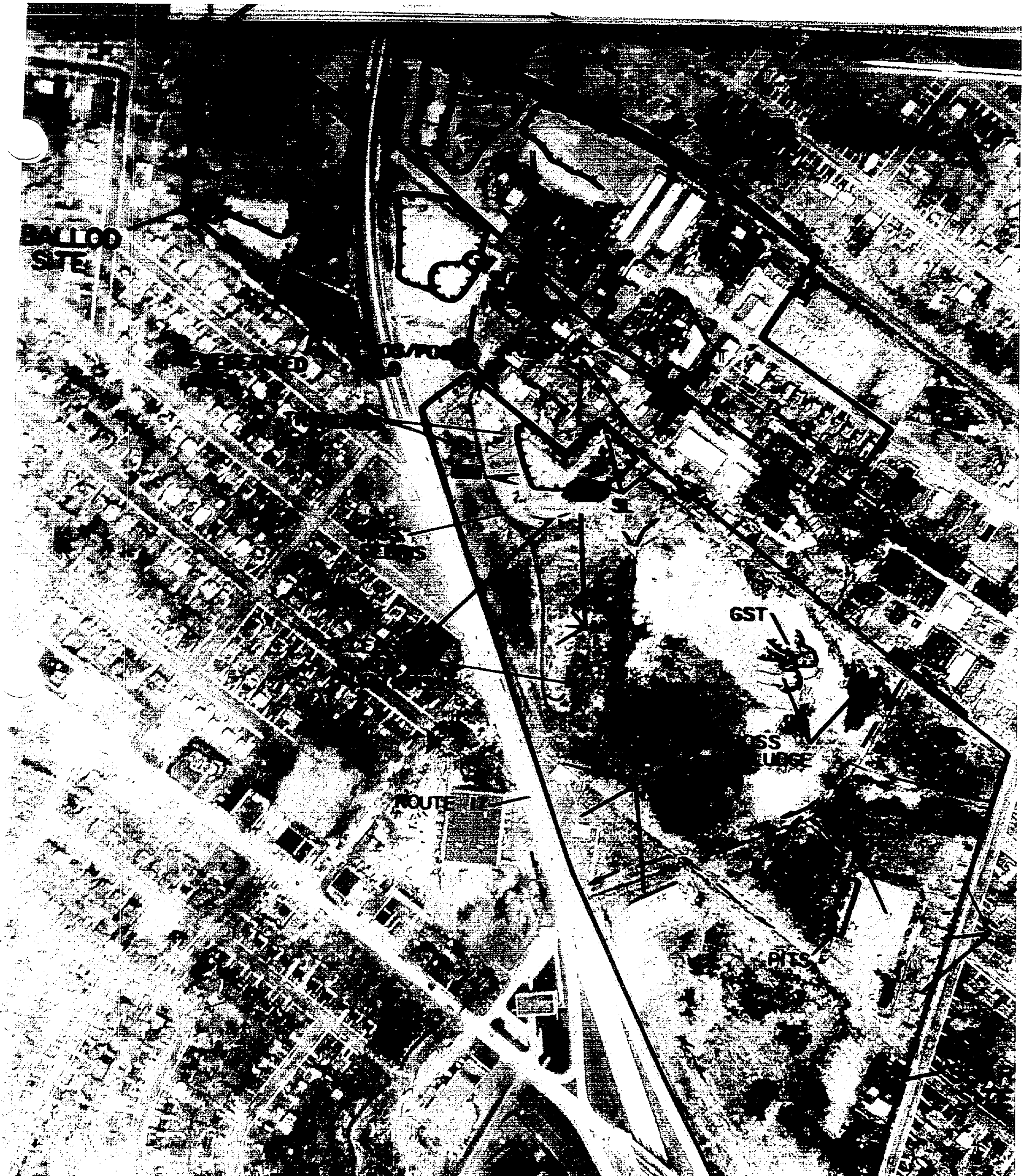
SEN 3383
CONFIDENTIAL
MIDDLE STATES
N.S. 7967
EASTERN UNDERWRITERS INSPECTION BUREAU
HUNTER AVE
RESERVOIR
SKETCH No. 1
Sketch of Pumps & Piping for Building 5-A.
SKETCH No. 2
Sketch of Fire Pumps in Building 49
SKETCH No. 3
Sketch of Pumps & Piping in Building 36-B.
SECTION D-D
SECTION B-B
SECTION A-A
SECTION G-G
SECTION E-E
SECTION F-F
SECTION H-H
SECTION J-J
SECTION C-C
MAYWOOD CHEMICAL WORKS
MAYWOOD BERGEN CO, N. J.

APRIL 6, 1940

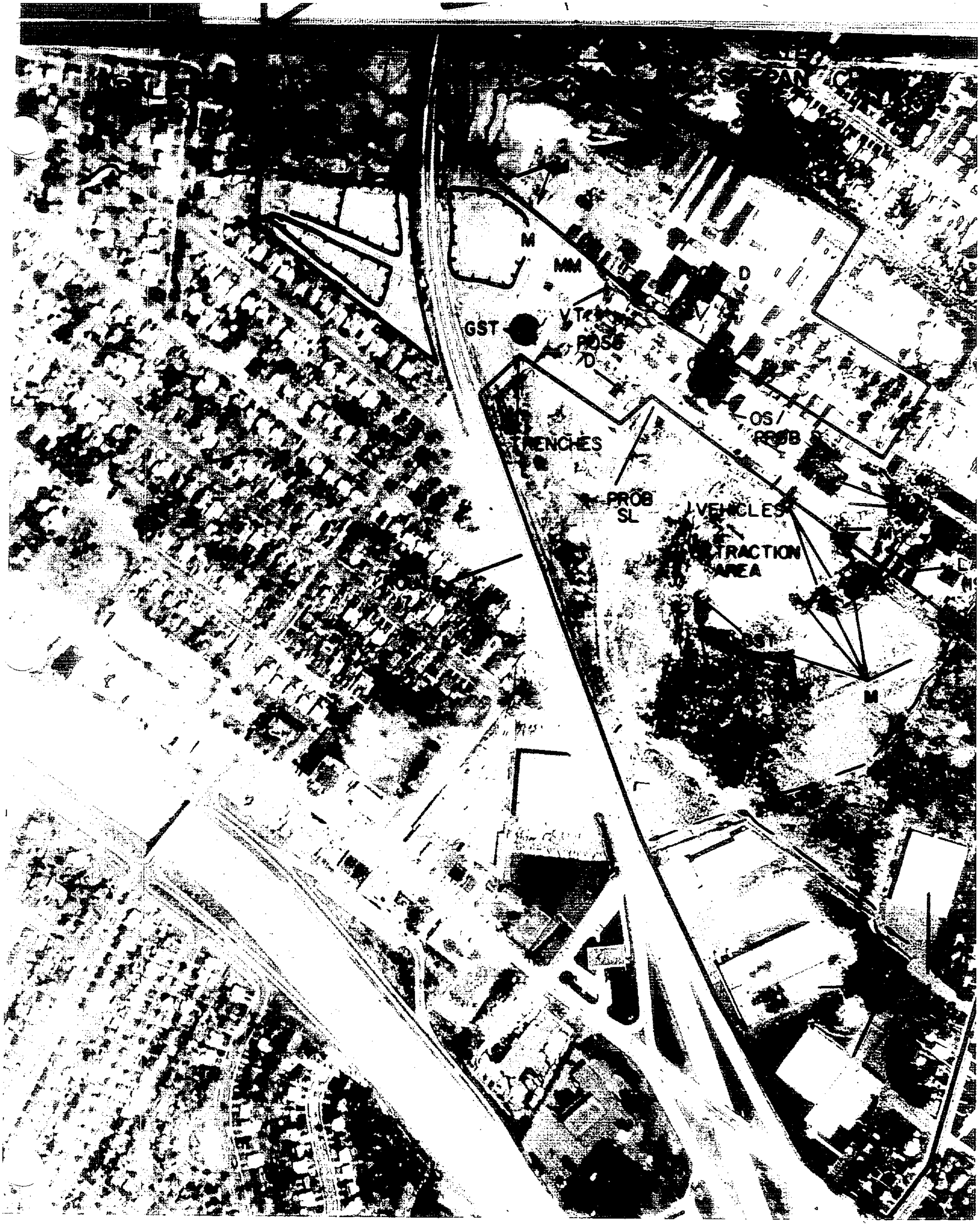


APRIL 7, 1951

CHEMICAL SITES



6
DOD CHEMICAL SITES APRIL 12, 1961 APPROX SCALE



URE 7
AYWOOD CHEMICAL SITES MAY 1, 1965 APPROX SC

TABLE B-1
Historical Results for Radioactive Parameters in Groundwater at MISS

STATION_ID	DATE	ANALYTE NAME	RESULT	REV Q	ERROR	SQL	UNITS
B38W14S	1990	RADIUM-226	0.5				
B38W14S	1991	RADIUM-226	1.09				
B38W14S	1995	RADIUM-226	0.1	UJ	0.1	0.11	PCI/L
B38W14S	1997	RADIUM-226	0.13	UJ	0.1	0.5	PCI/L
B38W14S	1998	RADIUM-226	0.07	UJ	0.14	0.5	PCI/L
B38W14S	1999	RADIUM-226	0.16	UJ	0.16	0.5	PCI/L
B38W14D	1990	RADIUM-226	0.5				PCI/L
B38W14D	1991	RADIUM-226	0.2				PCI/L
B38W14D	1995	RADIUM-226	0.09	UJ	0.1	0.14	PCI/L
B38W14D	1997	RADIUM-226	0.15	UJ	0.13	0.5	PCI/L
B38W14D	1998	RADIUM-226	0.23	UJ	0.23	0.5	PCI/L
B38W14D	1999	RADIUM-226	0.34	UJ	0.08	0.5	PCI/L
B38W15S	1990	RADIUM-226	0.8				PCI/L
B38W15S	1991	RADIUM-226	0.2				PCI/L
B38W15S	1994	RADIUM-226	0.43		0.21		PCI/L
B38W15S	1995	RADIUM-226	0.27		0.17	0.14	PCI/L
B38W15S	1997	RADIUM-226	0.25		0.14	0.5	PCI/L
B38W15S	1998	RADIUM-226	0.21	UJ	0.21	0.5	PCI/L
B38W15D	1990	RADIUM-226	0.5				PCI/L
B38W15D	1991	RADIUM-226	0.3				PCI/L
B38W15D	1994	RADIUM-226	0.28		0.17		PCI/L
B38W15D	1995	RADIUM-226	0.04		0.07	0.11	PCI/L
B38W15D	1997	RADIUM-226	0.24		0.15	0.5	PCI/L
B38W15D	1998	RADIUM-226	0.44		0.31	0.5	PCI/L
							PCI/L
B38W17A	1991	RADIUM-226	1.9				PCI/L
B38W17A	1994	RADIUM-226	0.44		0.21		PCI/L
B38W17A	1995	RADIUM-226	0.05	UJ	0.08	0.07	PCI/L
B38W17A	1997	RADIUM-226	0.16	UJ	0.12	0.5	PCI/L
B38W17A	1998	RADIUM-226	0.24	UJ	0.25	0.5	PCI/L
B38W17A	1999	RADIUM-226	0.62	J	0.41	0.5	PCI/L
B38W17B	1991	RADIUM-226	0.24				PCI/L
B38W17B	1994	RADIUM-226	1.79		0.44		PCI/L
B38W17B	1995	RADIUM-226	0.28		0.17		PCI/L
B38W17B	1997	RADIUM-226	0.54		0.22	0.5	PCI/L
B38W17B	1998	RADIUM-226	0.11	UJ	0.16	0.5	PCI/L
B38W17B	1999	RADIUM-226	0.46	UJ	0.4	0.5	PCI/L
B38W19D	1993	RADIUM-226	0.04	UJ	0.08	0.21	PCI/L
B38W19D	1994	RADIUM-226	1.3	U	0.37	0.15	PCI/L
B38W19D	1995	RADIUM-226	0.09	UJ	0.1	0.16	PCI/L
B38W19D	1996	RADIUM-226	0.19		0.12	0.14	PCI/L
B38W19D	1997	RADIUM-226	0.29		0.16	0.16	PCI/L
B38W19D	1998	RADIUM-226	0.15	UJ	0.2	0.41	PCI/L
B38W19D	1999	RADIUM-226	0.33	UJ	0.26	0.38	PCI/L
B38W19S	1994	RADIUM-226	0.78		0.28	0.11	PCI/L

TABLE B-1
Historical Results for Radioactive Parameters in Groundwater at MISS

STATION_ID	DATE	ANALYTE NAME	RESULT	REV Q	ERROR	SQL	UNITS
B38W19S	1995	RADIUM-226	0.11		0.09	0.05	PCI/L
B38W19S	1996	RADIUM-226	0.11		0.09	0.09	PCI/L
B38W19S	1998	RADIUM-226	0.32	UJ	0.24	0.34	PCI/L
B38W19S	1999	RADIUM-226	0.35	UJ	0.3	0.4	PCI/L
B38W25S	1993	RADIUM-226	0.34		0.22	0.09	PCI/L
B38W25S	1994	RADIUM-226	0.37		0.19	0.13	PCI/L
B38W25S	1995	RADIUM-226	0.16		0.12	0.09	PCI/L
B38W25S	1996	RADIUM-226	0.26	UJ	0	0.26	PCI/L
B38W25S	1997	RADIUM-226	0.13	UJ	0.1	0.14	PCI/L
B38W25S	1998	RADIUM-226	0.13	UJ	0.17	0.34	PCI/L
B38W25S	1999	RADIUM-226	0.08	UJ	0.13	0.27	PCI/L
MISS02B	1993	RADIUM-226	0.05	UJ	0.1	0.29	PCI/L
MISS02B	1994	RADIUM-226	2	U	0.46	0.14	PCI/L
MISS02B	1995	RADIUM-226	0.1		0.09	0.06	PCI/L
MISS02B	1996	RADIUM-226	0.11	UJ	0.11	0.2	PCI/L
MISS02B	1997	RADIUM-226	0.28		0.16	0.12	PCI/L
MISS02B	1998	RADIUM-226	0.35		0.24	0.3	PCI/L
MISS02B	1999	RADIUM-226	0.46		0.31	0.42	PCI/L
MISS05A	1994	RADIUM-226	1.33		0.54	0.14	PCI/L
MISS05A	1995	RADIUM-226	0.2	UJ	0.18	0.22	PCI/L
MISS05A	1996	RADIUM-226	0.04	UJ	0.06	0.16	PCI/L
MISS05A	1997	RADIUM-226	0.52		0.27	0.27	PCI/L
MISS05A	1998	RADIUM-226	0.23	UJ	0.24	0.42	PCI/L
MISS05A	1999	RADIUM-226	0.68		0.48	0.64	PCI/L
B38W14S	1991	RADIUM-228	2.0				PCI/L
B38W14S	1997	RADIUM-228	0.1	UJ	0.15	0.5	PCI/L
B38W14S	1998	RADIUM-228	0.2	UJ	0.24	0.5	PCI/L
B38W14S	1999	RADIUM-228	0.4		0.38	0.5	PCI/L
B38W14D	1991	RADIUM-228	3.0				PCI/L
B38W14D	1997	RADIUM-228	0.0	UJ	0.09	0.5	PCI/L
B38W14D	1998	RADIUM-228	0.0	UJ	0.13	0.5	PCI/L
B38W14D	1999	RADIUM-228	0.0	UJ	0.23	0.5	PCI/L
B38W15S	1991	RADIUM-228	2.0				PCI/L
B38W15S	1997	RADIUM-228	0.2	UJ	0.21	0.5	PCI/L
B38W15S	1998	RADIUM-228	0.0	UJ	0.2	0.5	PCI/L
B38W15D	1991	RADIUM-228	2.0				PCI/L
B38W15D	1997	RADIUM-228	0.1	UJ	0.14	0.5	PCI/L
B38W15D	1998	RADIUM-228	0.2	UJ	0.22	0.5	PCI/L
B38W17A	1991	RADIUM-228	2.0				PCI/L
B38W17A	1997	RADIUM-228	0.3	UJ	0.27	0.5	PCI/L
B38W17A	1998	RADIUM-228	0.2	UJ	0.27	0.5	PCI/L
B38W17A	1999	RADIUM-228	1.1	UJ	0.31	0.5	PCI/L
B38W17B	1991	RADIUM-228	2.0				PCI/L
B38W17B	1997	RADIUM-228	0.2	UJ	0.21	0.5	PCI/L

TABLE B-1
Historical Results for Radioactive Parameters in Groundwater at MISS

STATION_ID	DATE	ANALYTE NAME	RESULT	REV Q	ERROR	SQL	UNITS
B38W17B	1998	RADIUM-228	0.1	UJ	0.17	0.5	PCI/L
B38W17B	1999	RADIUM-228	0.3	UJ	0.53	0.5	PCI/L
B38W19D	1996	RADIUM-228	0.04	UJ	0.08	0.24	PCI/L
B38W19D	1997	RADIUM-228	0.08	UJ	0.12	0.22	PCI/L
B38W19D	1998	RADIUM-228	0.04	UJ	0.18	0.46	PCI/L
B38W19D	1999	RADIUM-228	0.13	UJ	0.39	0.91	PCI/L
B38W19S	1996	RADIUM-228	0.11	UJ	0.15	0.31	PCI/L
B38W19S	1998	RADIUM-228	0.26	UJ	0.27	0.41	PCI/L
B38W19S	1999	RADIUM-228	0.48	UJ	0.15	0.48	PCI/L
B38W25S	1996	RADIUM-228	0.21		0.19	0.19	PCI/L
B38W25S	1997	RADIUM-228	0.13	UJ	0.15	0.26	PCI/L
B38W25S	1998	RADIUM-228	0.3	UJ	0.31	0.48	PCI/L
B38W25S	1999	RADIUM-228	0.12	UJ	0.22	0.44	PCI/L
MISS02B	1996	RADIUM-228	0.09	UJ	0.12	0.39	PCI/L
MISS02B	1997	RADIUM-228	0.05	UJ	0.14	0.34	PCI/L
MISS02B	1998	RADIUM-228	0.01	UJ	0.12	0.37	PCI/L
MISS02B	1999	RADIUM-228	0.02	UJ	0.17	0.48	PCI/L
MISS05A	1996	RADIUM-228	0.14	UJ	0.21	0.46	PCI/L
MISS05A	1997	RADIUM-228	0.67		0.44	0.51	PCI/L
MISS05A	1998	RADIUM-228	0.55		0.42	0.53	PCI/L
MISS05A	1999	RADIUM-228	0.16	UJ	0.31	0.66	PCI/L
B38W19D	1996	THORIUM-228	0.04	UJ	0.08	0.24	PCI/L
B38W19D	1997	THORIUM-228	0.08	UJ	0.12	0.22	PCI/L
B38W19D	1998	THORIUM-228	0.04	UJ	0.18	0.46	PCI/L
B38W19D	1999	THORIUM-228	0.13	U	0.39	0.91	PCI/L
B38W19S	1996	THORIUM-228	0.11	UJ	0.15	0.31	PCI/L
B38W19S	1998	THORIUM-228	0.26	UJ	0.27	0.41	PCI/L
B38W19S	1999	THORIUM-228	0.48	U	0.15	0.48	PCI/L
B38W25S	1996	THORIUM-228	0.21		0.19	0.19	PCI/L
B38W25S	1996	THORIUM-228	0.21	UJ	0.19	0.33	PCI/L
B38W25S	1997	THORIUM-228	0.13	UJ	0.15	0.26	PCI/L
B38W25S	1998	THORIUM-228	0.3	UJ	0.31	0.48	PCI/L
B38W25S	1999	THORIUM-228	0.12	UJ	0.22	0.44	PCI/L
MISS02B	1996	THORIUM-228	0.09	UJ	0.12	0.39	PCI/L
MISS02B	1997	THORIUM-228	0.05	UJ	0.14	0.34	PCI/L
MISS02B	1998	THORIUM-228	0.01	UJ	0.12	0.37	PCI/L
MISS02B	1999	THORIUM-228	0.02	UJ	0.17	0.48	PCI/L
MISS05A	1996	THORIUM-228	0.14	UJ	0.21	0.46	PCI/L
MISS05A	1997	THORIUM-228	0.67		0.44	0.51	PCI/L
MISS05A	1998	THORIUM-228	0.55		0.42	0.53	PCI/L
MISS05A	1999	THORIUM-228	0.16	UJ	0.31	0.66	PCI/L
B38W14S	1991	THORIUM-230	0.7				PCI/L

TABLE B-1
Historical Results for Radioactive Parameters in Groundwater at MISS

STATION_ID	DATE	ANALYTE NAME	RESULT	REV Q	ERROR	SQL	UNITS
B38W14S	1995	THORIUM-230	0.31	J	0.27	0.14	PCI/L
B38W14S	1997	THORIUM-230	0.45	UJ	0.28	0.5	PCI/L
B38W14S	1998	THORIUM-230	0.35	UJ	0.29	0.5	PCI/L
B38W14S	1999	THORIUM-230	0.2	UJ	0.29	0.5	PCI/L
B38W14D	1991	THORIUM-230	0.2				PCI/L
B38W14D	1995	THORIUM-230	0.15	UJ	0.17	0.22	PCI/L
B38W14D	1997	THORIUM-230	0.35	U	0.25	0.5	PCI/L
B38W14D	1998	THORIUM-230	0.26	UJ	0.27	0.5	PCI/L
B38W14D	1999	THORIUM-230	1.02		0.61	0.5	PCI/L
B38W15S	1991	THORIUM-230	0.22				PCI/L
B38W15S	1995	THORIUM-230	0.5	U	0.31	0.11	PCI/L
B38W15S	1997	THORIUM-230	1.15		0.57	0.5	PCI/L
B38W15S	1998	THORIUM-230	0.29	UJ	0.29	0.5	PCI/L
							PCI/L
B38W15D	1991	THORIUM-230	0.12				PCI/L
B38W15D	1995	THORIUM-230	0.22	U	0.18	0.1	PCI/L
B38W15D	1997	THORIUM-230	0.52		0.21	0.5	PCI/L
B38W15D	1998	THORIUM-230	0.58		0.37	0.5	PCI/L
B38W17A	1991	THORIUM-230	0.24				PCI/L
B38W17A	1995	THORIUM-230	0.47	U	0.31	0.24	PCI/L
B38W17A	1997	THORIUM-230	0.76		0.44	0.5	PCI/L
B38W17A	1998	THORIUM-230	0.21	UJ	0.26	0.5	PCI/L
B38W17A	1999	THORIUM-230	1.47	J	0.83	0.5	PCI/L
B38W17B	1991	THORIUM-230	0.1				PCI/L
B38W17B	1995	THORIUM-230	0.37	U	0.29	0.26	PCI/L
B38W17B	1997	THORIUM-230	0.99		0.51	0.5	PCI/L
B38W17B	1998	THORIUM-230	0.51		0.37	0.5	PCI/L
B38W17B	1999	THORIUM-230	1.06		0.58	0.5	PCI/L
B38W19D	1995	THORIUM-230	0.37	U	0.23	0.09	PCI/L
B38W19D	1996	THORIUM-230	0.24		0.2	0.11	PCI/L
B38W19D	1997	THORIUM-230	0.5	U	0.3	0.25	PCI/L
B38W19D	1998	THORIUM-230	0.17	UJ	0.24	0.42	PCI/L
B38W19D	1999	THORIUM-230	0.67	UJ	0.57	0.76	PCI/L
B38W19S	1995	THORIUM-230	0.35	U	0.25	0.18	PCI/L
B38W19S	1996	THORIUM-230	3.4	J	1.03	0.14	PCI/L
B38W19S	1998	THORIUM-230	0.17	UJ	0.21	0.34	PCI/L
B38W19S	1999	THORIUM-230	0.07	UJ	0.17	0.4	PCI/L
B38W25S	1995	THORIUM-230	0.14	UJ	0.16	0.21	PCI/L
B38W25S	1996	THORIUM-230	0.5		0.3	0.19	PCI/L
B38W25S	1997	THORIUM-230	0.44	U	0.29	0.26	PCI/L
B38W25S	1998	THORIUM-230	0.14	UJ	0.2	0.33	PCI/L
B38W25S	1999	THORIUM-230	0.26	UJ	0.26	0.36	PCI/L
MISS02B	1995	THORIUM-230	0.08	UJ	0.12	0.19	PCI/L
MISS02B	1996	THORIUM-230	0.38		0.26	0.19	PCI/L
MISS02B	1997	THORIUM-230	0.81	U	0.4	0.21	PCI/L

TABLE B-1
Historical Results for Radioactive Parameters in Groundwater at MISS

STATION_ID	DATE	ANALYTE NAME	RESULT	REV Q	ERROR	SQL	UNITS
MISS02B	1998	THORIUM-230	0.18	UJ	0.22	0.32	PCI/L
MISS02B	1999	THORIUM-230	0.59		0.4	0.43	PCI/L
MISS05A	1995	THORIUM-230	0.43	U	0.28	0.22	PCI/L
MISS05A	1996	THORIUM-230	1.7	J	0.77	0.33	PCI/L
MISS05A	1997	THORIUM-230	0.92		0.52	0.43	PCI/L
MISS05A	1998	THORIUM-230	0.28	UJ	0.3	0.46	PCI/L
MISS05A	1999	THORIUM-230	0.69		0.48	0.44	PCI/L
MISS07B	1995	THORIUM-230	0.34	U	0.22	0.09	PCI/L
MISS07B	1996	THORIUM-230	0.26	U	0.22	0.26	PCI/L
MISS07B	1997	THORIUM-230	0.44	U	0.27	0.22	PCI/L
MISS07B	1999	THORIUM-230	0.39	U	0.88	0.49	PCI/L
B38W14S	1990	THORIUM-232	0.2				PCI/L
B38W14S	1991	THORIUM-232	0.7				PCI/L
B38W14S	1995	THORIUM-232	0.02	UJ	0.03	0.14	PCI/L
B38W14S	1997	THORIUM-232	0.21	UJ	0.19	0.5	PCI/L
B38W14S	1998	THORIUM-232	0.05	UJ	0.1	0.5	PCI/L
B38W14S	1999	THORIUM-232	0.07	UJ	0.17	0.5	PCI/L
B38W14D	1990	THORIUM-232	0.2				PCI/L
B38W14D	1991	THORIUM-232	0.1				PCI/L
B38W14D	1995	THORIUM-232	0.11	UJ	0	0.11	PCI/L
B38W14D	1997	THORIUM-232	0.35		0.25	0.5	PCI/L
B38W14D	1998	THORIUM-232	0.03	UJ	0.12	0.5	PCI/L
B38W14D	1999	THORIUM-232	0.1	UJ	0.22	0.5	PCI/L
B38W15S	1990	THORIUM-232	0.2				PCI/L
B38W15S	1991	THORIUM-232	0.2				PCI/L
B38W15S	1994	THORIUM-232	0.01	UJ	0.01		PCI/L
B38W15S	1995	THORIUM-232	0.01	UJ	0.01	0.2	PCI/L
B38W15S	1997	THORIUM-232	0.12	UJ	0.17	0.5	PCI/L
B38W15S	1998	THORIUM-232	0.41	UJ	0.04	0.5	PCI/L
B38W15D	1990	THORIUM-232	0.1				PCI/L
B38W15D	1991	THORIUM-232	0.1				PCI/L
B38W15D	1994	THORIUM-232	0.05	UJ	0.09		PCI/L
B38W15D	1995	THORIUM-232	0.07	UJ	0.1	0.1	PCI/L
B38W15D	1997	THORIUM-232	0.24		0.21	0.5	PCI/L
B38W15D	1998	THORIUM-232	0.08	UJ	0.15	0.5	PCI/L
B38W17A	1991	THORIUM-232	2.1				PCI/L
B38W17A	1994	THORIUM-232	0.03	UJ	0.06		PCI/L
B38W17A	1995	THORIUM-232	0.02	UJ	0.09	0.26	PCI/L
B38W17A	1997	THORIUM-232	0.23	UJ	0.24	0.5	PCI/L
B38W17A	1998	THORIUM-232	0.06	UJ	0.11	0.5	PCI/L
B38W17A	1999	THORIUM-232	0.44	UJ	0.03	0.5	PCI/L
B38W17B	1991	THORIUM-232	0.08				PCI/L
B38W17B	1994	THORIUM-232	0.01	UJ	0.01		PCI/L
B38W17B	1995	THORIUM-232	0.01	UJ	0.02	0.22	PCI/L
B38W17B	1997	THORIUM-232	0.12	UJ	0.17	0.5	PCI/L

TABLE B-1
Historical Results for Radioactive Parameters in Groundwater at MISS

STATION_ID	DATE	ANALYTE NAME	RESULT	REV Q	ERROR	SQL	UNITS
B38W17B	1998	THORIUM-232	0.15	UJ	0	0.5	PCI/L
B38W17B	1999	THORIUM-232	0.16	UJ	0.32	0.5	PCI/L
B38W19D	1993	THORIUM-232	0.14	UJ	0.29	0.43	PCI/L
B38W19D	1994	THORIUM-232	0.04	UJ	0.07	0.1	PCI/L
B38W19D	1995	THORIUM-232	0.09	UJ		0.09	PCI/L
B38W19D	1996	THORIUM-232	0.19	UJ	0	0.19	PCI/L
B38W19D	1997	THORIUM-232	0.29	U	0.22	0.22	PCI/L
B38W19D	1998	THORIUM-232	0.15	UJ	0.2	0.31	PCI/L
B38W19D	1999	THORIUM-232	0.22	UJ	0.32	0.54	PCI/L
B38W19S	1994	THORIUM-232	0.04	UJ	0.09	0.12	PCI/L
B38W19S	1995	THORIUM-232	-0.01	UJ	0.02	0.21	PCI/L
B38W19S	1996	THORIUM-232	0.24	UJ	0	0.24	PCI/L
B38W19S	1998	THORIUM-232	0.03	UJ	0.11	0.32	PCI/L
B38W19S	1999	THORIUM-232	0.02	UJ	0.1	0.29	PCI/L
B38W25S	1993	THORIUM-232	0.24		0.16	0.14	PCI/L
B38W25S	1994	THORIUM-232	0.13	UJ	0	0.13	PCI/L
B38W25S	1995	THORIUM-232	0.06	UJ	0.11	0.2	PCI/L
B38W25S	1996	THORIUM-232	0.08	UJ	0.12	0.19	PCI/L
B38W25S	1997	THORIUM-232	0.17	UJ	0.18	0.2	PCI/L
B38W25S	1998	THORIUM-232	0.04	UJ	0.11	0.3	PCI/L
B38W25S	1999	THORIUM-232	0.13	UJ	0.18	0.3	PCI/L
MISS02B	1993	THORIUM-232	0	UJ	0	0.2	PCI/L
MISS02B	1995	THORIUM-232	0.07	UJ	0.12	0.22	PCI/L
MISS02B	1996	THORIUM-232	0.25	UJ	0	0.25	PCI/L
MISS02B	1997	THORIUM-232	0.14	UJ	0.16	0.12	PCI/L
MISS02B	1998	THORIUM-232	0.05	UJ	0.11	0.14	PCI/L
MISS02B	1999	THORIUM-232	0.04	UJ	0.11	0.3	PCI/L
MISS05A	1994	THORIUM-232	0.4	J	0.29	0.21	PCI/L
MISS05A	1995	THORIUM-232	0.23		0.2	0.18	PCI/L
MISS05A	1996	THORIUM-232	0.21	UJ	0.25	0.19	PCI/L
MISS05A	1997	THORIUM-232	0.13	UJ	0.19	0.51	PCI/L
MISS05A	1998	THORIUM-232	0.04	UJ	0.17	0.48	PCI/L
MISS05A	1999	THORIUM-232	0.17	UJ	0.26	0.47	PCI/L
B38W14S	1990	TOTAL URANIUM	4.40				UG/L
B38W14S	1991	TOTAL URANIUM	4.00				UG/L
B38W14S	1995	TOTAL URANIUM	1.70		0.18	0.03	UG/L
B38W14S	1997	TOTAL URANIUM	1.88		0.04	0.03	UG/L
B38W14S	1998	TOTAL URANIUM	0.03	UJ	0	0.03	UG/L
B38W14S	1999	TOTAL URANIUM	1.42		0.04	0.03	UG/L
B38W14D	1990	TOTAL URANIUM	4.40				UG/L
B38W14D	1991	TOTAL URANIUM	4.00				UG/L
B38W14D	1995	TOTAL URANIUM	1.10		0.19	0.03	UG/L
B38W14D	1997	TOTAL URANIUM	1.36		0.03	0.04	UG/L
B38W14D	1998	TOTAL URANIUM	0.78		0.04	0.04	UG/L
B38W14D	1999	TOTAL URANIUM	1.03		0.03	0.04	UG/L

TABLE B-1
Historical Results for Radioactive Parameters in Groundwater at MISS

STATION_ID	DATE	ANALYTE NAME	RESULT	REV Q	ERROR	SQL	UNITS
B38W15S	1990	TOTAL URANIUM	4.40				UG/L
B38W15S	1991	TOTAL URANIUM	3.00				UG/L
B38W15S	1994	TOTAL URANIUM	0.88		0.09		UG/L
B38W15S	1995	TOTAL URANIUM	1.10		0.19	0.03	UG/L
B38W15S	1997	TOTAL URANIUM	1.02		0.01	0.03	UG/L
B38W15S	1998	TOTAL URANIUM	0.03	UJ	0	0.03	UG/L
B38W15D	1990	TOTAL URANIUM	5.90				UG/L
B38W15D	1991	TOTAL URANIUM	5.00				UG/L
B38W15D	1994	TOTAL URANIUM	0.02	U	0.01		UG/L
B38W15D	1995	TOTAL URANIUM	5.42		0.56	0.03	UG/L
B38W15D	1997	TOTAL URANIUM	6.30		0.13	0.04	UG/L
B38W15D	1998	TOTAL URANIUM	4.30		0.1	0.04	UG/L
B38W17A	1991	TOTAL URANIUM	4.00				UG/L
B38W17A	1994	TOTAL URANIUM	0.20		0.02		UG/L
B38W17A	1995	TOTAL URANIUM	0.19		0.02	0.03	UG/L
B38W17A	1997	TOTAL URANIUM	0.37		0.01	0.03	UG/L
B38W17A	1998	TOTAL URANIUM	0.03	UJ	0	0.03	UG/L
B38W17A	1999	TOTAL URANIUM	0.13		0.04	0.03	UG/L
B38W17B	1991	TOTAL URANIUM	3.0				UG/L
B38W17B	1994	TOTAL URANIUM	0.0	UJ	0		UG/L
B38W17B	1995	TOTAL URANIUM	0.3		0.04	0.03	UG/L
B38W17B	1997	TOTAL URANIUM	0.4		0.01	0.04	UG/L
B38W17B	1998	TOTAL URANIUM	0.0	UJ	0	0.04	UG/L
B38W17B	1999	TOTAL URANIUM	0.0	UJ	0	0.04	UG/L
B38W19D	1993	TOTAL URANIUM	0.36		0.04	0.03	UG/L
B38W19D	1994	TOTAL URANIUM	0.35		0.04	0.03	UG/L
B38W19D	1995	TOTAL URANIUM	0.29		0.03	0.03	UG/L
B38W19D	1996	TOTAL URANIUM	1.27		0.03	0.03	UG/L
B38W19D	1997	TOTAL URANIUM	0.3		0.01	0.03	UG/L
B38W19D	1998	TOTAL URANIUM	0.03	UJ	0	0.03	UG/L
B38W19D	1999	TOTAL URANIUM	0.26	UJ	0.02	0.03	UG/L
B38W19S	1994	TOTAL URANIUM	0.38		0.04	0.03	UG/L
B38W19S	1995	TOTAL URANIUM	1.4		0.15	0.03	UG/L
B38W19S	1996	TOTAL URANIUM	0.58		0.01	0.03	UG/L
B38W19S	1998	TOTAL URANIUM	0.03	UJ	0	0.03	UG/L
B38W19S	1999	TOTAL URANIUM	0.02	UJ	0.01	0.03	UG/L
B38W25S	1993	TOTAL URANIUM	0.5		0.05	0.03	UG/L
B38W25S	1994	TOTAL URANIUM	0.06		0.01	0.03	UG/L
B38W25S	1995	TOTAL URANIUM	0.09		0.01	0.03	UG/L
B38W25S	1996	TOTAL URANIUM	0.45		0.01	0.03	UG/L
B38W25S	1997	TOTAL URANIUM	0.5		0.01	0.03	UG/L
B38W25S	1998	TOTAL URANIUM	0.03	UJ	0	0.03	UG/L
B38W25S	1999	TOTAL URANIUM	0.17	UJ	0.01	0.03	UG/L
MISS02B	1993	TOTAL URANIUM	0.33		0.04	0.03	UG/L
MISS02B	1994	TOTAL URANIUM	0.29		0.03	0.03	UG/L
MISS02B	1995	TOTAL URANIUM	0.29		0.03	0.03	UG/L

TABLE B-1
Historical Results for Radioactive Parameters in Groundwater at MISS

STATION_ID	DATE	ANALYTE NAME	RESULT	REV Q	ERROR	SQL	UNITS
MISS02B	1996	TOTAL URANIUM	0.68		0.02	0.03	UG/L
MISS02B	1997	TOTAL URANIUM	0.28		0.02	0.03	UG/L
MISS02B	1998	TOTAL URANIUM	0.03	UJ	0	0.03	UG/L
MISS02B	1999	TOTAL URANIUM	0.12		0.01	0.03	UG/L
MISS05A	1994	TOTAL URANIUM	86.8		10.3	0.03	UG/L
MISS05A	1995	TOTAL URANIUM	41.2		4.8	0.03	UG/L
MISS05A	1996	TOTAL URANIUM	140		8.6	0.03	UG/L
MISS05A	1996	TOTAL URANIUM	139.05		8.95	0.03	UG/L
MISS05A	1997	TOTAL URANIUM	96.15		6.03	0.03	UG/L
MISS05A	1998	TOTAL URANIUM	181.71		12.18	0.03	UG/L
MISS05A	1999	TOTAL URANIUM	110.46		2.51	0.03	UG/L

Legend
UJ - Estimated non-detect
J - Estimated concentration

TABLE B-2						
Historical Results for Detected VOCs in Groundwater at MISS						
			RESULT	QUALIFIER		DETECTION
STATION	DATE	ANALYTE	(ug/L)	BNI	Lab	LIMIT (ug/L)
B38W14D	04-Aug-93	1,1,1-Trichloroethane	8.00			5
B38W14D	20-May-95	1,1,1-Trichloroethane	6.00			5
B38W14D	04-Jun-97	1,1,1-Trichloroethane	4.00	J	J	5
B38W14D	07-Jul-98	1,1,1-Trichloroethane	3.00	J	J	10
B38W14D	20-May-99	1,1,1-Trichloroethane	3.00	J	J	10
B38W14S	20-May-95	1,1,1-Trichloroethane	7.00			5
B38W14S	04-Jun-97	1,1,1-Trichloroethane	4.00	J	J	5
B38W14S	07-Jul-98	1,1,1-Trichloroethane	4.00	J	J	5
B38W14S	17-May-99	1,1,1-Trichloroethane	2.00	J	J	5
B38W15D	02-Aug-93	1,1,1-Trichloroethane	10.00			5
B38W15D	26-May-94	1,1,1-Trichloroethane	5.00			5
B38W15D	19-May-95	1,1,1-Trichloroethane	7.00			5
B38W15D	13-May-96	1,1,1-Trichloroethane	3.00			2
B38W15D	03-Jun-97	1,1,1-Trichloroethane	3.00	J	J	5
B38W15D	06-Jul-98	1,1,1-Trichloroethane	5.00			5
B38W15S	02-Aug-93	1,1,1-Trichloroethane	2.00		J	5
B38W15S	26-May-94	1,1,1-Trichloroethane	2.00		J	5
B38W15S	13-May-96	1,1,1-Trichloroethane	1.00	J	J	2
MISS07B	13-Oct-92	1,1,1-Trichloroethane	1.00		J	5
MISS07B	12-Aug-93	1,1,1-Trichloroethane	2.00	J	J	5
MISS07B	18-May-94	1,1,1-Trichloroethane	2.00		J	5
MISS07B	18-May-94	1,1,1-Trichloroethane	2.00		J	5
B38W14D	04-Aug-93	1,1-Dichloroethane	3.00		J	5
B38W14D	20-May-95	1,1-Dichloroethane	4.00		J	5
B38W14D	04-Jun-97	1,1-Dichloroethane	3.00	J	J	5
B38W14D	17-May-99	1,1-Dichloroethane	2.00	J	J	5
B38W14S	20-May-95	1,1-Dichloroethane	2.00		J	5
B38W14S	04-Jun-97	1,1-Dichloroethane	2.00	J	J	5
B38W14S	07-Jul-98	1,1-Dichloroethane	1.00	J	J	5
B38W15D	02-Aug-93	1,1-Dichloroethane	6.00			5
B38W15D	26-May-94	1,1-Dichloroethane	4.00		J	5
B38W15D	19-May-95	1,1-Dichloroethane	6.00			5
B38W15D	13-May-96	1,1-Dichloroethane	3.00			2
B38W15D	03-Jun-97	1,1-Dichloroethane	4.00	J	J	5
B38W15D	06-Jul-98	1,1-Dichloroethane	6.00			5
B38W15S	02-Aug-93	1,1-Dichloroethane	4.00		J	5
B38W15S	26-May-94	1,1-Dichloroethane	6.00			5
B38W15S	19-May-95	1,1-Dichloroethane	4.00		J	5
B38W15S	13-May-96	1,1-Dichloroethane	5.00			2
B38W15S	03-Jun-97	1,1-Dichloroethane	4.00	J	J	5
B38W15S	06-Jul-98	1,1-Dichloroethane	4.00	J	J	5
B38W14D	04-Aug-93	1,1-Dichloroethene	6.00			5
B38W14D	20-May-95	1,1-Dichloroethene	7.00			5
B38W14D	04-Jun-97	1,1-Dichloroethene	5.00			1
B38W14D	07-Jul-98	1,1-Dichloroethene	3.00	J	J	10

TABLE B-2						
Historical Results for Detected VOCs in Groundwater at MISS						
			RESULT	QUALIFIER		DETECTION
STATION	DATE	ANALYTE	(ug/L)	BNI	Lab	LIMIT (ug/L)
B38W14D	07-May-99	1,1-Dichloroethene	3.00	J	J	5
B38W14S	20-May-95	1,1-Dichloroethene	7.00			5
B38W14S	17-May-96	1,1-Dichloroethene	6.00	J	J	10
B38W14S	04-Jun-97	1,1-Dichloroethene	5.00			1
B38W14S	07-Jul-98	1,1-Dichloroethene	5.00	J	J	5
B38W14S	17-May-99	1,1-Dichloroethene	2.00	J	J	5
B38W15D	02-Aug-93	1,1-Dichloroethene	8.00			5
B38W15D	26-May-94	1,1-Dichloroethene	7.00			5
B38W15D	19-May-95	1,1-Dichloroethene	9.00			5
B38W15D	13-May-96	1,1-Dichloroethene	5.00			2
B38W15D	03-Jun-97	1,1-Dichloroethene	7.00	J		1
B38W15D	06-Jul-98	1,1-Dichloroethene	6.00			5
B38W15S	13-May-96	1,1-Dichloroethene	0.30	J	J	2
MISS01B	16-May-94	1,1-Dichloroethene	1.00		J	5
MISS07B	13-Oct-92	1,1-Dichloroethene	2.00		J	5
MISS07B	18-May-94	1,1-Dichloroethene	3.00		J	5
MISS07B	11-May-95	1,1-Dichloroethene	2.00		J	5
MISS07B	16-May-96	1,1-Dichloroethene	2.00	J	J	2
MISS07B	16-May-97	1,1-Dichloroethene	2.00			1
B38W07B	16-Jun-98	1,2-Dichloroethene (Total)	6.00			5
B38W14D	04-Aug-93	1,2-Dichloroethene (Total)	56.00			5
B38W14D	20-May-95	1,2-Dichloroethene (Total)	93.00			5
B38W14D	17-May-96	1,2-Dichloroethene (Total)	83.00			50
B38W14D	04-Jun-97	1,2-Dichloroethene (Total)	78.00			5
B38W14D	07-Jul-98	1,2-Dichloroethene (Total)	71.00			10
B38W14D	17-May-99	1,2-Dichloroethene (Total)	77.00			5
B38W14S	04-Aug-93	1,2-Dichloroethene (Total)	10.00			5
B38W14S	20-May-95	1,2-Dichloroethene (Total)	53.00			5
B38W14S	17-May-96	1,2-Dichloroethene (Total)	29.00			10
B38W14S	17-May-96	1,2-Dichloroethene (Total)	0.90	J	J	1
B38W14S	04-Jun-97	1,2-Dichloroethene (Total)	43.00			5
B38W14S	07-Jul-98	1,2-Dichloroethene (Total)	44.00			5
B38W14S	17-May-99	1,2-Dichloroethene (Total)	43.00			5
B38W15D	02-Aug-93	1,2-Dichloroethene (Total)	150.00			5
B38W15D	26-May-94	1,2-Dichloroethene (Total)	120.00			5
B38W15D	19-May-95	1,2-Dichloroethene (Total)	160.00			5
B38W15D	13-May-96	1,2-Dichloroethene (Total)	110.00			2
B38W15D	03-Jun-97	1,2-Dichloroethene (Total)	120.00	J		5
B38W15D	06-Jul-98	1,2-Dichloroethene (Total)	140.00			5
B38W15S	02-Aug-93	1,2-Dichloroethene (Total)	42.00			5
B38W15S	26-May-94	1,2-Dichloroethene (Total)	94.00			5
B38W15S	19-May-95	1,2-Dichloroethene (Total)	6.00			5
B38W15S	19-May-95	1,2-Dichloroethene (Total)	10.00			5
B38W15S	13-May-96	1,2-Dichloroethene (Total)	55.00			2
B38W15S	03-Jun-97	1,2-Dichloroethene (Total)	13.00			5

TABLE B-2						
Historical Results for Detected VOCs in Groundwater at MISS						
			RESULT	QUALIFIER		DETECTION
STATION	DATE	ANALYTE	(ug/L)	BNI	Lab	LIMIT (ug/L)
B38W15S	06-Jul-98	1,2-Dichloroethene (Total)	15.00			5
B38W17B	29-Jul-93	1,2-Dichloroethene (Total)	3.00		J	5
B38W17B	25-May-94	1,2-Dichloroethene (Total)	1.00		J	5
B38W17B	20-May-95	1,2-Dichloroethene (Total)	2.00	J	J	5
B38W19D	11-Aug-93	1,2-Dichloroethene (Total)	2.00		J	5
B38W19D	16-May-96	1,2-Dichloroethene (Total)	0.30	J	J	1
B38W24D	09-May-96	1,2-Dichloroethene (Total)	0.70	J	J	1
B38W24S	09-May-96	1,2-Dichloroethene (Total)	0.20	J	J	1
MISS01B	15-Oct-92	1,2-Dichloroethene (Total)	1.00		J	5
MISS01B	21-Jul-93	1,2-Dichloroethene (Total)	5.00		J	5
MISS01B	16-May-94	1,2-Dichloroethene (Total)	31.00			5
MISS01B	10-May-95	1,2-Dichloroethene (Total)	3.00		J	5
MISS01B	15-May-96	1,2-Dichloroethene (Total)	22.00			5
MISS01B	18-JUN-98	1,2-Dichloroethene (Total)	11.00			5
MISS01B	25-May-99	1,2-Dichloroethene (Total)	2.00	J	J	5
MISS07B	13-Oct-92	1,2-Dichloroethene (Total)	10.00			5
MISS07B	12-Aug-93	1,2-Dichloroethene (Total)	11.00	J	J	5
MISS07B	18-May-94	1,2-Dichloroethene (Total)	9.00			5
MISS07B	18-May-94	1,2-Dichloroethene (Total)	10.00			5
MISS07B	11-May-95	1,2-Dichloroethene (Total)	8.00			5
MISS07B	16-May-96	1,2-Dichloroethene (Total)	7.00			2
MISS07B	16-May-97	1,2-Dichloroethene (Total)	7.00			5
MISS07B	16-Jun-98	1,2-Dichloroethene (Total)	6.00			5
MISS07B	27-May-99	1,2-Dichloroethene (Total)	6.00			5
B38W14D	04-Aug-93	1,2-Dichloropropane	1.00		J	5
B38W14D	20-May-95	1,2-Dichloropropane	1.00		J	5
B38W15D	02-Aug-93	1,2-Dichloropropane	2.00		J	5
B38W15D	26-May-94	1,2-Dichloropropane	1.00		J	5
B38W15D	13-May-96	1,2-Dichloropropane	0.80	J	J	2
B38W15D	06-Jul-98	1,2-Dichloropropane	2.00	J	J	5
B38W15S	26-May-94	1,2-Dichloropropane	2.00		J	5
B38W15S	13-May-96	1,2-Dichloropropane	0.90	J	J	2
MISS02A	11-Jun-98	2-Butanone	23.00			10
B38W15D	13-May-96	Benzene	0.70	J	J	2
B38W15S	26-May-94	Benzene	1.00		J	5
B38W15S	13-May-96	Benzene	0.50	J	J	2
B38W19D	16-May-94	Benzene	5.00			5
B38W19D	10-May-95	Benzene	1.00		J	5
B38W19D	16-May-96	Benzene	5.00			1
B38W24D	18-May-94	Benzene	2.00		J	5
B38W24D	09-May-96	Benzene	0.40	J	J	1
MISS02B	15-Oct-92	Benzene	3.00		J	5
MISS02B	20-Jul-93	Benzene	7.00			5

TABLE B-2						
Historical Results for Detected VOCs in Groundwater at MISS						
			RESULT	QUALIFIER		DETECTION
STATION	DATE	ANALYTE	(ug/L)	BNI	Lab	LIMIT (ug/L)
MISS02B	13-May-94	Benzene	2.00		J	5
MISS02B	09-May-95	Benzene	1.00		J	5
MISS02B	14-May-96	Benzene	1.00			1
MISS05B	14-Oct-92	Benzene	200.00			5
MISS05B	12-Aug-93	Benzene	83.00	J		5
MISS05B	17-May-94	Benzene	170.00			5
MISS05B	11-May-95	Benzene	89.00	J		5
MISS05B	16-May-96	Benzene	97.00			2
MISS05B	14-May-97	Benzene	62.00			5
MISS05B	30-JUN-98	Benzene	15.00			5
B38W24D	02-JUL-98	Benzene, 1,2-Dichloro-3-Methyl	9.00	NJ	NJ	0
B38W17B	02-JUL-98	Benzene, 1,2-Dichloro-3-Methyl	4.00	NJ	NJ	0
MISS05B	30-JUN-98	Benzene, 1,2-Dichloro-3-Methyl	10.00	NJ	NJ	0
MISS01AA	16-Oct-92	Bis(2-Ethylhexyl)Phthalate	11.00		JB	10
B38W02D	17-May-96	C4-Alkenylbenzene	1.00	NJ	J	0
B38W19D	16-May-96	Chlorobenzene	0.60	J	J	1
B38W25S	15-May-96	Chlorobenzene	0.40	J	J	1
MISS02B	14-May-96	Chlorobenzene	0.10	J	J	1
MISS05B	16-May-96	Chlorobenzene	0.60	J	J	2
B38W14D	04-Aug-93	Chloroform	7.00			5
B38W14D	17-May-96	Chloroform	6.00	J	J	50
B38W14D	04-Jun-97	Chloroform	6.00			5
B38W14D	17-May-99	Chloroform	2.00	J	J	5
B38W14S	20-May-95	Chloroform	3.00		J	5
B38W14S	17-May-96	Chloroform	3.00	J	J	10
B38W14S	04-Jun-97	Chloroform	3.00	J	J	5
B38W15D	13-May-96	Chloroform	0.30	J	J	2
MISS01B	15-Oct-92	Chloroform	15.00			5
MISS01B	21-Jul-93	Chloroform	4.00		J	5
MISS01B	16-May-94	Chloroform	2.00		J	5
MISS01B	15-May-96	Chloroform	0.90	J	J	5
MISS06A	10-May-96	Chloroform	0.20	J	J	1
B38W17B	29-Jul-93	Chlorotoluene	20.00	NJ	J	0
B38W17B	03-Jun-97	Chlorotoluene	10.00	NJ	J	0
MISS05B	12-Aug-93	Chlorotoluene	30.00	NJ	J	0
MISS05B	12-Aug-93	Chlorotoluene	20.00	NJ	J	0
B38W25S	15-May-95	Dichloromethane	1.00		J	5
B38W24D	09-Aug-93	Dichlorotoluene	30.00	NJ	J	0
MISS05B	12-Aug-93	Dichlorotoluene	5.00	NJ	J	0

TABLE B-2						
Historical Results for Detected VOCs in Groundwater at MISS						
			RESULT	**QUALIFIER**		**DETECTION**
STATION	**DATE**	**ANALYTE**	**(ug/L)**	**BNI**	**Lab**	**LIMIT (ug/L)**
B38W24D	09-May-96	Ethylbenzene	0.10	J	J	1
B38W19D	13-Oct-92	N-Nitrosodiphenylamine	3.00		J	10
MISS02B	15-Oct-92	Phenol	1.00	J	J	10
B38W02D	30-Jun-98	Propane, 2-Methoxy-2-Methyl-	30.00	NJ	NJ	0
B38W15D	06-Jul-98	Propane, 2-Methoxy-2-Methyl-	20.00	NJ	NJ	0
B38W15S	06-Jul-98	Propane, 2-Methoxy-2-Methyl-	6.00	NJ	NJ	0
B38W25S	01-Jul-98	Silanol, Trimethyl-	10.00	J	NJ	0
B38W18D	08-Jun-98	Sulfur Dioxide	6.00	NJ	NJ	0
B38W01S	07-Jul-98	Tetrachloroethene	6.00			5
B38W07B	16-Jun-98	Tetrachloroethene	48.00			5
B38W14D	17-May-96	Tetrachloroethene	1100.00			50
B38W14D	07-Jul-98	Tetrachloroethene	840.00		D	25
B38W14D	17-May-99	Tetrachloroethene	630.00		D	5
B38W14S	04-Aug-93	Tetrachloroethene	23.00			5
B38W14S	17-May-96	Tetrachloroethene	360.00			10
B38W14S	17-May-96	Tetrachloroethene	34.00			1
B38W14S	07-Jul-98	Tetrachloroethene	300.00	E		12
B38W14S	17-May-99	Tetrachloroethene	290.00		D	5
B38W15S	13-May-96	Tetrachloroethene	0.30	J	J	2
MISS01B	15-Oct-92	Tetrachloroethene	15.00			5
MISS01B	21-Jul-93	Tetrachloroethene	33.00			5
MISS01B	16-May-94	Tetrachloroethene	140.00			5
MISS01B	10-May-95	Tetrachloroethene	20.00			5
MISS01B	15-May-96	Tetrachloroethene	120.00			5
MISS01B	18-Jun-98	Tetrachloroethene	69.00			5
MISS01B	18-May-99	Tetrachloroethene	15.00			5
MISS06A	04-Aug-93	Tetrachloroethene	14.00			5
MISS07B	13-Oct-92	Tetrachloroethene	43.00			5
MISS07B	12-Aug-93	Tetrachloroethene	61.00	J		5
MISS07B	18-May-94	Tetrachloroethene	94.00			5
MISS07B	18-May-94	Tetrachloroethene	88.00			5
MISS07B	11-May-95	Tetrachloroethene	45.00			5
MISS07B	16-May-96	Tetrachloroethene	61.00			2
MISS07B	16-May-97	Tetrachloroethene	57.00			1
MISS07B	16-Jun-98	Tetrachloroethene	48.00			1
MISS07B	27-May-99	Tetrachloroethene	24.00			5
B38W01S	17-May-96	Toluene	0.20	J	J	1
B38W19D	16-May-96	Toluene	0.10	J	J	1

TABLE B-2						
Historical Results for Detected VOCs in Groundwater at MISS						
			RESULT	QUALIFIER		DETECTION
STATION	DATE	ANALYTE	(ug/L)	BNI	Lab	LIMIT (ug/L)
B38W24D	09-May-96	Toluene	0.10	J	J	1
B38W24D	13-May-99	Toluene	2.00	J	J	5
MISS02A	11-JUN-98	Toluene	2.00	J	J	5
MISS05B	14-Oct-92	Toluene	2.00		J	5
MISS05B	17-May-94	Toluene	1.00		J	5
B38W01S	07-Jul-98	Trichloroethene	2.00	J	J	5
B38W07B	16-Jun-98	Trichloroethene	2.00	J	J	5
B38W14D	17-May-96	Trichloroethene	240.00			50
B38W14D	04-Jun-97	Trichloroethene	200.00	J		1
B38W14D	07-Jul-98	Trichloroethene	210.00			10
B38W14D	17-May-99	Trichloroethene	160.00			5
B38W14S	04-Aug-93	Trichloroethene	6.00			5
B38W14S	20-May-95	Trichloroethene	140.00			5
B38W14S	17-May-96	Trichloroethene	77.00			10
B38W14S	17-May-96	Trichloroethene	4.00			1
B38W14S	04-Jun-97	Trichloroethene	91.00	J		1
B38W14S	07-JUL-98	Trichloroethene	79.00			5
B38W14S	17-May-99	Trichloroethene	67.00			5
B38W15D	26-May-94	Trichloroethene	170.00			5
B38W15D	03-Jun-97	Trichloroethene	170.00	J		1
B38W15S	02-Aug-93	Trichloroethene	1.00		J	5
B38W15S	26-May-94	Trichloroethene	2.00		J	5
B38W15S	13-May-96	Trichloroethene	1.00	J	J	2
MISS01B	21-Jul-93	Trichloroethene	2.00		J	5
MISS01B	16-May-94	Trichloroethene	9.00			5
MISS01B	10-May-95	Trichloroethene	2.00		J	5
MISS01B	15-May-96	Trichloroethene	9.00			5
MISS01B	18-Jun-98	Trichloroethene	5.00	J	J	5
MISS02A	11-Jun-98	Trichloroethene	1.00	J	J	5
MISS06A	04-Aug-93	Trichloroethene	1.00		J	5
MISS07B	13-Oct-92	Trichloroethene	2.00		J	5
MISS07B	12-Aug-93	Trichloroethene	4.00	J	J	5
MISS07B	18-May-94	Trichloroethene	3.00		J	5
MISS07B	18-May-94	Trichloroethene	3.00		J	5
MISS07B	11-May-95	Trichloroethene	3.00		J	5
MISS07B	16-May-96	Trichloroethene	3.00			2
MISS07B	16-May-97	Trichloroethene	2.00			1
MISS07B	16-Jun-98	Trichloroethene	2.00	J		1
MISS07B	27-May-99	Trichloroethene	2.00	J	J	5
B38W14S	04-Aug-93	Vinyl Chloride	6.00		J	10
B38W15D	02-Aug-93	Vinyl Chloride	4.00		J	10
B38W15D	26-May-94	Vinyl Chloride	3.00		J	10
B38W15D	13-May-96	Vinyl Chloride	1.00	J	J	4
B38W15D	03-Jun-97	Vinyl Chloride	1.00	J	J	2

TABLE B-2						
Historical Results for Detected VOCs in Groundwater at MISS						
			RESULT	**QUALIFIER**		**DETECTION**
STATION	**DATE**	**ANALYTE**	**(ug/L)**	**BNI**	**Lab**	**LIMIT (ug/L)**
B38W15S	02-Aug-93	Vinyl Chloride	40.00			10
B38W15S	26-May-94	Vinyl Chloride	95.00			10
B38W15S	19-May-95	Vinyl Chloride	4.00		J	10
B38W15S	19-May-95	Vinyl Chloride	5.00		J	10
B38W15S	13-May-96	Vinyl Chloride	54.00			4
B38W15S	03-Jun-97	Vinyl Chloride	9.00			2
B38W15S	06-Jul-98	Vinyl Chloride	12.00			2
B38W17B	25-May-94	Vinyl Chloride	2.00		J	10
B38W17B	20-May-95	Vinyl Chloride	2.00	J	J	10
MISS07B	18-May-94	Vinyl Chloride	2.00		J	10
MISS07B	18-May-94	Vinyl Chloride	2.00		J	10
MISS07B	16-May-96	Vinyl Chloride	0.80	J	J	4
MISS07B	16-May-97	Vinyl Chloride	0.80	J	J	2
B38W19D	16-May-96	Xylenes (Total)	0.10	J	J	1
B38W24D	09-May-96	Xylenes (Total)	0.50	J	J	1
MISS05B	16-May-96	Xylenes (Total)	0.40	J	J	2

Legend

J- Estimated concentration
UJ - Estimated non-detect
D - Diluted sample
E - Exceeded calibration range

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
B38W15D	06-JUL-98	REG	ANTIMONY	0.7	
B38W15S	06-JUL-98	REG	ANTIMONY	0.75	
B38W17A	28-JUL-93	REG	ANTIMONY	445	
B38W17A	02-JUL-98	REG	ANTIMONY	1	
B38W19S	29-JUN-98	REG	ANTIMONY	0.65	
B38W24D	02-JUL-98	REG	ANTIMONY	0.6	
B38W24S	02-JUL-98	REG	ANTIMONY	0.7	
B38W25D	12-MAY-95	REG	ANTIMONY	2.9	
B38W25D	15-MAY-97	REG	ANTIMONY	2	
B38W25D	01-JUL-98	REG	ANTIMONY	0.65	
B38W25S	15-MAY-95	REG	ANTIMONY	1.5	
B38W25S	01-JUL-98	REG	ANTIMONY	0.6	
MISS02A	10-MAY-95	REG	ANTIMONY	2.4	
MISS02A	15-MAY-97	DUP	ANTIMONY	5.1	
MISS02A	11-JUN-98	DUP	ANTIMONY	3.2	
MISS02A	18-May-99	DUP	ANTIMONY	3.9	
MISS05A	27-MAY-94	REG	ANTIMONY	36.4	
MISS05A	12-MAY-95	REG	ANTIMONY	1.8	
MISS05A	29-JUN-98	REG	ANTIMONY	1.2	
MISS05A	14-May-99	REG	ANTIMONY	0.7	
MISS06A	24-MAY-94	REG	ANTIMONY	34.9	
MISS06A	01-JUL-98	REG	ANTIMONY	1.8	
MISS06A	17-May-99	REG	ANTIMONY	0.81	
MISS07B	18-MAY-94	REG	ANTIMONY	25.7	
MISS07B	16-JUN-98	REG	ARSENIC	57.3	
MISS07B	27-May-99	REG	ARSENIC	49.9	J
B38W02D	30-JUN-98	REG	ARSENIC	0.75	
B38W02D	20-May-99	REG	ARSENIC	0.61	
B38W14S	04-AUG-93	REG	ARSENIC	2.1	J
B38W14S	04-JUN-97	REG	ARSENIC	4.7	
B38W14S	17-May-99	REG	ARSENIC	0.52	
B38W15D	02-AUG-93	REG	ARSENIC	6.8	J
B38W15D	26-MAY-94	REG	ARSENIC	2.6	J
B38W15D	13-MAY-96	REG	ARSENIC	5.4	
B38W15D	03-JUN-97	REG	ARSENIC	5.7	
B38W15D	06-JUL-98	REG	ARSENIC	7.5	
B38W15S	02-AUG-93	REG	ARSENIC	3.9	J
B38W15S	19-MAY-95	REG	ARSENIC	4.9	
B38W15S	19-MAY-95	DUP	ARSENIC	4.8	
B38W15S	03-JUN-97	REG	ARSENIC	2.6	
B38W15S	06-JUL-98	REG	ARSENIC	3.1	
B38W17A	28-JUL-93	REG	ARSENIC	8.9	
B38W17A	02-JUL-98	REG	ARSENIC	2.9	
B38W17B	03-JUN-97	REG	ARSENIC	1.8	
B38W17B	02-JUL-98	REG	ARSENIC	1.3	
B38W17B	13-May-99	REG	ARSENIC	0.76	
B38W18D	21-JUL-93	REG	ARSENIC	2.5	
B38W18D	08-JUN-98	REG	ARSENIC	1.7	
B38W18D	20-May-99	REG	ARSENIC	2.3	
B38W19D	23-JUL-93	REG	ARSENIC	93	
B38W19D	16-MAY-94	REG	ARSENIC	68.7	
B38W19D	10-MAY-95	REG	ARSENIC	48.8	J
B38W19D	16-MAY-96	REG	ARSENIC	50.5	
B38W19D	16-MAY-97	REG	ARSENIC	59.5	
B38W19D	17-JUN-98	REG	ARSENIC	60.8	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
B38W19D	27-May-99	REG	ARSENIC	55.1	J
B38W19S	27-MAY-94	REG	ARSENIC	8.6	
B38W19S	10-MAY-96	REG	ARSENIC	5.4	
B38W19S	29-JUN-98	REG	ARSENIC	18.1	
B38W19S	14-May-99	REG	ARSENIC	17.8	
B38W24S	02-JUL-98	REG	ARSENIC	1.8	
B38W25D	15-MAY-97	REG	ARSENIC	2.9	
B38W25D	01-JUL-98	REG	ARSENIC	1.1	
B38W25S	03-AUG-93	REG	ARSENIC	3.9	J
B38W25S	15-MAY-95	DUP	ARSENIC	2.5	
B38W25S	05-JUN-97	REG	ARSENIC	1.3	
B38W25S	01-JUL-98	REG	ARSENIC	2.8	
B38W25S	17-May-99	REG	ARSENIC	2.3	
MISS01AA	31-JUL-93	REG	ARSENIC	2.8	J
MISS01AA	18-MAY-95	REG	ARSENIC	18.7	
MISS01AA	23-MAY-97	REG	ARSENIC	4.2	
MISS01AA	18-JUN-98	REG	ARSENIC	5.2	
MISS01AA	12-May-99	REG	ARSENIC	6.5	
MISS01B	21-JUL-93	REG	ARSENIC	3.6	
MISS01B	16-MAY-94	REG	ARSENIC	3.6	
MISS01B	10-MAY-95	REG	ARSENIC	2.7	J
MISS01B	18-JUN-98	REG	ARSENIC	2.1	
MISS01B	25-May-99	REG	ARSENIC	1.1	J
MISS02A	20-JUL-93	REG	ARSENIC	2840	
MISS02A	12-MAY-94	REG	ARSENIC	6600	J
MISS02A	10-MAY-95	REG	ARSENIC	6000	J
MISS02A	16-MAY-96	REG	ARSENIC	6360	
MISS02A	15-MAY-97	REG	ARSENIC	5660	
MISS02A	15-MAY-97	DUP	ARSENIC	5580	
MISS02A	11-JUN-98	REG	ARSENIC	4310	
MISS02A	11-JUN-98	DUP	ARSENIC	5150	
MISS02A	18-May-99	DUP	ARSENIC	6350	
MISS05A	27-MAY-94	REG	ARSENIC	3.5	
MISS05A	12-MAY-95	REG	ARSENIC	3.8	
MISS05A	02-JUN-97	REG	ARSENIC	16.6	
MISS05A	29-JUN-98	REG	ARSENIC	16.4	
MISS05A	14-May-99	REG	ARSENIC	2	
MISS05B	23-JUL-93	REG	ARSENIC	16.6	
MISS05B	17-MAY-94	REG	ARSENIC	11.9	J
MISS05B	11-MAY-95	REG	ARSENIC	10.9	J
MISS05B	16-MAY-96	REG	ARSENIC	10.6	
MISS05B	14-MAY-97	REG	ARSENIC	10.1	J
MISS05B	30-JUN-98	REG	ARSENIC	9.9	
MISS06A	03-JUN-97	REG	ARSENIC	3.4	
MISS06A	01-JUL-98	REG	ARSENIC	5.4	
MISS06A	17-May-99	REG	ARSENIC	2.2	
B38W01S	23-MAY-94	REG	BARIUM	17.8	
B38W01S	21-MAY-95	REG	BARIUM	13.1	
B38W01S	17-MAY-96	REG	BARIUM	14.4	
B38W01S	04-JUN-97	REG	BARIUM	16.8	
B38W01S	07-JUL-98	REG	BARIUM	16.3	
B38W02D	27-JUL-93	REG	BARIUM	385	
B38W02D	19-MAY-94	REG	BARIUM	342	
B38W02D	20-MAY-95	REG	BARIUM	298	
B38W02D	17-MAY-96	REG	BARIUM	349	
B38W02D	04-JUN-97	REG	BARIUM	391	
B38W02D	30-JUN-98	REG	BARIUM	364	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
B38W02D	20-May-99	REG	BARIUM	342	
MISS07B	16-JUN-98	REG	BARIUM	28.1	
MISS07B	27-May-99	REG	BARIUM	21.4	
B38W14D	04-AUG-93	REG	BARIUM	106	
B38W14D	20-MAY-95	REG	BARIUM	73.6	
B38W14D	17-MAY-96	REG	BARIUM	97.3	
B38W14D	04-JUN-97	REG	BARIUM	113	
B38W14D	07-JUL-98	REG	BARIUM	111	
B38W14D	07-JUL-98	DUP	BARIUM	113	
B38W14D	17-May-99	DUP	BARIUM	116	
B38W14S	04-AUG-93	REG	BARIUM	106	
B38W14S	20-MAY-95	REG	BARIUM	61.6	
B38W14S	17-MAY-96	REG	BARIUM	85.2	
B38W14S	17-MAY-96	DUP	BARIUM	77.8	
B38W14S	04-JUN-97	REG	BARIUM	90	
B38W14S	07-JUL-98	REG	BARIUM	108	
B38W14S	17-May-99	REG	BARIUM	86.6	
B38W15D	02-AUG-93	REG	BARIUM	32.4	
B38W15D	26-MAY-94	REG	BARIUM	30.3	
B38W15D	19-MAY-95	REG	BARIUM	22.3	
B38W15D	13-MAY-96	REG	BARIUM	39.4	
B38W15D	03-JUN-97	REG	BARIUM	27.5	
B38W15D	06-JUL-98	REG	BARIUM	22.6	
B38W15S	02-AUG-93	REG	BARIUM	50	
B38W15S	26-MAY-94	REG	BARIUM	34	
B38W15S	19-MAY-95	REG	BARIUM	50.9	
B38W15S	19-MAY-95	DUP	BARIUM	46.1	
B38W15S	13-MAY-96	REG	BARIUM	35.7	
B38W15S	03-JUN-97	REG	BARIUM	32.2	
B38W15S	06-JUL-98	REG	BARIUM	32.5	
B38W17A	28-JUL-93	REG	BARIUM	299	
B38W17A	25-MAY-94	REG	BARIUM	46.9	
B38W17A	20-MAY-95	REG	BARIUM	36.4	
B38W17A	13-MAY-96	REG	BARIUM	60.3	
B38W17A	03-JUN-97	REG	BARIUM	49.3	
B38W17A	02-JUL-98	REG	BARIUM	78.1	
B38W17A	13-May-99	REG	BARIUM	63.1	
B38W17B	29-JUL-93	REG	BARIUM	64.9	
B38W17B	25-MAY-94	REG	BARIUM	89.4	
B38W17B	20-MAY-95	REG	BARIUM	71.8	
B38W17B	13-MAY-96	REG	BARIUM	98.3	
B38W17B	03-JUN-97	REG	BARIUM	96.5	
B38W17B	02-JUL-98	REG	BARIUM	71.6	
B38W17B	13-May-99	REG	BARIUM	89.1	
B38W18D	21-JUL-93	REG	BARIUM	13.1	
B38W18D	13-MAY-94	REG	BARIUM	14.7	
B38W18D	15-MAY-95	REG	BARIUM	22.7	
B38W18D	14-MAY-96	REG	BARIUM	22.1	
B38W18D	09-MAY-97	REG	BARIUM	17.2	
B38W18D	08-JUN-98	REG	BARIUM	18.8	
B38W18D	20-May-99	REG	BARIUM	20.8	
B38W19D	16-MAY-94	REG	BARIUM	30.8	
B38W19D	10-MAY-95	REG	BARIUM	22.4	
B38W19D	16-MAY-96	REG	BARIUM	29.7	
B38W19D	16-MAY-97	REG	BARIUM	29.5	
B38W19D	17-JUN-98	REG	BARIUM	32.4	
B38W19D	23-JUL-93	REG	BARIUM	23.9	
B38W19D	23-May-99	REG	BARIUM	31	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
B38W19S	27-MAY-94	REG	BARIUM	50.2	
B38W19S	17-MAY-95	REG	BARIUM	47.5	
B38W19S	10-MAY-96	REG	BARIUM	43.1	
B38W19S	29-JUN-98	REG	BARIUM	42.7	
B38W19S	14-May-99	REG	BARIUM	43.2	
B38W24D	09-AUG-93	REG	BARIUM	49.6	
B38W24D	18-May-94	REG	BARIUM	41.2	
B38W24D	17-MAY-95	REG	BARIUM	24.6	
B38W24D	09-MAY-96	REG	BARIUM	56.2	
B38W24D	02-JUN-97	REG	BARIUM	50.6	
B38W24D	02-JUL-98	REG	BARIUM	96.5	
B38W24D	13-May-99	REG	BARIUM	45.6	
B38W24S	05-AUG-93	REG	BARIUM	45	
B38W24S	25-MAY-94	REG	BARIUM	46	
B38W24S	17-MAY-95	REG	BARIUM	45.6	
B38W24S	09-MAY-96	REG	BARIUM	39.4	
B38W24S	02-JUN-97	REG	BARIUM	43.9	
B38W24S	02-JUL-98	REG	BARIUM	43.3	
B38W24S	02-May-99	DUP	BARIUM	39.1	
B38W25D	03-AUG-93	REG	BARIUM	49	
B38W25D	18-May-94	REG	BARIUM	51.7	
B38W25D	12-MAY-95	REG	BARIUM	62.7	
B38W25D	15-MAY-96	REG	BARIUM	54.5	
B38W25D	15-MAY-97	REG	BARIUM	48.3	
B38W25D	01-JUL-98	REG	BARIUM	48.1	
B38W25D	26-May-99	REG	BARIUM	58.4	
B38W25S	03-AUG-93	REG	BARIUM	126	
B38W25S	24-MAY-94	REG	BARIUM	50.5	
B38W25S	15-MAY-95	REG	BARIUM	68.5	
B38W25S	15-MAY-95	DUP	BARIUM	43.1	
B38W25S	15-MAY-96	REG	BARIUM	39	
B38W25S	15-MAY-96	DUP	BARIUM	39.4	
B38W25S	05-JUN-97	REG	BARIUM	47	
B38W25S	01-JUL-98	REG	BARIUM	112	
B38W25S	17-May-99	REG	BARIUM	73.6	
MISS01AA	31-JUL-93	REG	BARIUM	159	
MISS01AA	23-MAY-94	REG	BARIUM	19.5	
MISS01AA	18-MAY-95	REG	BARIUM	10.6	
MISS01AA	09-MAY-96	REG	BARIUM	14.4	
MISS01AA	23-MAY-97	REG	BARIUM	7	
MISS01AA	18-JUN-98	REG	BARIUM	8.1	
MISS01AA	12-May-99	REG	BARIUM	8.7	
MISS01B	21-JUL-93	REG	BARIUM	72.9	
MISS01B	21-JUL-93	REG	BARIUM	69.6	
MISS01B	16-MAY-94	REG	BARIUM	82.9	
MISS01B	10-MAY-95	REG	BARIUM	66.9	
MISS01B	15-MAY-96	REG	BARIUM	98.3	
MISS01B	18-JUN-98	REG	BARIUM	80	
MISS01B	25-May-99	REG	BARIUM	73.5	
MISS02A	20-JUL-93	REG	BARIUM	10	
MISS02A	12-MAY-94	REG	BARIUM	10.1	J
MISS02A	10-MAY-95	REG	BARIUM	12	
MISS02A	16-MAY-96	REG	BARIUM	9.5	
MISS02A	15-MAY-97	DUP	BARIUM	8.4	
MISS02A	11-JUN-98	DUP	BARIUM	6.2	
MISS02A	18-May-99	DUP	BARIUM	21	
MISS02B	20-JUL-93	REG	BARIUM	13.3	
MISS02B	13-MAY-94	REG	BARIUM	7.8	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
MISS02B	09-MAY-95	REG	BARIUM	18.1	
MISS02B	14-MAY-96	REG	BARIUM	9.2	
MISS02B	19-MAY-97	REG	BARIUM	9	
MISS02B	10-JUN-98	REG	BARIUM	10	
MISS02B	18-May-99	REG	BARIUM	11	
MISS05A	27-MAY-94	REG	BARIUM	28.2	
MISS05A	12-MAY-95	REG	BARIUM	37.8	
MISS05A	10-MAY-96	REG	BARIUM	32	
MISS05A	02-JUN-97	REG	BARIUM	23.1	
MISS05A	29-JUN-98	REG	BARIUM	18.4	
MISS05A	14-May-99	REG	BARIUM	20.3	
MISS05B	23-JUL-93	REG	BARIUM	52.2	
MISS05B	17-MAY-94	REG	BARIUM	89.9	
MISS05B	11-MAY-95	REG	BARIUM	128	
MISS05B	16-MAY-96	REG	BARIUM	38.3	
MISS05B	14-MAY-97	REG	BARIUM	37.9	
MISS05B	30-JUN-98	REG	BARIUM	26.3	
MISS06A	04-AUG-93	REG	BARIUM	80.3	
MISS06A	24-MAY-94	REG	BARIUM	44.3	
MISS06A	16-MAY-95	REG	BARIUM	122	
MISS06A	10-MAY-96	REG	BARIUM	39.4	
MISS06A	03-JUN-97	REG	BARIUM	57.9	
MISS06A	01-JUL-98	REG	BARIUM	48.1	
MISS06A	17-May-99	REG	BARIUM	48	
B38W01S	28-JUL-93	REG	BERYLLIUM	4	
B38W01S	23-MAY-94	REG	BERYLLIUM	1.1	
B38W01S	21-MAY-95	REG	BERYLLIUM	3.1	
B38W01S	17-MAY-96	REG	BERYLLIUM	2.3	
B38W01S	04-JUN-97	REG	BERYLLIUM	2.7	
B38W01S	07-JUL-98	REG	BERYLLIUM	1.9	
B38W02D	04-JUN-97	REG	BERYLLIUM	0.24	
MISS07B	16-JUN-98	REG	BERYLLIUM	0.14	
B38W14D	04-JUN-97	REG	BERYLLIUM	0.2	
B38W14S	04-JUN-97	REG	BERYLLIUM	0.28	
B38W15D	26-MAY-94	REG	BERYLLIUM	0.5	
B38W15D	03-JUN-97	REG	BERYLLIUM	0.24	
B38W15S	03-JUN-97	REG	BERYLLIUM	0.2	
B38W17A	28-JUL-93	REG	BERYLLIUM	2.7	
B38W17A	03-JUN-97	REG	BERYLLIUM	0.2	
B38W17B	03-JUN-97	REG	BERYLLIUM	0.26	
B38W18D	15-MAY-95	REG	BERYLLIUM	1.1	
B38W18D	14-MAY-96	REG	BERYLLIUM	0.84	
B38W18D	09-MAY-97	REG	BERYLLIUM	0.46	
B38W18D	08-JUN-98	REG	BERYLLIUM	0.86	
B38W18D	20-May-99	DUP	BERYLLIUM	0.99	
B38W24D	02-JUN-97	REG	BERYLLIUM	0.52	
B38W24D	02-JUL-98	REG	BERYLLIUM	0.82	
B38W24D	13-May-99	REG	BERYLLIUM	0.42	
B38W24S	25-MAY-94	REG	BERYLLIUM	1.5	
B38W24S	17-MAY-95	REG	BERYLLIUM	0.77	
B38W24S	09-MAY-96	REG	BERYLLIUM	2	
B38W24S	02-JUN-97	REG	BERYLLIUM	6.3	
B38W24S	02-JUL-98	REG	BERYLLIUM	4.5	
B38W24S	13-May-99	REG	BERYLLIUM	1.1	
B38W25S	03-AUG-93	REG	BERYLLIUM	1.1	
B38W25S	05-JUN-97	REG	BERYLLIUM	0.3	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
MISS02B	20-JUL-93	REG	BERYLLIUM	1.8	
MISS02B	14-MAY-96	REG	BERYLLIUM	0.68	
MISS02B	19-MAY-97	REG	BERYLLIUM	0.66	
MISS02B	10-JUN-98	REG	BERYLLIUM	0.74	
MISS02B	18-May-99	REG	BERYLLIUM	0.84	
MISS05A	02-JUN-97	REG	BERYLLIUM	0.48	
MISS05A	29-JUN-98	REG	BERYLLIUM	0.14	
B38W01S	28-JUL-93	REG	BORON	516	
B38W01S	23-MAY-94	REG	BORON	496	
B38W01S	21-MAY-95	REG	BORON	444	
B38W01S	04-JUN-97	REG	BORON	373	
B38W01S	07-JUL-98	REG	BORON	270	
B38W02D	20-MAY-95	REG	BORON	125	
B38W02D	04-JUN-97	REG	BORON	23.3	
B38W02D	30-JUN-98	REG	BORON	24.8	
B38W02D	20-May-99	REG	BORON	24.2	
B38W14D	04-AUG-93	REG	BORON	63.9	
B38W14D	20-MAY-95	REG	BORON	108	
B38W14D	04-JUN-97	REG	BORON	49.8	
B38W14D	07-JUL-98	DUP	BORON	49.8	
B38W14D	17-May-99	REG	BORON	47.5	
B38W14S	04-AUG-93	REG	BORON	68	
B38W14S	20-MAY-95	REG	BORON	142	
B38W14S	04-JUN-97	REG	BORON	40.6	
B38W14S	07-JUL-98	REG	BORON	39.3	
B38W14S	17-May-99	REG	BORON	38.6	
B38W15D	02-AUG-93	REG	BORON	297	
B38W15D	26-MAY-94	REG	BORON	520	
B38W15D	19-MAY-95	REG	BORON	338	
B38W15D	13-MAY-96	REG	BORON	521	
B38W15D	03-JUN-97	REG	BORON	415	
B38W15D	06-JUL-98	REG	BORON	235	
B38W15S	02-AUG-93	REG	BORON	532	
B38W15S	26-MAY-94	REG	BORON	425	
B38W15S	19-MAY-95	REG	BORON	608	
B38W15S	19-MAY-95	DUP	BORON	566	
B38W15S	13-MAY-96	REG	BORON	432	
B38W15S	03-JUN-97	REG	BORON	492	
B38W15S	06-JUL-98	REG	BORON	455	
B38W17A	20-MAY-95	REG	BORON	156	
B38W17A	13-MAY-96	REG	BORON	143	
B38W17A	03-JUN-97	REG	BORON	72.3	
B38W17A	02-JUL-98	REG	BORON	63.7	
B38W17A	13-May-99	REG	BORON	66.2	
B38W17B	29-JUL-93	REG	BORON	392	
B38W17B	25-MAY-94	REG	BORON	355	
B38W17B	20-MAY-95	REG	BORON	382	
B38W17B	13-MAY-96	REG	BORON	303	
B38W17B	03-JUN-97	REG	BORON	365	
B38W17B	02-JUL-98	REG	BORON	289	
B38W17B	13-May-99	REG	BORON	317	
B38W18D	21-JUL-93	REG	BORON	491	
B38W18D	13-MAY-94	REG	BORON	449	J
B38W18D	15-MAY-95	REG	BORON	425	
B38W18D	09-MAY-97	REG	BORON	405	
B38W18D	08-JUN-98	REG	BORON	425	
B38W18D	20-May-99	REG	BORON	366	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
B38W19D	23-JUL-93	REG	BORON	2020	
B38W19D	16-MAY-94	REG	BORON	1020	
B38W19D	10-MAY-95	REG	BORON	885	
B38W19D	16-MAY-96	REG	BORON	762	J
B38W19D	16-MAY-97	REG	BORON	879	
B38W19D	17-JUN-98	REG	BORON	962	
B38W19D	27-May-99	REG	BORON	1120	
B38W19S	27-MAY-94	REG	BORON	1130	
B38W19S	17-MAY-95	REG	BORON	1240	
B38W19S	10-MAY-96	REG	BORON	1030	
B38W19S	29-JUN-98	REG	BORON	741	
B38W19S	14-May-99	REG	BORON	756	
B38W24D	09-AUG-93	REG	BORON	142	
B38W24D	09-MAY-96	REG	BORON	138	
B38W24D	02-JUN-97	REG	BORON	90.4	
B38W24D	02-JUL-98	REG	BORON	76.6	
B38W24D	13-May-99	REG	BORON	98.3	
B38W24S	05-AUG-93	REG	BORON	104	
B38W24S	17-MAY-95	REG	BORON	132	
B38W24S	09-MAY-96	REG	BORON	105	
B38W24S	02-JUN-97	REG	BORON	79.3	
B38W24S	02-JUL-98	REG	BORON	82	
B38W24S	13-May-99	REG	BORON	104	
B38W25D	03-AUG-93	REG	BORON	168	
B38W25D	18-MAY-94	REG	BORON	172	
B38W25D	12-MAY-95	REG	BORON	236	J
B38W25D	15-MAY-96	REG	BORON	159	
B38W25D	15-MAY-97	REG	BORON	154	
B38W25D	01-JUL-98	REG	BORON	138	
B38W25D	26-May-99	REG	BORON	146	
B38W25S	03-AUG-93	REG	BORON	134	
B38W25S	24-MAY-94	REG	BORON	133	UJ
B38W25S	15-MAY-95	REG	BORON	227	
B38W25S	15-MAY-95	DUP	BORON	171	
B38W25S	15-MAY-96	REG	BORON	150	
B38W25S	15-MAY-96	DUP	BORON	142	
B38W25S	05-JUN-97	REG	BORON	126	
B38W25S	01-JUL-98	REG	BORON	98.4	
B38W25S	17-May-99	REG	BORON	79.6	
MISS01AA	31-JUL-93	REG	BORON	189	
MISS01AA	23-MAY-94	REG	BORON	204	
MISS01AA	18-MAY-95	REG	BORON	222	
MISS01AA	09-MAY-96	REG	BORON	178	
MISS01AA	23-MAY-97	REG	BORON	234	
MISS01AA	18-JUN-98	REG	BORON	270	
MISS01AA	12-May-99	REG	BORON	278	
MISS01B	21-JUL-93	REG	BORON	106	
MISS01B	21-JUL-93	REG	BORON	85.3	
MISS01B	15-MAY-96	REG	BORON	94.9	
MISS01B	18-JUN-98	REG	BORON	72.1	
MISS01B	25-May-99	REG	BORON	61.6	
MISS02A	20-JUL-93	REG	BORON	1300	
MISS02A	12-MAY-94	REG	BORON	897	J
MISS02A	10-MAY-95	REG	BORON	1190	
MISS02A	16-MAY-96	REG	BORON	878	J
MISS02A	15-MAY-97	REG	BORON	1000	
MISS02A	15-MAY-97	DUP	BORON	910	
MISS02A	11-JUN-98	DUP	BORON	818	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
MISS02A	18-May-99	REG	BORON	1680	
MISS02B	20-JUL-93	REG	BORON	2150	
MISS02B	13-MAY-94	REG	BORON	1260	J
MISS02B	09-MAY-95	REG	BORON	1220	
MISS02B	14-MAY-96	REG	BORON	1680	
MISS02B	19-MAY-97	REG	BORON	1450	
MISS02B	10-JUN-98	REG	BORON	1620	
MISS02B	18-May-99	REG	BORON	1580	
MISS05A	27-MAY-94	REG	BORON	420	
MISS05A	12-MAY-95	REG	BORON	588	J
MISS05A	10-MAY-96	REG	BORON	385	
MISS05A	02-JUN-97	REG	BORON	402	
MISS05A	29-JUN-98	REG	BORON	291	
MISS05A	14-May-99	REG	BORON	352	
MISS05B	17-MAY-94	REG	BORON	747	
MISS05B	11-MAY-95	REG	BORON	665	J
MISS05B	14-MAY-97	REG	BORON	662	
MISS05B	30-JUN-98	REG	BORON	281	
MISS05B	23-JUL-93	REG	BORON	806	
MISS06A	04-AUG-93	REG	BORON	1800	
MISS06A	24-MAY-94	REG	BORON	498	J
MISS06A	16-MAY-95	REG	BORON	2080	
MISS06A	10-MAY-96	REG	BORON	326	
MISS06A	03-JUN-97	REG	BORON	482	
MISS06A	01-JUL-98	REG	BORON	327	
MISS06A	17-May-99	REG	BORON	352	
MISS07B	22-JUL-93	REG	BORON	1180	
MISS07B	18-MAY-94	REG	BORON	757	
MISS07B	11-MAY-95	REG	BORON	1210	J
MISS07B	16-MAY-96	REG	BORON	963	
MISS07B	16-MAY-97	REG	BORON	1050	
MISS07B	16-JUN-98	REG	BORON	1260	
MISS07B	27-MAY-99	REG	BORON	1670	
B38W01S	23-MAY-94	REG	CADMIUM	2.4	
B38W01S	04-JUN-97	REG	CADMIUM	0.66	
B38W01S	07-JUL-98	REG	CADMIUM	1.2	
B38W14D	04-AUG-93	REG	CADMIUM	9.7	J
B38W14D	04-JUN-97	REG	CADMIUM	1	
B38W14D	07-JUL-98	DUP	CADMIUM	2.4	
B38W14D	07-JUL-98	REG	CADMIUM	2.4	
B38W14S	04-AUG-93	REG	CADMIUM	9.5	J
B38W14S	04-JUN-97	REG	CADMIUM	1.3	
B38W14S	07-JUL-98	REG	CADMIUM	11.9	
B38W15D	02-AUG-93	REG	CADMIUM	6.4	
B38W15D	06-JUL-98	REG	CADMIUM	0.44	
B38W15S	03-JUN-97	REG	CADMIUM	2.6	
B38W15S	06-JUL-98	REG	CADMIUM	2.2	
B38W17A	02-JUL-98	REG	CADMIUM	0.79	
B38W17B	03-JUN-97	REG	CADMIUM	0.33	
B38W17B	02-JUL-98	REG	CADMIUM	0.36	
B38W19D	16-MAY-97	REG	CADMIUM	0.44	
B38W19D	17-JUN-98	REG	CADMIUM	0.26	
B38W19S	29-JUN-98	REG	CADMIUM	0.54	
B38W24D	02-JUL-98	REG	CADMIUM	2.6	
B38W24S	02-JUL-98	REG	CADMIUM	0.79	
B38W25S	05-JUN-97	REG	CADMIUM	0.4	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
B38W25S	01-JUL-98	REG	CADMIUM	1.4	
MISS01AA	31-JUL-93	REG	CADMIUM	7	
MISS01AA	23-MAY-97	REG	CADMIUM	1.4	
MISS01AA	18-JUN-98	REG	CADMIUM	0.82	
MISS02A	12-MAY-94	REG	CADMIUM	7.9	
MISS02A	15-MAY-97	REG	CADMIUM	0.46	
MISS02A	15-MAY-97	DUP	CADMIUM	0.32	
MISS05A	29-JUN-98	REG	CADMIUM	0.98	
MISS05B	30-JUN-98	REG	CADMIUM	0.48	
MISS06A	24-MAY-94	REG	CADMIUM	4.2	UJ
MISS06A	03-JUN-97	REG	CADMIUM	2.6	
MISS06A	01-JUL-98	REG	CADMIUM	2.2	
B38W01S	28-JUL-93	REG	CALCIUM	427000	
B38W01S	23-MAY-94	REG	CALCIUM	392000	
B38W01S	21-MAY-95	REG	CALCIUM	371000	
B38W01S	17-MAY-96	REG	CALCIUM	420000	
B38W01S	04-JUN-97	REG	CALCIUM	433000	
B38W01S	07-JUL-98	REG	CALCIUM	404000	
B38W02D	27-JUL-93	REG	CALCIUM	89000	
B38W02D	19-MAY-94	REG	CALCIUM	77700	
B38W02D	20-MAY-95	REG	CALCIUM	73700	
B38W02D	17-MAY-96	REG	CALCIUM	87700	
B38W02D	04-JUN-97	REG	CALCIUM	88700	
B38W02D	30-JUN-98	REG	CALCIUM	84700	
B38W02D	20-May-99	REG	CALCIUM	95600	
B38W14D	04-AUG-93	REG	CALCIUM	97900	J
B38W14D	20-MAY-95	REG	CALCIUM	77400	
B38W14D	17-MAY-96	REG	CALCIUM	111000	
B38W14D	04-JUN-97	REG	CALCIUM	110000	
B38W14D	07-JUL-98	DUP	CALCIUM	109000	
B38W14D	17-May-99	DUP	CALCIUM	119000	
B38W14S	04-AUG-93	REG	CALCIUM	47800	J
B38W14S	20-MAY-95	REG	CALCIUM	70800	
B38W14S	17-MAY-96	REG	CALCIUM	99700	
B38W14S	17-MAY-96	DUP	CALCIUM	90600	
B38W14S	04-JUN-97	REG	CALCIUM	90500	
B38W14S	07-JUL-98	REG	CALCIUM	85200	
B38W14S	17-May-99	REG	CALCIUM	95600	
B38W15D	02-AUG-93	REG	CALCIUM	48600	
B38W15D	26-MAY-94	REG	CALCIUM	92800	
B38W15D	19-MAY-95	REG	CALCIUM	58700	J
B38W15D	13-MAY-96	REG	CALCIUM	98600	J
B38W15D	03-JUN-97	REG	CALCIUM	71300	
B38W15D	06-JUL-98	REG	CALCIUM	44400	
B38W15S	02-AUG-93	REG	CALCIUM	75700	
B38W15S	26-MAY-94	REG	CALCIUM	55100	
B38W15S	19-MAY-95	REG	CALCIUM	80500	J
B38W15S	19-MAY-95	DUP	CALCIUM	75100	J
B38W15S	13-MAY-96	REG	CALCIUM	52500	J
B38W15S	03-JUN-97	REG	CALCIUM	57200	
B38W15S	06-JUL-98	REG	CALCIUM	55400	
B38W17A	28-JUL-93	REG	CALCIUM	133000	
B38W17A	25-MAY-94	REG	CALCIUM	75000	
B38W17A	20-MAY-95	REG	CALCIUM	57300	
B38W17A	13-MAY-96	REG	CALCIUM	93800	J
B38W17A	03-JUN-97	REG	CALCIUM	53400	
B38W17A	02-JUL-98	REG	CALCIUM	60800	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
B38W17A	17-May-99	DUP	CALCIUM	88300	
B38W17B	29-JUL-93	REG	CALCIUM	219000	J
B38W17B	25-MAY-94	REG	CALCIUM	291000	
B38W17B	20-MAY-95	REG	CALCIUM	223000	
B38W17B	13-MAY-96	REG	CALCIUM	309000	J
B38W17B	03-JUN-97	REG	CALCIUM	313000	
B38W17B	02-JUL-98	REG	CALCIUM	235000	
B38W17B	13-May-99	REG	CALCIUM	303000	
B38W18D	21-JUL-93	REG	CALCIUM	151000	
B38W18D	13-MAY-94	REG	CALCIUM	164000	J
B38W18D	15-MAY-95	REG	CALCIUM	154000	
B38W18D	14-MAY-96	REG	CALCIUM	166000	
B38W18D	09-MAY-97	REG	CALCIUM	154000	
B38W18D	08-JUN-98	REG	CALCIUM	162000	
B38W18D	20-May-99	REG	CALCIUM	161000	
B38W19D	23-JUL-93	REG	CALCIUM	214000	
B38W19D	16-MAY-94	REG	CALCIUM	296000	
B38W19D	10-MAY-95	REG	CALCIUM	180000	
B38W19D	16-MAY-96	REG	CALCIUM	262000	
B38W19D	16-MAY-97	REG	CALCIUM	256000	
B38W19D	17-JUN-98	REG	CALCIUM	226000	
B38W19D	17-JUN-98	REG	CALCIUM	209000	
B38W19D	27-May-99	REG	CALCIUM	258000	
B38W19S	27-MAY-94	REG	CALCIUM	629000	
B38W19S	17-MAY-95	REG	CALCIUM	657000	
B38W19S	10-MAY-96	REG	CALCIUM	611000	J
B38W19S	29-JUN-98	REG	CALCIUM	670000	
B38W19S	27-May-99	REG	CALCIUM	654000	
B38W24D	09-AUG-93	REG	CALCIUM	80700	J
B38W24D	18-MAY-94	REG	CALCIUM	81300	
B38W24D	17-MAY-95	REG	CALCIUM	69700	
B38W24D	09-MAY-96	REG	CALCIUM	98300	J
B38W24D	02-JUN-97	REG	CALCIUM	83600	
B38W24D	02-JUL-98	REG	CALCIUM	82900	
B38W24D	14-May-99	REG	CALCIUM	98800	
B38W24S	05-AUG-93	REG	CALCIUM	42600	J
B38W24S	25-MAY-94	REG	CALCIUM	54000	
B38W24S	17-MAY-95	REG	CALCIUM	57000	
B38W24S	09-MAY-96	REG	CALCIUM	61300	J
B38W24S	02-JUN-97	REG	CALCIUM	43900	
B38W24S	02-JUL-98	REG	CALCIUM	41000	
B38W24S	13-May-99	REG	CALCIUM	67100	
B38W25D	03-AUG-93	REG	CALCIUM	152000	
B38W25D	18-MAY-94	REG	CALCIUM	117000	
B38W25D	12-MAY-95	REG	CALCIUM	144000	
B38W25D	15-MAY-96	REG	CALCIUM	134000	J
B38W25D	15-MAY-97	REG	CALCIUM	109000	J
B38W25D	01-JUL-98	REG	CALCIUM	109000	
B38W25D	26-May-99	REG	CALCIUM	109000	
B38W25S	03-AUG-93	REG	CALCIUM	255000	
B38W25S	24-MAY-94	REG	CALCIUM	189000	J
B38W25S	15-MAY-95	REG	CALCIUM	208000	
B38W25S	15-MAY-95	DUP	CALCIUM	199000	
B38W25S	15-MAY-96	REG	CALCIUM	162000	J
B38W25S	15-MAY-96	DUP	CALCIUM	183000	J
B38W25S	05-JUN-97	REG	CALCIUM	169000	
B38W25S	01-JUL-98	REG	CALCIUM	144000	
B38W25S	01-May-99	REG	CALCIUM	185000	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
MISS01AA	31-JUL-93	REG	CALCIUM	616000	J
MISS01AA	23-MAY-94	REG	CALCIUM	564000	
MISS01AA	18-MAY-95	REG	CALCIUM	714000	
MISS01AA	09-MAY-96	REG	CALCIUM	555000	J
MISS01AA	23-MAY-97	REG	CALCIUM	616000	
MISS01AA	18-JUN-98	REG	CALCIUM	645000	
MISS01AA	12-May-99	REG	CALCIUM	645000	
MISS01B	21-JUL-93	REG	CALCIUM	92200	
MISS01B	16-MAY-94	REG	CALCIUM	90800	
MISS01B	10-MAY-95	REG	CALCIUM	84500	
MISS01B	15-MAY-96	REG	CALCIUM	97100	J
MISS01B	18-JUN-98	REG	CALCIUM	91900	
MISS01B	25-May-99	REG	CALCIUM	96600	
MISS02A	20-JUL-93	REG	CALCIUM	164000	
MISS02A	12-MAY-94	REG	CALCIUM	79400	J
MISS02A	10-MAY-95	REG	CALCIUM	54500	
MISS02A	16-MAY-96	REG	CALCIUM	67600	
MISS02A	15-MAY-97	REG	CALCIUM	66700	J
MISS02A	15-MAY-97	DUP	CALCIUM	62400	J
MISS02A	11-JUN-98	DUP	CALCIUM	106000	
MISS02A	81-MAY-99	REG	CALCIUM	116000	
MISS02B	20-JUL-93	REG	CALCIUM	295000	
MISS02B	13-MAY-94	REG	CALCIUM	221000	J
MISS02B	09-MAY-95	REG	CALCIUM	248000	
MISS02B	14-MAY-96	REG	CALCIUM	275000	
MISS02B	19-MAY-97	REG	CALCIUM	272000	
MISS02B	10-JUN-98	REG	CALCIUM	304000	
MISS02B	18-May-99	DUP	CALCIUM	304000	
MISS05A	27-MAY-94	REG	CALCIUM	582000	
MISS05A	12-MAY-95	REG	CALCIUM	683000	
MISS05A	10-MAY-96	REG	CALCIUM	603000	J
MISS05A	02-JUN-97	REG	CALCIUM	612000	
MISS05A	29-JUN-98	REG	CALCIUM	591000	
MISS05A	14-May-99	REG	CALCIUM	677000	
MISS05B	23-JUL-93	REG	CALCIUM	315000	
MISS05B	17-MAY-94	REG	CALCIUM	339000	
MISS05B	11-MAY-95	REG	CALCIUM	295000	
MISS05B	16-MAY-96	REG	CALCIUM	322000	
MISS05B	14-MAY-97	REG	CALCIUM	340000	
MISS05B	30-JUN-98	REG	CALCIUM	143000	
MISS06A	04-AUG-93	REG	CALCIUM	218000	J
MISS06A	24-MAY-94	REG	CALCIUM	249000	J
MISS06A	16-MAY-95	REG	CALCIUM	292000	
MISS06A	10-MAY-96	REG	CALCIUM	225000	J
MISS06A	03-JUN-97	REG	CALCIUM	273000	
MISS06A	01-JUL-98	REG	CALCIUM	198000	
MISS06A	17-May-99	DUP	CALCIUM	252000	
MISS07B	22-JUL-93	REG	CALCIUM	180000	
MISS07B	22-JUL-93	REG	CALCIUM	175000	
MISS07B	16-JUn-98	REG	CALCIUM	160000	
MISS07B	27-MAY-99	DUP	CALCIUM	250000	
B38W02D	27-JUL-93	REG	CHROMIUM	7.9	
B38W02D	17-MAY-96	REG	CHROMIUM	38.3	
B38W02D	04-JUN-97	REG	CHROMIUM	20.8	
B38W02D	30-JUN-98	REG	CHROMIUM	371	
B38W02D	20-May-99	REG	CHROMIUM	9.7	
B38W14D	04-JUN-97	REG	CHROMIUM	21.2	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
B38W14D	07-JUL-98	REG	CHROMIUM	3.9	
B38W14D	07-JUL-98	DUP	CHROMIUM	2.6	
B38W14D	17-May-99	REG	CHROMIUM	1	
B38W14S	20-MAY-95	REG	CHROMIUM	35.9	
B38W14S	17-MAY-96	REG	CHROMIUM	345	
B38W14S	17-MAY-96	DUP	CHROMIUM	296	
B38W14S	04-JUN-97	REG	CHROMIUM	354	
B38W14S	07-JUL-98	REG	CHROMIUM	420	
B38W14S	17-May-99	REG	CHROMIUM	67.2	
B38W15D	02-AUG-93	REG	CHROMIUM	9.3	
B38W15D	03-JUN-97	REG	CHROMIUM	2.2	
B38W15D	06-JUL-98	REG	CHROMIUM	6.5	
B38W15S	03-JUN-97	REG	CHROMIUM	1.8	
B38W15S	06-JUL-98	REG	CHROMIUM	5.5	
B38W17A	28-JUL-93	REG	CHROMIUM	21000	
B38W17A	25-MAY-94	REG	CHROMIUM	122	
B38W17A	20-MAY-95	REG	CHROMIUM	56.6	
B38W17A	13-MAY-96	REG	CHROMIUM	632	
B38W17A	03-JUN-97	REG	CHROMIUM	1880	
B38W17A	02-JUL-98	REG	CHROMIUM	5350	
B38W17A	13-May-99	REG	CHROMIUM	66.3	
B38W17B	03-JUN-97	REG	CHROMIUM	0.84	
B38W17B	02-JUL-98	REG	CHROMIUM	2.8	
B38W17B	13-May-99	REG	CHROMIUM	1.4	
B38W18D	21-JUL-93	REG	CHROMIUM	27.2	
B38W18D	13-MAY-94	REG	CHROMIUM	25.8	J
B38W18D	15-MAY-95	REG	CHROMIUM	29.9	
B38W18D	14-MAY-96	REG	CHROMIUM	30.8	J
B38W18D	09-MAY-97	REG	CHROMIUM	26.9	
B38W18D	08-JUN-98	REG	CHROMIUM	83.4	
B38W18D	20-May-99	REG	CHROMIUM	39.5	
B38W19D	16-MAY-94	REG	CHROMIUM	5.1	
B38W19D	16-MAY-97	REG	CHROMIUM	3.4	
B38W19S	29-JUN-98	REG	CHROMIUM	2.9	
B38W19S	14-May-99	REG	CHROMIUM	2.6	
B38W24D	09-AUG-93	REG	CHROMIUM	8.9	J
B38W24D	18-MAY-94	REG	CHROMIUM	6.2	
B38W24D	09-MAY-96	REG	CHROMIUM	6.2	
B38W24D	02-JUL-98	REG	CHROMIUM	17.9	
B38W24D	13-May-99	REG	CHROMIUM	6.4	
B38W24S	25-MAY-94	REG	CHROMIUM	4.9	
B38W24S	02-JUN-97	REG	CHROMIUM	4.5	
B38W25D	18-MAY-94	REG	CHROMIUM	8.8	
B38W25D	12-MAY-95	REG	CHROMIUM	36.5	J
B38W25D	15-MAY-97	REG	CHROMIUM	6.2	
B38W25D	01-JUL-98	REG	CHROMIUM	3.2	
B38W25S	03-AUG-93	REG	CHROMIUM	210	
B38W25S	15-MAY-95	REG	CHROMIUM	14.6	
B38W25S	15-MAY-95	DUP	CHROMIUM	12.7	
B38W25S	15-MAY-96	REG	CHROMIUM	4.9	
B38W25S	05-JUN-97	REG	CHROMIUM	20.7	
B38W25S	01-JUL-98	REG	CHROMIUM	50.7	
B38W25S	17-May-99	REG	CHROMIUM	106	
MISS01AA	31-JUL-93	REG	CHROMIUM	54.9	
MISS01AA	23-MAY-94	REG	CHROMIUM	285	
MISS01AA	23-MAY-97	REG	CHROMIUM	2.1	
MISS01AA	18-JUN-98	REG	CHROMIUM	7.4	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
MISS01AA	12-May-99	REG	CHROMIUM	1	
MISS02A	20-JUL-93	REG	CHROMIUM	157	
MISS02A	12-MAY-94	REG	CHROMIUM	15.1	J
MISS02A	10-MAY-95	REG	CHROMIUM	94.5	
MISS02A	15-MAY-97	REG	CHROMIUM	24.3	
MISS02A	15-MAY-97	DUP	CHROMIUM	22.3	
MISS02A	11-JUN-98	DUP	CHROMIUM	26.8	
MISS02A	18-May-99	REG	CHROMIUM	94.1	
MISS02B	20-JUL-93	REG	CHROMIUM	5.1	
MISS02B	09-MAY-95	REG	CHROMIUM	5.3	
MISS02B	19-MAY-97	REG	CHROMIUM	5.1	
MISS02B	10-JUN-98	REG	CHROMIUM	6.2	
MISS02B	18-May-99	REG	CHROMIUM	7.5	
MISS05B	11-MAY-95	REG	CHROMIUM	10.9	
MISS05B	14-MAY-97	REG	CHROMIUM	2.9	
MISS05B	30-JUN-98	REG	CHROMIUM	10.8	
B38W07B	16-JUN-98	REG	CHROMIUM	1.6	
B38W02D	04-JUN-97	REG	COBALT	1.1	
B38W02D	30-JUN-98	REG	COBALT	1.6	
B38W14D	07-JUL-98	REG	COBALT	0.42	
B38W14S	04-AUG-93	REG	COBALT	20.1	
B38W14S	04-JUN-97	REG	COBALT	0.97	
B38W14S	07-JUL-98	REG	COBALT	2.2	
B38W14S	17-May-99	REG	COBALT	1.5	
B38W15D	03-JUN-97	REG	COBALT	2.5	
B38W15D	06-JUL-98	REG	COBALT	1.4	
B38W15S	03-JUN-97	REG	COBALT	1.4	
B38W15S	06-JUL-98	REG	COBALT	0.69	
B38W17A	28-JUL-93	REG	COBALT	57	
B38W17A	25-MAY-94	REG	COBALT	5.8	
B38W17A	03-JUN-97	REG	COBALT	1.6	
B38W17A	02-JUL-98	REG	COBALT	8.1	
B38W17A	13-May-99	DUP	COBALT	1.2	
B38W18D	21-JUL-93	REG	COBALT	17.7	
B38W18D	13-MAY-94	REG	COBALT	19.1	J
B38W18D	15-MAY-95	REG	COBALT	18.5	
B38W18D	14-MAY-96	REG	COBALT	16.9	
B38W18D	09-MAY-97	REG	COBALT	11.5	
B38W18D	08-JUN-98	REG	COBALT	13.3	
B38W18D	20-May-99	REG	COBALT	15.7	
B38W24D	09-AUG-93	REG	COBALT	12	
B38W24D	02-JUL-98	REG	COBALT	0.74	
B38W25S	03-AUG-93	REG	COBALT	14.6	
B38W25S	15-MAY-95	REG	COBALT	3.6	
B38W25S	05-JUN-97	REG	COBALT	1.5	
B38W25S	01-JUL-98	REG	COBALT	2.4	
B38W25S	17-May-99	REG	COBALT	3.2	
MISS02A	15-MAY-97	REG	COBALT	1	
MISS02A	15-MAY-97	DUP	COBALT	0.98	
MISS02A	11-JUN-98	DUP	COBALT	1.1	
MISS02A	18-May-99	DUP	COBALT	2.2	
MISS02B	13-MAY-94	REG	COBALT	7	J
MISS02B	09-MAY-95	REG	COBALT	5.4	
MISS02B	19-MAY-97	REG	COBALT	3.3	
MISS02B	10-JUN-98	REG	COBALT	2.8	
MISS02B	18-May-99	REG	COBALT	3	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
MISS05A	12-MAY-95	REG	COBALT	9.1	
MISS05A	02-JUN-97	REG	COBALT	1.4	
MISS05A	29-JUN-98	REG	COBALT	1.3	
MISS05A	14-May-99	REG	COBALT	14.1	
MISS06A	24-MAY-94	REG	COBALT	4.2	
MISS06A	03-JUN-97	REG	COBALT	0.95	
MISS06A	01-JUL-98	REG	COBALT	0.64	
B38W07B	16-JUN-98	REG	COBALT	4.4	
B38W07B	27-May-99	DUP	COBALT	5.3	
B38W02D	19-MAY-94	REG	COPPER	3.8	
B38W02D	04-JUN-97	REG	COPPER	2.4	
B38W02D	30-JUN-98	REG	COPPER	8.7	
B38W02D	20-May-99	REG	COPPER	2.9	
B38W14D	04-AUG-93	REG	COPPER	33.1	
B38W14D	20-MAY-95	REG	COPPER	5.7	
B38W14D	04-JUN-97	REG	COPPER	15.7	
B38W14D	07-JUL-98	REG	COPPER	13	
B38W14D	07-JUL-98	DUP	COPPER	11.8	
B38W14D	17-May-99	DUP	COPPER	3.6	
B38W14S	04-AUG-93	REG	COPPER	14.7	
B38W14S	20-MAY-95	REG	COPPER	4.1	
B38W14S	04-JUN-97	REG	COPPER	8.9	
B38W14S	07-JUL-98	REG	COPPER	22.3	
B38W14S	17-May-99	REG	COPPER	4.9	
B38W15D	02-AUG-93	REG	COPPER	33.7	
B38W15D	13-MAY-96	REG	COPPER	9.7	
B38W15D	03-JUN-97	REG	COPPER	2.6	
B38W15D	06-JUL-98	REG	COPPER	9.2	
B38W15S	19-MAY-95	REG	COPPER	9.3	
B38W15S	19-MAY-95	DUP	COPPER	6.4	
B38W15S	03-JUN-97	REG	COPPER	5.4	
B38W15S	06-JUL-98	REG	COPPER	21.8	
B38W17A	28-JUL-93	REG	COPPER	118	
B38W17A	25-MAY-94	REG	COPPER	7.6	
B38W17A	13-MAY-96	REG	COPPER	8.4	
B38W17A	03-JUN-97	REG	COPPER	10	
B38W17A	02-JUL-98	REG	COPPER	36.6	
B38W17A	13-May-99	REG	COPPER	2.9	
B38W17B	02-JUL-98	REG	COPPER	2.1	
B38W17B	13-May-99	REG	COPPER	1.2	
B38W19D	16-MAY-97	REG	COPPER	3.9	
B38W19D	17-JUN-98	REG	COPPER	1	
B38W19S	17-MAY-95	REG	COPPER	4.8	
B38W19S	29-JUN-98	REG	COPPER	2.8	
B38W24D	09-AUG-93	REG	COPPER	6	
B38W24D	18-MAY-94	REG	COPPER	3.4	
B38W24D	02-JUN-97	REG	COPPER	1.3	
B38W24D	02-JUL-98	REG	COPPER	10.4	
B38W24D	13-May-99	REG	COPPER	3	
B38W24S	05-AUG-93	REG	COPPER	8.8	
B38W24S	02-JUN-97	REG	COPPER	24.2	
B38W24S	02-JUL-98	REG	COPPER	2.8	
B38W24S	13-May-99	REG	COPPER	9.4	
B38W25D	15-MAY-97	REG	COPPER	4.6	
B38W25D	01-JUL-98	REG	COPPER	1.3	
B38W25S	03-AUG-93	REG	COPPER	52.4	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
B38W25S	05-JUN-97	REG	COPPER	1	
B38W25S	01-JUL-98	REG	COPPER	7.3	
B38W25S	17-May-99	REG	COPPER	2.8	
MISS01AA	31-JUL-93	REG	COPPER	31.1	
MISS01AA	23-MAY-94	REG	COPPER	11.7	
MISS01AA	23-MAY-97	REG	COPPER	3.9	
MISS02A	20-JUL-93	REG	COPPER	126	
MISS02A	12-MAY-94	REG	COPPER	103	
MISS02A	10-MAY-95	REG	COPPER	173	
MISS02A	16-MAY-96	REG	COPPER	169	
MISS02A	15-MAY-97	REG	COPPER	112	
MISS02A	15-MAY-97	DUP	COPPER	114	
MISS02A	11-JUN-98	DUP	COPPER	96.2	
MISS02A	18-May-99	REG	COPPER	366	
MISS02B	13-MAY-94	REG	COPPER	166	J
MISS02B	09-MAY-95	REG	COPPER	6	
MISS02B	19-MAY-97	REG	COPPER	3.4	
MISS02B	10-JUN-98	REG	COPPER	1.1	
MISS05A	10-MAY-96	REG	COPPER	6	
MISS05A	02-JUN-97	REG	COPPER	3.7	
MISS05A	29-JUN-98	REG	COPPER	4.1	
MISS05A	14-May-99	REG	COPPER	1.7	
MISS05B	11-MAY-95	REG	COPPER	4.9	
MISS05B	30-JUN-98	REG	COPPER	3.4	
MISS06A	04-AUG-93	REG	COPPER	22.9	
MISS06A	24-MAY-94	REG	COPPER	21.8	
MISS06A	16-MAY-95	REG	COPPER	31.3	
MISS06A	10-MAY-96	REG	COPPER	27.2	
MISS06A	03-JUN-97	REG	COPPER	50.1	
MISS06A	01-JUL-98	REG	COPPER	44	
MISS06A	17-May-99	REG	COPPER	29.4	
B38W07B	16-JUN-98	REG	COPPER	4.9	
B38W01S	28-JUL-93	REG	IRON	31000	
B38W01S	23-MAY-94	REG	IRON	27500	
B38W01S	21-MAY-95	REG	IRON	22100	
B38W01S	17-MAY-96	REG	IRON	24700	
B38W01S	04-JUN-97	REG	IRON	28100	J
B38W01S	07-JUL-98	REG	IRON	28900	J
B38W02D	19-MAY-94	REG	IRON	33.1	
B38W02D	20-MAY-95	REG	IRON	72.4	
B38W02D	17-MAY-96	REG	IRON	737	
B38W02D	04-JUN-97	REG	IRON	183	J
B38W02D	30-JUN-98	REG	IRON	580	J
B38W02D	20-May-99	REG	IRON	28.8	
B38W14D	04-AUG-93	REG	IRON	320	
B38W14D	20-MAY-95	REG	IRON	32.4	
B38W14D	07-JUL-98	REG	IRON	274	J
B38W14D	07-JUL-98	DUP	IRON	204	J
B38W14D	17-May-99	REG	IRON	64.2	J
B38W14S	04-AUG-93	REG	IRON	403	
B38W14S	20-MAY-95	REG	IRON	324	
B38W14S	17-MAY-96	REG	IRON	820	
B38W14S	17-MAY-96	DUP	IRON	743	
B38W14S	04-JUN-97	REG	IRON	1200	J
B38W14S	07-JUL-98	REG	IRON	2540	J
B38W14S	17-May-99	REG	IRON	528	J
B38W15D	02-AUG-93	REG	IRON	709	
B38W15D	13-MAY-96	REG	IRON	103	UJ

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
B38W15D	03-JUN-97	REG	IRON	160	J
B38W15D	06-JUL-98	REG	IRON	593	J
B38W15S	02-AUG-93	REG	IRON	537	
B38W15S	26-MAY-94	REG	IRON	400	
B38W15S	19-MAY-95	REG	IRON	1720	
B38W15S	19-MAY-95	DUP	IRON	1450	
B38W15S	13-MAY-96	REG	IRON	530	J
B38W15S	03-JUN-97	REG	IRON	675	J
B38W15S	06-JUL-98	REG	IRON	1010	J
B38W17A	28-JUL-93	REG	IRON	116000	
B38W17A	25-MAY-94	REG	IRON	829	
B38W17A	20-MAY-95	REG	IRON	688	
B38W17A	13-MAY-96	REG	IRON	3280	J
B38W17A	03-JUN-97	REG	IRON	11700	J
B38W17A	02-JUL-98	REG	IRON	27900	J
B38W17A	13-May-99	REG	IRON	377	
B38W17B	29-JUL-93	REG	IRON	6520	J
B38W17B	25-MAY-94	REG	IRON	10200	
B38W17B	20-MAY-95	REG	IRON	6570	
B38W17B	13-MAY-96	REG	IRON	11400	J
B38W17B	03-JUN-97	REG	IRON	9470	J
B38W17B	02-JUL-98	REG	IRON	6890	J
B38W17B	13-May-99	REG	IRON	8350	
B38W18D	21-JUL-93	REG	IRON	16000	J
B38W18D	13-MAY-94	REG	IRON	12900	J
B38W18D	15-MAY-95	REG	IRON	14400	
B38W18D	14-MAY-96	REG	IRON	14200	
B38W18D	09-MAY-97	REG	IRON	12100	
B38W18D	08-JUN-98	REG	IRON	13500	
B38W18D	20-May-99	REG	IRON	14800	
B38W19D	23-JUL-93	REG	IRON	3030	J
B38W19D	16-MAY-94	REG	IRON	4090	
B38W19D	10-MAY-95	REG	IRON	2630	J
B38W19D	16-MAY-96	REG	IRON	3530	
B38W19D	16-MAY-97	REG	IRON	3260	J
B38W19D	17-JUN-98	REG	IRON	3110	J
B38W19D	17-JUN-98	REG	IRON	3160	
B38W19D	27-May-99	REG	IRON	3670	
B38W19S	27-MAY-94	REG	IRON	3240	
B38W19S	17-MAY-95	REG	IRON	1300	
B38W19S	10-MAY-96	REG	IRON	4590	J
B38W19S	29-JUN-98	REG	IRON	5980	J
B38W19S	14-May-99	REG	IRON	6600	
B38W24D	09-AUG-93	REG	IRON	22900	J
B38W24D	18-MAY-94	REG	IRON	21800	
B38W24D	17-MAY-95	REG	IRON	17500	
B38W24D	09-MAY-96	REG	IRON	28600	J
B38W24D	02-JUN-97	REG	IRON	26600	J
B38W24D	02-JUL-98	REG	IRON	25600	J
B38W24D	13-May-99	REG	IRON	27000	
B38W24S	05-AUG-93	REG	IRON	34800	
B38W24S	25-MAY-94	REG	IRON	35900	
B38W24S	17-MAY-95	REG	IRON	46500	
B38W24S	09-MAY-96	REG	IRON	33400	J
B38W24S	02-JUN-97	REG	IRON	51100	J
B38W24S	02-JUL-98	REG	IRON	31700	J
B38W24S	13-May-99	DUP	IRON	36100	
B38W25D	03-AUG-93	REG	IRON	5380	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
B38W25D	18-MAY-94	REG	IRON	5550	
B38W25D	12-MAY-95	REG	IRON	6760	
B38W25D	15-MAY-96	REG	IRON	6460	J
B38W25D	15-MAY-97	REG	IRON	5640	J
B38W25D	01-JUL-98	REG	IRON	4620	J
B38W25D	26-May-99	REG	IRON	4980	
B38W25S	03-AUG-93	REG	IRON	19700	
B38W25S	24-MAY-94	REG	IRON	9080	J
B38W25S	15-MAY-95	REG	IRON	14600	
B38W25S	15-MAY-95	DUP	IRON	12000	
B38W25S	15-MAY-96	REG	IRON	9620	J
B38W25S	15-MAY-96	DUP	IRON	10200	J
B38W25S	05-JUN-97	REG	IRON	6260	J
B38W25S	01-JUL-98	REG	IRON	7490	J
B38W25S	17-May-99	REG	IRON	10400	J
MISS01AA	31-JUL-93	REG	IRON	9340	
MISS01AA	23-MAY-94	REG	IRON	2210	
MISS01AA	18-MAY-95	REG	IRON	360	
MISS01AA	09-MAY-96	REG	IRON	725	J
MISS01AA	23-MAY-97	REG	IRON	571	
MISS01AA	18-JUN-98	REG	IRON	512	
MISS01AA	12-May-99	REG	IRON	2790	
MISS01B	21-JUL-93	REG	IRON	1620	J
MISS01B	16-MAY-94	REG	IRON	7780	
MISS01B	10-MAY-95	REG	IRON	1030	J
MISS01B	15-MAY-96	REG	IRON	6260	J
MISS01B	18-JUN-98	REG	IRON	2080	
MISS01B	25-May-99	REG	IRON	1060	
MISS02A	20-JUL-93	REG	IRON	914	
MISS02A	12-MAY-94	REG	IRON	402	J
MISS02A	10-MAY-95	REG	IRON	892	J
MISS02A	16-MAY-96	REG	IRON	584	
MISS02A	15-MAY-97	REG	IRON	426	J
MISS02A	15-MAY-97	DUP	IRON	500	J
MISS02A	11-JUN-98	REG	IRON	1070	
MISS02A	11-JUN-98	DUP	IRON	1440	
MISS02A	18-May-99	REG	IRON	1010	
MISS02B	20-JUL-93	REG	IRON	19300	
MISS02B	13-MAY-94	REG	IRON	6800	J
MISS02B	09-MAY-95	REG	IRON	8690	
MISS02B	14-MAY-96	REG	IRON	7880	
MISS02B	19-MAY-97	REG	IRON	8880	J
MISS02B	10-JUN-98	REG	IRON	8140	
MISS02B	18-May-99	REG	IRON	8620	
MISS05A	27-MAY-94	REG	IRON	9770	
MISS05A	12-MAY-95	REG	IRON	15800	
MISS05A	10-MAY-96	REG	IRON	6590	J
MISS05A	02-JUN-97	REG	IRON	31600	J
MISS05A	29-JUN-98	REG	IRON	15900	J
MISS05A	14-May-99	REG	IRON	2190	
MISS05B	23-JUL-93	REG	IRON	2660	J
MISS05B	17-MAY-94	REG	IRON	2780	
MISS05B	11-MAY-95	REG	IRON	3180	J
MISS05B	16-MAY-96	REG	IRON	2910	
MISS05B	14-MAY-97	REG	IRON	2560	
MISS05B	30-JUN-98	REG	IRON	13800	J
MISS06A	04-AUG-93	REG	IRON	225	
MISS06A	24-MAY-94	REG	IRON	455	J

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
MISS06A	16-MAY-95	REG	IRON	333	
MISS06A	10-MAY-96	REG	IRON	157	J
MISS06A	03-JUN-97	REG	IRON	759	J
MISS06A	01-JUL-98	REG	IRON	1320	J
MISS06A	17-May-99	REG	IRON	370	J
B38W07B	16-JUN-98	REG	IRON	9160	
B38W07B	27-May-99	REG	IRON	5920	
B38W02D	17-MAY-96	REG	LEAD	1.4	
B38W02D	04-JUN-97	REG	LEAD	2.8	
B38W02D	30-JUN-98	REG	LEAD	7.1	
B38W14D	20-MAY-95	REG	LEAD	2.8	J
B38W14D	07-JUL-98	DUP	LEAD	1.7	
B38W14D	17-May-99	REG	LEAD	0.86	
B38W14S	20-MAY-95	REG	LEAD	2.9	J
B38W14S	17-MAY-96	REG	LEAD	1.2	
B38W14S	17-MAY-96	DUP	LEAD	1.8	
B38W14S	04-JUN-97	REG	LEAD	5.6	
B38W14S	07-JUL-98	REG	LEAD	23.9	
B38W14S	17-May-99	REG	LEAD	2.5	
B38W15D	02-AUG-93	REG	LEAD	27.5	J
B38W15D	03-JUN-97	REG	LEAD	1.8	
B38W15D	06-JUL-98	REG	LEAD	3.3	
B38W15S	02-AUG-93	REG	LEAD	2.3	J
B38W15S	26-MAY-94	REG	LEAD	3	J
B38W15S	19-MAY-95	REG	LEAD	2	
B38W15S	19-MAY-95	DUP	LEAD	2.4	
B38W15S	03-JUN-97	REG	LEAD	4	
B38W15S	06-JUL-98	REG	LEAD	5.3	
B38W17A	28-JUL-93	REG	LEAD	36.6	J
B38W17A	20-MAY-95	REG	LEAD	2.8	J
B38W17A	13-MAY-96	REG	LEAD	1.1	J
B38W17A	03-JUN-97	REG	LEAD	2.3	
B38W17A	02-JUL-98	REG	LEAD	1.3	
B38W18D	14-MAY-96	REG	LEAD	1	
B38W18D	08-JUN-98	REG	LEAD	0.45	
B38W18D	20-May-99	REG	LEAD	1.1	
B38W19S	29-JUN-98	REG	LEAD	0.35	
B38W24D	02-JUL-98	REG	LEAD	2.4	
B38W24D	13-May-99	REG	LEAD	1.2	
B38W24S	17-MAY-95	REG	LEAD	1.8	
B38W24S	02-JUL-98	REG	LEAD	0.85	
B38W25S	24-MAY-94	REG	LEAD	3.8	UJ
B38W25S	15-MAY-96	REG	LEAD	1.5	J
B38W25S	05-JUN-97	REG	LEAD	0.6	
B38W25S	01-JUL-98	REG	LEAD	1.3	
B38W25S	17-May-99	REG	LEAD	0.66	
MISS01AA	31-JUL-93	REG	LEAD	4.1	J
MISS01AA	18-MAY-95	REG	LEAD	2	
MISS01AA	18-JUN-98	REG	LEAD	9.8	
MISS01AA	12-May-99	REG	LEAD	1.6	
MISS02A	20-JUL-93	REG	LEAD	2.5	UJ
MISS02A	12-MAY-94	REG	LEAD	7.3	J
MISS02A	10-MAY-95	REG	LEAD	3.6	
MISS02A	16-MAY-96	REG	LEAD	8.1	
MISS02A	15-MAY-97	REG	LEAD	4.8	J
MISS02A	15-MAY-97	DUP	LEAD	4.7	J

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
MISS02A	11-JUN-98	REG	LEAD	3.9	
MISS02A	11-JUN-98	DUP	LEAD	4.9	
MISS02A	18-May-99	REG	LEAD	11	
MISS05A	29-JUN-98	REG	LEAD	11.9	
MISS05A	14-May-99	REG	LEAD	0.35	
MISS05B	17-MAY-94	REG	LEAD	2.1	J
MISS05B	30-JUN-98	REG	LEAD	0.5	
MISS06A	24-MAY-94	REG	LEAD	4.4	UJ
MISS06A	03-JUN-97	REG	LEAD	13.8	
MISS06A	01-JUL-98	REG	LEAD	17.8	
MISS06A	17-May-99	REG	LEAD	2.9	
B38W01S	28-JUL-93	REG	LITHIUM	2690	
B38W01S	23-MAY-94	REG	LITHIUM	2410	
B38W01S	17-MAY-96	REG	LITHIUM	1830	J
B38W01S	04-JUN-97	REG	LITHIUM	2370	
B38W01S	07-JUL-98	REG	LITHIUM	1840	J
B38W02D	19-MAY-94	REG	LITHIUM	30.1	
B38W02D	04-JUN-97	REG	LITHIUM	14.8	
B38W02D	30-JUN-98	REG	LITHIUM	16.5	J
B38W02D	20-May-99	REG	LITHIUM	11.7	
B38W14D	04-AUG-93	REG	LITHIUM	49.8	
B38W14D	04-JUN-97	REG	LITHIUM	44.5	
B38W14D	07-JUL-98	DUP	LITHIUM	48.4	J
B38W14D	07-JUL-98	REG	LITHIUM	47.2	J
B38W14D	17-May-99	REG	LITHIUM	34.3	
B38W14S	04-AUG-93	REG	LITHIUM	126	
B38W14S	04-JUN-97	REG	LITHIUM	48	
B38W14S	07-JUL-98	REG	LITHIUM	45.5	J
B38W14S	17-May-99	REG	LITHIUM	38	
B38W15D	02-AUG-93	REG	LITHIUM	1740	
B38W15D	26-MAY-94	REG	LITHIUM	2750	
B38W15D	13-MAY-96	REG	LITHIUM	2980	J
B38W15D	03-JUN-97	REG	LITHIUM	2980	
B38W15D	06-JUL-98	REG	LITHIUM	2060	
B38W15S	02-AUG-93	REG	LITHIUM	1910	
B38W15S	02-AUG-93	REG	LITHIUM	1970	
B38W15S	26-MAY-94	REG	LITHIUM	1590	
B38W15S	13-MAY-96	REG	LITHIUM	1800	J
B38W15S	03-JUN-97	REG	LITHIUM	2590	
B38W15S	06-JUL-98	REG	LITHIUM	2590	
B38W17A	28-JUL-93	REG	LITHIUM	348	
B38W17A	25-MAY-94	REG	LITHIUM	347	
B38W17A	13-MAY-96	REG	LITHIUM	431	J
B38W17A	03-JUN-97	REG	LITHIUM	334	
B38W17A	02-JUL-98	REG	LITHIUM	307	J
B38W17A	13-May-99	DUP	LITHIUM	363	
B38W17B	29-JUL-93	REG	LITHIUM	1650	J
B38W17B	25-MAY-94	REG	LITHIUM	1060	
B38W17B	13-MAY-96	REG	LITHIUM	920	J
B38W17B	03-JUN-97	REG	LITHIUM	1740	
B38W17B	02-JUL-98	REG	LITHIUM	1800	J
B38W17B	13-May-99	REG	LITHIUM	1460	J
B38W18D	21-JUL-93	REG	LITHIUM	3610	
B38W18D	13-MAY-94	REG	LITHIUM	3380	J
B38W18D	14-MAY-96	REG	LITHIUM	3000	J
B38W18D	09-MAY-97	REG	LITHIUM	3540	
B38W18D	08-JUN-98	REG	LITHIUM	3790	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
B38W18D	20-May-99	REG	LITHIUM	2850	
B38W19D	23-JUL-93	REG	LITHIUM	6890	
B38W19D	16-MAY-94	REG	LITHIUM	4600	
B38W19D	16-MAY-96	REG	LITHIUM	3800	J
B38W19D	16-MAY-97	REG	LITHIUM	5600	
B38W19D	17-JUN-98	REG	LITHIUM	6220	J
B38W19D	17-JUN-98	REG	LITHIUM	5920	
B38W19D	27-May-99	REG	LITHIUM	6350	J
B38W19S	27-MAY-94	REG	LITHIUM	1690	
B38W19S	10-MAY-96	REG	LITHIUM	1450	J
B38W19S	29-JUN-98	REG	LITHIUM	1700	J
B38W19S	14-May-99	REG	LITHIUM	1400	J
B38W24D	09-AUG-93	REG	LITHIUM	44.1	
B38W24D	18-MAY-94	REG	LITHIUM	37.5	
B38W24D	09-MAY-96	REG	LITHIUM	80.1	J
B38W24D	02-JUN-97	REG	LITHIUM	54.3	
B38W24D	02-JUL-98	REG	LITHIUM	46.1	J
B38W24D	13-May-99	REG	LITHIUM	50.4	
B38W24S	09-MAY-96	REG	LITHIUM	56	J
B38W24S	02-JUN-97	REG	LITHIUM	27.5	
B38W24S	02-JUL-98	REG	LITHIUM	26.5	J
B38W24S	13-May-99	DUP	LITHIUM	32.4	
B38W25D	03-AUG-93	REG	LITHIUM	1330	
B38W25D	18-MAY-94	REG	LITHIUM	1230	
B38W25D	15-MAY-96	REG	LITHIUM	1370	J
B38W25D	15-MAY-97	REG	LITHIUM	1600	
B38W25D	01-JUL-98	REG	LITHIUM	1430	J
B38W25D	26-May-99	REG	LITHIUM	1280	J
B38W25S	03-AUG-93	REG	LITHIUM	1360	
B38W25S	24-MAY-94	REG	LITHIUM	1130	J
B38W25S	15-MAY-96	DUP	LITHIUM	994	J
B38W25S	05-JUN-97	REG	LITHIUM	1190	
B38W25S	01-JUL-98	REG	LITHIUM	827	J
B38W25S	17-May-99	REG	LITHIUM	793	
MISS01AA	31-JUL-93	REG	LITHIUM	442	
MISS01AA	23-MAY-94	REG	LITHIUM	240	
MISS01AA	09-MAY-96	REG	LITHIUM	224	J
MISS01AA	23-MAY-97	REG	LITHIUM	265	
MISS01AA	18-JUN-98	REG	LITHIUM	258	
MISS01AA	12-May-99	REG	LITHIUM	224	J
MISS01B	21-JUL-93	REG	LITHIUM	114	
MISS01B	16-MAY-94	REG	LITHIUM	80.8	
MISS01B	15-MAY-96	REG	LITHIUM	128	J
MISS01B	18-JUN-98	REG	LITHIUM	105	
MISS01B	25-May-99	REG	LITHIUM	95.1	J
MISS02A	20-JUL-93	REG	LITHIUM	6990	
MISS02A	12-MAY-94	REG	LITHIUM	4660	
MISS02A	16-MAY-96	REG	LITHIUM	4480	J
MISS02A	15-MAY-97	REG	LITHIUM	7090	
MISS02A	15-MAY-97	DUP	LITHIUM	6650	
MISS02A	11-JUN-98	DUP	LITHIUM	6110	
MISS02A	11-May-99	REG	LITHIUM	9300	
MISS02B	20-JUL-93	REG	LITHIUM	14100	
MISS02B	13-MAY-94	REG	LITHIUM	10200	J
MISS02B	14-MAY-96	REG	LITHIUM	11900	J
MISS02B	19-MAY-97	REG	LITHIUM	15200	
MISS02B	10-JUN-98	REG	LITHIUM	12800	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
MISS02B	18-May-99	DUP	LITHIUM	12200	J
MISS05A	27-MAY-94	REG	LITHIUM	677	
MISS05A	10-MAY-96	REG	LITHIUM	664	J
MISS05A	02-JUN-97	REG	LITHIUM	854	
MISS05A	29-JUN-98	REG	LITHIUM	660	J
MISS05A	14-May-99	REG	LITHIUM	863	J
MISS05B	23-JUL-93	REG	LITHIUM	2520	
MISS05B	17-MAY-94	REG	LITHIUM	2370	
MISS05B	16-MAY-96	REG	LITHIUM	2130	J
MISS05B	14-MAY-97	REG	LITHIUM	2710	
MISS05B	30-JUN-98	REG	LITHIUM	1920	J
MISS06A	04-AUG-93	REG	LITHIUM	7340	
MISS06A	24-MAY-94	REG	LITHIUM	2140	J
MISS06A	10-MAY-96	REG	LITHIUM	1680	J
MISS06A	03-JUN-97	REG	LITHIUM	2780	
MISS06A	01-JUL-98	REG	LITHIUM	2130	J
MISS06A	17-May-99	REG	LITHIUM	2130	
B38W07B	16-JUN-98	REG	LITHIUM	5480	
B38W07B	27-May-99	REG	LITHIUM	6870	J
B38W01S	28-JUL-93	REG	MAGNESIUM	36900	
B38W01S	23-MAY-94	REG	MAGNESIUM	35400	
B38W01S	21-MAY-95	REG	MAGNESIUM	27600	
B38W01S	17-MAY-96	REG	MAGNESIUM	32800	
B38W01S	04-JUN-97	REG	MAGNESIUM	30300	
B38W01S	07-JUL-98	REG	MAGNESIUM	25600	J
B38W02D	27-JUL-93	REG	MAGNESIUM	3830	
B38W02D	19-MAY-94	REG	MAGNESIUM	3480	
B38W02D	20-MAY-95	REG	MAGNESIUM	3020	
B38W02D	17-MAY-96	REG	MAGNESIUM	3710	
B38W02D	04-JUN-97	REG	MAGNESIUM	3840	
B38W02D	20-May-99	REG	MAGNESIUM	4020	
B38W07B	16-JUN-98	REG	MAGNESIUM	57500	
B38W07B	27-May-99	DUP	MAGNESIUM	88300	
B38W14D	04-AUG-93	REG	MAGNESIUM	25100	J
B38W14D	20-MAY-95	REG	MAGNESIUM	19500	
B38W14D	17-MAY-96	REG	MAGNESIUM	27800	
B38W14D	04-JUN-97	REG	MAGNESIUM	27700	
B38W14D	07-JUL-98	DUP	MAGNESIUM	28700	J
B38W14D	17-May-99	REG	MAGNESIUM	30000	
B38W14S	04-AUG-93	REG	MAGNESIUM	12100	J
B38W14S	20-MAY-95	REG	MAGNESIUM	20000	
B38W14S	17-MAY-96	REG	MAGNESIUM	28900	
B38W14S	17-MAY-96	DUP	MAGNESIUM	26300	
B38W14S	04-JUN-97	REG	MAGNESIUM	25300	
B38W14S	07-JUL-98	REG	MAGNESIUM	25000	J
B38W14S	17-May-99	REG	MAGNESIUM	27400	
B38W15D	02-AUG-93	REG	MAGNESIUM	18100	
B38W15D	26-MAY-94	REG	MAGNESIUM	35500	
B38W15D	19-MAY-95	REG	MAGNESIUM	22700	J
B38W15D	13-MAY-96	REG	MAGNESIUM	37500	
B38W15D	03-JUN-97	REG	MAGNESIUM	26500	
B38W15D	06-JUL-98	REG	MAGNESIUM	17100	J
B38W15S	02-AUG-93	REG	MAGNESIUM	25200	
B38W15S	26-MAY-94	REG	MAGNESIUM	19300	
B38W15S	19-MAY-95	REG	MAGNESIUM	27700	J
B38W15S	19-MAY-95	DUP	MAGNESIUM	25300	J
B38W15S	13-MAY-96	REG	MAGNESIUM	17800	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
B38W15S	03-JUN-97	REG	MAGNESIUM	19000	
B38W15S	06-JUL-98	REG	MAGNESIUM	18100	J
B38W17A	28-JUL-93	REG	MAGNESIUM	13300	
B38W17A	25-MAY-94	REG	MAGNESIUM	7340	
B38W17A	20-MAY-95	REG	MAGNESIUM	5610	
B38W17A	13-MAY-96	REG	MAGNESIUM	9720	
B38W17A	03-JUN-97	REG	MAGNESIUM	5620	
B38W17A	02-JUL-98	REG	MAGNESIUM	6280	J
B38W17A	13-May-99	DUP	MAGNESIUM	9300	
B38W17B	29-JUL-93	REG	MAGNESIUM	25400	J
B38W17B	25-MAY-94	REG	MAGNESIUM	26600	
B38W17B	20-MAY-95	REG	MAGNESIUM	22800	
B38W17B	13-MAY-96	REG	MAGNESIUM	23500	
B38W17B	03-JUN-97	REG	MAGNESIUM	24900	
B38W17B	13-May-99	REG	MAGNESIUM	25200	
B38W18D	21-JUL-93	REG	MAGNESIUM	13600	
B38W18D	13-MAY-94	REG	MAGNESIUM	14400	J
B38W18D	15-MAY-95	REG	MAGNESIUM	14100	
B38W18D	14-MAY-96	REG	MAGNESIUM	14300	
B38W18D	09-MAY-97	REG	MAGNESIUM	14000	
B38W18D	08-JUN-98	REG	MAGNESIUM	14400	
B38W18D	20-May-99	REG	MAGNESIUM	14500	
B38W19D	23-JUL-93	REG	MAGNESIUM	37200	
B38W19D	16-MAY-94	REG	MAGNESIUM	52600	
B38W19D	10-MAY-95	REG	MAGNESIUM	31200	
B38W19D	16-MAY-96	REG	MAGNESIUM	43900	
B38W19D	16-MAY-97	REG	MAGNESIUM	36600	J
B38W19D	17-JUN-98	REG	MAGNESIUM	38900	
B38W19D	27-May-99	REG	MAGNESIUM	42000	
B38W19S	27-MAY-94	REG	MAGNESIUM	76200	
B38W19S	17-MAY-95	REG	MAGNESIUM	69000	
B38W19S	10-MAY-96	REG	MAGNESIUM	62600	
B38W19S	29-JUN-98	REG	MAGNESIUM	43300	J
B38W19S	14-May-99	REG	MAGNESIUM	46100	
B38W24D	09-AUG-93	REG	MAGNESIUM	9710	J
B38W24D	18-MAY-94	REG	MAGNESIUM	9810	
B38W24D	17-MAY-95	REG	MAGNESIUM	8290	
B38W24D	09-MAY-96	REG	MAGNESIUM	11600	
B38W24D	02-JUN-97	REG	MAGNESIUM	10100	
B38W24D	02-JUL-98	REG	MAGNESIUM	9790	J
B38W24D	24-May-99	REG	MAGNESIUM	11400	
B38W24S	05-AUG-93	REG	MAGNESIUM	6330	J
B38W24S	25-MAY-94	REG	MAGNESIUM	7930	
B38W24S	17-MAY-95	REG	MAGNESIUM	8430	
B38W24S	09-MAY-96	REG	MAGNESIUM	8550	
B38W24S	02-JUN-97	REG	MAGNESIUM	6280	
B38W24S	02-JUL-98	REG	MAGNESIUM	5810	J
B38W24S	13-May-99	REG	MAGNESIUM	4910	
B38W25D	03-AUG-93	REG	MAGNESIUM	6810	
B38W25D	18-MAY-94	REG	MAGNESIUM	5680	
B38W25D	12-MAY-95	REG	MAGNESIUM	6940	
B38W25D	15-MAY-96	REG	MAGNESIUM	6470	
B38W25D	15-MAY-97	REG	MAGNESIUM	5670	J
B38W25D	01-JUL-98	REG	MAGNESIUM	5520	J
B38W25D	26-May-99	REG	MAGNESIUM	5290	
B38W25S	03-AUG-93	REG	MAGNESIUM	7480	
B38W25S	24-MAY-94	REG	MAGNESIUM	7290	J
B38W25S	15-MAY-95	REG	MAGNESIUM	9110	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
B38W25S	15-MAY-95	DUP	MAGNESIUM	7630	
B38W25S	15-MAY-96	REG	MAGNESIUM	7550	
B38W25S	15-MAY-96	DUP	MAGNESIUM	7980	
B38W25S	05-JUN-97	REG	MAGNESIUM	7470	
B38W25S	01-JUL-98	REG	MAGNESIUM	7810	J
B38W25S	17-May-99	REG	MAGNESIUM	6150	
MISS01AA	31-JUL-93	REG	MAGNESIUM	23800	
MISS01AA	23-MAY-94	REG	MAGNESIUM	22200	
MISS01AA	18-MAY-95	REG	MAGNESIUM	22000	
MISS01AA	09-MAY-96	REG	MAGNESIUM	24100	
MISS01AA	23-MAY-97	REG	MAGNESIUM	32100	
MISS01AA	18-JUN-98	REG	MAGNESIUM	33800	
MISS01AA	12-May-99	REG	MAGNESIUM	31700	
MISS01B	21-JUL-93	REG	MAGNESIUM	18700	
MISS01B	16-MAY-94	REG	MAGNESIUM	18400	
MISS01B	10-MAY-95	REG	MAGNESIUM	17600	
MISS01B	15-MAY-96	REG	MAGNESIUM	19200	
MISS01B	18-JUN-98	REG	MAGNESIUM	18900	
MISS01B	25-May-99	REG	MAGNESIUM	18800	
MISS02A	20-JUL-93	REG	MAGNESIUM	16100	
MISS02A	12-MAY-94	REG	MAGNESIUM	7980	
MISS02A	10-MAY-95	REG	MAGNESIUM	3410	
MISS02A	16-MAY-96	REG	MAGNESIUM	5980	
MISS02A	15-MAY-97	REG	MAGNESIUM	7560	J
MISS02A	15-MAY-97	DUP	MAGNESIUM	7030	J
MISS02A	11-JUN-98	DUP	MAGNESIUM	11800	
MISS02A	18-May-99	REG	MAGNESIUM	5700	
MISS02B	20-JUL-93	REG	MAGNESIUM	42300	
MISS02B	13-MAY-94	REG	MAGNESIUM	30100	J
MISS02B	09-MAY-95	REG	MAGNESIUM	33600	
MISS02B	14-MAY-96	REG	MAGNESIUM	36100	
MISS02B	19-MAY-97	REG	MAGNESIUM	32500	J
MISS02B	10-JUN-98	REG	MAGNESIUM	34600	
MISS02B	18-May-99	DUP	MAGNESIUM	40500	
MISS05A	27-MAY-94	REG	MAGNESIUM	48200	
MISS05A	12-MAY-95	REG	MAGNESIUM	79200	
MISS05A	10-MAY-96	REG	MAGNESIUM	42700	
MISS05A	02-JUN-97	REG	MAGNESIUM	43300	
MISS05A	29-JUN-98	REG	MAGNESIUM	33100	J
MISS05A	14-May-99	REG	MAGNESIUM	47700	
MISS05B	23-JUL-93	REG	MAGNESIUM	58200	
MISS05B	17-MAY-94	REG	MAGNESIUM	64400	
MISS05B	11-MAY-95	REG	MAGNESIUM	52200	J
MISS05B	16-MAY-96	REG	MAGNESIUM	47400	
MISS05B	14-MAY-97	REG	MAGNESIUM	60300	
MISS05B	30-JUN-98	REG	MAGNESIUM	19000	J
MISS06A	04-AUG-93	REG	MAGNESIUM	14800	J
MISS06A	24-MAY-94	REG	MAGNESIUM	9830	J
MISS06A	16-MAY-95	REG	MAGNESIUM	19200	
MISS06A	10-MAY-96	REG	MAGNESIUM	8630	
MISS06A	03-JUN-97	REG	MAGNESIUM	13600	
MISS06A	01-JUL-98	REG	MAGNESIUM	9670	J
MISS06A	17-May-99	DUP	MAGNESIUM	12400	
B38W01S	28-JUL-93	REG	MANGANESE	2880	J
B38W01S	23-MAY-94	REG	MANGANESE	2910	
B38W01S	21-MAY-95	REG	MANGANESE	2340	
B38W01S	17-MAY-96	REG	MANGANESE	2810	
B38W01S	04-JUN-97	REG	MANGANESE	2780	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
B38W01S	07-JUL-98	REG	MANGANESE	2270	
B38W02D	27-JUL-93	REG	MANGANESE	2220	J
B38W02D	19-MAY-94	REG	MANGANESE	2000	
B38W02D	20-MAY-95	REG	MANGANESE	1240	
B38W02D	17-MAY-96	REG	MANGANESE	1350	
B38W02D	04-JUN-97	REG	MANGANESE	2480	
B38W02D	30-JUN-98	REG	MANGANESE	3700	
B38W02D	20-May-99	REG	MANGANESE	1130	
B38W14D	04-AUG-93	REG	MANGANESE	31.7	
B38W14D	20-MAY-95	REG	MANGANESE	5.3	
B38W14D	17-MAY-96	REG	MANGANESE	5.3	
B38W14D	04-JUN-97	REG	MANGANESE	33.5	
B38W14D	07-JUL-98	REG	MANGANESE	14.2	
B38W14D	07-JUL-98	DUP	MANGANESE	13.3	
B38W14D	17-May-99	REG	MANGANESE	6.1	J
B38W14S	04-AUG-93	REG	MANGANESE	505	
B38W14S	20-MAY-95	REG	MANGANESE	7.9	
B38W14S	17-MAY-96	REG	MANGANESE	22.6	
B38W14S	17-MAY-96	DUP	MANGANESE	20.3	
B38W14S	04-JUN-97	REG	MANGANESE	15.7	
B38W14S	07-JUL-98	REG	MANGANESE	126	J
B38W14S	17-May-99	REG	MANGANESE	32.1	
B38W15D	02-AUG-93	REG	MANGANESE	474	J
B38W15D	26-MAY-94	REG	MANGANESE	944	
B38W15D	19-MAY-95	REG	MANGANESE	638	J
B38W15D	13-MAY-96	REG	MANGANESE	1080	J
B38W15D	03-JUN-97	REG	MANGANESE	809	
B38W15D	06-JUL-98	REG	MANGANESE	514	
B38W15S	02-AUG-93	REG	MANGANESE	1850	J
B38W15S	26-MAY-94	REG	MANGANESE	1370	
B38W15S	19-MAY-95	REG	MANGANESE	2170	J
B38W15S	19-MAY-95	DUP	MANGANESE	1970	J
B38W15S	13-MAY-96	REG	MANGANESE	1400	J
B38W15S	03-JUN-97	REG	MANGANESE	1540	
B38W15S	06-JUL-98	REG	MANGANESE	1550	
B38W17A	28-JUL-93	REG	MANGANESE	1030	J
B38W17A	25-MAY-94	REG	MANGANESE	57.7	
B38W17A	20-MAY-95	REG	MANGANESE	55.9	
B38W17A	13-MAY-96	REG	MANGANESE	38.4	J
B38W17A	03-JUN-97	REG	MANGANESE	59.9	
B38W17A	02-JUL-98	REG	MANGANESE	137	
B38W17A	13-May-99	DUP	MANGANESE	42.7	
B38W17B	29-JUL-93	REG	MANGANESE	3940	J
B38W17B	25-MAY-94	REG	MANGANESE	4650	
B38W17B	20-MAY-95	REG	MANGANESE	4020	
B38W17B	13-MAY-96	REG	MANGANESE	4710	J
B38W17B	03-JUN-97	REG	MANGANESE	4860	
B38W17B	02-JUL-98	REG	MANGANESE	3940	
B38W17B	13-May-99	REG	MANGANESE	4920	
B38W18D	21-JUL-93	REG	MANGANESE	4010	J
B38W18D	13-MAY-94	REG	MANGANESE	3800	J
B38W18D	15-MAY-95	REG	MANGANESE	4010	
B38W18D	14-MAY-96	REG	MANGANESE	3950	
B38W18D	09-MAY-97	REG	MANGANESE	2980	
B38W18D	08-JUN-98	REG	MANGANESE	3670	
B38W18D	20-May-99	REG	MANGANESE	4590	
B38W19D	23-JUL-93	REG	MANGANESE	2450	J
B38W19D	16-MAY-94	REG	MANGANESE	3090	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
B38W19D	10-MAY-95	REG	MANGANESE	2030	
B38W19D	16-MAY-96	REG	MANGANESE	2570	
B38W19D	16-MAY-97	REG	MANGANESE	2400	
B38W19D	17-JUN-98	REG	MANGANESE	2530	
B38W19D	27-May-99	REG	MANGANESE	2820	
B38W19S	27-MAY-94	REG	MANGANESE	860	
B38W19S	17-MAY-95	REG	MANGANESE	301	
B38W19S	10-MAY-96	REG	MANGANESE	744	J
B38W19S	29-JUN-98	REG	MANGANESE	682	
B38W19S	29-May-99	REG	MANGANESE	841	
B38W24D	09-AUG-93	REG	MANGANESE	5620	
B38W24D	18-MAY-94	REG	MANGANESE	4730	J
B38W24D	17-MAY-95	REG	MANGANESE	3980	
B38W24D	09-MAY-96	REG	MANGANESE	6190	J
B38W24D	02-JUN-97	REG	MANGANESE	5600	
B38W24D	02-JUL-98	REG	MANGANESE	4720	
B38W24D	13-May-99	REG	MANGANESE	5860	
B38W24S	05-AUG-93	REG	MANGANESE	4720	
B38W24S	25-MAY-94	REG	MANGANESE	4610	
B38W24S	17-MAY-95	REG	MANGANESE	5420	
B38W24S	09-MAY-96	REG	MANGANESE	4430	J
B38W24S	02-JUN-97	REG	MANGANESE	3190	
B38W24S	02-JUL-98	REG	MANGANESE	2910	
B38W24S	13-May-99	DUP	MANGANESE	5040	
B38W25D	03-AUG-93	REG	MANGANESE	1620	J
B38W25D	18-MAY-94	REG	MANGANESE	1380	J
B38W25D	12-MAY-95	REG	MANGANESE	1740	J
B38W25D	15-MAY-96	REG	MANGANESE	1610	J
B38W25D	15-MAY-97	REG	MANGANESE	1380	
B38W25D	01-JUL-98	REG	MANGANESE	1400	
B38W25D	26-May-99	REG	MANGANESE	1390	
B38W25S	03-AUG-93	REG	MANGANESE	1730	J
B38W25S	24-MAY-94	REG	MANGANESE	1250	J
B38W25S	15-MAY-95	REG	MANGANESE	1540	
B38W25S	15-MAY-95	DUP	MANGANESE	1410	
B38W25S	15-MAY-96	REG	MANGANESE	1330	J
B38W25S	15-MAY-96	DUP	MANGANESE	1480	J
B38W25S	05-JUN-97	REG	MANGANESE	1450	
B38W25S	01-JUL-98	REG	MANGANESE	2390	
B38W25S	17-May-99	REG	MANGANESE	2670	J
MISS01AA	31-JUL-93	REG	MANGANESE	309	J
MISS01AA	23-MAY-94	REG	MANGANESE	156	
MISS01AA	18-MAY-95	REG	MANGANESE	8.6	
MISS01AA	09-MAY-96	REG	MANGANESE	119	J
MISS01AA	23-MAY-97	REG	MANGANESE	116	
MISS01AA	18-JUN-98	REG	MANGANESE	117	
MISS01AA	12-May-99	REG	MANGANESE	118	
MISS01B	21-JUL-93	REG	MANGANESE	236	J
MISS01B	16-MAY-94	REG	MANGANESE	356	
MISS01B	10-MAY-95	REG	MANGANESE	271	
MISS01B	15-MAY-96	REG	MANGANESE	390	J
MISS01B	18-JUN-98	REG	MANGANESE	375	
MISS01B	25-May-99	REG	MANGANESE	359	
MISS02A	20-JUL-93	REG	MANGANESE	96.8	
MISS02A	12-MAY-94	REG	MANGANESE	21.9	J
MISS02A	10-MAY-95	REG	MANGANESE	50.6	
MISS02A	16-MAY-96	REG	MANGANESE	20.9	
MISS02A	15-MAY-97	DUP	MANGANESE	19.4	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
MISS02A	11-JUN-98	DUP	MANGANESE	49.7	
MISS02A	18-May-99	REG	MANGANESE	71	
MISS02B	20-JUL-93	REG	MANGANESE	4500	
MISS02B	13-MAY-94	REG	MANGANESE	4190	J
MISS02B	09-MAY-95	REG	MANGANESE	4210	
MISS02B	14-MAY-96	REG	MANGANESE	5470	
MISS02B	19-MAY-97	REG	MANGANESE	4630	
MISS02B	10-JUN-98	REG	MANGANESE	5120	
MISS02B	18-May-99	DUP	MANGANESE	5650	
MISS05A	27-MAY-94	REG	MANGANESE	728	
MISS05A	12-MAY-95	REG	MANGANESE	1330	J
MISS05A	10-MAY-96	REG	MANGANESE	646	J
MISS05A	02-JUN-97	REG	MANGANESE	584	
MISS05A	29-JUN-98	REG	MANGANESE	330	
MISS05A	14-May-99	REG	MANGANESE	688	
MISS05B	23-JUL-93	REG	MANGANESE	2220	J
MISS05B	17-MAY-94	REG	MANGANESE	2530	
MISS05B	11-MAY-95	REG	MANGANESE	2180	
MISS05B	16-MAY-96	REG	MANGANESE	1920	
MISS05B	14-MAY-97	REG	MANGANESE	2450	
MISS05B	30-JUN-98	REG	MANGANESE	771	
MISS06A	04-AUG-93	REG	MANGANESE	826	
MISS06A	24-MAY-94	REG	MANGANESE	49.7	J
MISS06A	16-MAY-95	REG	MANGANESE	1540	
MISS06A	10-MAY-96	REG	MANGANESE	95	J
MISS06A	03-JUN-97	REG	MANGANESE	374	
MISS06A	01-JUL-98	REG	MANGANESE	267	
MISS06A	17-May-99	REG	MANGANESE	58.6	J
MISS02A	11-JUN-98	REG	MERCURY	0.51	J
MISS02A	11-JUN-98	DUP	MERCURY	0.52	J
B38W02D	20-MAY-95	REG	MOLYBDENUM	9.7	
B38W02D	04-JUN-97	REG	MOLYBDENUM	2.5	
B38W02D	30-JUN-98	REG	MOLYBDENUM	23.6	
B38W14D	20-MAY-95	REG	MOLYBDENUM	16.6	
B38W14S	20-MAY-95	REG	MOLYBDENUM	18.1	
B38W14S	04-JUN-97	REG	MOLYBDENUM	20.5	
B38W14S	07-JUL-98	REG	MOLYBDENUM	29.7	
B38W14S	17-May-99	REG	MOLYBDENUM	9.4	
B38W17A	28-JUL-93	REG	MOLYBDENUM	281	
B38W17A	20-MAY-95	REG	MOLYBDENUM	18.9	
B38W17A	03-JUN-97	REG	MOLYBDENUM	18.7	
B38W17A	02-JUL-98	REG	MOLYBDENUM	79.1	
B38W17A	13-May-99	REG	MOLYBDENUM	2.6	
B38W18D	08-JUN-98	REG	MOLYBDENUM	9.7	
B38W19S	17-MAY-95	REG	MOLYBDENUM	20.4	
B38W19S	10-MAY-96	REG	MOLYBDENUM	10.1	
B38W24D	02-JUL-98	REG	MOLYBDENUM	3.9	
B38W25S	24-MAY-94	REG	MOLYBDENUM	6.4	
B38W25S	01-JUL-98	REG	MOLYBDENUM	7.6	
B38W25S	17-May-99	REG	MOLYBDENUM	16.6	
MISS01AA	23-MAY-94	REG	MOLYBDENUM	49.2	J
MISS01AA	18-MAY-95	REG	MOLYBDENUM	10	
MISS01AA	23-MAY-97	REG	MOLYBDENUM	1.8	
MISS01AA	18-JUN-98	REG	MOLYBDENUM	3	
MISS02A	12-MAY-94	REG	MOLYBDENUM	5.9	J
MISS02A	15-MAY-97	REG	MOLYBDENUM	3.5	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
MISS02A	15-MAY-97	DUP	MOLYBDENUM	3.5	
MISS02A	11-JUN-98	REG	MOLYBDENUM	3.4	
MISS02A	11-JUN-98	DUP	MOLYBDENUM	3.8	
MISS02A	11-JUN-99	REG	MOLYBDENUM	31.1	
MISS05A	02-JUN-97	REG	MOLYBDENUM	2.5	
MISS05A	29-JUN-98	REG	MOLYBDENUM	3.3	
MISS05A	14-May-99	REG	MOLYBDENUM	1.9	
B38W01S	28-JUL-93	REG	NICKEL	14.8	
B38W01S	04-JUN-97	REG	NICKEL	3.6	
B38W01S	07-JUL-98	REG	NICKEL	2.7	
B38W02D	27-JUL-93	REG	NICKEL	14.8	
B38W02D	19-MAY-94	REG	NICKEL	10.1	
B38W02D	17-MAY-96	REG	NICKEL	40.8	
B38W02D	04-JUN-97	REG	NICKEL	17.6	
B38W02D	30-JUN-98	REG	NICKEL	41.6	
B38W02D	20-May-99	REG	NICKEL	5.7	
B38W14D	04-JUN-97	REG	NICKEL	18.5	
B38W14D	07-JUL-98	REG	NICKEL	10.2	
B38W14D	07-JUL-98	DUP	NICKEL	9.1	
B38W14D	17-MAY-99	REG	NICKEL	3.3	
B38W14S	04-Aug-93	REG	NICKEL	31.2	
B38W14S	17-MAY-96	REG	NICKEL	17	
B38W14S	17-MAY-96	DUP	NICKEL	17	
B38W14S	04-JUN-97	REG	NICKEL	19.7	
B38W14S	07-JUL-98	REG	NICKEL	31.3	
B38W14S	17-MAY-99	REG	NICKEL	23.5	
B38W15D	26-MAY-94	REG	NICKEL	30.9	
B38W15D	03-JUN-97	REG	NICKEL	6.8	
B38W15D	06-JUL-98	REG	NICKEL	8.2	
B38W15S	03-JUN-97	REG	NICKEL	3.8	
B38W15S	06-JUL-98	REG	NICKEL	5.2	
B38W17A	28-JUL-93	REG	NICKEL	824	
B38W17A	25-MAY-94	REG	NICKEL	153	
B38W17A	20-MAY-95	REG	NICKEL	167	
B38W17A	13-MAY-96	REG	NICKEL	143	
B38W17A	03-JUN-97	REG	NICKEL	148	
B38W17A	02-JUL-98	REG	NICKEL	201	
B38W17A	13-MAY-99	DUP	NICKEL	120	
B38W17B	03-JUN-97	REG	NICKEL	1.2	
B38W17B	02-JUL-98	REG	NICKEL	2.4	
B38W17B	13-MAY-99	REG	NICKEL	1.6	
B38W18D	21-JUL-93	REG	NICKEL	37.6	
B38W18D	13-MAY-94	REG	NICKEL	39.5	J
B38W18D	15-MAY-95	REG	NICKEL	26.3	
B38W18D	14-MAY-96	REG	NICKEL	28.4	
B38W18D	09-MAY-97	REG	NICKEL	17.3	
B38W18D	08-JUN-98	REG	NICKEL	55.5	
B38W18D	20-MAY-99	REG	NICKEL	24.9	
B38W19D	16-MAY-97	REG	NICKEL	3.9	
B38W19D	17-JUN-98	REG	NICKEL	1.9	
B38W19D	27-MAY-99	REG	NICKEL	1.7	
B38W19S	29-JUN-98	REG	NICKEL	4.7	
B38W19S	14-MAY-99	REG	NICKEL	4.2	
B38W24D	18-MAY-94	REG	NICKEL	12.5	
B38W24D	02-JUN-97	REG	NICKEL	1.2	
B38W24D	02-JUL-98	REG	NICKEL	14.7	
B38W24D	13-MAY-99	REG	NICKEL	4.4	
B38W24S	02-JUN-97	REG	NICKEL	5.4	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
B38W24S	02-JUL-98	REG	NICKEL	0.85	
B38W25D	12-MAY-95	REG	NICKEL	27.7	
B38W25D	15-MAY-97	REG	NICKEL	5.3	
B38W25D	01-JUL-98	REG	NICKEL	2.7	
B38W25D	26-MAY-99	REG	NICKEL	2.7	
B38W25S	03-AUG-93	REG	NICKEL	134	
B38W25S	15-MAY-95	REG	NICKEL	22.5	
B38W25S	15-MAY-95	DUP	NICKEL	30	
B38W25S	05-JUN-97	REG	NICKEL	5.8	
B38W25S	01-JUL-98	REG	NICKEL	35.1	
B38W25S	17-MAY-99	DUP	NICKEL	78.1	
MISS01AA	31-JUL-93	REG	NICKEL	66.5	
MISS01AA	23-MAY-94	REG	NICKEL	243	
MISS01AA	23-MAY-97	REG	NICKEL	4.1	
MISS01AA	18-JUN-98	REG	NICKEL	9.9	
MISS01AA	12-MAY-99	REG	NICKEL	3.6	
MISS02A	20-JUL-93	REG	NICKEL	20.7	
MISS02A	12-MAY-94	REG	NICKEL	27.1	
MISS02A	10-MAY-95	REG	NICKEL	11.4	
MISS02A	15-MAY-97	REG	NICKEL	12.2	
MISS02A	15-MAY-97	DUP	NICKEL	13.5	
MISS02A	11-JUN-98	REG	NICKEL	9.7	
MISS02A	11-JUN-98	DUP	NICKEL	10.4	
MISS02A	18-MAY-99	REG	NICKEL	31.1	
MISS02B	20-JUL-93	REG	NICKEL	22.6	
MISS02B	13-MAY-94	REG	NICKEL	181	J
MISS02B	19-MAY-97	REG	NICKEL	9.2	
MISS02B	10-JUN-98	REG	NICKEL	9.2	
MISS02B	18-MAY-99	REG	NICKEL	9.6	
MISS05A	10-MAY-96	REG	NICKEL	10.9	
MISS05A	02-JUN-97	REG	NICKEL	6.1	
MISS05A	29-JUN-98	REG	NICKEL	5	
MISS05A	14-MAY-99	REG	NICKEL	22.8	
MISS05B	23-JUL-93	REG	NICKEL	17.7	
MISS05B	14-MAY-97	REG	NICKEL	4.1	
MISS05B	30-JUN-98	REG	NICKEL	10.8	
MISS06A	10-MAY-96	REG	NICKEL	17.3	
MISS06A	03-JUN-97	REG	NICKEL	10.6	
MISS06A	01-JUL-98	REG	NICKEL	8.1	
MISS06A	17-MAY-99	DUP	NICKEL	7.9	
B38W01S	28-JUL-93	REG	POTASSIUM	59500	
B38W01S	23-MAY-94	REG	POTASSIUM	54100	
B38W01S	21-MAY-95	REG	POTASSIUM	44600	
B38W01S	17-MAY-96	REG	POTASSIUM	49300	
B38W01S	04-JUN-97	REG	POTASSIUM	49500	
B38W01S	07-JUL-98	REG	POTASSIUM	43700	
B38W02D	19-MAY-94	REG	POTASSIUM	1210	
B38W02D	17-MAY-96	REG	POTASSIUM	449	
B38W02D	04-JUN-97	REG	POTASSIUM	819	
B38W02D	30-JUN-98	REG	POTASSIUM	941	
B38W02D	20-MAY-99	REG	POTASSIUM	777	
B38W14D	04-AUG-93	REG	POTASSIUM	7440	
B38W14D	20-MAY-95	REG	POTASSIUM	3750	
B38W14D	17-MAY-96	REG	POTASSIUM	4380	
B38W14D	04-JUN-97	REG	POTASSIUM	5300	
B38W14D	07-JUL-98	REG	POTASSIUM	6020	
B38W14D	07-JUL-98	DUP	POTASSIUM	6110	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
B38W14D	17-MAY-99	REG	POTASSIUM	4140	
B38W14S	04-AUG-93	REG	POTASSIUM	5700	
B38W14S	20-MAY-95	REG	POTASSIUM	2850	
B38W14S	17-MAY-96	REG	POTASSIUM	3720	
B38W14S	17-MAY-96	DUP	POTASSIUM	3790	
B38W14S	04-JUN-97	REG	POTASSIUM	5080	
B38W14S	07-JUL-98	REG	POTASSIUM	4930	
B38W14S	17-MAY-99	REG	POTASSIUM	4810	
B38W15D	02-AUG-93	REG	POTASSIUM	41200	
B38W15D	26-MAY-94	REG	POTASSIUM	58800	
B38W15D	19-MAY-95	REG	POTASSIUM	43300	J
B38W15D	13-MAY-96	REG	POTASSIUM	65000	J
B38W15D	03-JUN-97	REG	POTASSIUM	50500	
B38W15D	06-JUL-98	REG	POTASSIUM	44200	
B38W15S	02-AUG-93	REG	POTASSIUM	146000	
B38W15S	26-MAY-94	REG	POTASSIUM	138000	
B38W15S	19-MAY-95	REG	POTASSIUM	168000	J
B38W15S	19-MAY-95	DUP	POTASSIUM	154000	J
B38W15S	13-MAY-96	REG	POTASSIUM	136000	J
B38W15S	03-JUN-97	REG	POTASSIUM	136000	
B38W15S	06-JUL-98	REG	POTASSIUM	120000	
B38W17A	28-JUL-93	REG	POTASSIUM	26600	
B38W17A	25-MAY-94	REG	POTASSIUM	20300	
B38W17A	20-MAY-95	REG	POTASSIUM	13900	
B38W17A	13-MAY-96	REG	POTASSIUM	31000	J
B38W17A	03-JUN-97	REG	POTASSIUM	19200	
B38W17A	02-JUL-98	REG	POTASSIUM	20800	
B38W17A	13-MAY-99	DUP	POTASSIUM	25000	
B38W17B	29-JUL-93	REG	POTASSIUM	78400	J
B38W17B	25-MAY-94	REG	POTASSIUM	83300	
B38W17B	20-MAY-95	REG	POTASSIUM	73200	
B38W17B	13-MAY-96	REG	POTASSIUM	88500	J
B38W17B	03-JUN-97	REG	POTASSIUM	91100	
B38W17B	02-JUL-98	REG	POTASSIUM	88000	
B38W17B	13-MAY-99	REG	POTASSIUM	98900	
B38W18D	21-JUL-93	REG	POTASSIUM	6910	
B38W18D	13-MAY-94	REG	POTASSIUM	6240	J
B38W18D	15-MAY-95	REG	POTASSIUM	6370	
B38W18D	14-MAY-96	REG	POTASSIUM	6830	
B38W18D	09-MAY-97	REG	POTASSIUM	7530	
B38W18D	08-JUN-98	REG	POTASSIUM	8870	
B38W18D	20-MAY-99	DUP	POTASSIUM	7370	
B38W19D	23-JUL-93	REG	POTASSIUM	381000	
B38W19D	16-MAY-94	REG	POTASSIUM	485000	
B38W19D	10-MAY-95	REG	POTASSIUM	329000	
B38W19D	16-MAY-96	REG	POTASSIUM	435000	
B38W19D	16-MAY-97	REG	POTASSIUM	397000	J
B38W19D	17-JUN-98	REG	POTASSIUM	415000	J
B38W19D	27-MAY-99	REG	POTASSIUM	408000	
B38W19S	27-MAY-94	REG	POTASSIUM	43500	
B38W19S	17-MAY-95	REG	POTASSIUM	40400	
B38W19S	10-MAY-96	REG	POTASSIUM	33500	J
B38W19S	29-JUN-98	REG	POTASSIUM	31800	
B38W19S	14-MAY-99	REG	POTASSIUM	35500	
B38W24D	09-AUG-93	REG	POTASSIUM	13000	
B38W24D	18-MAY-94	REG	POTASSIUM	9900	
B38W24D	17-MAY-95	REG	POTASSIUM	7530	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
B38W24D	09-MAY-96	REG	POTASSIUM	12700	J
B38W24D	02-JUN-97	REG	POTASSIUM	12800	
B38W24D	02-JUL-98	REG	POTASSIUM	12200	
B38W24D	13-MAY-99	REG	POTASSIUM	12800	
B38W24S	05-AUG-93	REG	POTASSIUM	8060	
B38W24S	25-MAY-94	REG	POTASSIUM	6600	
B38W24S	17-MAY-95	REG	POTASSIUM	7050	
B38W24S	09-MAY-96	REG	POTASSIUM	8790	J
B38W24S	02-JUN-97	REG	POTASSIUM	6030	
B38W24S	02-JUL-98	REG	POTASSIUM	6450	
B38W24S	13-MAY-99	DUP	POTASSIUM	7710	
B38W25D	03-AUG-93	REG	POTASSIUM	92300	
B38W25D	18-MAY-94	REG	POTASSIUM	62800	
B38W25D	12-MAY-95	REG	POTASSIUM	73900	J
B38W25D	15-MAY-96	REG	POTASSIUM	77800	J
B38W25D	15-MAY-97	REG	POTASSIUM	61700	J
B38W25D	01-JUL-98	REG	POTASSIUM	56900	
B38W25D	26-MAY-99	DUP	POTASSIUM	56200	
B38W25S	03-AUG-93	REG	POTASSIUM	167000	
B38W25S	24-MAY-94	REG	POTASSIUM	89600	J
B38W25S	15-MAY-95	REG	POTASSIUM	88400	
B38W25S	15-MAY-95	DUP	POTASSIUM	88800	
B38W25S	15-MAY-96	REG	POTASSIUM	72800	J
B38W25S	15-MAY-96	DUP	POTASSIUM	77900	J
B38W25S	05-JUN-97	REG	POTASSIUM	71400	
B38W25S	01-JUL-98	REG	POTASSIUM	45900	
B38W25S	17-MAY-99	REG	POTASSIUM	74400	
MISS01AA	31-JUL-93	REG	POTASSIUM	2340	J
MISS01AA	18-MAY-95	REG	POTASSIUM	1550	
MISS01AA	09-MAY-96	REG	POTASSIUM	1460	J
MISS01AA	23-MAY-97	REG	POTASSIUM	1900	
MISS01AA	18-JUN-98	REG	POTASSIUM	2100	
MISS01AA	12-MAY-99	REG	POTASSIUM	1590	
MISS01B	21-JUL-93	REG	POTASSIUM	6350	
MISS01B	16-MAY-94	REG	POTASSIUM	5710	
MISS01B	10-MAY-95	REG	POTASSIUM	6950	
MISS01B	15-MAY-96	REG	POTASSIUM	15300	J
MISS01B	18-JUN-98	REG	POTASSIUM	13900	
MISS01B	25-MAY-99	REG	POTASSIUM	11900	
MISS02A	20-JUL-93	REG	POTASSIUM	9390	
MISS02A	12-MAY-94	REG	POTASSIUM	2850	
MISS02A	10-MAY-95	REG	POTASSIUM	4340	
MISS02A	16-MAY-96	REG	POTASSIUM	3190	
MISS02A	15-MAY-97	REG	POTASSIUM	5120	J
MISS02A	15-MAY-97	DUP	POTASSIUM	4940	J
MISS02A	11-JUN-98	REG	POTASSIUM	4790	J
MISS02A	11-JUN-98	DUP	POTASSIUM	5260	J
MISS02A	18-MAY-99	REG	POTASSIUM	12500	
MISS02B	20-JUL-93	REG	POTASSIUM	55100	
MISS02B	13-MAY-94	REG	POTASSIUM	32000	J
MISS02B	09-MAY-95	REG	POTASSIUM	40300	
MISS02B	14-MAY-96	REG	POTASSIUM	38000	
MISS02B	19-MAY-97	REG	POTASSIUM	40100	J
MISS02B	10-JUN-98	REG	POTASSIUM	46200	J
MISS02B	18-MAY-99	REG	POTASSIUM	70700	
MISS05A	27-MAY-94	REG	POTASSIUM	57800	
MISS05A	12-MAY-95	REG	POTASSIUM	84600	J
MISS05A	10-MAY-96	REG	POTASSIUM	53000	J

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
MISS05A	02-JUN-97	REG	POTASSIUM	64100	
MISS05A	29-JUN-98	REG	POTASSIUM	45000	
MISS05A	14-MAY-99	REG	POTASSIUM	58300	
MISS05B	23-JUL-93	REG	POTASSIUM	224000	
MISS05B	17-MAY-94	REG	POTASSIUM	230000	
MISS05B	11-MAY-95	REG	POTASSIUM	231000	
MISS05B	16-MAY-96	REG	POTASSIUM	234000	
MISS05B	14-MAY-97	REG	POTASSIUM	224000	
MISS05B	30-JUN-98	REG	POTASSIUM	162000	
MISS06A	04-AUG-93	REG	POTASSIUM	75400	
MISS06A	24-MAY-94	REG	POTASSIUM	12100	J
MISS06A	16-MAY-95	REG	POTASSIUM	97000	
MISS06A	10-MAY-96	REG	POTASSIUM	12300	J
MISS06A	03-JUN-97	REG	POTASSIUM	22900	
MISS06A	01-JUL-98	REG	POTASSIUM	15000	
MISS06A	17-MAY-99	REG	POTASSIUM	15800	
B38W02D	30-JUN-98	REG	SILVER	0.78	
B38W07B	16-JUN-98	REG	SILVER	1.1	J
B38W07B	27-MAY-99	DUP	SILVER	3	
B38W19D	16-MAY-94	REG	SILVER	6	
B38W19D	17-JUN-98	REG	SILVER	4.3	
B38W19S	14-MAY-99	REG	SILVER	1.5	
B38W24D	18-MAY-94	REG	SILVER	4.8	
B38W24D	02-JUL-98	REG	SILVER	0.56	
MISS01AA	18-JUN-98	REG	SILVER	1.3	J
MISS01B	16-MAY-94	REG	SILVER	6.4	
MISS01B	25-MAY-99	REG	SILVER	1.4	
MISS02A	11-JUN-98	REG	SILVER	3.5	J
MISS02A	11-JUN-98	DUP	SILVER	0.96	J
MISS02A	18-MAY-99	REG	SILVER	1.4	
MISS02B	10-JUN-98	REG	SILVER	1.2	J
MISS02B	18-MAY-99	REG	SILVER	1.4	
MISS05A	27-MAY-94	REG	SILVER	5.6	
MISS05A	14-MAY-99	REG	SILVER	1.5	
B38W01S	28-JUL-93	REG	SODIUM	91100	
B38W01S	23-MAY-94	REG	SODIUM	80300	
B38W01S	21-MAY-95	REG	SODIUM	53700	
B38W01S	17-MAY-96	REG	SODIUM	59900	
B38W01S	04-JUN-97	REG	SODIUM	52200	
B38W01S	07-JUL-98	REG	SODIUM	39500	J
B38W02D	27-JUL-93	REG	SODIUM	7820	
B38W02D	19-MAY-94	REG	SODIUM	7060	
B38W02D	20-MAY-95	REG	SODIUM	6050	
B38W02D	17-MAY-96	REG	SODIUM	7210	
B38W02D	04-JUN-97	REG	SODIUM	8410	
B38W02D	30-JUN-98	REG	SODIUM	8710	J
B38W02D	20-MAY-99	REG	SODIUM	8350	
B38W14D	04-AUG-93	REG	SODIUM	29400	
B38W14D	20-MAY-95	REG	SODIUM	22100	
B38W14D	17-MAY-96	REG	SODIUM	31100	
B38W14D	04-JUN-97	REG	SODIUM	34800	
B38W14D	07-JUL-98	REG	SODIUM	34500	J
B38W14D	07-JUL-98	DUP	SODIUM	35400	J
B38W14D	17-MAY-99	REG	SODIUM	38800	
B38W14S	04-AUG-93	REG	SODIUM	11500	
B38W14S	20-MAY-95	REG	SODIUM	13500	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
B38W14S	17-MAY-96	REG	SODIUM	19500	
B38W14S	17-MAY-96	DUP	SODIUM	17700	
B38W14S	04-JUN-97	REG	SODIUM	21900	
B38W14S	07-JUL-98	REG	SODIUM	19900	J
B38W14S	17-MAY-99	REG	SODIUM	22800	
B38W15D	02-AUG-93	REG	SODIUM	229000	
B38W15D	26-MAY-94	REG	SODIUM	340000	
B38W15D	19-MAY-95	REG	SODIUM	245000	
B38W15D	13-MAY-96	REG	SODIUM	361000	J
B38W15D	03-JUN-97	REG	SODIUM	251000	
B38W15D	06-JUL-98	REG	SODIUM	181000	J
B38W15S	02-AUG-93	REG	SODIUM	223000	
B38W15S	26-MAY-94	REG	SODIUM	205000	
B38W15S	19-MAY-95	REG	SODIUM	269000	
B38W15S	19-MAY-95	DUP	SODIUM	248000	
B38W15S	13-MAY-96	REG	SODIUM	207000	J
B38W15S	03-JUN-97	REG	SODIUM	207000	
B38W15S	06-JUL-98	REG	SODIUM	187000	J
B38W17A	28-JUL-93	REG	SODIUM	47000	
B38W17A	25-MAY-94	REG	SODIUM	37500	
B38W17A	20-MAY-95	REG	SODIUM	28000	
B38W17A	13-MAY-96	REG	SODIUM	58100	J
B38W17A	03-JUN-97	REG	SODIUM	33300	
B38W17A	02-JUL-98	REG	SODIUM	32300	J
B38W17A	13-MAY-99	REG	SODIUM	50800	
B38W17B	29-JUL-93	REG	SODIUM	207000	J
B38W17B	25-MAY-94	REG	SODIUM	208000	
B38W17B	20-MAY-95	REG	SODIUM	232000	
B38W17B	13-MAY-96	REG	SODIUM	194000	J
B38W17B	03-JUN-97	REG	SODIUM	218000	
B38W17B	02-JUL-98	REG	SODIUM	172000	J
B38W17B	13-MAY-99	REG	SODIUM	197000	
B38W18D	21-JUL-93	REG	SODIUM	28300	
B38W18D	13-MAY-94	REG	SODIUM	32800	J
B38W18D	15-MAY-95	REG	SODIUM	27000	
B38W18D	14-MAY-96	REG	SODIUM	29700	
B38W18D	09-MAY-97	REG	SODIUM	29100	
B38W18D	08-JUN-98	REG	SODIUM	34800	
B38W18D	20-MAY-99	REG	SODIUM	34300	
B38W19D	23-JUL-93	REG	SODIUM	469000	
B38W19D	16-MAY-94	REG	SODIUM	499000	
B38W19D	10-MAY-95	REG	SODIUM	306000	
B38W19D	16-MAY-96	REG	SODIUM	391000	
B38W19D	16-MAY-97	REG	SODIUM	327000	
B38W19D	17-JUN-98	REG	SODIUM	367000	
B38W19D	27-MAY-99	REG	SODIUM	383000	
B38W19S	27-MAY-94	REG	SODIUM	25900	
B38W19S	17-MAY-95	REG	SODIUM	23700	J
B38W19S	10-MAY-96	REG	SODIUM	22700	J
B38W19S	29-JUN-98	REG	SODIUM	21300	J
B38W19S	14-MAY-99	REG	SODIUM	21700	
B38W24D	09-AUG-93	REG	SODIUM	59800	J
B38W24D	18-MAY-94	REG	SODIUM	46600	
B38W24D	17-MAY-95	REG	SODIUM	39700	J
B38W24D	09-MAY-96	REG	SODIUM	54500	J
B38W24D	02-JUN-97	REG	SODIUM	41300	
B38W24D	02-JUL-98	REG	SODIUM	33800	J

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
B38W24D	13-MAY-99	REG	SODIUM	40000	
B38W24S	05-AUG-93	REG	SODIUM	21700	
B38W24S	25-MAY-94	REG	SODIUM	19800	
B38W24S	17-MAY-95	REG	SODIUM	18800	J
B38W24S	09-MAY-96	REG	SODIUM	15700	J
B38W24S	02-JUN-97	REG	SODIUM	12500	
B38W24S	02-JUL-98	REG	SODIUM	12000	J
B38W24S	13-MAY-99	DUP	SODIUM	15600	
B38W25D	03-AUG-93	REG	SODIUM	54500	
B38W25D	18-MAY-94	REG	SODIUM	40200	
B38W25D	12-MAY-95	REG	SODIUM	43700	J
B38W25D	15-MAY-96	REG	SODIUM	37600	J
B38W25D	15-MAY-97	REG	SODIUM	30900	
B38W25D	01-JUL-98	REG	SODIUM	28900	J
B38W25D	26-MAY-99	REG	SODIUM	27700	
B38W25S	03-AUG-93	REG	SODIUM	83800	
B38W25S	24-MAY-94	REG	SODIUM	42200	J
B38W25S	15-MAY-95	REG	SODIUM	37200	
B38W25S	15-MAY-95	DUP	SODIUM	37000	
B38W25S	15-MAY-96	REG	SODIUM	28300	J
B38W25S	15-MAY-96	DUP	SODIUM	31400	J
B38W25S	05-JUN-97	REG	SODIUM	31800	
B38W25S	01-JUL-98	REG	SODIUM	21600	J
B38W25S	17-MAY-99	REG	SODIUM	29900	
MISS01AA	31-JUL-93	REG	SODIUM	7400	
MISS01AA	23-MAY-94	REG	SODIUM	4810	
MISS01AA	18-MAY-95	REG	SODIUM	5990	J
MISS01AA	09-MAY-96	REG	SODIUM	3870	J
MISS01AA	23-MAY-97	REG	SODIUM	5260	
MISS01AA	18-JUN-98	REG	SODIUM	5300	
MISS01AA	12-MAY-99	REG	SODIUM	5140	
MISS01B	21-JUL-93	REG	SODIUM	53200	
MISS01B	16-MAY-94	REG	SODIUM	48100	
MISS01B	10-MAY-95	REG	SODIUM	48100	
MISS01B	15-MAY-96	REG	SODIUM	56900	J
MISS01B	18-JUN-98	REG	SODIUM	49000	
MISS01B	25-MAY-99	REG	SODIUM	51500	
MISS02A	20-JUL-93	REG	SODIUM	870000	
MISS02A	12-MAY-94	REG	SODIUM	878000	
MISS02A	10-MAY-95	REG	SODIUM	986000	
MISS02A	16-MAY-96	REG	SODIUM	800000	
MISS02A	15-MAY-97	REG	SODIUM	709000	
MISS02A	15-MAY-97	DUP	SODIUM	679000	
MISS02A	11-JUN-98	DUP	SODIUM	555000	
MISS02B	20-JUL-93	REG	SODIUM	1310000	
MISS02B	13-MAY-94	REG	SODIUM	801000	J
MISS02B	09-MAY-95	REG	SODIUM	932000	J
MISS02B	14-MAY-96	REG	SODIUM	981000	
MISS02B	19-MAY-97	REG	SODIUM	959000	
MISS02B	10-JUN-98	REG	SODIUM	973000	
MISS02B	18-MAY-99	REG	SODIUM	1000000	
MISS05A	27-MAY-94	REG	SODIUM	17300	
MISS05A	12-MAY-95	REG	SODIUM	24200	J
MISS05A	10-MAY-96	REG	SODIUM	14000	J
MISS05A	02-JUN-97	REG	SODIUM	20100	
MISS05A	29-JUN-98	REG	SODIUM	13800	J
MISS05A	14-MAY-99	REG	SODIUM	18000	
MISS05B	23-JUL-93	REG	SODIUM	321000	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
MISS05B	17-MAY-94	REG	SODIUM	382000	
MISS05B	11-MAY-95	REG	SODIUM	303000	
MISS05B	16-MAY-96	REG	SODIUM	272000	
MISS05B	14-MAY-97	REG	SODIUM	297000	
MISS05B	30-JUN-98	REG	SODIUM	107000	J
MISS06A	04-AUG-93	REG	SODIUM	57300	
MISS06A	24-MAY-94	REG	SODIUM	15100	J
MISS06A	16-MAY-95	REG	SODIUM	62600	
MISS06A	10-MAY-96	REG	SODIUM	10500	J
MISS06A	03-JUN-97	REG	SODIUM	19400	
MISS06A	01-JUL-98	REG	SODIUM	15800	J
MISS06A	17-MAY-99	DUP	SODIUM	21300	
MISS07B	27-MAY-99	REG	SODIUM	1290000	
B38W02D	04-JUN-97	REG	VANADIUM	1.2	
B38W02D	30-JUN-98	REG	VANADIUM	2.7	
B38W02D	20-MAY-99	REG	VANADIUM	1	
B38W14D	17-MAY-96	REG	VANADIUM	4.7	
B38W14D	07-JUL-98	REG	VANADIUM	1.1	
B38W14D	07-JUL-98	DUP	VANADIUM	0.8	
B38W14D	17-MAY99	REG	VANADIUM	1.1	
B38W14S	17-MAY-96	REG	VANADIUM	7.4	
B38W14S	17-MAY-96	DUP	VANADIUM	7.2	
B38W14S	04-JUN-97	REG	VANADIUM	6.2	
B38W14S	07-JUL-98	REG	VANADIUM	9.8	
B38W14S	17-MAY-99	REG	VANADIUM	2.9	
B38W15D	26-MAY-94	REG	VANADIUM	11.9	
B38W15D	13-MAY-96	REG	VANADIUM	12.3	
B38W15D	03-JUN-97	REG	VANADIUM	4.2	
B38W15D	06-JUL-98	REG	VANADIUM	4.2	
B38W15S	02-AUG-93	REG	VANADIUM	13.3	
B38W15S	03-JUN-97	REG	VANADIUM	2.1	
B38W15S	06-JUL-98	REG	VANADIUM	2.2	
B38W17A	25-MAY-94	REG	VANADIUM	9.9	
B38W17A	13-MAY-96	REG	VANADIUM	8.4	
B38W17A	03-JUN-97	REG	VANADIUM	7.2	
B38W17A	02-JUL-98	REG	VANADIUM	28.2	
B38W17B	25-MAY-94	REG	VANADIUM	20.8	
B38W17B	20-MAY-95	REG	VANADIUM	7.6	
B38W17B	13-MAY-96	REG	VANADIUM	20.6	
B38W17B	03-JUN-97	REG	VANADIUM	2	
B38W17B	02-JUL-98	REG	VANADIUM	1	
B38W17B	13-MAY-99	REG	VANADIUM	2.1	
B38W19D	16-MAY-94	REG	VANADIUM	4.2	
B38W19D	16-MAY-96	REG	VANADIUM	8.1	
B38W19D	16-MAY-97	REG	VANADIUM	5.2	
B38W19D	17-JUN-98	REG	VANADIUM	4.2	
B38W19D	27-MAY-99	REG	VANADIUM	8.2	
B38W19S	27-MAY-94	REG	VANADIUM	56.6	
B38W19S	17-MAY-95	REG	VANADIUM	6.7	
B38W19S	10-MAY-96	REG	VANADIUM	41.9	
B38W19S	29-JUN-98	REG	VANADIUM	1.1	
B38W19S	14-MAY-99	REG	VANADIUM	2	
B38W24D	02-JUN-97	REG	VANADIUM	1.2	
B38W24D	02-JUL-98	REG	VANADIUM	0.8	
B38W24D	13-MAY-99	REG	VANADIUM	0.8	
B38W24S	02-JUN-97	REG	VANADIUM	2.8	
B38W24S	02-JUL-98	REG	VANADIUM	1.1	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
B38W24S	13-MAY-99	REG	VANADIUM	0.89	
B38W25S	03-AUG-93	REG	VANADIUM	16.7	J
B38W25S	24-MAY-94	REG	VANADIUM	15	
B38W25S	15-MAY-96	REG	VANADIUM	9.3	
B38W25S	15-MAY-96	DUP	VANADIUM	13.1	
B38W25S	05-JUN-97	REG	VANADIUM	1.3	
B38W25S	01-JUL-98	REG	VANADIUM	1.8	
B38W25S	17-MAY-99	REG	VANADIUM	1.7	
MISS01AA	31-JUL-93	REG	VANADIUM	46.1	J
MISS01AA	23-MAY-94	REG	VANADIUM	42.1	
MISS01AA	09-MAY-96	REG	VANADIUM	37.9	
MISS01AA	23-MAY-97	REG	VANADIUM	0.5	
MISS01AA	18-JUN-98	REG	VANADIUM	4.6	
MISS01AA	12-MAY-99	REG	VANADIUM	2.8	
MISS01B	16-MAY-94	REG	VANADIUM	7.4	
MISS01B	15-MAY-96	REG	VANADIUM	13.6	
MISS01B	18-JUN-98	REG	VANADIUM	2.5	
MISS01B	25-MAY-99	REG	VANADIUM	3.4	
MISS02A	10-MAY-95	REG	VANADIUM	10.1	
MISS02A	16-MAY-96	REG	VANADIUM	6.3	
MISS02A	15-MAY-97	REG	VANADIUM	4.7	
MISS02A	15-MAY-97	DUP	VANADIUM	4.8	
MISS02A	11-JUN-98	REG	VANADIUM	2	
MISS02A	11-JUN-98	DUP	VANADIUM	2.4	
MISS02A	18-MAY-99	DUP	VANADIUM	9.7	
MISS02B	09-MAY-95	REG	VANADIUM	6.8	
MISS02B	19-MAY-97	REG	VANADIUM	3.4	
MISS02B	10-JUN-98	REG	VANADIUM	3.4	
MISS02B	18-MAY-99	DUP	VANADIUM	3.9	
MISS05A	27-MAY-94	REG	VANADIUM	50.5	
MISS05A	10-MAY-96	REG	VANADIUM	41.9	
MISS05A	02-JUN-97	REG	VANADIUM	16.9	
MISS05A	29-JUN-98	REG	VANADIUM	11.3	
MISS05A	14-MAY-99	REG	VANADIUM	1.6	
MISS05B	17-MAY-94	REG	VANADIUM	27.7	
MISS05B	16-MAY-96	REG	VANADIUM	6	
MISS05B	14-MAY-97	REG	VANADIUM	3.8	
MISS05B	30-JUN-98	REG	VANADIUM	0.96	
MISS06A	04-AUG-93	REG	VANADIUM	21.9	J
MISS06A	24-MAY-94	REG	VANADIUM	23.6	
MISS06A	10-MAY-96	REG	VANADIUM	17.6	
MISS06A	03-JUN-97	REG	VANADIUM	1.2	
MISS06A	01-JUL-98	REG	VANADIUM	1.2	
MISS06A	17-MAY-99	REG	VANADIUM	1.2	
MISS07B	27-MAY-99	DUP	VANADIUM	19.6	
B38W01S	23-MAY-94	REG	ZINC	129	J
B38W01S	07-JUL-98	REG	ZINC	13.5	
B38W02D	27-JUL-93	REG	ZINC	15.2	
B38W02D	17-MAY-96	REG	ZINC	3.2	
B38W02D	30-JUN-98	REG	ZINC	7.4	
B38W14D	04-AUG-93	REG	ZINC	23.7	
B38W14D	17-MAY-96	REG	ZINC	4.2	
B38W14D	07-JUL-98	REG	ZINC	21.1	
B38W14D	07-JUL-98	DUP	ZINC	17.9	
B38W14S	04-AUG-93	REG	ZINC	47.1	
B38W14S	20-MAY-95	REG	ZINC	40.1	
B38W14S	17-MAY-96	REG	ZINC	6.5	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	Date	Sample Type	Analyte	Result(ug/l)	Rev Q
B38W14S	17-MAY-96	DUP	ZINC	5.3	
B38W14S	07-JUL-98	REG	ZINC	40.3	
B38W14S	13-MAY-99	REG	ZINC	6.9	
B38W15D	02-AUG-93	REG	ZINC	57.5	UJ
B38W15D	26-MAY-94	REG	ZINC	67.2	
B38W15D	06-JUL-98	REG	ZINC	11.2	
B38W15S	02-AUG-93	REG	ZINC	48.6	UJ
B38W15S	02-AUG-93	REG	ZINC	36.4	UJ
B38W15S	06-JUL-98	REG	ZINC	13.9	
B38W17A	28-JUL-93	REG	ZINC	147	
B38W17A	25-MAY-94	REG	ZINC	34.3	
B38W17A	02-JUL-98	REG	ZINC	22	
B38W17A	13-MAY-99	REG	ZINC	4.9	
B38W17B	25-MAY-94	REG	ZINC	42.8	
B38W17B	02-JUL-98	REG	ZINC	3.2	
B38W17B	13-MAY-99	REG	ZINC	1.6	
B38W18D	21-JUL-93	REG	ZINC	138	
B38W18D	13-MAY-94	REG	ZINC	226	J
B38W18D	15-MAY-95	REG	ZINC	152	J
B38W18D	14-MAY-96	REG	ZINC	102	
B38W18D	09-MAY-97	REG	ZINC	76.8	
B38W18D	08-JUN-98	REG	ZINC	79.7	
B38W18D	20-MAY-99	DUP	ZINC	81.5	
B38W19D	16-MAY-96	REG	ZINC	4.6	
B38W19D	16-MAY-97	REG	ZINC	3.1	
B38W19D	17-JUN-98	REG	ZINC	2.9	
B38W19D	27-MAY-99	REG	ZINC	2.1	
B38W19S	17-MAY-95	REG	ZINC	6	UJ
B38W19S	29-JUN-98	REG	ZINC	6.2	
B38W19S	14-MAY-99	REG	ZINC	1.7	
B38W24D	09-AUG-93	REG	ZINC	38.1	J
B38W24D	17-MAY-95	REG	ZINC	17.2	UJ
B38W24D	02-JUL-98	REG	ZINC	15.4	
B38W24D	13-MAY-99	REG	ZINC	5.9	
B38W24S	17-MAY-95	REG	ZINC	7.6	UJ
B38W24S	02-JUL-98	REG	ZINC	12.3	
B38W24S	13-MAY-99	REG	ZINC	30.4	
B38W25D	03-AUG-93	REG	ZINC	28.5	UJ
B38W25D	15-MAY-97	REG	ZINC	2.8	
B38W25D	01-JUL-98	REG	ZINC	4.6	
B38W25D	26-MAY-99	REG	ZINC	4.5	
B38W25S	03-AUG-93	REG	ZINC	231	J
B38W25S	15-MAY-95	REG	ZINC	12.4	UJ
B38W25S	15-MAY-95	DUP	ZINC	13.1	UJ
B38W25S	15-MAY-96	REG	ZINC	38.2	
B38W25S	15-MAY-96	DUP	ZINC	31.6	J
B38W25S	01-JUL-98	REG	ZINC	198	
B38W25S	17-MAY-99	REG	ZINC	29.7	
MISS01AA	31-JUL-93	REG	ZINC	142	J
MISS01AA	23-MAY-94	REG	ZINC	88.8	J
MISS01AA	18-MAY-95	REG	ZINC	7.6	UJ
MISS01AA	23-MAY-97	REG	ZINC	4.8	
MISS01AA	18-JUN-98	REG	ZINC	2.8	UJ
MISS01B	21-JUL-93	REG	ZINC	13.8	
MISS01B	10-MAY-95	REG	ZINC	34.6	
MISS01B	18-JUN-98	REG	ZINC	2.2	UJ
MISS01B	25-MAY-99	REG	ZINC	2.9	

TABLE B-3					
Historical Results for Detected Selected Metals in Groundwater at MISS					
Station	**Date**	**Sample Type**	**Analyte**	**Result(ug/l)**	**Rev Q**
MISS02A	20-JUL-93	REG	ZINC	17.3	
MISS02A	12-MAY-94	REG	ZINC	50	J
MISS02A	10-MAY-95	REG	ZINC	19.3	
MISS02A	16-MAY-96	REG	ZINC	4.5	
MISS02A	15-MAY-97	REG	ZINC	8	
MISS02A	15-MAY-97	DUP	ZINC	10.5	
MISS02A	11-JUN-98	REG	ZINC	17.7	J
MISS02A	11-JUN-98	DUP	ZINC	11	J
MISS02A	18-MAY-99	REG	ZINC	36	
MISS02B	13-MAY-94	REG	ZINC	148	J
MISS02B	09-MAY-95	REG	ZINC	22	
MISS02B	14-MAY-96	REG	ZINC	1.8	
MISS02B	19-MAY-97	REG	ZINC	70.8	
MISS02B	10-JUN-98	REG	ZINC	2.1	J
MISS05A	27-MAY-94	REG	ZINC	34.6	
MISS05A	12-MAY-95	REG	ZINC	34.4	
MISS05A	10-MAY-96	REG	ZINC	72.1	
MISS05A	29-JUN-98	REG	ZINC	27.4	
MISS05A	14-MAY-99	REG	ZINC	74.5	
MISS05B	11-MAY-95	REG	ZINC	98	J
MISS05B	16-MAY-96	REG	ZINC	7.8	
MISS05B	30-JUN-98	REG	ZINC	39.3	
MISS06A	04-AUG-93	REG	ZINC	1260	
MISS06A	24-MAY-94	REG	ZINC	1120	
MISS06A	16-MAY-95	REG	ZINC	865	
MISS06A	10-MAY-96	REG	ZINC	968	
MISS06A	03-JUN-97	REG	ZINC	1060	
MISS06A	01-JUL-98	REG	ZINC	802	
MISS06A	17-MAY-99	DUP	ZINC	934	
MISS07B	27-MAY-99	DUP	ZINC	4.8	

Legend
J = Estimated Concentration
UJ = Estimated non-detect
B = Detected in blank

TABLE B-4						
Historical Results for Radioactive Parameters in Sediment at MISS						
			RESULT			DETECTION
STATION	DATE	ANALYTE	(pCi/g)	(ug/g)	QUALIFIER	LIMIT(pCi/g)
SWSD002	04/10/92	Radium-226	0.55		J	0.00
SWSD002	10/26/92	Radium-226	0.25			0.18
SWSD002	04/21/93	Radium-226	0.44			0.27
SWSD002	10/07/93	Radium-226	0.57		J	0.28
SWSD002	05/30/94	Radium-226	0.47			0.23
SWSD002	05/08/95	Radium-226	0.48			0.09
SWSD002	11/13/95	Radium-226	0.30			0.09
SWSD002	05/08/96	Radium-226	0.41			0.13
SWSD002	10/15/96	Radium-226	0.57			0.11
SWSD002	05/05/97	Radium-226	0.67			0.13
SWSD002	06/02/98	Radium-226	0.31			1.00
SWSD002	11/03/98	Radium-226	0.52			1.00
SWSD002	05/21/99	Radium-226	0.36			0.18
SWSD003	04/10/92	Radium-226	0.52		J	0.00
SWSD003	10/26/92	Radium-226	0.45			0.16
SWSD003	04/21/93	Radium-226	0.35			0.33
SWSD003	10/07/93	Radium-226	0.39		J	0.30
SWSD003	05/30/94	Radium-226	0.46			0.29
SWSD003	05/08/95	Radium-226	0.55			0.08
SWSD003	11/13/95	Radium-226	0.29			0.05
SWSD003	05/08/96	Radium-226	0.52			0.12
SWSD003	10/15/96	Radium-226	0.70			0.10
SWSD003	05/05/97	Radium-226	0.49			0.10
SWSD003	06/02/98	Radium-226	0.28			1.00
SWSD003	11/03/98	Radium-226	0.28			1.00
SWSD003	05/21/99	Radium-226	0.3			0.19
SWSD005	04/10/92	Radium-226	0.51		J	0.00
SWSD005	10/26/92	Radium-226	0.44			0.16
SWSD005	04/21/93	Radium-226	0.35		UJ	0.35
SWSD005	10/07/93	Radium-226	0.00		UJ	0.44
SWSD005	05/30/94	Radium-226	0.76			0.26
SWSD005	05/30/94	Radium-226	0.87		J	0.25
SWSD005	08/31/94	Radium-226	1.30		U	0.11
SWSD005	05/08/95	Radium-226	1.50			0.09
SWSD005	05/08/95	Radium-226	1.70			0.12
SWSD005	11/13/95	Radium-226	1.28			0.16
SWSD005	11/13/95	Radium-226	2.79			0.09
SWSD005	05/08/96	Radium-226	0.50			0.09
SWSD005	10/15/96	Radium-226	0.97			0.07
SWSD005	05/05/97	Radium-226	0.90			0.15
SWSD005	06/02/98	Radium-226	1.26			1.00
SWSD005	11/03/98	Radium-226	1.01			1.00
SWSD005	05/21/99	Radium-226	1.44			0.16

TABLE B-4						
Historical Results for Radioactive Parameters in Sediment at MISS						
			RESULT			DETECTION
STATION	DATE	ANALYTE	(pCi/g)	(ug/g)	QUALIFIER	LIMIT(pCi/g)
SWSD006	05/30/94	Radium-226	3.10			0.99
SWSD006	08/31/94	Radium-226	2.90			0.14
SWSD006	05/08/95	Radium-226	1.30			0.12
SWSD006	11/13/95	Radium-226	4.45			0.15
SWSD006	05/08/96	Radium-226	0.99			0.09
SWSD006	10/15/96	Radium-226	4.50			0.08
SWSD006	05/05/97	Radium-226	3.50			0.15
SWSD006	06/02/98	Radium-226	4.65			1.00
SWSD006	11/03/98	Radium-226	3.86			1.00
SWSD006	05/21/99	Radium-226	8.04			0.28
SWSD007	08/31/94	Radium-226	0.99		U	0.11
SWSD007	05/08/95	Radium-226	5.40			0.12
SWSD007	11/13/95	Radium-226	3.32			0.12
SWSD007	05/08/96	Radium-226	3.70			0.05
SWSD007	05/08/96	Radium-226	3.29			0.18
SWSD007	10/15/96	Radium-226	5.05			0.14
SWSD007	10/15/96	Radium-226	4.04			0.11
SWSD007	05/05/97	Radium-226	4.25			0.18
SWSD007	05/05/97	Radium-226	5.23			0.20
SWSD007	06/02/98	Radium-226	6.97			1.00
SWSD007	11/03/98	Radium-226	2.22			1.00
SWSD007	05/21/99	Radium-226	1.07			0.12
SWSD002	04/10/92	Radium-228	0.98		J	0.00
SWSD002	10/26/92	Radium-228	0.29		J	0.32
SWSD002	04/21/93	Radium-228	0.44		UJ	0.44
SWSD002	10/07/93	Radium-228	0.00		UJ	0.71
SWSD002	05/30/94	Radium-228	0.81		J	0.41
SWSD002	11/13/95	Radium-228	1.60			0.42
SWSD002	05/08/96	Radium-228	0.60			0.16
SWSD002	10/15/96	Radium-228	0.72			0.13
SWSD002	05/05/97	Radium-228	0.56			0.17
SWSD002	06/02/98	Radium-228	0.55			1.00
SWSD002	11/03/98	Radium-228	0.54			1.00
SWSD002	05/21/99	Radium-228	0.74			0.17
SWSD003	04/10/92	Radium-228	0.74		J	0.00
SWSD003	10/26/92	Radium-228	0.65		J	0.29
SWSD003	04/21/93	Radium-228	0.77			0.31
SWSD003	10/07/93	Radium-228	0.00		UJ	0.61
SWSD003	11/13/95	Radium-228	0.90			0.50
SWSD003	05/08/96	Radium-228	0.40		U	0.11
SWSD003	10/15/96	Radium-228	0.43			0.14
SWSD003	05/05/97	Radium-228	0.45			0.14
SWSD003	06/02/98	Radium-228	0.4			1.00

TABLE B-4						
Historical Results for Radioactive Parameters in Sediment at MISS						
			RESULT			DETECTION
STATION	DATE	ANALYTE	(pCi/g)	(ug/g)	QUALIFIER	LIMIT(pCi/g)
SWSD003	11/03/98	Radium-228	0.65			1.00
SWSD003	05/21/99	Radium-228	0.35			0.19
SWSD005	04/10/92	Radium-228	0.73		J	0.00
SWSD005	10/26/92	Radium-228	0.47		J	0.29
SWSD005	04/21/93	Radium-228	0.69			0.24
SWSD005	10/07/93	Radium-228	0.00		UJ	0.76
SWSD005	05/30/94	Radium-228	3.00		J	0.44
SWSD005	05/30/94	Radium-228	3.60		J	0.46
SWSD005	11/13/95	Radium-228	1.60			0.58
SWSD005	11/13/95	Radium-228	13.60			0.69
SWSD005	05/08/96	Radium-228	0.90			0.13
SWSD005	10/15/96	Radium-228	3.34			0.11
SWSD005	05/05/97	Radium-228	2.84			0.16
SWSD005	06/02/98	Radium-228	2.32			1.00
SWSD005	11/03/98	Radium-228	4.41			1.00
SWSD005	05/21/99	Radium-228	3.13			0.19
SWSD006	05/30/94	Radium-228	19.60		J	1.70
SWSD006	11/13/95	Radium-228	9.60			0.53
SWSD006	05/08/96	Radium-228	5.15			0.16
SWSD006	10/15/96	Radium-228	20.33			0.30
SWSD006	05/05/97	Radium-228	17.33			0.13
SWSD006	06/02/98	Radium-228	16.22		J	1.00
SWSD006	11/03/98	Radium-228	17.74			1.00
SWSD006	05/21/99	Radium-228	7.67			0.26
SWSD007	11/13/95	Radium-228	11.70			0.56
SWSD007	05/08/96	Radium-228	14.22			0.12
SWSD007	05/08/96	Radium-228	8.16			0.10
SWSD007	10/15/96	Radium-228	22.41			0.29
SWSD007	10/15/96	Radium-228	16.79			0.25
SWSD007	05/05/97	Radium-228	8.75			0.17
SWSD007	05/05/97	Radium-228	8.78			0.18
SWSD007	06/02/98	Radium-228	16.46		J	1.00
SWSD007	11/03/98	Radium-228	8.49			1.00
SWSD007	05/21/99	Radium-228	1.79			0.17
SWSD002	05/08/96	Thorium-230	1.11		U	0.09
SWSD002	10/15/96	Thorium-230	0.67			0.05
SWSD002	05/05/97	Thorium-230	0.80		U	0.12
SWSD002	06/02/98	Thorium-230	0.52		U	1.00
SWSD002	11/03/98	Thorium-230	0.91			1.00
SWSD002	05/21/99	Thorium-230	0.55		U	0.17

TABLE B-4						
Historical Results for Radioactive Parameters in Sediment at MISS						
			RESULT			DETECTION
STATION	DATE	ANALYTE	(pCi/g)	(ug/g)	QUALIFIER	LIMIT(pCi/g)
SWSD003	05/08/96	Thorium-230	1.33		U	0.15
SWSD003	10/15/96	Thorium-230	0.47			0.06
SWSD003	05/05/97	Thorium-230	0.66		U	0.09
SWSD003	06/02/98	Thorium-230	0.52		U	1.00
SWSD003	11/03/98	Thorium-230	0.64			1.00
SWSD003	05/21/99	Thorium-230	0.96			0.15
SWSD005	05/08/96	Thorium-230	0.97		U	0.08
SWSD005	10/15/96	Thorium-230	1.33			0.06
SWSD005	05/05/97	Thorium-230	2.08			0.16
SWSD005	06/02/98	Thorium-230	0.7		U	1.00
SWSD005	11/03/98	Thorium-230	1.42			1.00
SWSD005	05/21/99	Thorium-230	1.81			0.10
SWSD006	05/08/96	Thorium-230	1.48		U	0.12
SWSD006	10/15/96	Thorium-230	4.72			0.11
SWSD006	05/05/97	Thorium-230	3.54			0.05
SWSD006	06/02/98	Thorium-230	3.28		J	1.00
SWSD006	11/03/98	Thorium-230	4.29			1.00
SWSD006	05/21/99	Thorium-230	1.62			0.22
SWSD007	05/08/96	Thorium-230	3.19			0.09
SWSD007	05/08/96	Thorium-230	1.81			0.05
SWSD007	10/15/96	Thorium-230	4.52			0.18
SWSD007	10/15/96	Thorium-230	3.31			0.14
SWSD007	05/05/97	Thorium-230	2.64			0.16
SWSD007	05/05/97	Thorium-230	2.09			0.09
SWSD007	06/02/98	Thorium-230	3.37		J	1.00
SWSD007	11/03/98	Thorium-230	2.42			1.00
SWSD007	05/21/99	Thorium-230	1.18			0.13
SWSD002	04/10/92	Thorium-232	0.80			0.00
SWSD002	10/26/92	Thorium-232	0.42			0.25
SWSD002	04/21/93	Thorium-232	0.70			0.20
SWSD002	10/07/93	Thorium-232	0.59			0.40
SWSD002	05/30/94	Thorium-232	0.71			0.36
SWSD002	05/08/95	Thorium-232	0.50			0.08
SWSD002	11/13/95	Thorium-232	0.39		U	0.05
SWSD002	05/08/96	Thorium-232	0.44			0.15
SWSD002	10/15/96	Thorium-232	0.62			0.08
SWSD002	05/05/97	Thorium-232	0.33			0.06
SWSD002	06/02/98	Thorium-232	0.33			1.00
SWSD002	11/03/98	Thorium-232	0.5		U	1.00
SWSD002	05/21/99	Thorium-232	0.39		U	0.12
SWSD003	04/10/92	Thorium-232	0.85		J	0.00

TABLE B-4						
Historical Results for Radioactive Parameters in Sediment at MISS						
			RESULT			DETECTION
STATION	DATE	ANALYTE	(pCi/g)	(ug/g)	QUALIFIER	LIMIT(pCi/g)
SWSD003	10/26/92	Thorium-232	0.65			0.23
SWSD003	04/21/93	Thorium-232	0.66			0.24
SWSD003	10/07/93	Thorium-232	0.00		UJ	0.49
SWSD003	05/30/94	Thorium-232	0.65		UJ	0.65
SWSD003	05/08/95	Thorium-232	0.56			0.10
SWSD003	11/13/95	Thorium-232	0.32		U	0.04
SWSD003	05/08/96	Thorium-232	0.57			0.11
SWSD003	10/15/96	Thorium-232	0.30			0.06
SWSD003	05/05/97	Thorium-232	0.37			0.10
SWSD003	06/02/98	Thorium-232	0.39			1.00
SWSD003	11/03/98	Thorium-232	0.57		U	1.00
SWSD003	05/21/99	Thorium-232	0.48		U	0.11
SWSD005	04/10/92	Thorium-232	0.76		J	0.00
SWSD005	10/26/92	Thorium-232	0.55			0.23
SWSD005	04/21/93	Thorium-232	0.65			0.19
SWSD005	10/07/93	Thorium-232	0.00		UJ	0.60
SWSD005	05/30/94	Thorium-232	3.20		J	0.38
SWSD005	05/30/94	Thorium-232	3.60			0.39
SWSD005	08/31/94	Thorium-232	1.00			0.05
SWSD005	05/08/95	Thorium-232	2.40			0.08
SWSD005	05/08/95	Thorium-232	2.20			0.05
SWSD005	11/13/95	Thorium-232	2.53			0.06
SWSD005	11/13/95	Thorium-232	12.62			0.10
SWSD005	05/08/96	Thorium-232	0.92			0.10
SWSD005	10/15/96	Thorium-232	3.18			0.11
SWSD005	05/05/97	Thorium-232	2.94			0.13
SWSD005	06/02/98	Thorium-232	2.33			1.00
SWSD005	11/03/98	Thorium-232	4			1.00
SWSD005	05/21/99	Thorium-232	3.56			0.15
SWSD006	05/30/94	Thorium-232	20.90			1.50
SWSD006	08/31/94	Thorium-232	16.80			0.04
SWSD006	05/08/95	Thorium-232	2.50			0.04
SWSD006	11/13/95	Thorium-232	11.47			0.04
SWSD006	05/08/96	Thorium-232	4.93			0.13
SWSD006	10/15/96	Thorium-232	21.66			0.11
SWSD006	05/05/97	Thorium-232	17.34			0.09
SWSD006	06/02/98	Thorium-232	15.78		J	1.00
SWSD006	11/03/98	Thorium-232	17.97			1.00
SWSD006	05/21/99	Thorium-232	8.13			0.15
SWSD007	08/31/94	Thorium-232	1.10			0.10
SWSD007	05/08/95	Thorium-232	14.60			0.07
SWSD007	11/13/95	Thorium-232	9.49			0.04

TABLE B-4						
Historical Results for Radioactive Parameters in Sediment at MISS						
			RESULT			DETECTION
STATION	DATE	ANALYTE	(pCi/g)	(ug/g)	QUALIFIER	LIMIT(pCi/g)
SWSD007	05/08/96	Thorium-232	14.75			0.05
SWSD007	05/08/96	Thorium-232	7.63			0.08
SWSD007	10/15/96	Thorium-232	18.47			0.14
SWSD007	10/15/96	Thorium-232	22.50			0.21
SWSD007	05/05/97	Thorium-232	7.39			0.07
SWSD007	05/05/97	Thorium-232	8.54			0.07
SWSD007	06/02/98	Thorium-232	17.08		J	1.00
SWSD007	11/03/98	Thorium-232	8.76			1.00
SWSD007	05/21/99	Thorium-232	1.9			0.11
SWSD002	04/10/92	Total Uranium	2.90	4.29		0.00
SWSD002	10/26/92	Total Uranium	1.42	2.10		0.10
SWSD002	04/21/93	Total Uranium	1.62	2.40	J	0.10
SWSD002	10/07/93	Total Uranium	0.88	1.30	U	0.10
SWSD002	05/30/94	Total Uranium	0.88	1.30		0.10
SWSD002	05/08/95	Total Uranium	0.74	1.10	U	0.10
SWSD002	11/13/95	Total Uranium	1.10	1.62	U	0.10
SWSD002	05/08/96	Total Uranium	1.16	1.72		0.10
SWSD002	10/15/96	Total Uranium	1.20	1.77	U	0.10
SWSD002	05/05/97	Total Uranium	0.93	1.38		0.10
SWSD002	06/02/98	Total Uranium	1.23	1.91		1.00
SWSD002	11/03/98	Total Uranium	2.01	3.12	U	1.00
SWSD002	05/21/99	Total Uranium	1.27	1.87		0.10
SWSD003	04/10/92	Total Uranium	2.72	4.02		0.00
SWSD003	10/26/92	Total Uranium	2.10	3.10		0.10
SWSD003	04/21/93	Total Uranium	2.57	3.80	J	0.10
SWSD003	10/07/93	Total Uranium	0.81	1.20	U	0.10
SWSD003	05/30/94	Total Uranium	0.68	1.00	U	0.10
SWSD003	05/08/95	Total Uranium	1.29	1.90	U	0.10
SWSD003	11/13/95	Total Uranium	1.27	1.88	U	0.10
SWSD003	05/08/96	Total Uranium	1.02	1.50	U	0.10
SWSD003	10/15/96	Total Uranium	1.16	1.72	U	0.10
SWSD003	05/05/97	Total Uranium	1.06	1.56		0.10
SWSD003	06/02/98	Total Uranium	1.11	1.72		1.00
SWSD003	11/03/98	Total Uranium	2.13	3.3	U	1.00
SWSD003	05/21/99	Total Uranium	1.19	1.76		0.10
SWSD005	04/10/92	Total Uranium	2.94	4.34		0.00
SWSD005	10/26/92	Total Uranium	2.30	3.40		0.10
SWSD005	04/21/93	Total Uranium	2.71	4.00	J	0.10
SWSD005	10/07/93	Total Uranium	0.74	1.10	U	0.10
SWSD005	05/30/94	Total Uranium	1.42	2.10		0.10
SWSD005	05/30/94	Total Uranium	1.56	2.30		0.10
SWSD005	08/31/94	Total Uranium	1.49	2.20	U	0.10
SWSD005	05/08/95	Total Uranium	1.42	2.10	U	0.10

TABLE B-4						
Historical Results for Radioactive Parameters in Sediment at MISS						
			RESULT			DETECTION
STATION	DATE	ANALYTE	(pCi/g)	(ug/g)	QUALIFIER	LIMIT(pCi/g)
SWSD005	05/08/95	Total Uranium	1.22	1.80	U	0.10
SWSD005	11/13/95	Total Uranium	1.66	2.45	U	0.10
SWSD005	11/13/95	Total Uranium	3.22	4.76		0.10
SWSD005	05/08/96	Total Uranium	1.21	1.79		0.10
SWSD005	10/15/96	Total Uranium	1.79	2.64		0.10
SWSD005	05/05/97	Total Uranium	1.20	1.77		0.10
SWSD005	06/02/98	Total Uranium	1.24	1.92		1.00
SWSD005	11/03/98	Total Uranium	3.97	6.17		1.00
SWSD005	05/21/99	Total Uranium	1.18	1.75		0.10
SWSD006	05/30/94	Total Uranium	7.04	10.40		0.10
SWSD006	08/31/94	Total Uranium	9.27	13.70		0.10
SWSD006	05/08/95	Total Uranium	1.35	2.00	U	0.10
SWSD006	11/13/95	Total Uranium	7.18	10.61		0.10
SWSD006	05/08/96	Total Uranium	2.86	4.22		0.10
SWSD006	10/15/96	Total Uranium	8.86	13.09		0.10
SWSD006	05/05/97	Total Uranium	7.39	10.91		0.10
SWSD006	06/02/98	Total Uranium	8.06	12.51		1.00
SWSD006	11/03/98	Total Uranium	10.05	15.61		1.00
SWSD006	05/21/99	Total Uranium	12.41	18.33		0.10
SWSD007	08/31/94	Total Uranium	2.03	3.00	U	0.10
SWSD007	05/08/95	Total Uranium	6.16	9.10		0.10
SWSD007	11/13/95	Total Uranium	6.11	9.03		0.10
SWSD007	05/08/96	Total Uranium	5.84	8.62		0.10
SWSD007	05/08/96	Total Uranium	3.97	5.86		0.10
SWSD007	10/15/96	Total Uranium	8.88	13.12		0.10
SWSD007	10/15/96	Total Uranium	8.77	12.96		0.10
SWSD007	05/05/97	Total Uranium	5.29	7.82		0.10
SWSD007	05/05/97	Total Uranium	5.04	7.44		0.10
SWSD007	06/02/98	Total Uranium	5.13	8.02		1.00
SWSD007	11/03/98	Total Uranium	5.15	7.99		1.00
SWSD007	05/21/99	Total Uranium	2.00	3.00		0.10

Legend
U = Non-detect
UJ = Estimated non-detect

APPENDIX C

NJDEP Preliminary Assessment and Investigation Report for Dixo Co., Inc.

PRELIMINARY ASSESSMENT AND SITE INVESTIGATION REPORT

PART I: GENERAL INFORMATION

Site Name: Dixo Co., Inc.
Address: 158 Central Avenue
Municipality: Rochelle Park **State:** New Jersey **Zip Code:** 07662
County: Bergen
EPA ID No.: NJD002009850
Block: 25.01 **Lot(s):** 1, 8
Latitude: 40° 54' 00" **Longitude:** 74° 04' 22"
USGS Quadrangle: Hackensack
Acreage: 0.5 **SIC Code:** 5169

Current Owner: Jerry Schapiro
Mailing Address: 158 Central Avenue
City: Rochelle Park **State:** New Jersey **Zip Code:** 07662
Telephone No.: (201) 845-6000

Current Operator: Dixo Co., Inc.

Owner/Operator History:

NAME	OPERATOR/ OWNER	DATES	
		FROM	TO
Jerry Schapiro	owner (Dixo)	1966	present
Sandra and Jerry Corp.	owner (property)	1970s	present
Sol Schapiro	owner	1954	1966
Walter Keoghdwyer	owner	1940s	1954
Dominick Torriello	owner	1930s	1940s

The Dixo Co. (Dixo) is owned by Jerry Schapiro, however, the property is owned by the Sandra and Jerry Corporation which was established by Jerry Schapiro and his sister Sandra Schapiro. Lot 1 was purchased by Sol Schapiro (Jerry Schapiro's father) in 1954 and lot 8 was added in the 1970s. Although Walter Keoghdwyer sold the facility in 1954, he remained on site as a lessee, operating a machine shop in the main building for an unspecified period of time.

Surrounding Land Use (zoning, adjacent properties):

The facility is located in a mixed residential, commercial and industrial section of Rochelle Park with Route 17 to the west, FIMS Manufacturing Corp. to the east, Central Avenue to the south and Bill Yee Associates directly to the north. Other businesses in the immediate area include, Tri County Painters, Central Park Auto Body and Collision, Saddle River Bus Tours, Hanson and Blakeney Tanks and Heating Products and All Custom Packaging and Shipping Supplies.

Distance to Nearest Residence or School:

The nearest residence is located approximately 190 feet to the west.

Population Density (residents per square mile):

The population density for Rochelle Park is 5,340 people per square mile according to a 1990 Census.

PART II: SITE OPERATIONS

Discuss all current and past operations at the site. Include a description of the buildings or structures on site and their physical condition. In addition, tabulate all areas of concern (AOC) and provide the waste source type for each AOC. Include the physical state of waste at each AOC as stored or disposed, the condition of containers and the presence or absence of secondary containment and the volume of waste stored or disposed, or the volume or area of contaminated soil or water.

Site activities began in the 1940s when Mr. Dominick Torriello reportedly ran a construction business on site. The duration and exact nature of site operations is unclear, but aerial photographs indicate that area wetlands were filled in to solidify the original building foundation. (Attachment G)

Dixo is a repackager of toluol (toluene) and tetrahydrofuran adhesives. Site operations began in 1954 and involved the repackaging of solvents and adhesives. Prior to 1954, Dixo was located in Garfield, New Jersey. Materials arrive on site in liquid form in 55-gallon drums and are repackaged in quart-size plastic containers which are boxed, blister wrapped and shipped to customers. In the past, the facility repackaged dry cleaning products such as tetrachloroethylene (PCE). The facility consists of two buildings. The two-story main building, measuring 100 feet by 70 feet, is where most of the single shift, five-day-a-week site operations occur. The building is separated into offices, a warehouse, a small maintenance shop with a drill press, a shipping and receiving area and a laboratory where quality assurance and quality control tests are conducted. A covered, concrete drum storage pad separates the main building from a second smaller building measuring 25 feet by 40 feet. Products such as adhesives are transferred in the smaller building in two rooms with four 110-gallon and one 275-gallon aboveground storage tanks. Products delivered in 55-gallon drums are emptied into the tanks by a hand-driven hoist and transferred via a 2-inch, stainless-steel flexible hose into smaller bottles prior to being blister packed and boxed in the main building. Bad batches are reportedly kept to a minimum by a quality assurance check by the suppliers before the materials arrive on site. The ground surrounding both buildings is predominantly covered by concrete, broken asphalt and a grass-covered alley along the eastern property boundary. Dixo markets its products in the US, Europe and the Far East. (Attachment B, G and H)

A RCRA inspection was conducted by the NJDEP, Division of Hazardous Waste Management, on August 16, 1990, to determine regulatory compliance with generator requirements as established under N.J.A.C. 7:26-1 and EPA Land Ban restriction requirements established under 40 CFR Section 268. The case was referred by the NJDEP, Metro Field Office, as a result of drums being observed on site. The drums contained product-grade material stored on a covered, concrete storage pad. No hazardous waste was observed and no violations were issued as a result of the inspection. (Attachment B)

A RCRA inspection was conducted by the NJDEP, Metro Field Office, on November 21, 1994, due to a report of drums being stored on site. The drums were filled with product-grade material ready for repackaging. No hazardous waste was reportedly generated on site, however, a one-time shipment of hazardous waste was recorded on August 27, 1993. The facility owner stated that the waste was product-grade material which could not be sold because the packing containers were opened. The material was shipped under waste classification number U070 (1,2-dichlorobenzene) and number D001. The facility is considered a small quantity generator under N.J.A.C. 7:26-7 and N.J.A.C. 7:26-9 through 11. No violations were issued during the inspection. (Attachment H)

PCE was stored in a 5,000-gallon aboveground storage tank located on the drum storage pad. The last delivery of the dry cleaning solvent, according to the facility owner, was in 1986. The facility was cited on June 15, 1983, for not registering the tank, which is now empty. Number two fuel oil was also stored in three 500-gallon aboveground storage tanks. There are currently seven, 275-gallon aboveground storage tanks for number two fuel oil storage located on the drum storage pad which was reportedly constructed approximately 25 years ago. (Attachment G)

Hazardous waste manifest records between 1993 and 1997 lists the following materials shipped off site: flammable liquid (3-methyl butyl acetate), combustible liquid (synthetic resin), combustible liquid (2-butoxyethanol), combustible liquid (diethylene glycol monoethyl ether), combustible liquid (oleic fatty acid), combustible liquid (cyclohexanol), nonregulated material (glycerine), nonregulated material (tergitol nonionic surfactant), nonregulated material (1,3-butylene glycol), waste flammable liquid (aluminum chelate), waste combustible liquid (primary amyl acetate), waste combustible liquid (mineral spirits), waste butyl alcohol, waste dichlorobenzene, waste combustible liquid (propylene glycol methyl ether acetate) and waste flammable liquid (toluene). The facility's main licensed waste hauler is Eldredge Inc. of West Chester, Pennsylvania. (Attachment F)

The NJDEP Right to Know data base lists the daily inventories for the following substances:

<u>Substance</u>	<u>Maximum Daily Inventory (lbs)</u>
Acetone	11 - 100
Adhesives	1,001 - 10,000
Denatured Alcohol	11 - 100
Ammonium Hydroxide	11 - 100
Chloroform	11 - 100
Cleaning Compound	101 - 1,000
Ethyl Acetate	1 - 10
Ethyl Ether	1 - 10
Methanol	101 - 1,000
Nitrogen	101 - 1,000
Petroleum Oil	11 - 100
Sodium Phosphate	11 - 100
Stoddard Solvent (Mineral Spirits)	101 - 1,000
Tetrahydrofuran	1,001 - 10,000
Trichloroethylene	101 - 1,000

Other materials that were used or stored on site which are not listed include tetrachloroethylene (a dry cleaning solvent detected in area potable wells), toluene, 1,1,1-trichloroethane, glycol, carbitol solvent, butoxyl ethanol, orthodichlorobenzene and plastic resin. (Attachment J)

AOC SUMMARY TABLE

AOC Name	HRS Source Type	CERCLA Exempt	Physical State	Waste Quantity
Unpaved empty drum storage area	Drums	No	liquid	varies
5,000-gallon AGST	Tank	No	liquid	5,000 gal
Concrete drum pad	Drums	No	liquid	varies
4,000-gal UST	Tank	Yes	liquid	4,000 gal
Warehouse floor drain	Other	No	liquid	unknown
French drain	Other	No	liquid	unknown
5,000-gallon UST	Tank	Yes	liquid	5,000 gal

A french drain was observed in the product-transfer building on February 26, 1998, during a Pre-Sampling Assessment conducted by the NJDEP, Division of Responsible Party Site Remediation (DRPSR), Environmental Measurements and Site Assessment Section (EMSA). The drain was reportedly connected to the storm sewer at one time, but has been "blocked" for approximately 25 years according to the facility owner. A Site Assessment Summary for underground storage tank closure submitted by Bertin Engineering Associates, Inc. (Bertin) of Glen Rock, New Jersey, in January 1992, stated that an abandoned sewer line was found in the alley during the in-place abandonment of a 4,000-gallon underground storage tank. Attempts by the NJDEP to trace the drain with a sewer clean-out device and magnetometer were unsuccessful. (Attachment C)

On January 30, 1998, legal counsel representing Dixo responded to an EPA Information Request under 42 U.S.C. 9601 et seq. Dixo stated that the company did not generate any wastewater containing hazardous substances and that there were no operative floor drains, dry wells, sumps or other disposal drains at the facility. It was also stated that no leaks, spills, explosions or fires occurred on site. (Attachment I)

PART III: PERMITS

A. NJPDES

No NJPDES permits were applied for.

B. New Jersey Air Pollution Control Certificates

Plant ID No.: 025699
No. of Certificates: one
Equipment Permitted: underground storage tank

C. BUST Registration

Registration No.: 0028622
No. of Tanks: Three

Tank No.	Capacity (gallons)	Contents of Tank	Status
not given	4,000	Leaded gasoline	The tank was abandoned in place in 1991 (Closure # C912415).
not given	5,000	Floor oil	The tank was removed and issued a NFA on 5/28/92.
not given	< 2,000	# 2 Fuel oil	The nonregulated tank was abandoned in place beneath the drum pad.

A Site Assessment Summary Report for the closure of an underground storage tank was prepared by Bertin Engineering in January 1992. On August 22, 1991, a 4,000-gallon underground gasoline storage tank was abandoned in-place under NJDEP, Underground Storage Tank Closure Approval No. C91-2415. TFB Pump and Tank (TFB) of Clifton, New Jersey, performed the abandonment of the steel tank. (Attachment C)

A July 2, 1992, letter issued by the NJDEP, Industrial Site Evaluation Element, indicates that Dixo complied with the Department's existing requirements for closure of underground storage tank systems and therefore was not required to conduct corrective actions pursuant to N.J.A.C. 7:14B-8. (Attachment D)

D. RCRA Status (TSD, Generator, Protective Filer, etc.)

The facility is classified as a Small Quantity Generator.

E. Other Permits (RCRA, NRC, etc.)

There are no other permits on record.

PART IV: SOIL EXPOSURE

Describe soil type. Include soil series, composition of the soil and permeability of the soil.

Soil at the site is classified as Urban Land (UR), which is nearly level or sloping from 1 to 5 percent. Urban Land areas have been cut or filled and covered with an impervious surface such as paving materials or buildings. Included in mapping are high-density residential areas that are less than 85 percent covered or contain reworked soil. Soils in the Meadowlands area are Udorthents. Most Urban Land is used for commercial and industrial development or for central school sites. (Attachment A)

Soil logs documented from hand-augured borings drilled for soil sample collection by TFB on August 30, 1991, indicate the following soil profile:

0 - 2'	miscellaneous fill mixed with brown silty sand and gravel
2' - 3.5'	tan silty sand
3.5' - 5'	gray/green clayey sand
5' - 7'	brown sand

(Attachment C)

Borings collected in April 1998 by the NJDEP, DPFSR, EMSA from seven soil sample locations, to a maximum depth of 12 feet with a Geoprobe, a hydraulicly-powered, soil-coring device, revealed the following subsurface profile throughout the site:

0 - 0.5'	topsoil with a mix of grass and broken asphalt
0.5'- 4'	dark-brown to reddish-brown silty sand with some trace clay
4' - 5'	yellowish-brown, silty sand mixed with clay

5' - 8' light brown, coarse sand mixed with clay and gravel

8' - 10' brown, medium to fine sand mixed with brown, silty clay

(Attachment P)

Discuss contaminants identified in the soil. Include sampling date, sampling agency or company, sample locations, depth and contaminant level. Identify samples collected from a residential property, school, daycare center, workplace, terrestrial sensitive environment or resource. State whether Level 1 or Level 2 contamination is present. For each sampling event, list the name, address and certification number of the lab which performed the analyses. State who conducted the quality assurance review of the data and summarize any data qualifications.

On August 30, 1991, TFB drilled five soil borings (B-1, B-2, B-3, B-4 and B-5) around the perimeter of an abandoned-in-place 4,000-gallon underground gasoline tank. The deepest borings extended to the bottom of the tank elevation, approximately 7 feet. Two additional borings were advanced, one for a monitoring well (MW-1) which was 14.5 feet and a second (B-6) to a depth of 10 feet just south of the tank. Field screening with a photoionization detector (PID) revealed total volatile organic compounds concentrations as high as 25 ppm for borings B-1 through B-4. PID levels for B-5 were as high as 1,300 ppm. Soil samples were collected from the base of each boring. Laboratory analysis was performed on all seven borings (B-1 through B-6 and MW-1) by All-Test Environmental Laboratories (All-Test) of Hasbrouck Heights, New Jersey, (N.J. Certification # 02525) for volatile organic compounds and lead. The following table summarizes the analytical results:

Sample ID	Contaminant	Conc. (ppm)	SCC (ppm)
S-1	methylene chloride	0.03	10.0
	bromodichloromethane	0.05	1.0
	tetrachloroethene	0.01	1.0
S-2	methylene chloride	0.03	10.0
	chloroform	0.01	1.0
	bromodichloromethane	0.05	1.0

	tetrachloroethene	0.10	1.0
S-3	methylene chloride	0.04	10.0
	trichloroethene	0.06	1.0
	bromodichloromethane	0.05	1.0
	tetrachloroethene	0.38	1.0
S-4	methylene chloride	0.36	10.0
	chloroform	0.20	1.0
	bromodichloromethane	0.51	1.0
	tetrachloroethene	2.02	1.0
	ethylbenzene	0.16	100.0
	m&o xylenes	0.10	10.0
S-5	methylene chloride	1.13	10.0
	chloroform	0.89	1.0
	bromodichloromethane	**2.42**	1.0
	1,1,2-trichloroethane	**1.25**	1.0
	tetrachloroethene	**89.42**	1.0
	ethylbenzene	0.51	100.0
B-6	methylene chloride	2.52	10.0
	trichloroethene	0.75	1.0
	1,1,2-trichloroethane	0.87	1.0
	tetrachloroethene	**65.68**	1.0

ppm - parts per million
NC - no established criteria
SCC - NJDEP Impact to Ground water Soil Cleanup Criteria

(Attachment C)

From April 28 through 30, 1998, the NJDEP, DPFSR, EMSA, collected seven soil samples with a Geoprobe from areas of concern identified during a Pre-Sampling Assessment. The sample identification numbers, areas of concern and sample collection depths are as follows:

Sample ID	AOC	Depth (Feet)
S-1	warehouse floor drain	4
S-2	empty drum storage area	4
S-3	4,000-gal UST	4
S-4	4,000-gal UST	4
S-5	4,000-gal UST	4
S-6	5,000-gal AST	8 - 12
S-7	5,000-gal UST	4

AOC - Area of Concern

Sample collection was based on the highest PID and flame ionization detector (FID) field instrumentation readings and visual evidence of contamination, soil consistency and the ground water saturation zone, which was between 4 and 12 feet. The samples were analyzed for volatile organic compounds by Industrial Corrosion Management (ICM) Laboratories of Randolph, New Jersey. Sample point S-8 was a duplicate sample of S-7. The following table lists the sample results:

Sample ID	Contaminant	Conc. (ppm)	SCC (ppm)
S-1	1,2-dichloroethene (total)	2.4	50.0
	chloroform	**3.5**	1.0
	toluene	1.7	500.0
	ethylbenzene	2.0	100.0
	xylene (total)	4.7	10.0
	trichloroethene (TCE)	**33.0**	1.0
	tetrachloroethene (PCE)	**650.0**	1.0
S-2	tetrachloroethene	**1.8**	1.0
S-4	trichloroethene (TCE)	**120.0**	1.0
	tetrachloroethene (PCE)	**830.0**	1.0
S-5	ethylbenzene	3.7	100.0

	xylene (total)	6.8	10.0
S-6	1,2-dichloroethene (total)	12.0	50.0
	tetrachloroethene	**91.0**	1.0
S-8	trichloroethene (TCE)	**1.6**	1.0

ppm - parts per million
SCC - NJDEP Impact to Ground Water Soil Cleanup Criteria

(Attachments G and O)

The highest concentrations for TCE and PCE were at sample location S-4 which is adjacent to the 5,000-gallon aboveground storage tank which stored PCE at one time. PCE was also detected above the NJDEP Impact to Ground Water Soil Cleanup Criteria (SCC) at sample locations S-1, which is downgradient of the main area of concern, and S-6, which is also adjacent to the aboveground storage tank. Detectable levels of PCE below the NJDEP SCC were found in the sidegradient sample and samples collected around the former and abandoned underground storage tanks. Other compounds detected below the NJDEP SCC included breakdown products of PCE such as 1,2-dichloroethene and TCE, chloroform, and petroleum-related compounds such as ethylbenzene and xylene. Toluene, which is one of the chemicals currently being repackaged on site, was also detected but below the NJDEP SCC. The data indicates that Dixo is a source of contamination for PCE, TCE, and toluene and possibly the other contaminants mentioned. (Attachment O)

Total area of surficial contamination (square feet): unknown

If no soil sampling has been conducted, discuss areas of potentially contaminated soil, areas that are visibly contaminated or results from soil gas surveys.

Field instrumentation readings collected from soil borings with a FID and PID in April 1998 by the NJDEP, DPFSR, EMSA, exhibited elevated soil gas readings. FID readings exceeded the instrument's limitation of 1,000 parts per million at more than one area of concern. PID readings were as high as 500 ppm at one sample location. Some open borings emitted a strong, dry cleaning compound odor. (Attachment G)

Number of people occupying residences or attending school or day care on or within 200 feet of the site:

There are no schools or daycare centers on or within 200 feet of the site. There are approximately six residents within 200 feet of the facility.

Number of workers on or within 200 feet of the site: 25

Number of on-site employees: 6

Identify terrestrial sensitive environments on or within 200 feet of observed contamination.

There are no terrestrial sensitive environments on or within 200 feet of observed contamination.

Determine if any commercial agriculture, silviculture, livestock production or grazing are present on or within 200 feet of the site.

There are no commercial agriculture, silviculture, livestock production or grazing areas within 200 feet of the site.

PART V: GROUND WATER ROUTE

A. HYDROGEOLOGY

Describe geologic formations and aquifer(s) of concern. Include interconnections, confining layers, discontinuities, composition, hydraulic conductivity and permeability.

The facility lies within the Newark Basin which extends southwestward from New York's Hudson River Valley to southeastern Pennsylvania. The northeastern and northwestern margins of the basin are bordered by Precambrian and early Paleozoic rocks of the southwestern prongs of the New England Upland. The southeastern and southwestern portions of the basin overlie and are bordered by Paleozoic and Precambrian rocks of the Blue Ridge and Piedmont Provinces. Crystalline rocks of Precambrian age underlie most of northern New Jersey and adjacent portions of New York. These are primarily gneiss or granite-like rocks of metasedimentary origin that have been intruded by igneous magma. Bedrock consists of alternating beds of dark, reddish-brown sandstone and siltstone of the Passaic Formation. The facility is situated within a glaciated section of the Piedmont Plateau with generally level terrain with minor relief. Surface topography slopes gently to the west and is poorly drained. (Attachment E)

The primary ground water aquifer for the area is the Brunswick Formation. Ground water occurs in interconnected joints and fractures. The intervening unfractured rock has a negligible capacity to store and transmit ground water and, as depth increases, the fractures and joints decrease in number and size. Ground water occurs in a series of alternating tabular aquifers and aquitards 20 to 30 feet thick. The water-bearing fractures of each tabular aquifer are more or less continuous, but hydraulic connections between individual aquifers are poor. (Attachment E)

Virtually all ground water in the Brunswick Formation occurs in interconnecting fractures and joints. Additional void space occurs in the sandstone and conglomerate beds where cementing material is lacking, either because it was never deposited, or it was dissolved and removed by circulating ground water. Ground water occurs in both the bedrock and the overlying unconsolidated sediments. Bedrock is composed of fractured sandstone and shale of the Passaic Formation. Unconsolidated sediments are composed of interbedded sand and clay of glacial origin. No confining layers are present between the unconsolidated deposits and the bedrock unit, therefore, the units are hydraulically connected and a downward vertical hydraulic gradient is present. Ground water flow is primarily horizontal with some downward drift. The depth to the water table ranges from approximately 4 to 17 feet below grade. The predominant ground water flow in the shallow unconsolidated sediment/bedrock is southwest toward the Saddle River. Hydraulic gradients in the bedrock and unconsolidated sediments are generally low. (Attachment E)

Depth to water table: 4 to 17 feet (perched table)

Depth to aquifer of concern: ranges from 60 to 600 feet (Attachment E)

Depth from lowest point of waste disposal/storage to highest seasonal level of the saturated zone of the aquifer of concern:

4 feet.

Thickness and permeability of the least permeable layer between the ground surface and the aquifer of concern: 6 to 8 inches thick, 10^{-10} to 10^{-7} cm/sec

Thickness of aquifer: 8,000 feet

Direction of ground water flow: The predominant regional ground water flow is to the southwest toward the Saddle River.

Net precipitation at the site (inches): The average annual precipitation for Bergen County is 44 inches.

Karst (Y/N): N

Wellhead Protection Area within 4 miles of the site (Y/N): N
Does a waste source overlie a Wellhead Protection Area (Y/N): N

B. MONITORING WELL INFORMATION

Well No.	Screen Depth	Formation	Location
MW-1	13 feet	overburden	Adjacent to an abandoned-in-place 4,000-gal UST

Identify the upgradient well(s):

One monitoring well was installed immediately sidegradient to an abandoned in-place 4,000-gallon gasoline underground storage tank as part of the facility's underground storage tank closure requirements. (Attachment C)

Briefly discuss why the monitoring wells were installed and describe contaminants identified in the monitoring wells. Include Well No., sampling date, sampling agency or company, contaminant levels and remediation standards. Discuss any other groundwater sampling that has occurred. For each sampling event, list the name, address and certification number of the lab which performed the analyses. State who conducted the quality assurance review of the data and summarize any data qualifications.

On October 11, 1991, one ground water monitoring well (MW-1) was installed by Warren George, Inc., of Jersey City, New Jersey, under New Jersey Well Permit Number 26-27140. The flush-mount well was installed to a depth of 14.5 feet just north of the abandoned-in-place, 4,000-gallon underground gasoline storage tank. Field screening readings collected from the well cuttings with a photoionization detector were as high as 650 ppm. Dry cleaning odors were noted but no gasoline odors were present. (Attachment C)

The monitoring well was sampled in 1991 by Bertin Engineering and analyzed for volatile organic compounds by All-Test. The following table lists the detected contaminants:

Contaminant	Conc. (ppb)	GWQC (ppb)
trichloroethene	28.30	1.0

tetrachloroethene	**129.10**	1.0
1,2-dichloroethene	56.87	NC

ppb - parts per billion
GWQC - NJDEP Ground Water Quality Criteria
NC - no established criteria
* Bold values exceed NJDEP GWQC

(Attachment C)

As part of a site investigation conducted by the NJDEP, EMSA, the monitoring well was resampled on April 28, 1998. Three volumes of static water were purged before the sample was collected with a dedicated teflon bailer and analyzed for volatile organic compounds by ICM Laboratories. The following table summarizes the sample results:

Concentration	Conc. (ppb)	GWQC (ppb)
cis-1,2-dichloroethene	**9,100.0**	10.0
trichloroethene	**5,700.0**	1.0
tetrachloroethene	**15,000.0**	1.0

ppb - part per billion
GWQC - NJDEP Ground Water Quality Criteria
* Bold values exceed NJDEP GWQC

(Attachments G and O)

In addition to the monitoring well sample collected during April 1998, the NJDEP collected ground water samples from soil borings at several areas of concern and upgradient and downgradient location based on regional ground water flow to determine the potential for ground water contamination plume migration. The borings were advanced with a Geoprobe to a maximum depth of 16 feet. The underlying bedrock prevented the Geoprobe from advancing deeper, however, a perched water table as shallow as 4 feet below grade, permitted the collection of two representative samples at intervals of approximately 10 feet at each sample location. Volatile organic compounds were analyzed by ICM Laboratories. Duplicate samples were split with Environmental Partners Inc. (EPI) of Parsippany, New Jersey, an environmental consulting firm hired by Dixo to observe the sampling activities. The following table summarizes the ICM sample results:

Sample location 1 - empty drum storage area
Sample location 2 - downgradient location
Sample location 3 - downgradient location
Sample location 4 - 5,000-gallon AST
Sample location 5 - upgradient location

Location	**Depth Screened**
1A	9' to 12'
1B	13.5' to 16.5'
2A	9' to 12'
2B	14' to 16'
3A	9' to 12'
3B	15' to 18'
4A	6' to 9'
4B	9' to 12'
5A	9' to 12'
6A	duplicate of 4A

Sample ID	Contaminant	Conc. (ppb)	GWQC (ppb)
GW-1A	methylene chloride	**2.0**	2.0
	cis-1,2-dichloroethene	0.67	10.0
	1,1,1-trichloroethane	0.88	30.0
	trichloroethene	0.87	1.0
	tetrachloroethene	**4.5**	1.0
	carbon disulfide	0.85	NC
GW-1B	methylene chloride	**3.1**	2.0
	cis-1,2-dichloroethene	4.3	10.0
	1,1,1-trichloroethane	3.4	30.0
	trichloroethene	**3.1**	1.0
	tetrachloroethene	**8.2**	1.0
GW-2A	trans-1,2-dichloroethene	6.1	100.0
	cis-1,2-dichloroethene	**190.0**	10.0
	chloroform	**70.0**	6.0
	1,1,1-trichloroethane	6.9	30.0
	trichloroethene	**120.0**	1.0

	tetrachloroethene	**1,200.0**	1.0
GW-2B	cis-1,2-dichloroethene	**190.0**	10.0
	trichloroethene	**310.0**	1.0
	tetrachloroethene	**2,400.0**	1.0
GW-3A	carbon disulfide	3.7	NC
GW-3B	cis-1,2-dichloroethene	**1,800.0**	10.0
	trichloroethene	**470.0**	1.0
	tetrachloroethene	**1,300.0**	1.0
GW-4A	methylene chloride	**8,900.0**	2.0
	trichloroethene	**12,000.0**	1.0
	tetrachloroethene	**64,000.0**	1.0
GW-4B	methylene chloride	**1,300.0**	2.0
	tetrachloroethene	**3,900.0**	1.0
GW-5A	methylene chloride	**5.5**	2.0
	trans-1,2-dichloroethene	3.6	100.0
	cis-1,2-dichloroethene	**190.0**	10.0
	trichloroethene	**27.0**	1.0
	tetrachloroethene	**15.0**	1.0
GW-6A	methylene chloride	**22,000.0**	2.0
	cis-1,2-dichloroethene	**69,000.0**	10.0
	trichloroethene	**20,000.0**	1.0
	tetrachloroethene	**140,000.0**	1.0

ppb - parts per billion
GWQC - NJDEP Ground Water Quality Criteria
NC - no established criteria
* Bold values exceed NJDEP GWQC

(Attachments G and O)

Field gas chromatography screening of samples was also performed by the NJDEP, EMSA, using a Photovac 10S50 calibrated to a PCE (10 ppb) and TCE (9.0 ppb) standard. The following table summarizes the field GC results:

Sample ID	Contaminant	Conc. (ppb)	GWQC (ppb)
1A	TCE	1.69	1.0
	PCE	10.73	1.0
1B	TCE	3.65	1.0
	PCE	15.08	1.0
2A	TCE	73.18	1.0
	PCE	1,257.0	1.0
2B	TCE	69.52	1.0
	PCE	856.80	1.0
3A	no detection		
3B	TCE	99.58	1.0
	PCE	690.10	1.0
4A	off scale no integration		
5A	TCE	30.11	1.0
	PCE	62.47	1.0

ppb - part per billion
TCE - trichloroethene
PCE - tetrachloroethene
GWQC - NJDEP Ground Water Quality Criteria
NC - no established criteria

(Attachment S)

Sample 4B was not analyzed in the field due to the excessive amounts of contamination detected in sample 4A. Gross contamination was considered too highly concentrated and potentially destructive for the instrument column. (Attachment S)

A letter issued to Dixo on July 8, 1992, by the NJDEP, Division of Responsible Party Site Remediation, Industrial Site Evaluation Element, stated that Dixo complied with the existing requirements regarding the closure of underground storage tank system(s) and was therefore not required to conduct corrective action pursuant to N.J.A.C. 7:14B-8. The facility owner was instructed not to seal their monitoring well which could be used at a later date to evaluate ground water quality. (Attachment D)

C. POTABLE WELL INFORMATION

Distance to nearest potable well: 500 feet
Depth of nearest potable well: 155 feet

Identify all public supply wells within 4 miles of the site:

Water Company	Distance from Site (miles)	Depth (feet)	Formation
United Water New Jersey Inc.	2.9	550	Trb
United Water New Jersey Inc.	2.7	350	Trb
United Water New Jersey Inc.	2.7	235	Trb
United Water New Jersey Inc.	1.8	168	Qsd
United Water New Jersey Inc.	1.9	190	Qsd
United Water New Jersey Inc.	1.1	473	Trb
United Water New Jersey Inc.	3.9	28	Qsd
United Water New Jersey Inc.	3.9	388	Trb
Wallington Water Department	3.9	400	Trb
Wallington Water Department	3.3	400	Trb
Wallington Water Department	3.8	400	Trb
Wallington Water Department	3.7	503	Trb
Wallington Water Department	3.8	506	Trb
Garfield Water Department	2.7	404	Trb
Garfield Water Department	2.7	358	Trb
Garfield Water Department	2.4	350	Trb
Garfield Water Department	2.3	353	Trb
Garfield Water Department	2.8	350	Trb
Garfield Water Department	2.9	485	Trb
Garfield Water Department	3.1	400	Trb
Garfield Water Department	3.0	353	Trb
Garfield Water Department	3.0	300	Trb

Garfield Water Department	1.9	400	Trb
Garfield Water Department	2.0	475	Trb
Garfield Water Department	2.1	300	Trb
Garfield Water Department	2.2	405	Trb
Garfield Water Department	2.6	353	Trb
Garfield Water Department	2.5	353	Trb
Garfield Water Department	2.4	354	Trb
Fair Lawn Borough	3.4	300	Trb
Fair Lawn Borough	3.5	458	Trb
Fair Lawn Borough	3.1	430	Trb
Fair Lawn Borough	3.8	404	Trb
Fair Lawn Borough	4.0	413	Trb
Fair Lawn Borough	3.9	402	Trb
Fair Lawn Borough	2.9	370	Trb
Fair Lawn Borough	3.0	400	Trb
Fair Lawn Borough	3.2	355	Trb
Fair Lawn Borough	3.3	300	Trb

Trb - Triassic Brunswick Formation
Qsd - Quaternary Stratified Drift

State whether ground water is blended with surface water, ground water or both prior to distribution:

Wells operated by the Borough of Fairlawn and the Garfield Water Department are blended with bulk purchases from the Hackensack Water Company (now referred to as United Water of New Jersey) and the Passaic Valley Water Commission prior to distribution. Some of the wells are equipped with air strippers due to volatile organic compounds contamination. Due to contamination with chlorinated organic compounds, the Wallington Water Department also makes bulk purchases from the Passaic Valley Water Commission which gets its water from the Passaic Valley watershed upstream from Little Falls. Sources include the Passaic River and the Wanaque Reservoir. (Attachment R)

Discuss private potable well use within 4 miles of the site. Include depth, formation and distance, if available.

There are approximately 100 private potable wells located within a 4-mile radius of the site. The wells range in depth from 60 to 660 feet. A private Rochelle Park Swim Club potable well was contaminated with PCE at 18 times above the NJDEP Maximum Contaminant Levels for Drinking Water. Homeowner wells located along West Magnolia Avenue, approximately 2,500 feet to the northeast, with PCE, TCE and 1,2-dichloroethylene. (Attachment E)

Discuss the site's source of potable water.

Ground water is generally not used for potable purposes in the lower Saddle River Basin. The main source of water for the area is surface water in the Hackensack River Basin supplied by the Hackensack Water Company (now referred to as United Water of New Jersey). (Attachments E, R and Map 5)

Discuss information regarding the population utilizing wells that are known to be contaminated by hazardous substances attributed to an observed release from the site. Also include any other evidence of contaminated drinking water or wells closed due to contamination. State whether Level 1 or Level 2 contamination is present.

PCE, the primary ground water contaminant at Dixo, was detected above the NJDEP Maximum Contaminant Level (MCL) for drinking water at the Rochelle Park Swim Club well in 1997. The well supplies water to the private club's olympic-size swimming pool, showers and drinking water fountains. Samples were collected from the well on August 29, 1997, by the Bergen County Health Department and analyzed for volatile organic compounds by Garden State Laboratories of Hillside, New Jersey. The well, which is located approximately 2,050 feet to the west of Dixo, exhibited concentrations of PCE at 18 parts per billion (ppb). Confirmatory samples, analyzed by Aqua Associates, Inc., of Fairfield, New Jersey, (N.J. Certification No. 07066) exhibited PCE at 16 ppb. (Attachment K,M and Q)

As a result of the MCL exceedances, the Rochelle Park Swim Club was instructed by the Bergen County Health Department in November 1997 to cease using the well for potable and recreational purposes. It was also recommended that the swim club connect to the public community water supply. Based on the analytical results of the April 1998 soil and ground water investigation, Dixo is considered a source of the contamination. (Attachment N)

Private potable wells located along West Magnolia Avenue, approximately 2,500 feet to the northeast, were also contaminated with PCE and products of its decompostion at concentrations exceeding NJDEP MCLs. Approximately 25 additional private potable wells are at risk of also being contaminated. (Attachment E and L)

Tabulate for each aquifer the population utilizing that aquifer for drinking purposes within 4 miles of the site. Include only those populations which utilize wells that have a potential to be impacted, not wells which are actually impacted.

Distance from site (miles)	Population/Aquifer	
	Trb	Qsd
0 - 1/4	50	0
> 1/4 - 1/2	50	0
> 1/2 - 1	50	0
> 1 - 2	50	202,517
> 2 - 3	32,780	0
> 3 - 4	36,025	22,502

Trb - Triassic Brunswick Formation
Qsd - Quaternary Stratified Drift

(Attachments E and R, Map 5)

Identify one of the following resource uses of ground water within 4 miles of the site (i.e., commercial livestock watering, ingredient in commercial food preparation, supply for commercial aquaculture, supply for major, or designated water recreation area, excluding drinking water use, irrigation of commercial food or commercial forage crops, unusable).

Ground water is not used for commercial livestock watering, commercial food preparation, commercial aquaculture or recreation within 4 miles of the site.

D. LIKELIHOOD OF RELEASE

Discuss the likelihood of a release of contaminants to ground water, including any other information concerning the ground water contamination route. Identify contaminants detected or suspected and provide a rationale for attributing them to the site.

Ground water samples collected by the NJDEP, DPFSR, EMSA have confirmed a release of PCE to the underlying aquifer as a result of site operations. Gross concentrations of PCE (140,000 ppb), the primary ground water contaminant detected at the suspected point of discharge, which is hydraulically upgradient from the Rochelle Park Swim Club potable well, implicates Dixo as a primary source of PCE contamination in area ground water. Private potable wells along West Magnolia Avenue with levels of PCE, TCE and 1,2-DCE contamination above the NJDEP Maximum Contaminant Level (MCL) were likely contaminated by the same source. (Attachment O)

PART VI: SURFACE WATER ROUTE

A. SURFACE WATER

Does a migration pathway to surface water exist? (Y/N): Y

A storm sewer catch basin located in the facility's parking lot discharges to the Westerly Brook which empties into the Saddle River. (Attachment E)

Flood plain: The facility is located in the 500-year flood plain.

Size of drainage area for sources at the site (acres): 0.5

2-year, 24-hour rainfall (inches): The net annual precipitation is 44 inches.

Does contaminated ground water discharge to surface water? (Y/N): unknown

Identify known or potentially contaminated surface water bodies. Follow the pathway of the surface water and indicate all adjoining bodies of water along a route of 15 stream miles.

Surface Water Body	Distance from Site (miles)	Flow (cfs)	Usage(s)
Westerly Brook	0.09	<10	stormwater runoff

Saddle River	0.5	100	fishery, recreation
Passaic River	4.3	1,150	fishery, recreation, potable water

Identify drinking water intakes and fisheries within 15 miles downstream (or upstream in tidal areas) of the site. For each intake or fishery identify the distance from the point of surface water entry, the name of the fishery and/or supplier and population served.

There are no surface water intakes within 15 miles downstream of the facility. A surface water intake is located in the Saddle River Basin at Arcola, approximately 2.5 miles upstream from the facility. (Attachment E)

Discuss surface water or sediment sampling conducted in relation to the site. Discuss visual observations if analytical data are not available (include date of observation). Include surface water body, sampling date, sampling agency or company, contaminant. State whether Level 1 or Level 2 contamination is present for surface water. State whether Level 2 contamination of sediments is present. For each sampling event, list the name, address and certification number of the lab which performed the analyses. State who conducted the quality assurance review of the data and summarize any data qualifications.

No surface water or sediment samples were collected as part of the site investigation. The nearest major body of surface water is the Saddle River, located 0.5 mile to the southwest. A storm drain located on the parking lot discharges to the Westerly Brook which empties into the Saddle River. (Attachment E)

Determine if a contaminant on site displays bioaccumulative properties. Identify all bioaccumulative substances that may impact the food chain.

No contaminants detected in the ground water or soil samples collected on site display bioaccumulative properties. (Attachment O)

Determine if surface water is used for irrigation of commercial food or commercial forage crops, watering of commercial livestock, commercial food preparation or recreation.

Surface water is not used for irrigation, commercial food or forage crops, watering of commercial livestock or commercial food preparation. Portions of the Passaic River are used for recreation.

B. SENSITIVE ENVIRONMENTS

Identify all sensitive environments, including wetlands, along the 15 stream-mile pathway from the site:

Environment Type	Surface Water Body	Flow (cfs)	Distance from Site (miles)	Wetland Frontage (feet)
Uplands	Passaic River	1,150	5.37	1,305
Deciduous Wooded	Passaic River	1,150	9.60	600

(Map 6)

C. LIKELIHOOD OF RELEASE

Discuss the likelihood of a release of contaminant(s) to surface water, include any additional information concerning the surface water route. Identify contaminants detected and provide rationale for attributing them to the site. Identify any intake fisheries and sensitive environments, listed above, that are or be actually contaminated by hazardous substances attributed t observed release from the site.

A storm sewer drain discharging to the Westerly Brook is loc the facility's parking lot. Most of the facility is pa contaminants appear to be concentrated below the upper 2 the soil profile. This currently reduces the c contaminated runoff entering the nearest body of surf since the above ground storage tank is no longer used spills in the past as a result of filling the tar migrated into the storm sewer. (Attachments C and O)

PART VII: AIR ROUTE

A. POPULATION AND SENSITIVE ENVIRONMENTS

Identify populations residing within 4 miles of the site.

Distance (miles)	Population
on site	8
> 0 - 1/4	1,154
> 1/4 - 1/2	2,994
> 1/2 - 1	15,182
> 1 - 2	65,426
> 2 - 3	97,925
> 3 - 4	171,648

(Map 8)

Identify sensitive environments and wetland acreage within 4 miles of the site.

Distance	Type of environment	Wetland acreage
0 - 1/4	freshwater wetlands	1
> 1/4 - 1/2	freshwater wetlands	7
> 1/2 - 1	freshwater wetlands	41
> 1 - 2	freshwater wetlands	130
> 2 - 3	freshwater wetlands	239
> 3 - 4	freshwater wetlands	580

(Map 9)

B. LIKELIHOOD OF RELEASE

Describe the likelihood of release of hazardous substances to air. Identify contaminants detected or suspected and provide a rationale for attributing them to the site. For observed release, define the supporting analytical evidence and relationship to background.

A wall fan located in the product-transfer building vents solvent vapors into the alley along the northeast side of the facility. NJDEP employees conducting a site investigation on April 28, 29, and 30, 1998, complained of dry throats, dizziness and nausea while working directly beneath the vent. The unpermitted discharge could have a health impact on site workers and employees at the adjacent facility.

If a release to air is observed or suspected, determine the number of people that reside within the area of air contamination.

There are approximately 20 employees in the vicinity of the vent.

If a release to air is observed, identify any sensitive environments that are located within the area of air contamination.

There are no sensitive environments in the vicinity of the site.

PART VIII: REMOVAL ACTION AND/OR IEC CONDITION

Discuss conditions which constitute an Immediate Environmental Concern (IEC) or warrant EPA Removal Action consideration (improper storage of incompatible/reactive materials, leaking or unsound containers, inadequate site security, subsurface gas threat).

The facility does not warrant EPA Removal Action consideration, but is considered an IEC as an uncontrolled source of potable well contamination.

PART IX: ENFORCEMENT ACTIONS

No record of violations or enforcement activities were on file at the NJDEP.

PART X: CONCLUSIONS AND RECOMMENDATIONS

List each area of concern and state whether further remediation is required.

Dixo has been a repackager of solvents at its Rochelle Park location for over forty years. In the past, the facility stored and transferred PCE from a 5,000-gallon aboveground storage tank. In 1997 contaminants, including PCE, above the State's Maximum Contaminant Level for Drinking Water were detected in the Rochelle Park Swim Club potable well which is 2,000 feet downgradient from Dixo. The levels, which were 18 times the NJDEP MCL, prompted an investigation of the Dixo facility by the NJDEP. As part of the investigation, soil and ground water samples were collected at upgradient and downgradient locations and at selected Areas of Environmental Concern throughout the site. The sample results confirm a release of PCE to ground water at the location of a 5,000-gallon aboveground storage tank which previously held PCE. Significant levels of contamination adjacent to and downgradient from the tank implicate Dixo as a primary source of contamination for the Rochelle Park Swim Club potable well and, possibly, for the West Magnolia Avenue wells to the northeast. Upgradient and sidegradient ground water samples exhibited a significant decrease in contamination.

A soil and ground water Remedial Investigation is recommended to determine the extent of contamination and to evaluate the potential risk to other potable wells in the area.

The site is assigned a higher priority for further action under CERCLA.

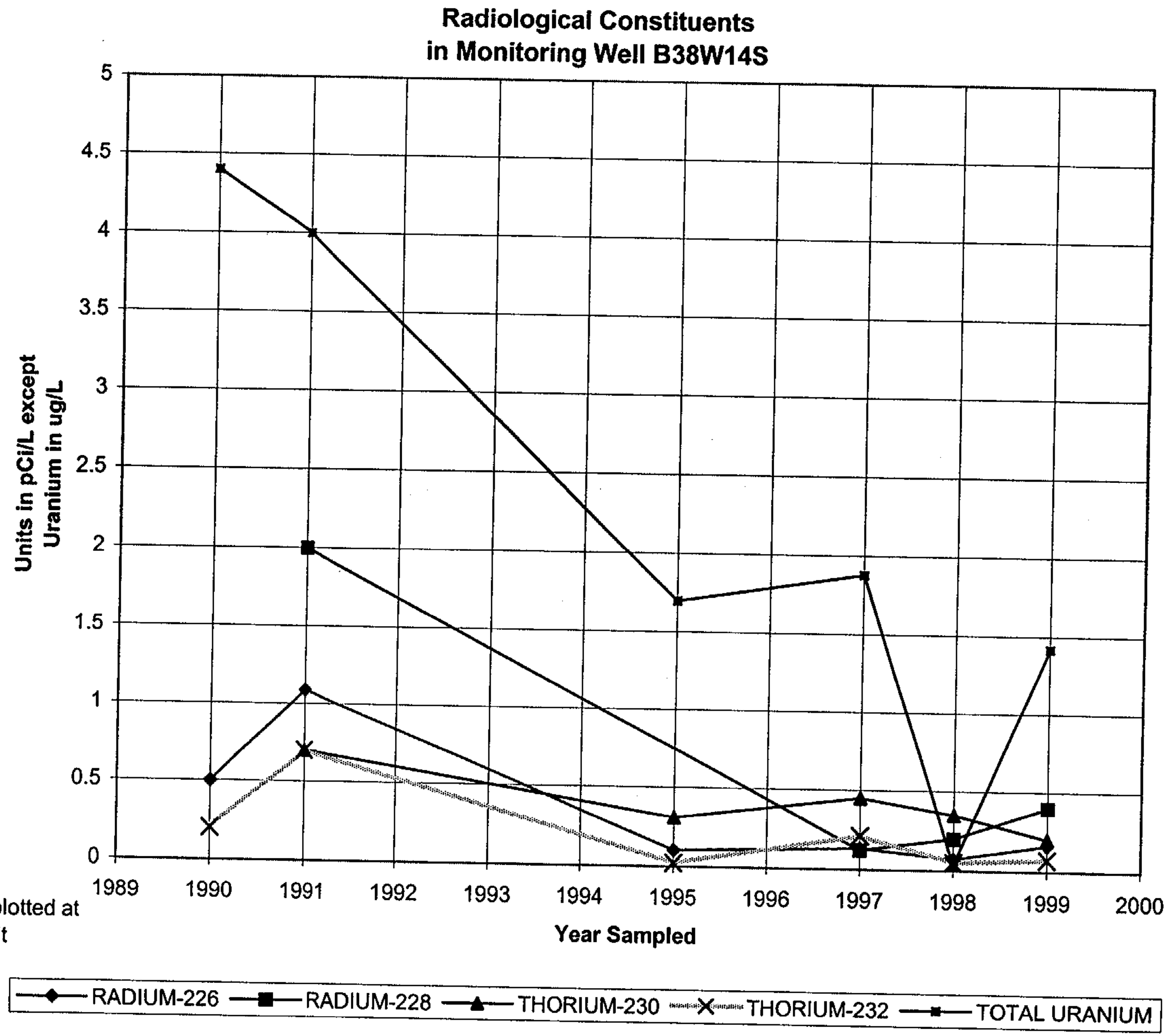
Submitted by: David E. Triggs
Title: HSMS II
NJDEP, Division of Publicly Funded Site Remediation,
Bureau of Environmental Measurements and Quality Assurance
Environmental Measurements and Site Assessment Section
Date: July 29, 1998

APPENDIX D

Concentration Plots for Radiological and Chemical Constituents

Radiological Plots

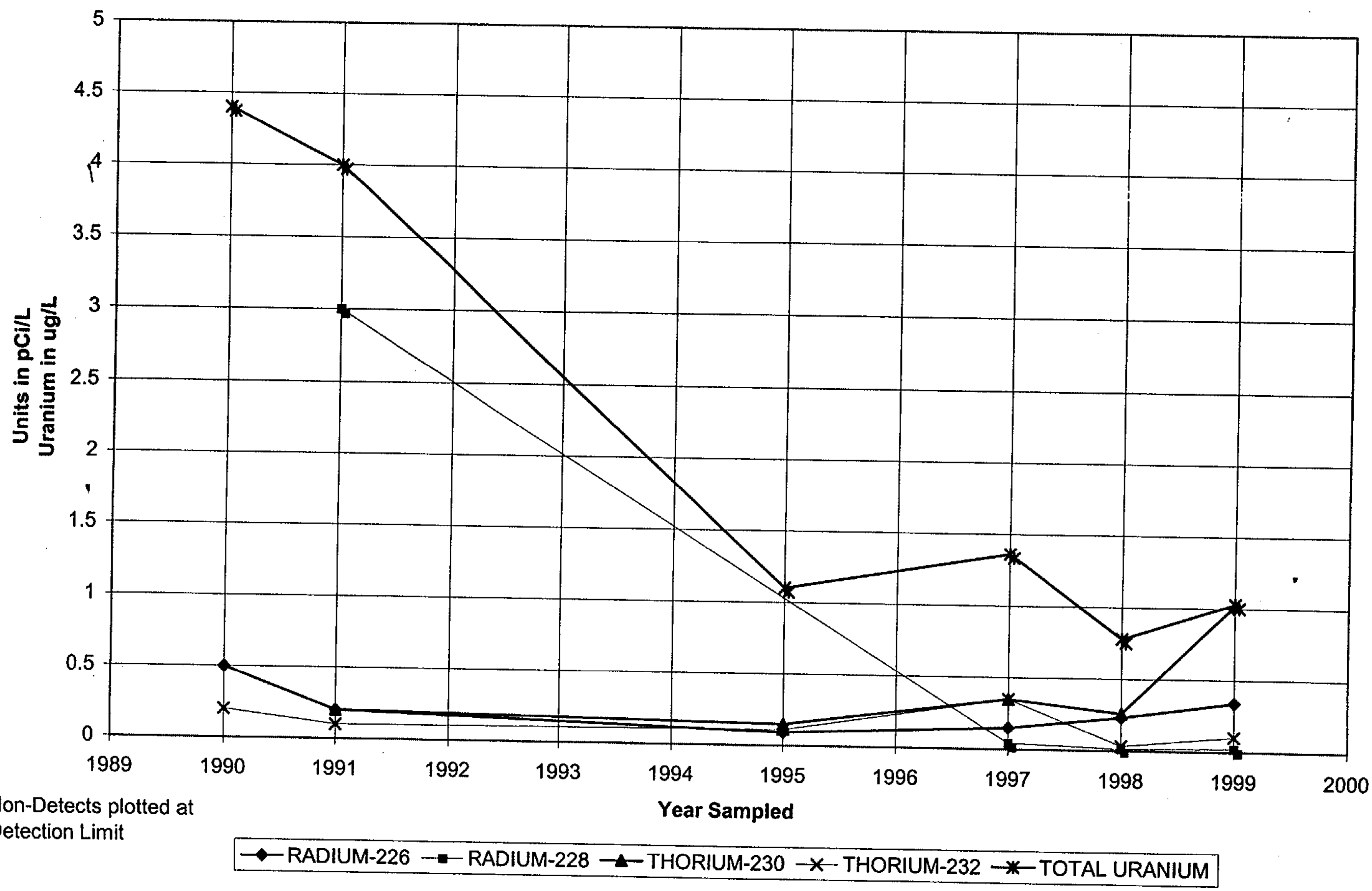
FUSRAP MAYWOOD SUPERFUND SITE
SUMMARY OF



Non-Detects plotted at
Detection Limit

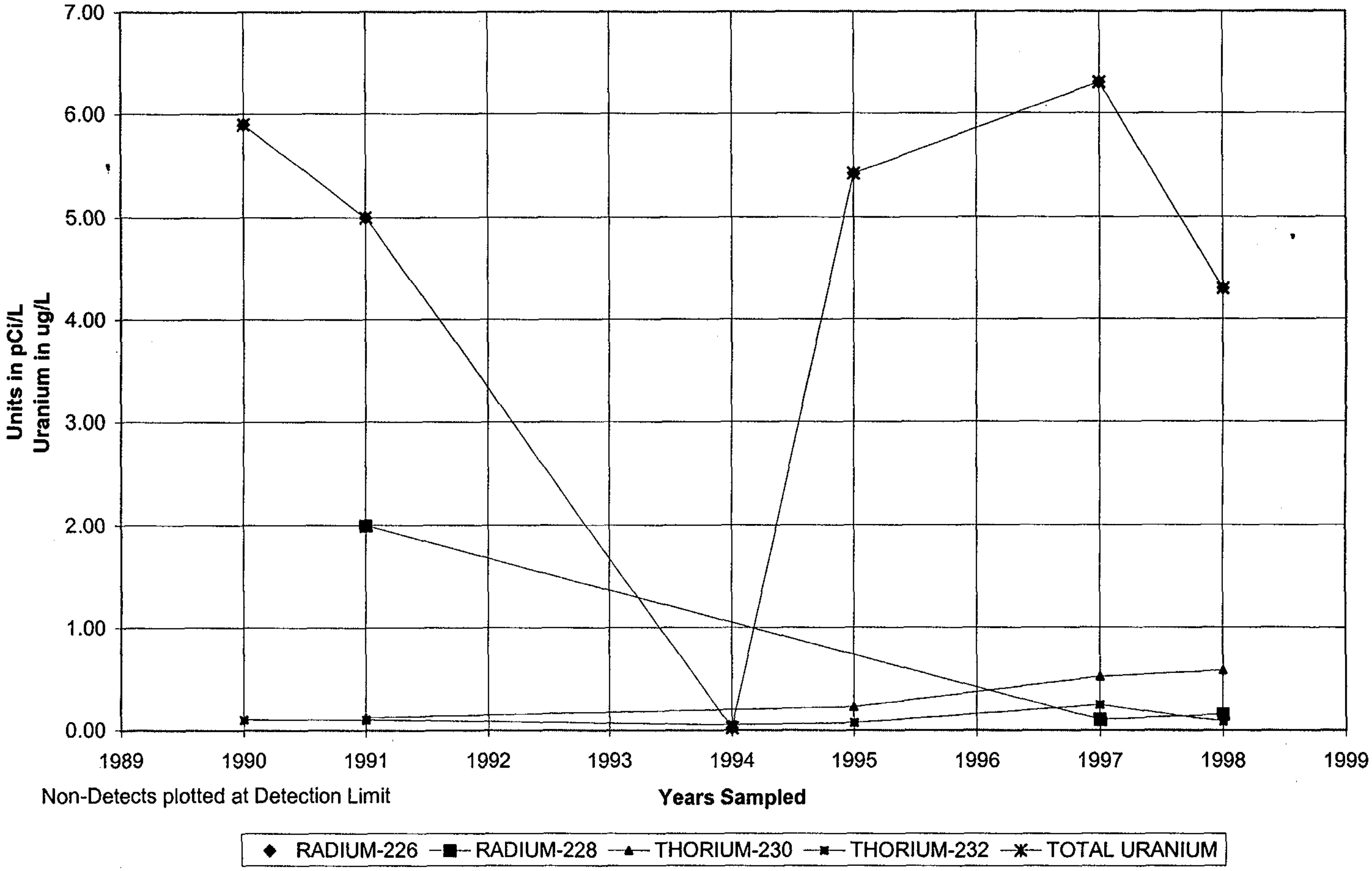
FUSRAP MAYWOOD SUPERFUND SITE
SUMMARY OF

Radiological Constituents in Monitoring Well B38W14D

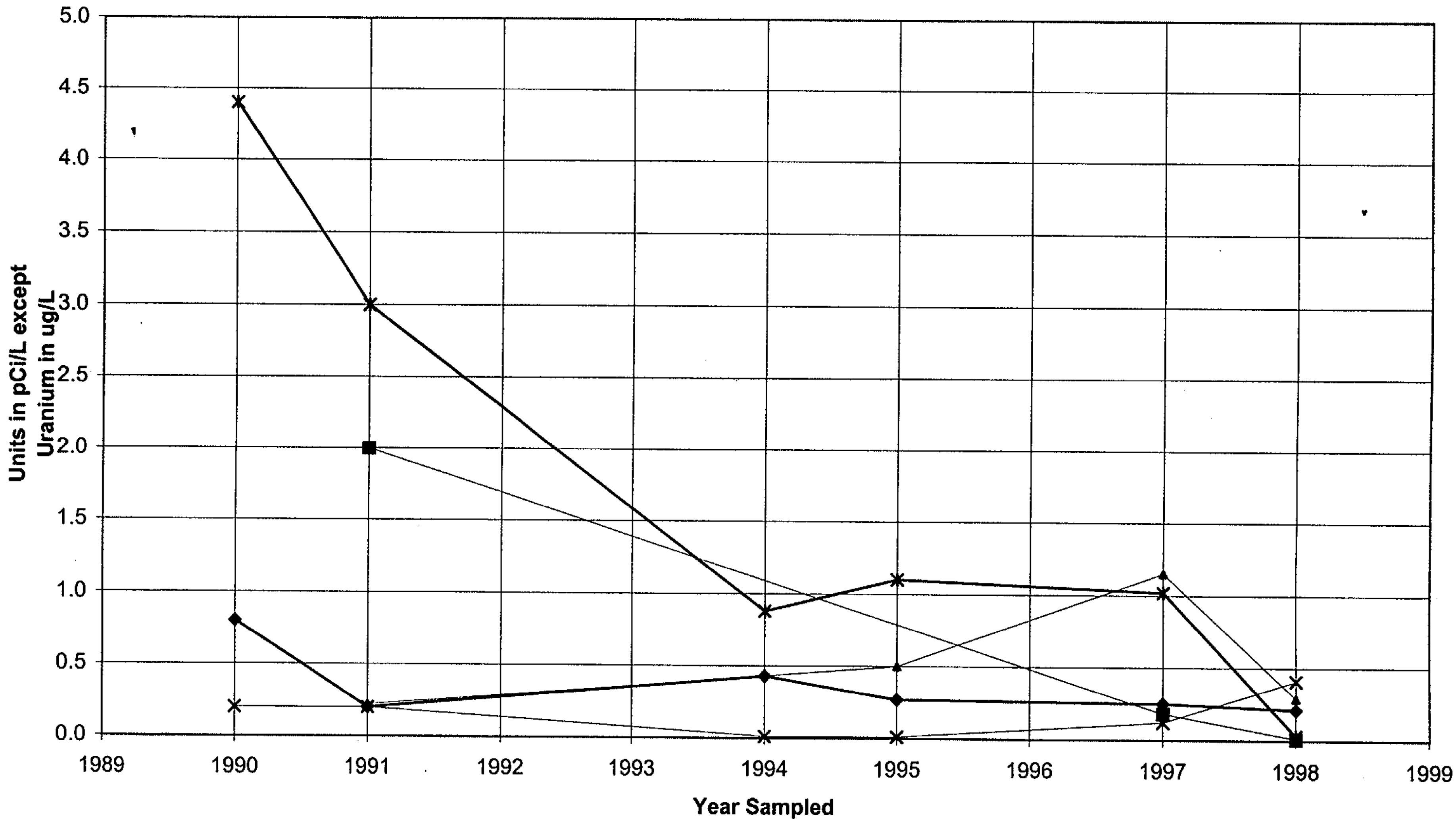


Non-Detects plotted at Detection Limit

Radiological Constituents in Monitoring Well B38W15D

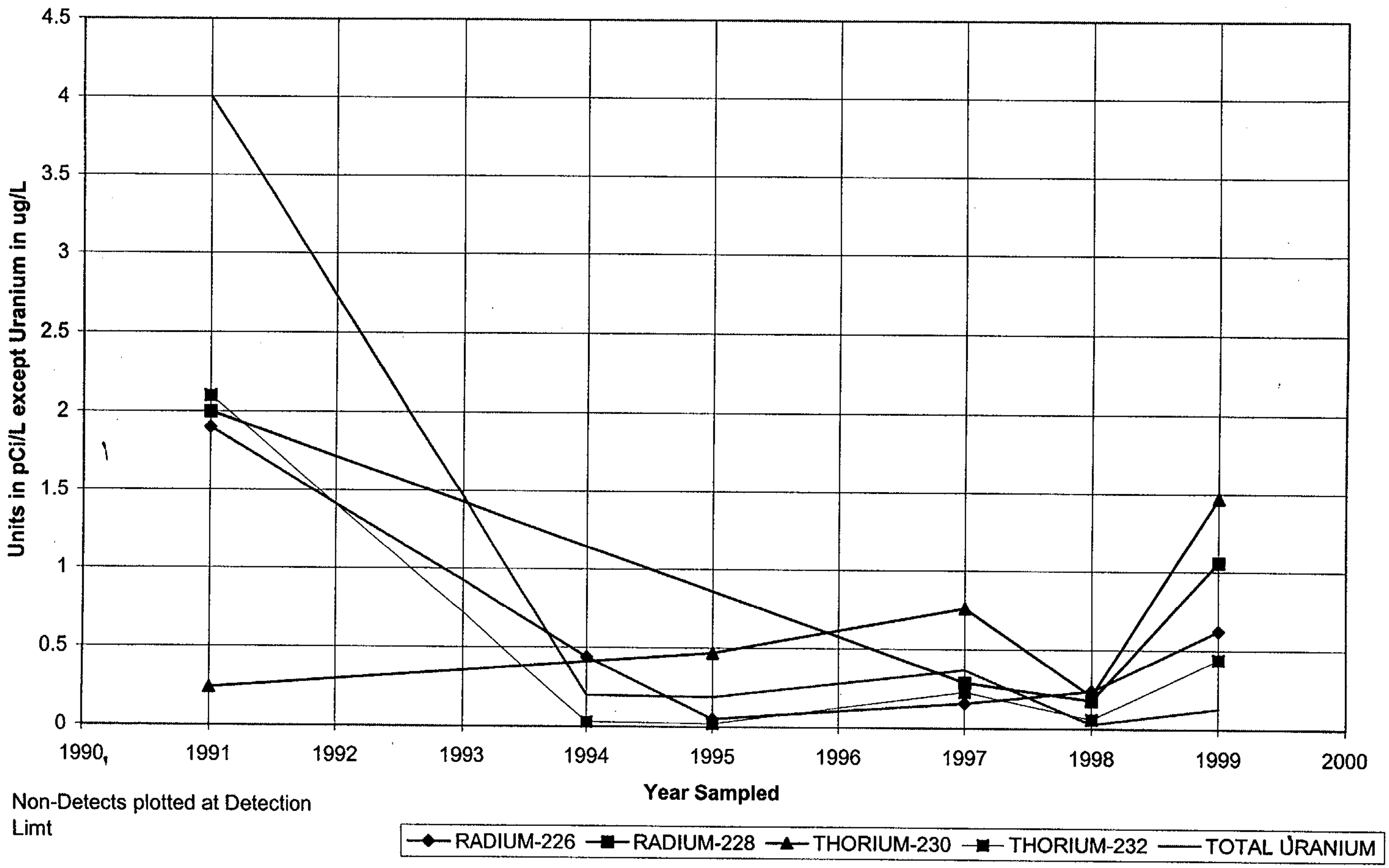


Radiological Constituents in Monitoring Well B38W15S



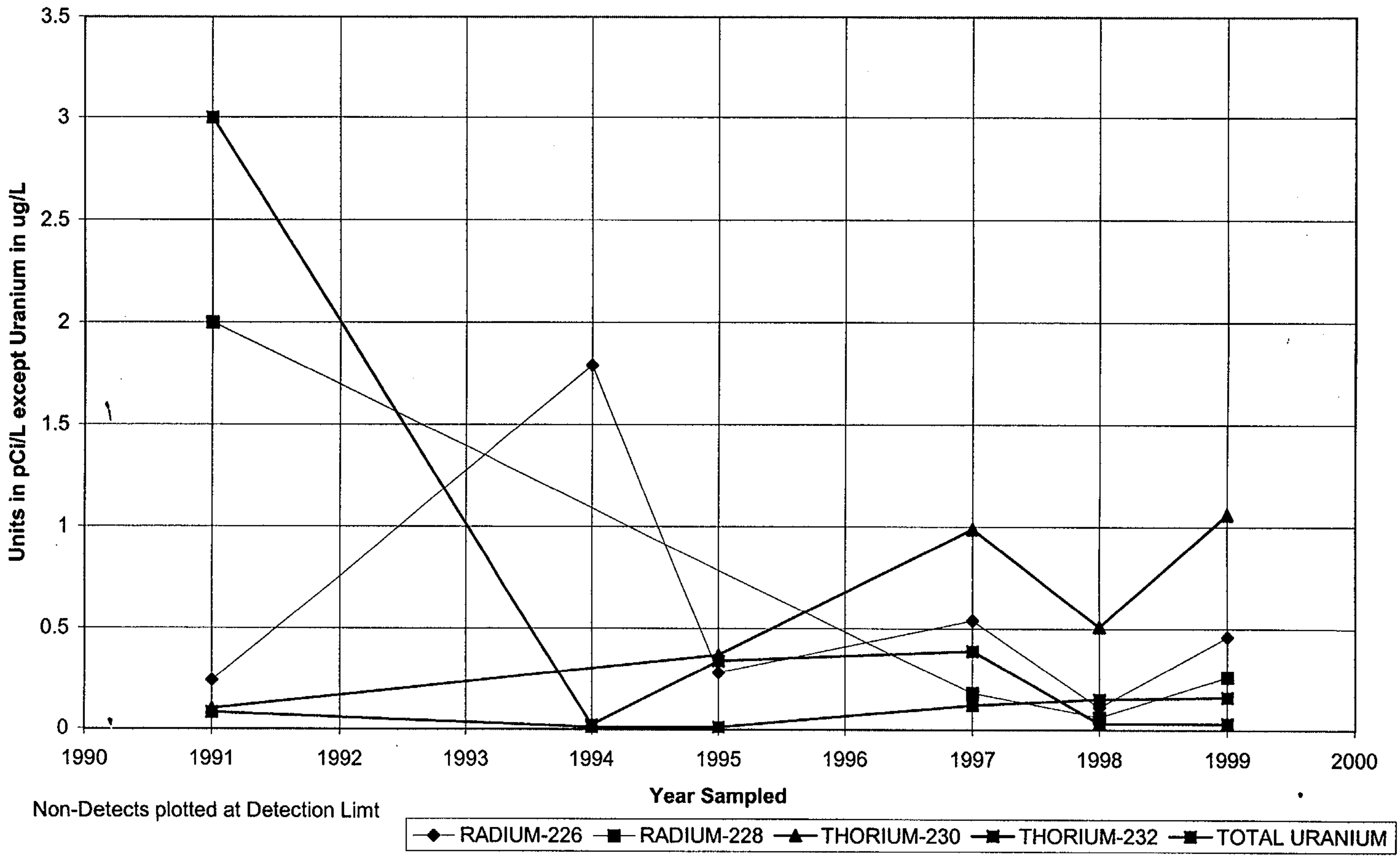
Non-Detects plotted at Detection Limit

Radiological Constituents in Monitoring Well B38W17A

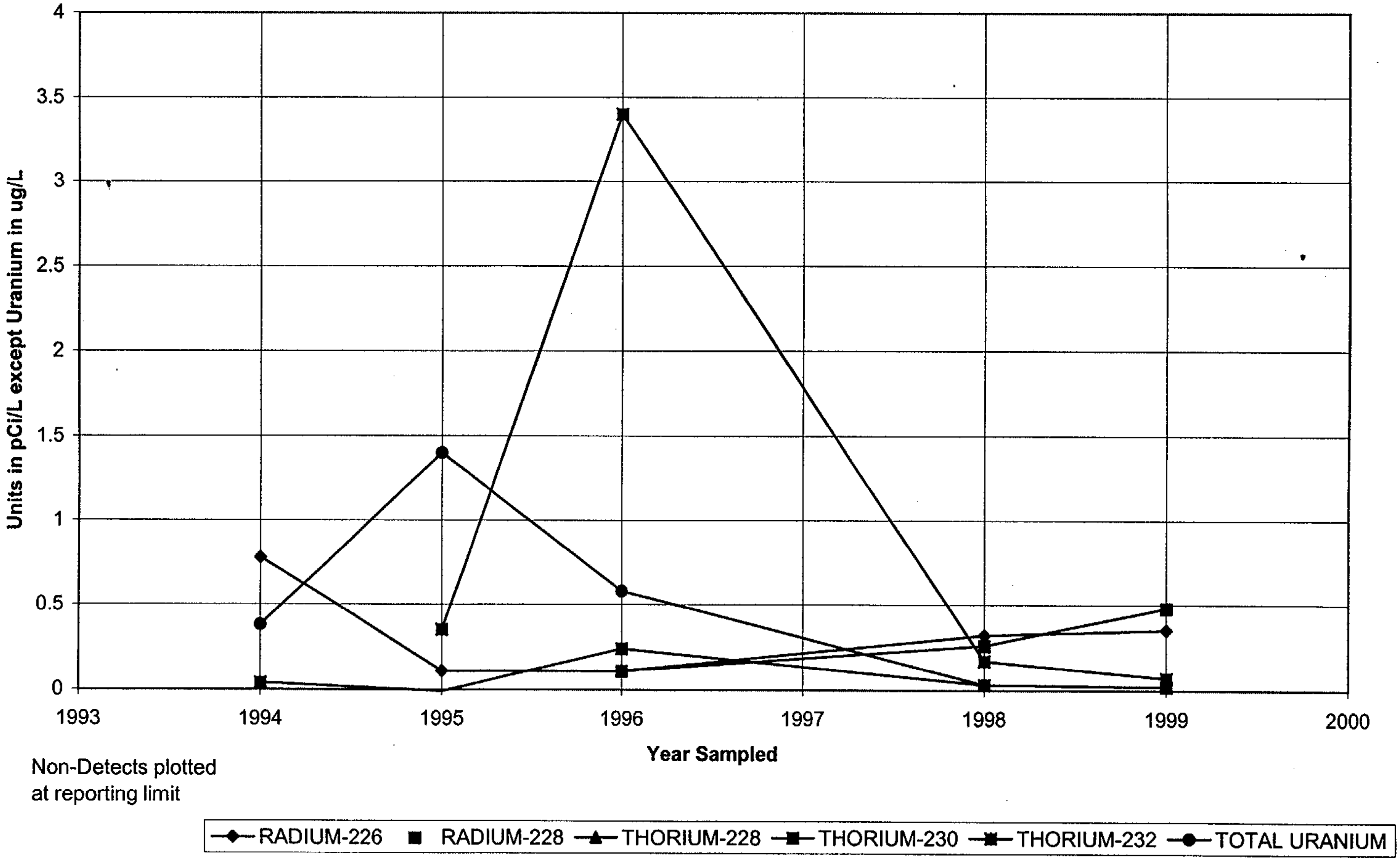


Non-Detects plotted at Detection Limt

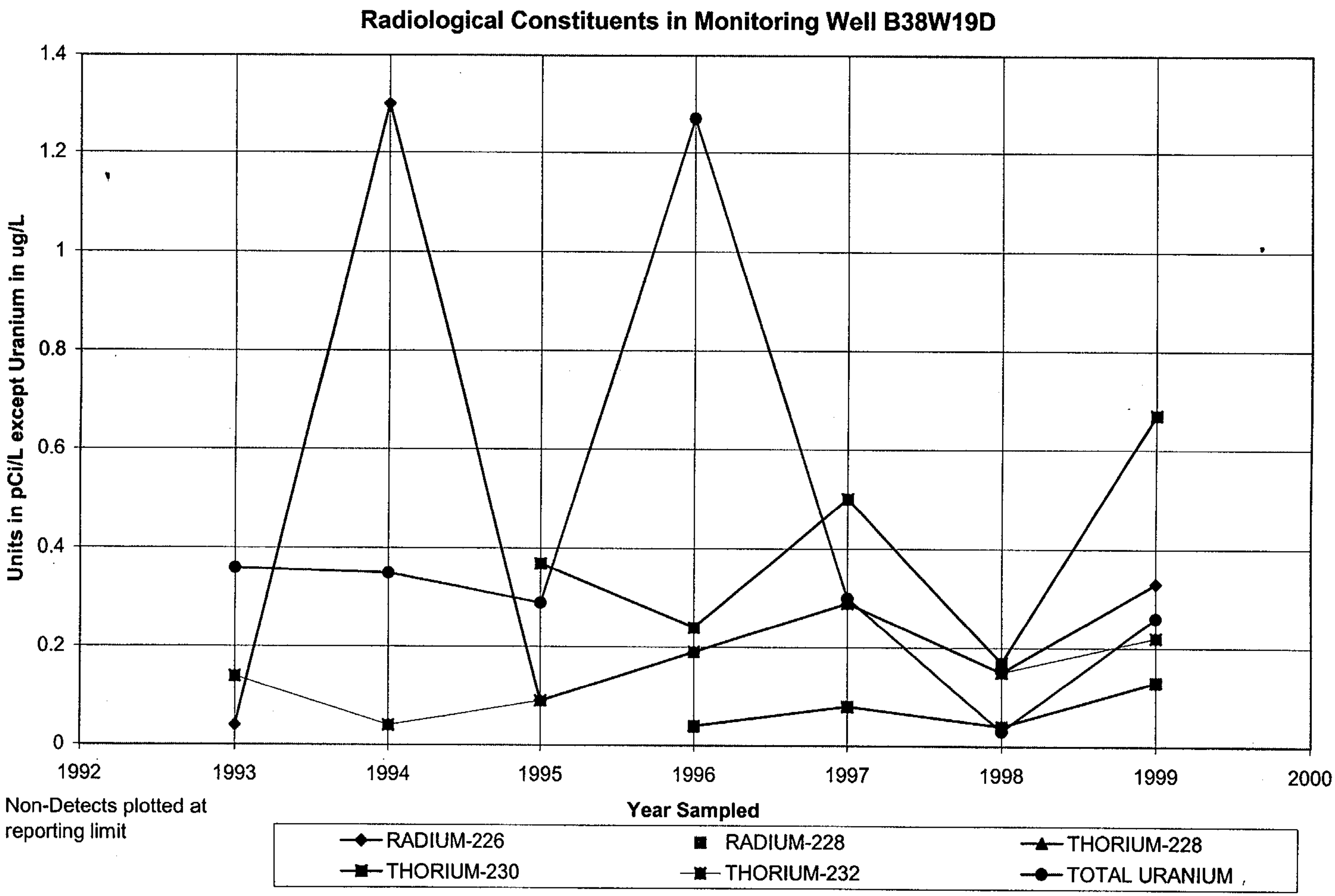
Radiological Constituents in Monitoring Well B38W17B



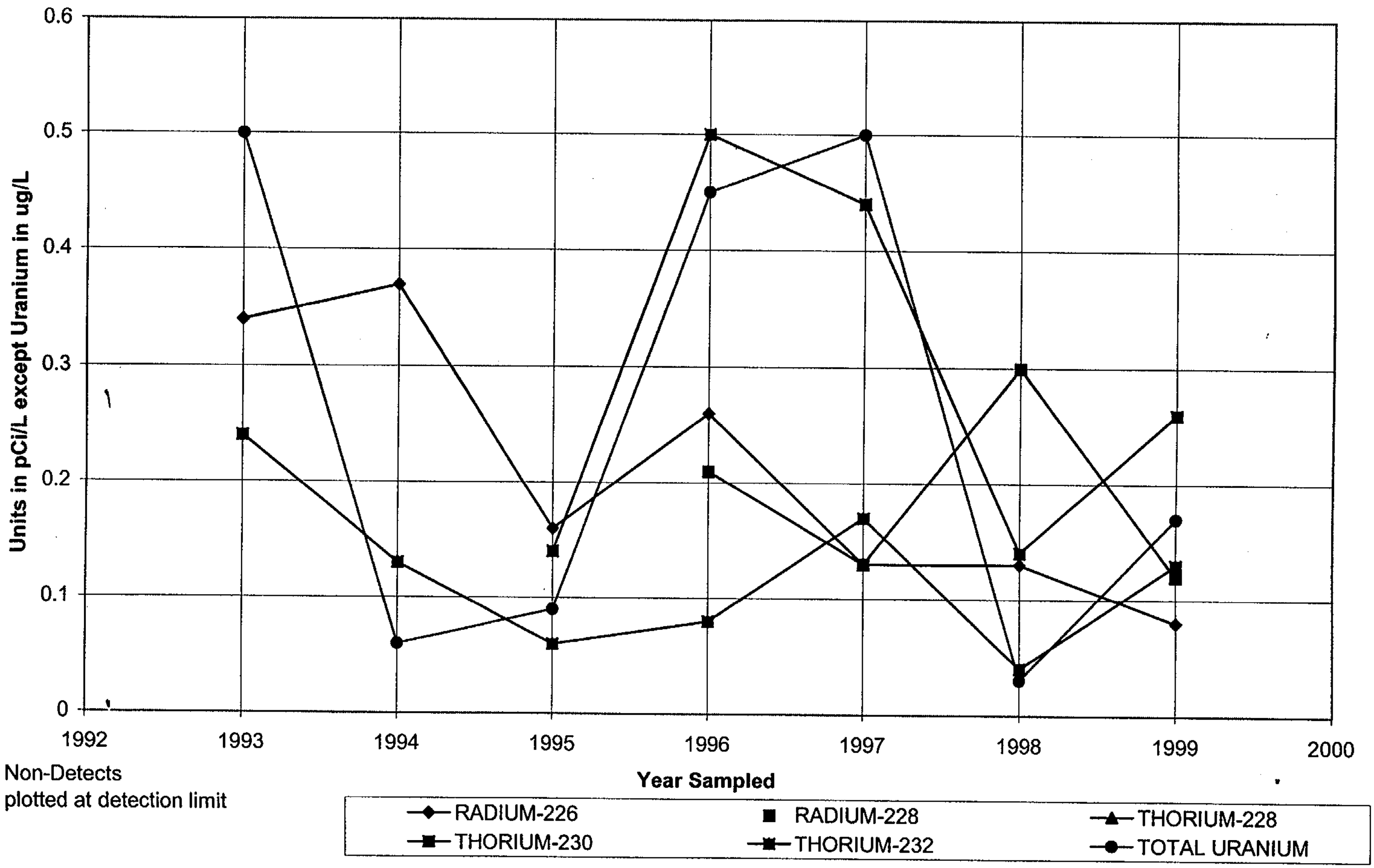
Radiological Constituents in Monitoring Well B38W19S



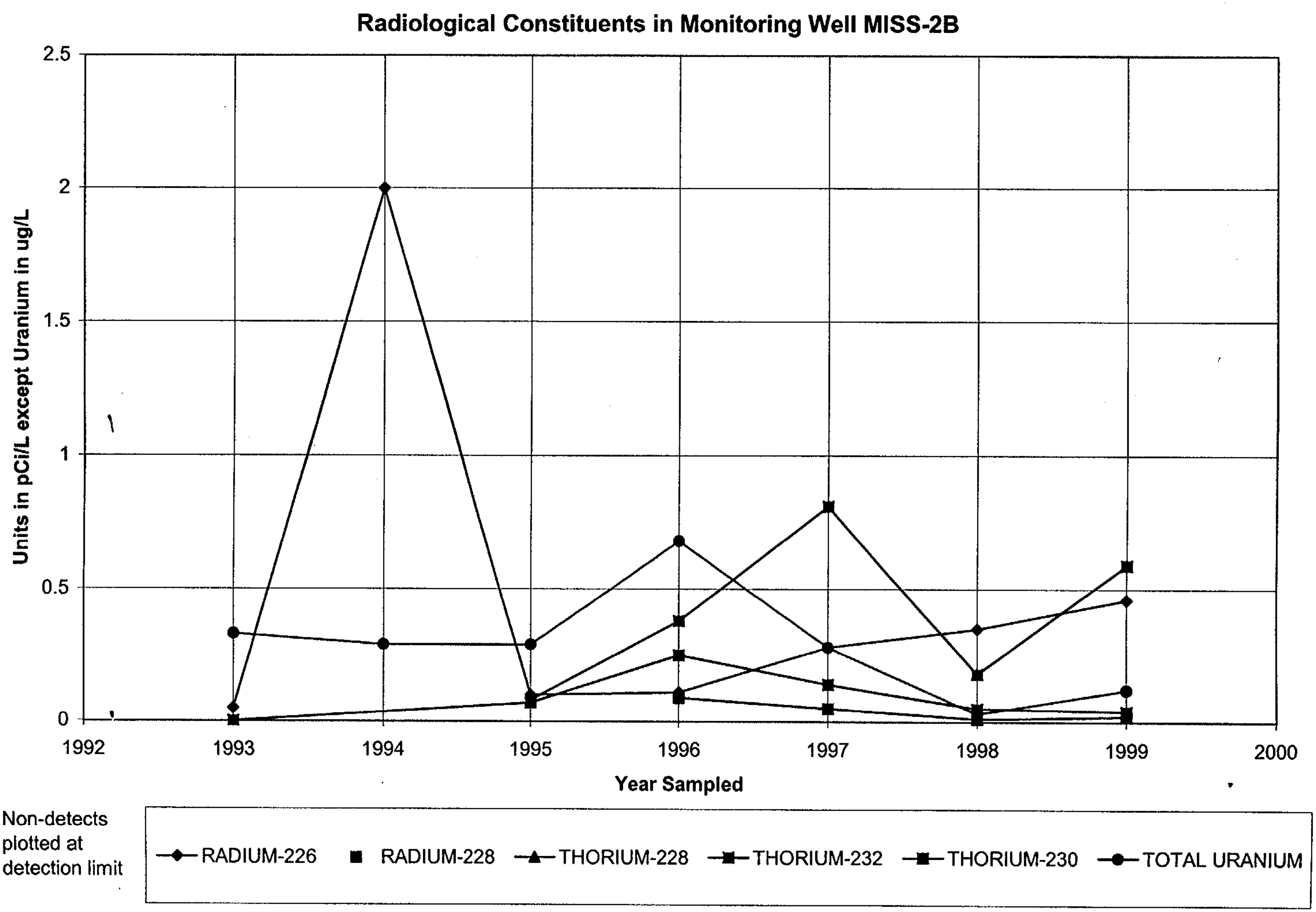
Non-Detects plotted
at reporting limit

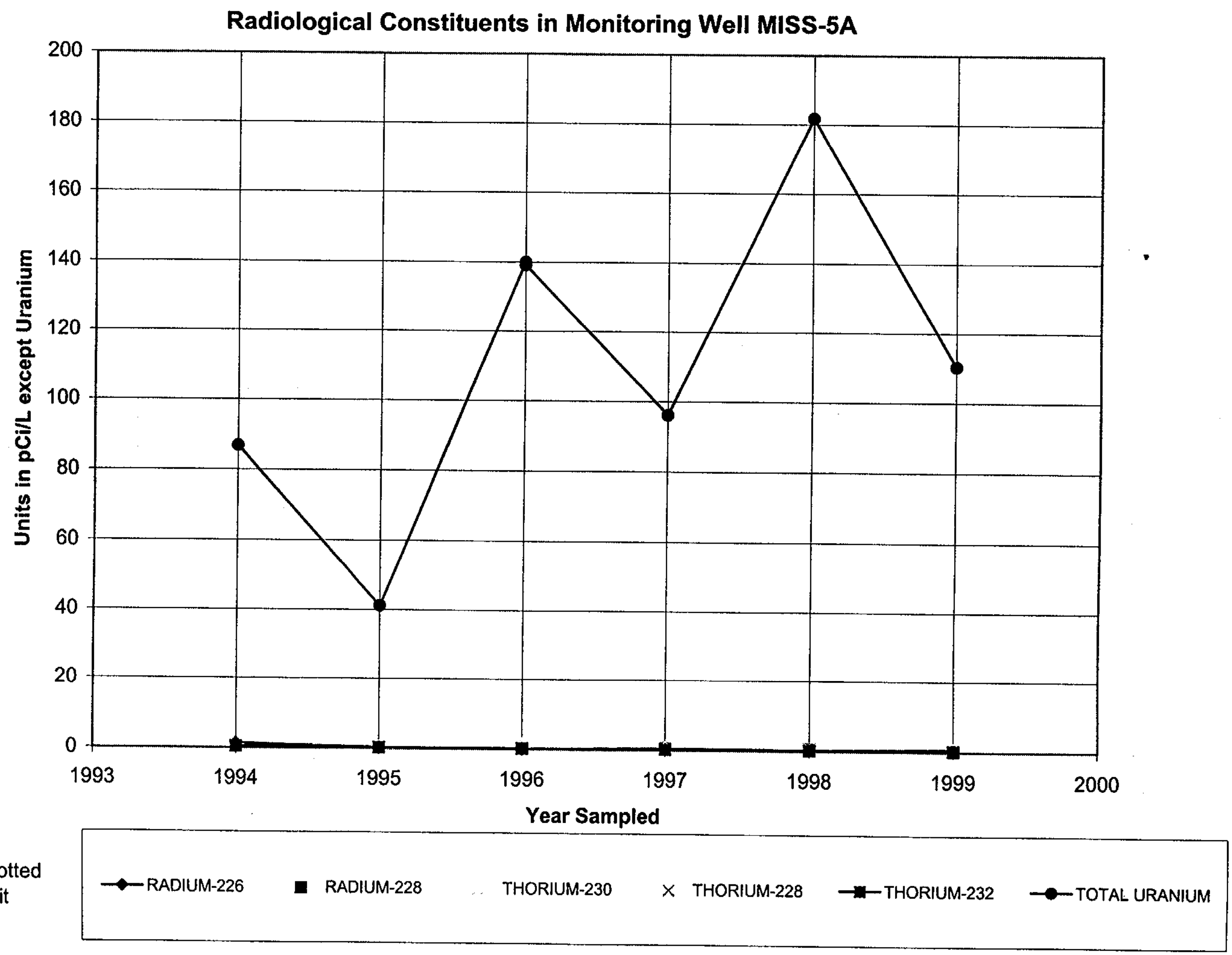

Radiological Constituents in Monitoring Well B38W19D
Units in pCi/L except Uranium in ug/L
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1992
1993
1994
1995
1996
1997
1998
1999
2000
Non-Detects plotted at reporting limit
Year Sampled
RADIUM-226
RADIUM-228
THORIUM-228
THORIUM-230
THORIUM-232
TOTAL URANIUM

Radiological Constituents in Monitoring Well B38W25S



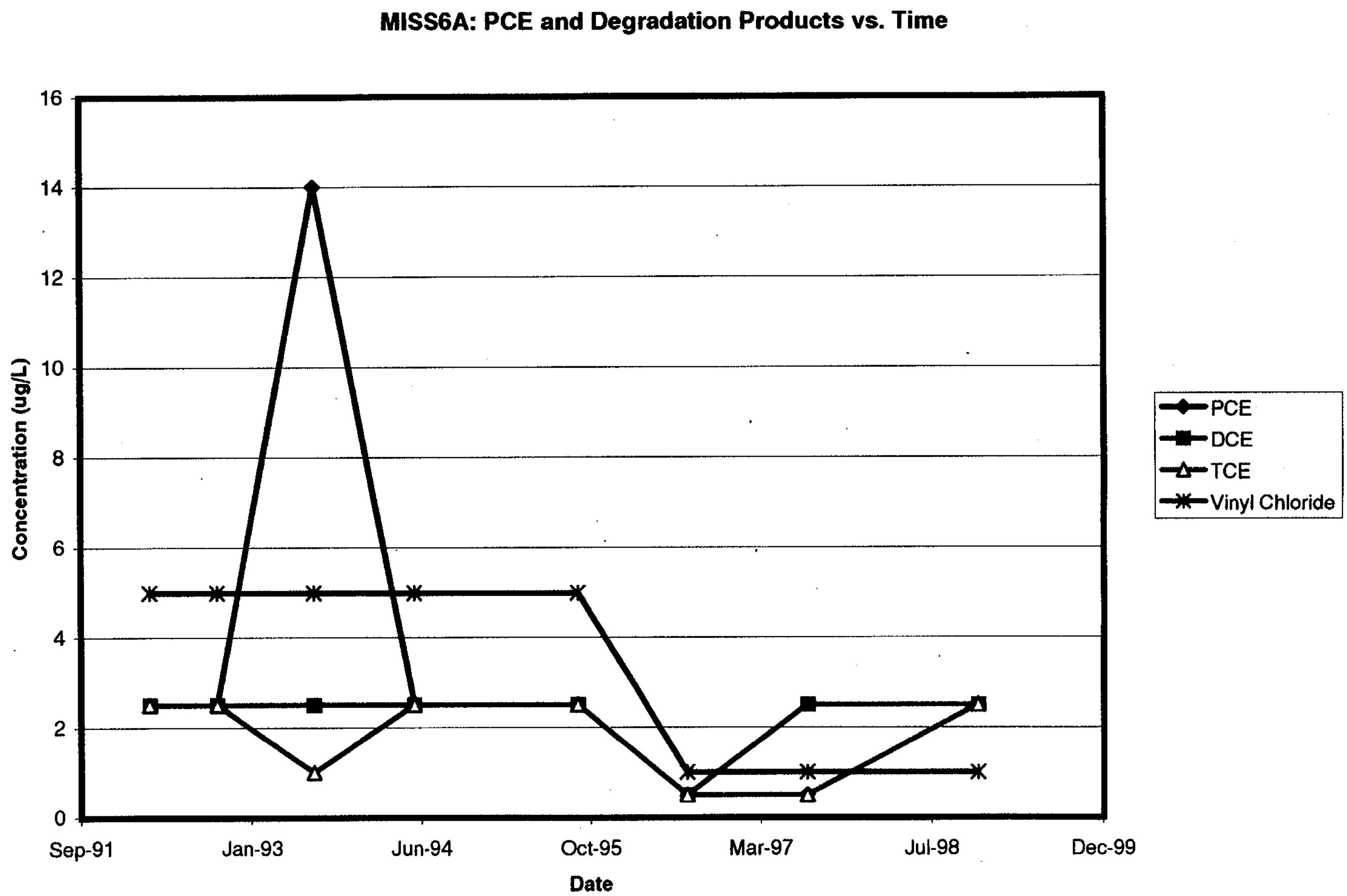
Non-Detects
plotted at detection limit


Radiological Constituents in Monitoring Well MISS-2B
Units in pCi/L except Uranium in ug/L
2.5
2
1.5
1
0.5
0
1992
1993
1994
1995
1996
1997
1998
1999
2000
Year Sampled
Non-detects plotted at detection limit
RADIUM-226
RADIUM-228
THORIUM-228
THORIUM-232
THORIUM-230
TOTAL URANIUM

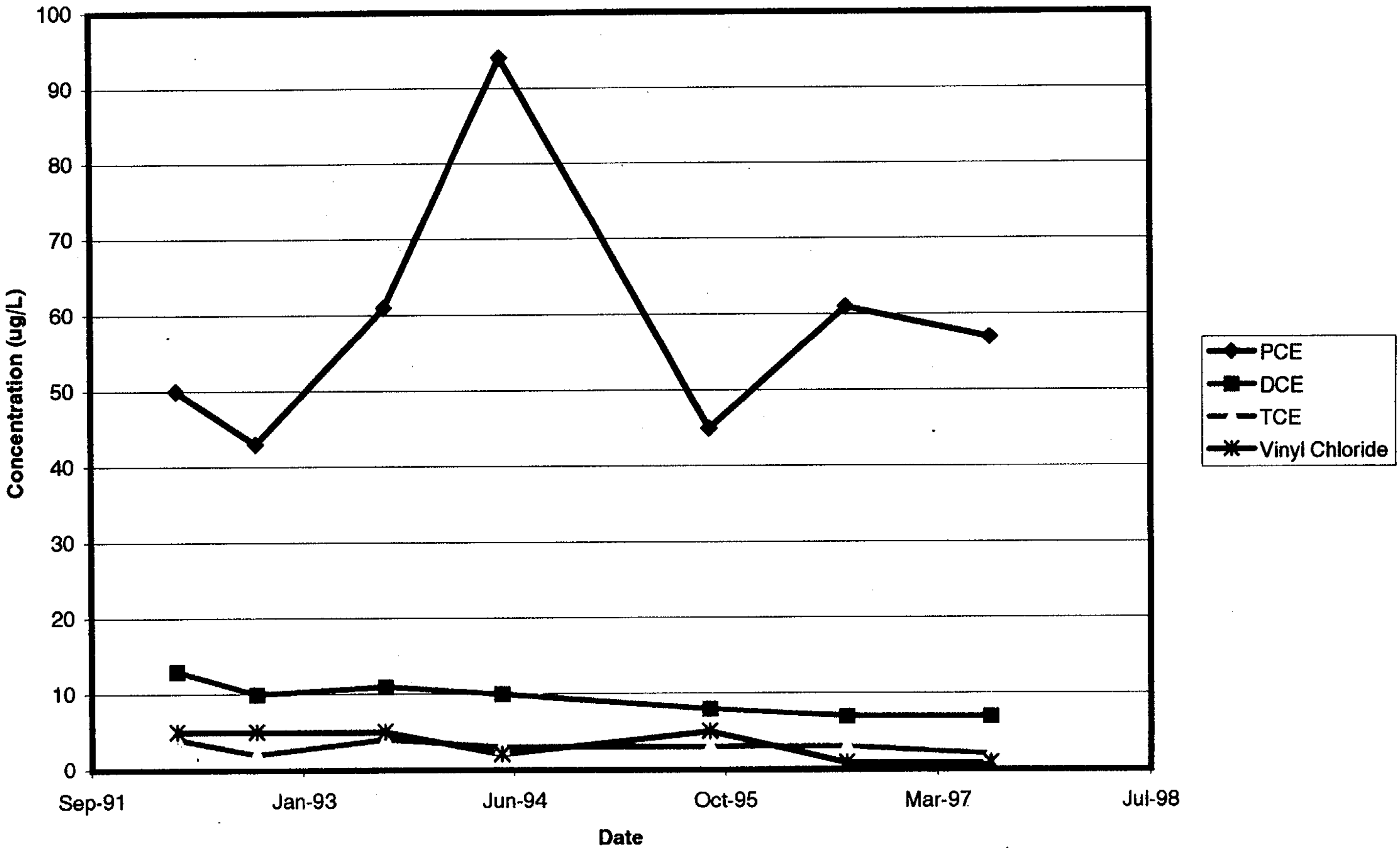


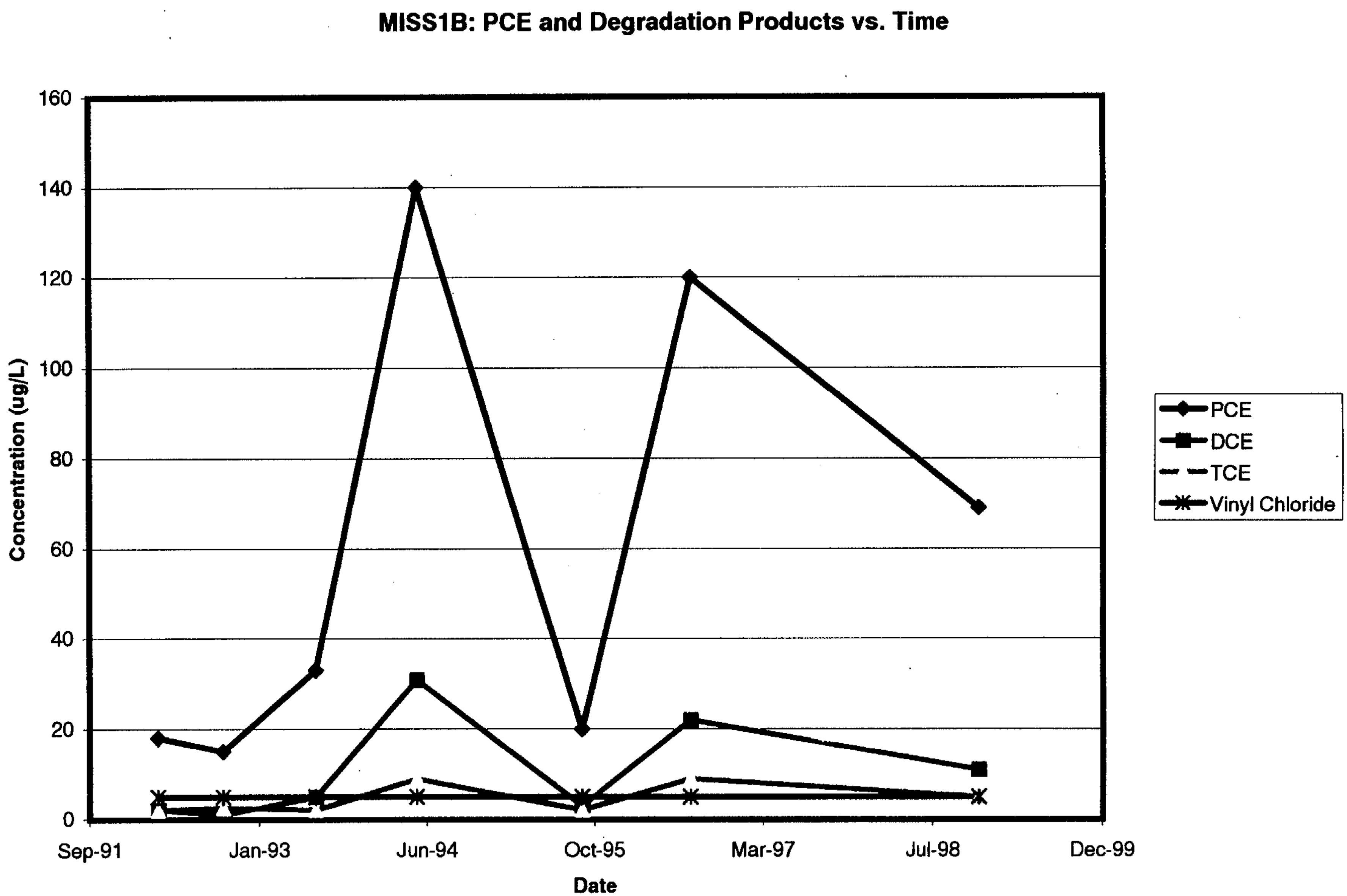
Non-Detects plotted at detection limit

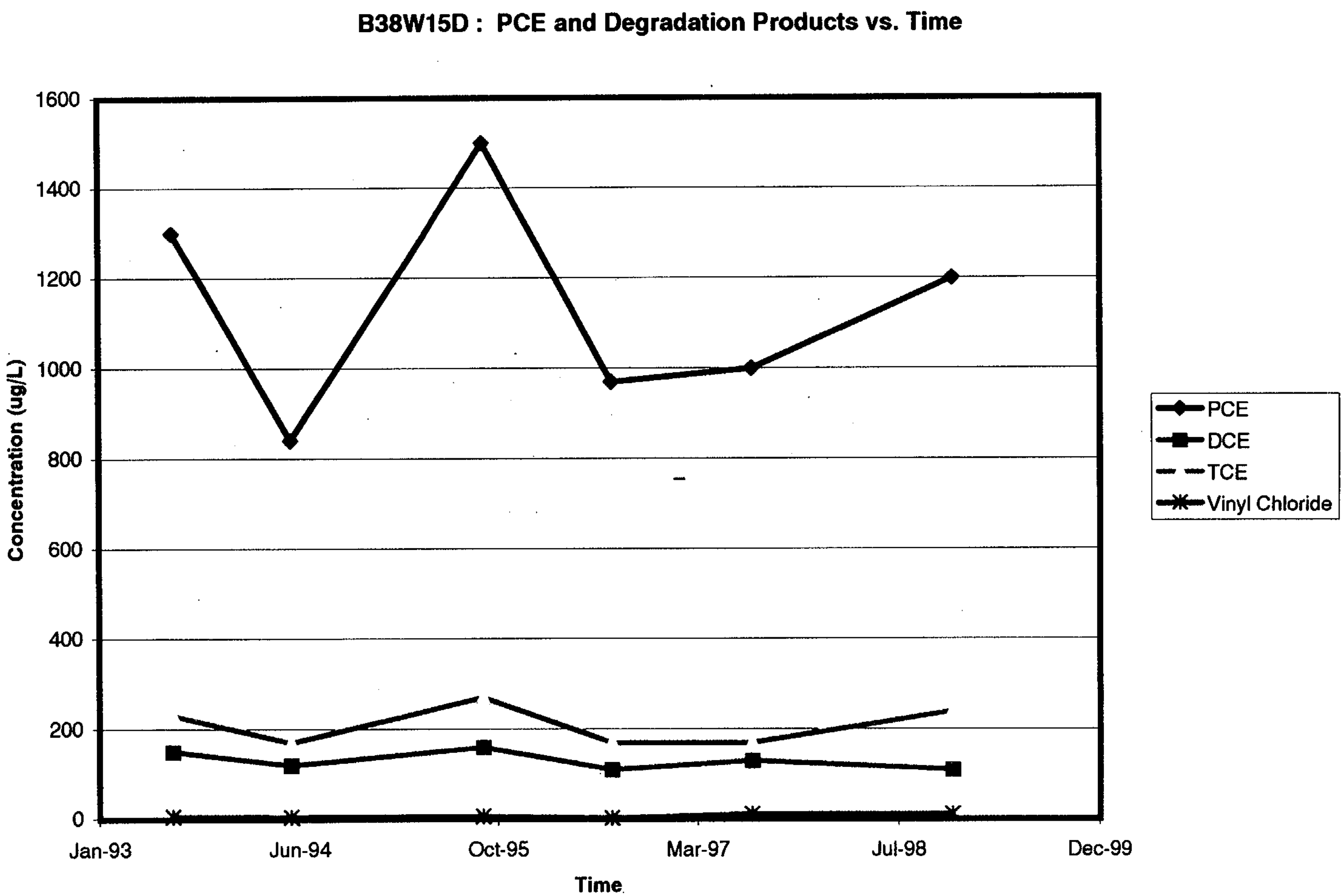
PCE AND DEGRADATION PRODUCTS VS. TIME


MISS6A: PCE and Degradation Products vs. Time
Concentration (ug/L)
16
14
12
10
8
6
4
2
0
Sep-91
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
PCE
DCE
TCE
Vinyl Chloride

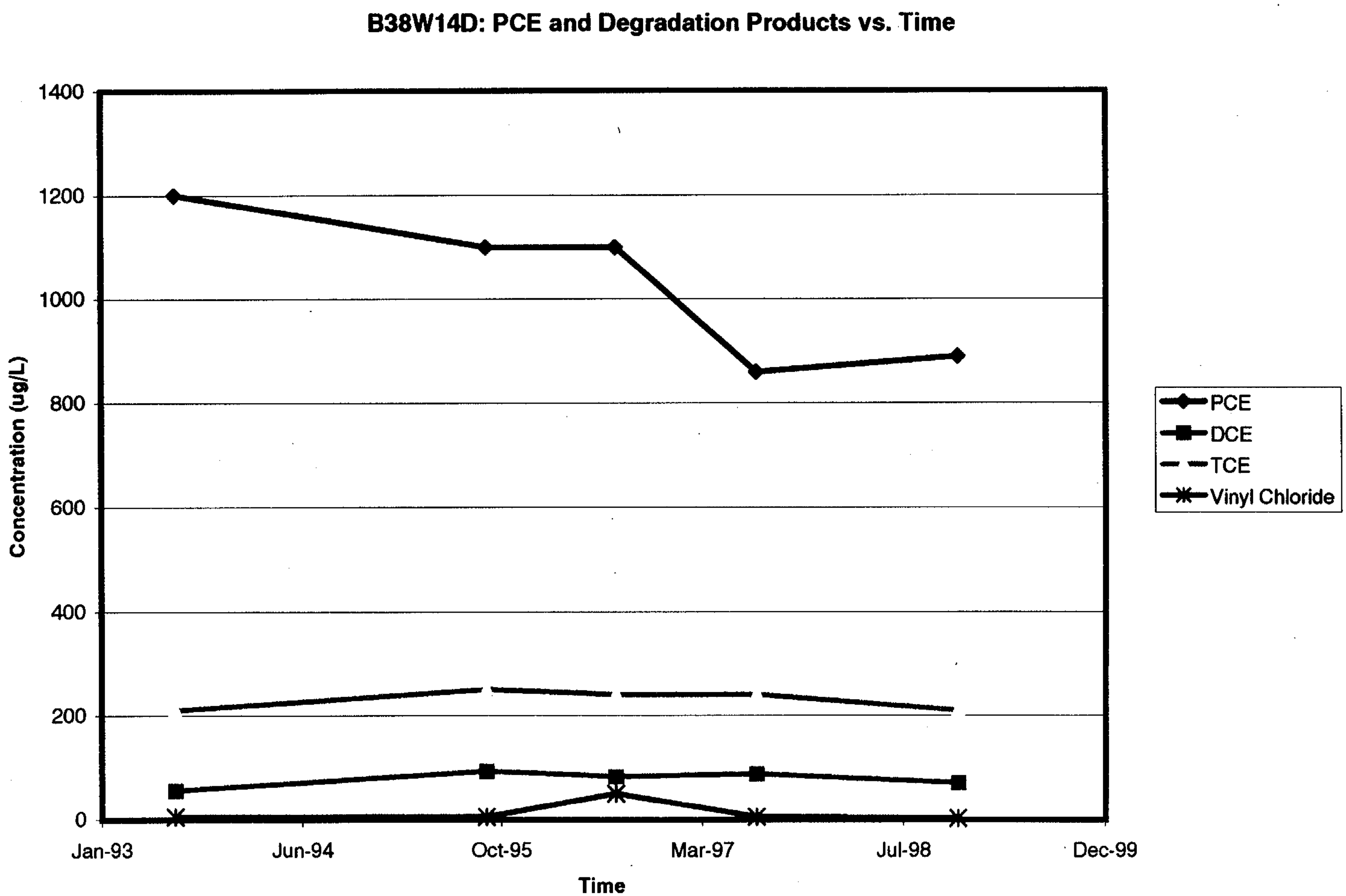
MISS7B: PCE and Degradation Products vs. Time



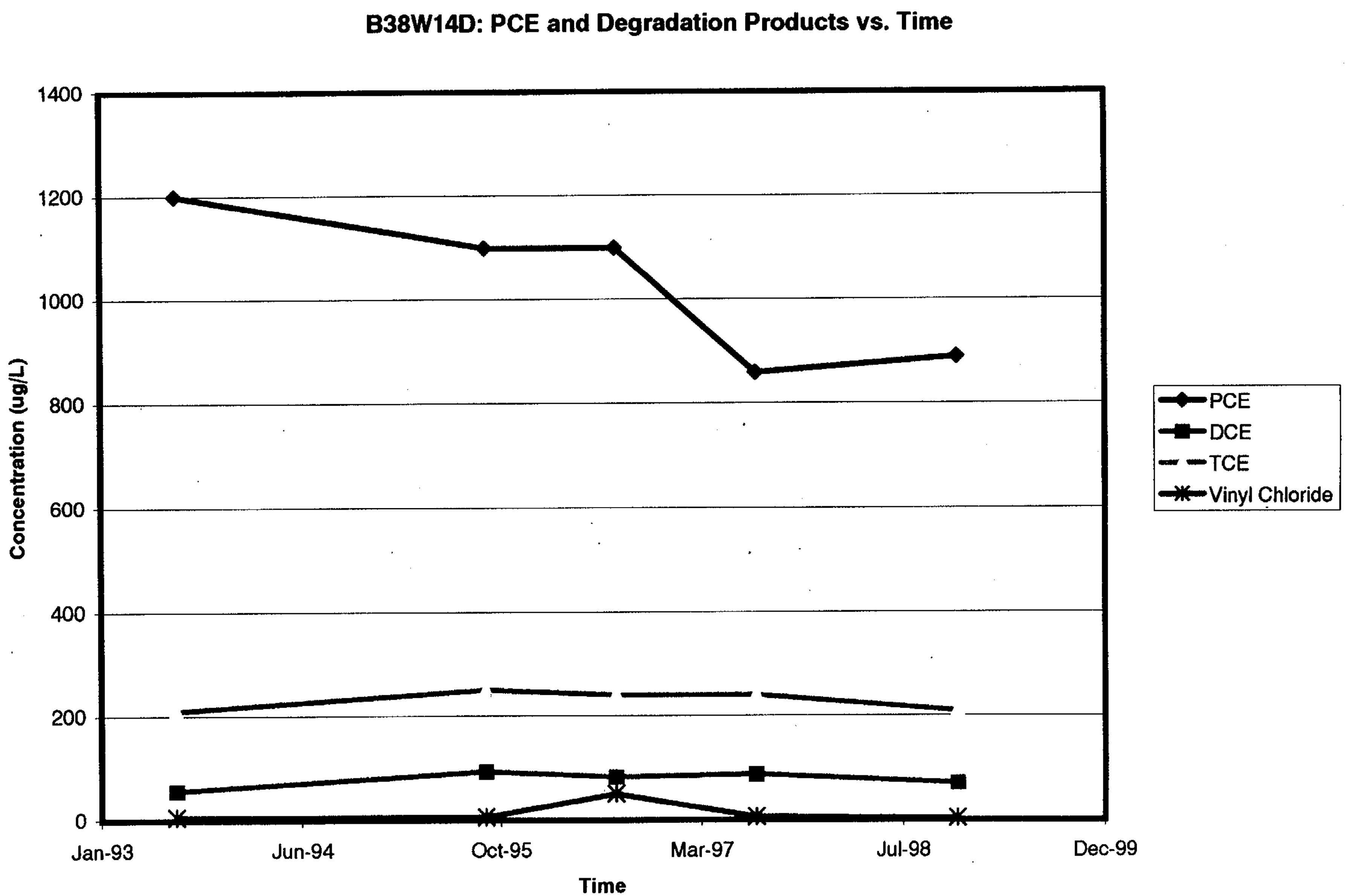

MISS1B: PCE and Degradation Products vs. Time
Concentration (ug/L)
160
140
120
100
80
60
40
20
0
Sep-91
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
PCE
DCE
TCE
Vinyl Chloride



B38W15D : PCE and Degradation Products vs. Time
Concentration (ug/L)
1600
1400
1200
1000
800
600
400
200
0
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Time
PCE
DCE
TCE
Vinyl Chloride

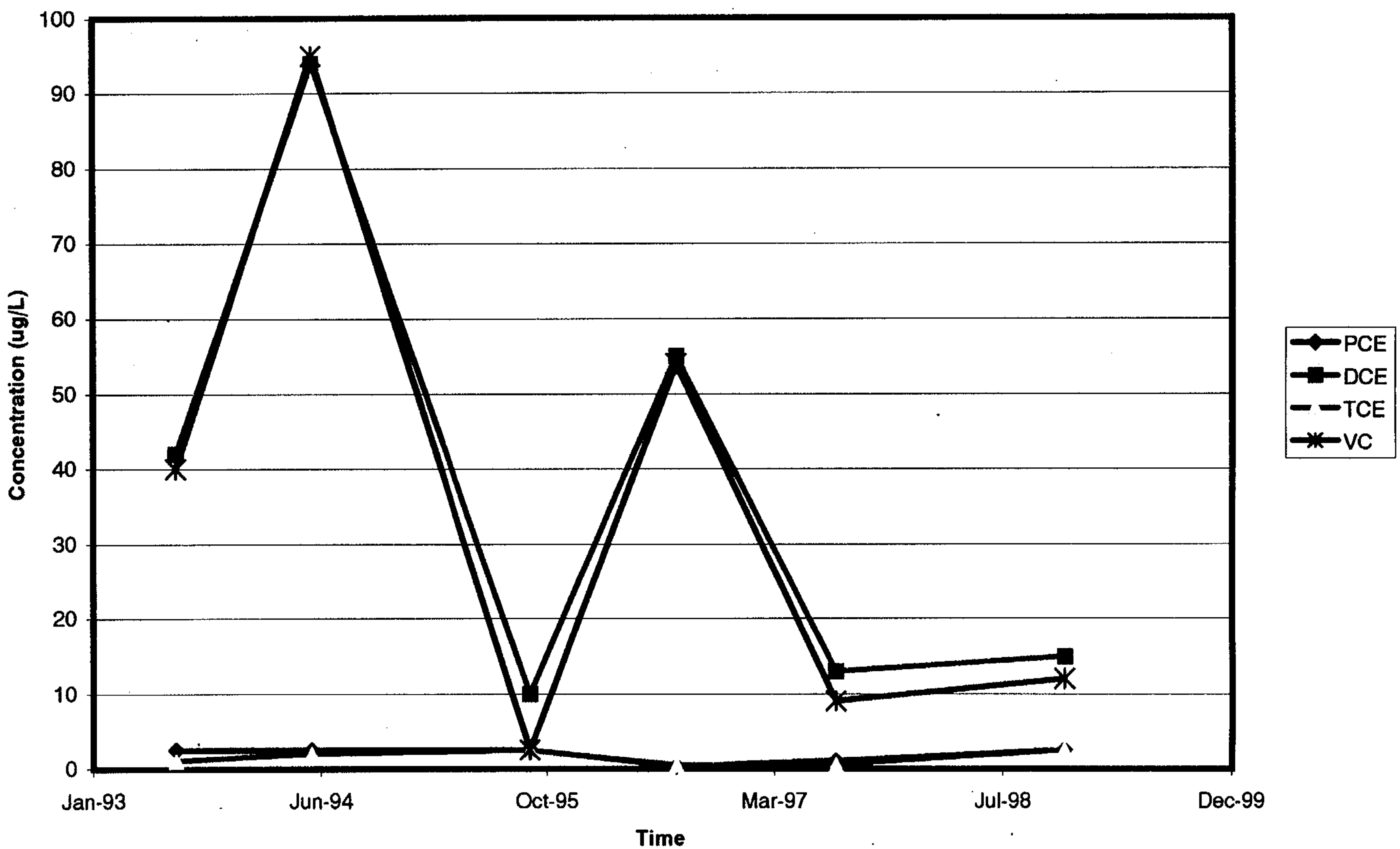


B38W14D: PCE and Degradation Products vs. Time
1400
1200
1000
800
600
400
200
0
Concentration (ug/L)
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Time
PCE
DCE
TCE
Vinyl Chloride

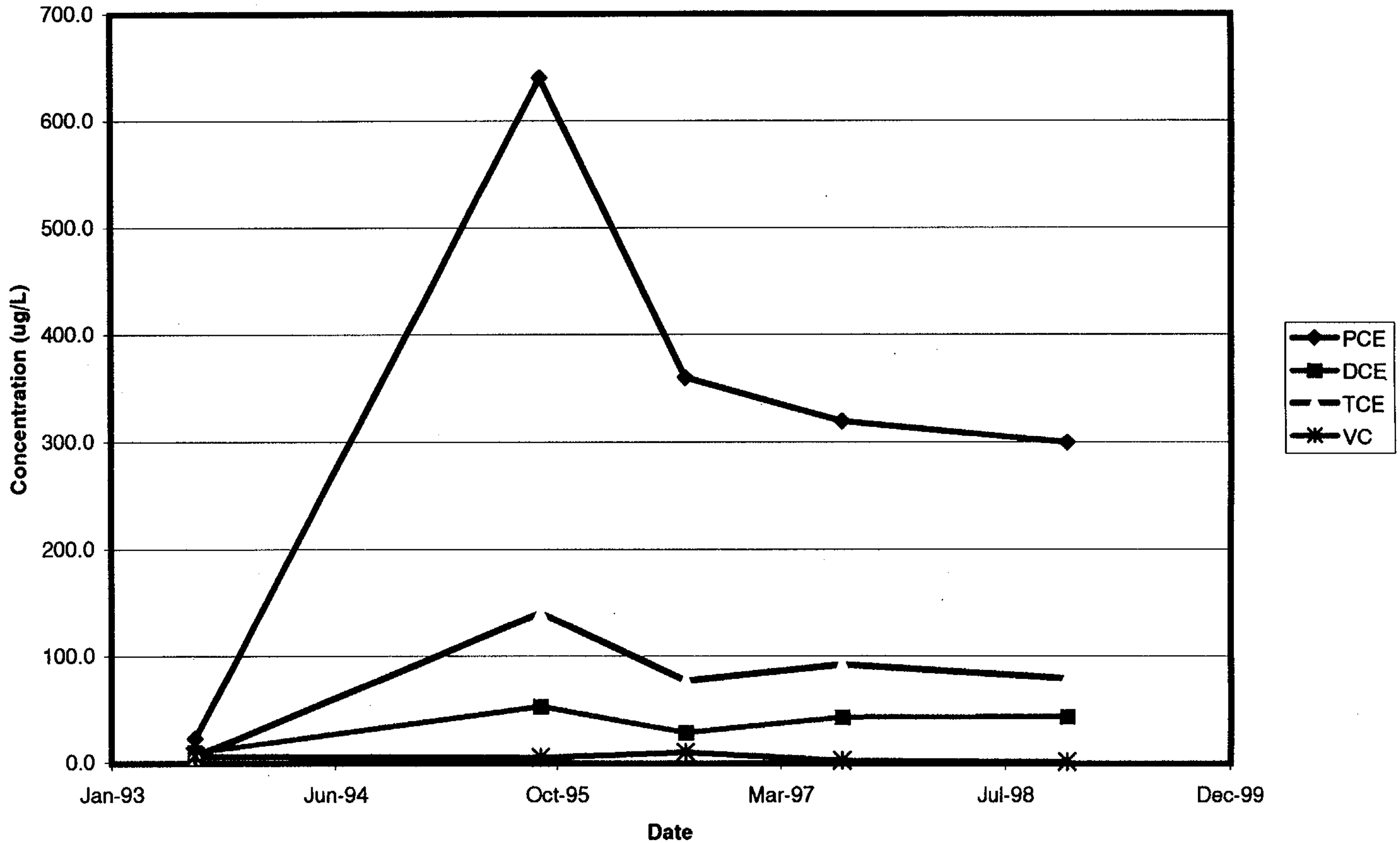


B38W14D: PCE and Degradation Products vs. Time
Concentration (ug/L)
1400
1200
1000
800
600
400
200
0
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Time
PCE
DCE
TCE
Vinyl Chloride

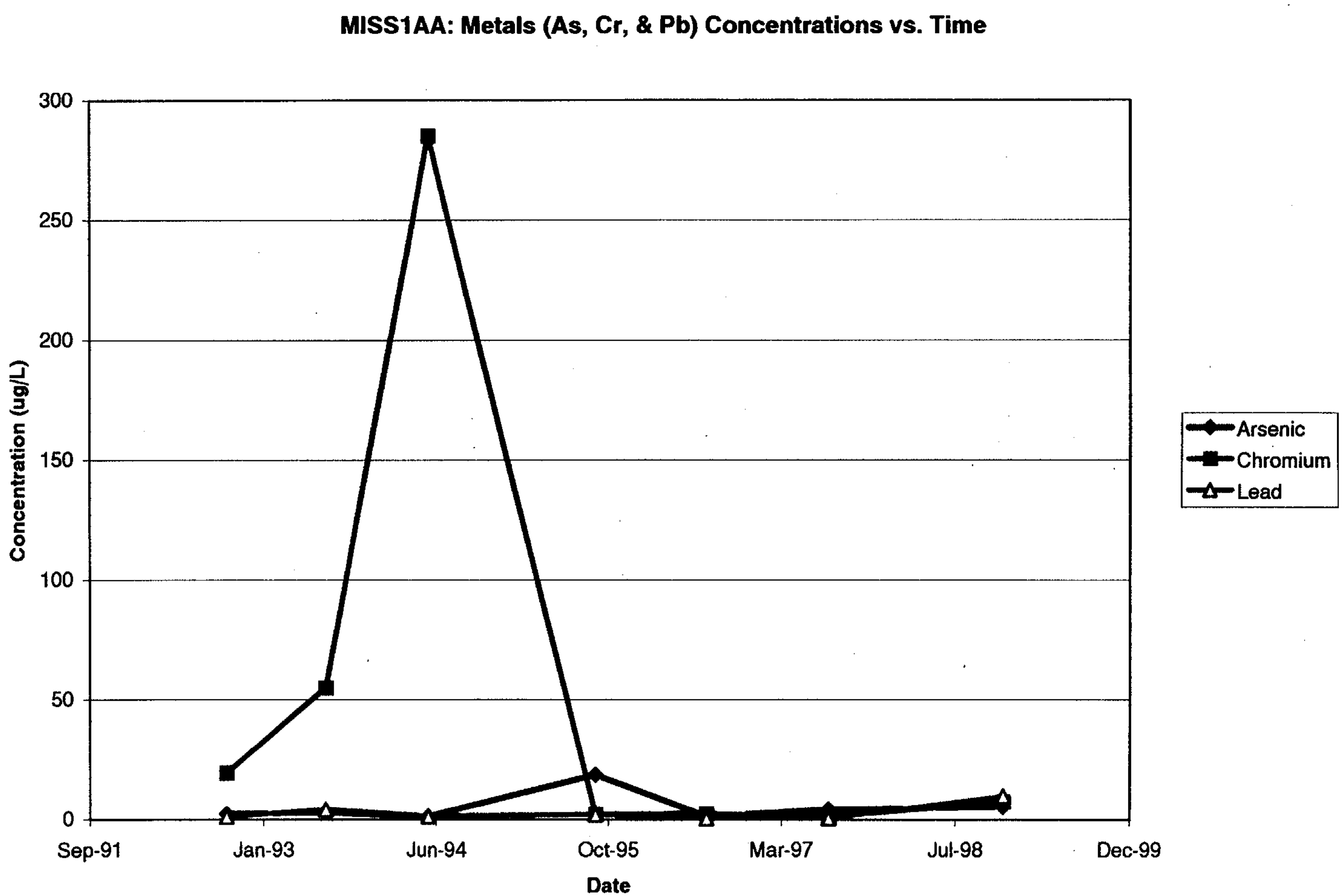
B38W15S: PCE and Degradation Products vs. Time



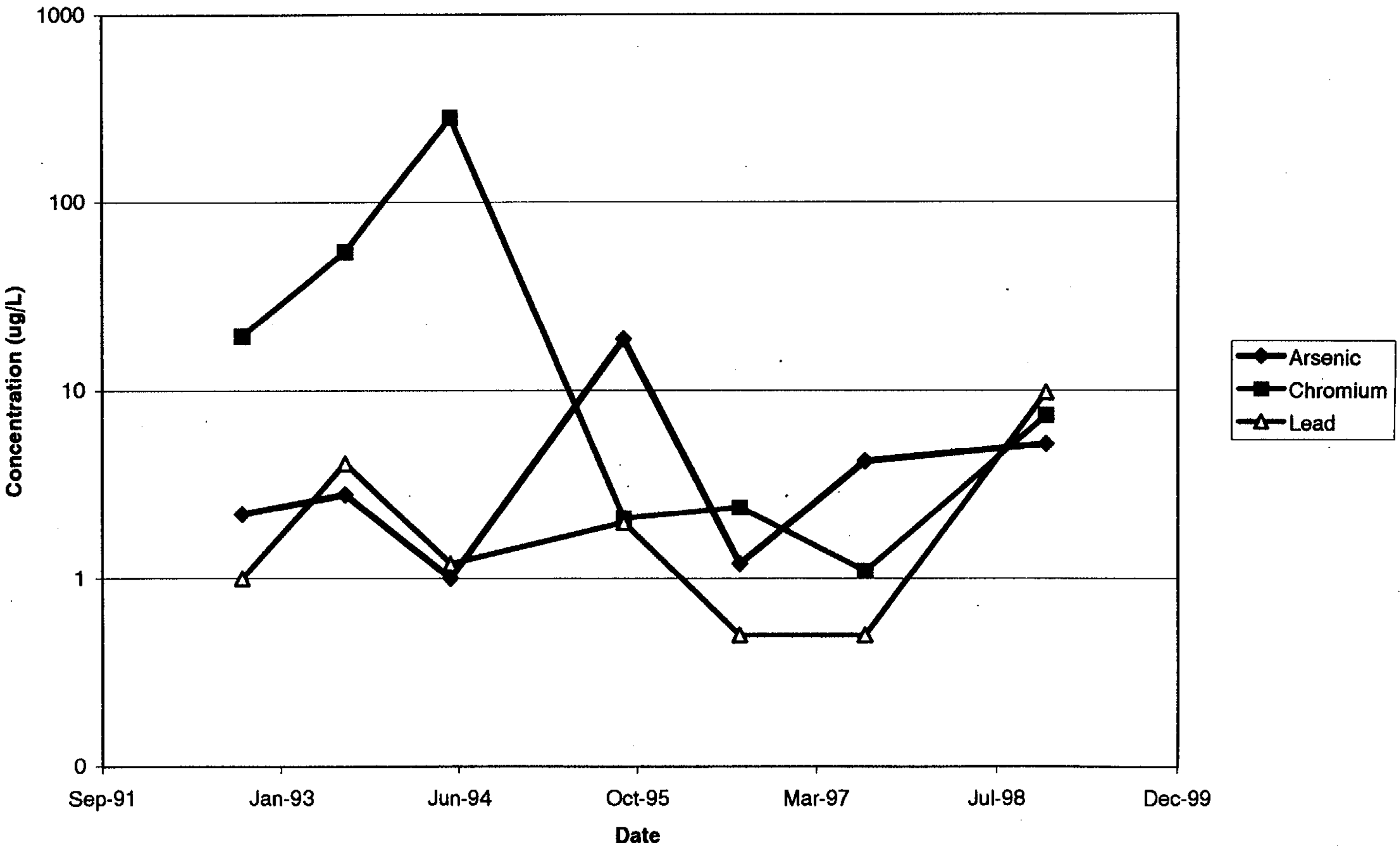
Monitoring Well B38W14S: PCE and Degradation Products vs. Time

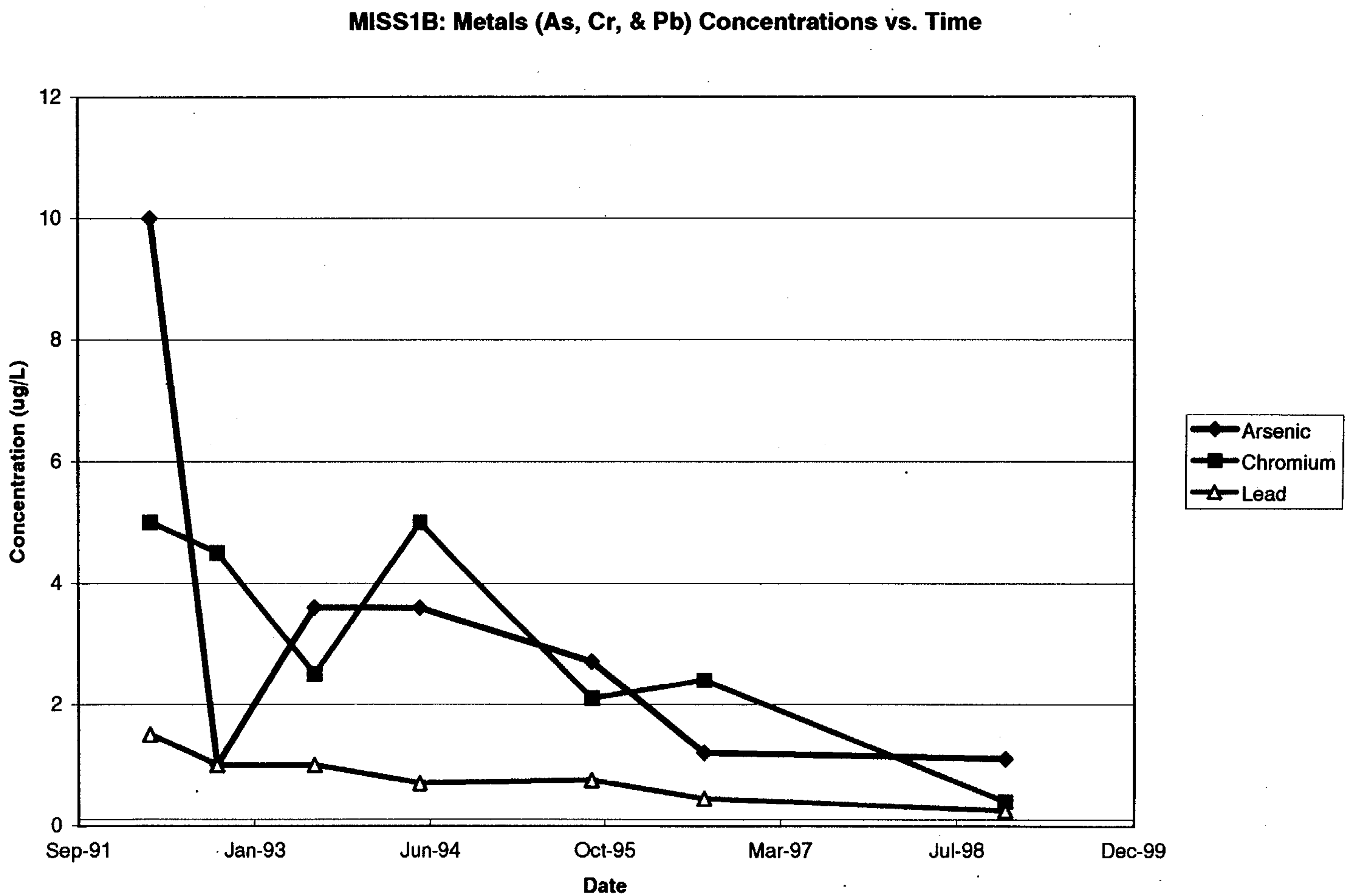


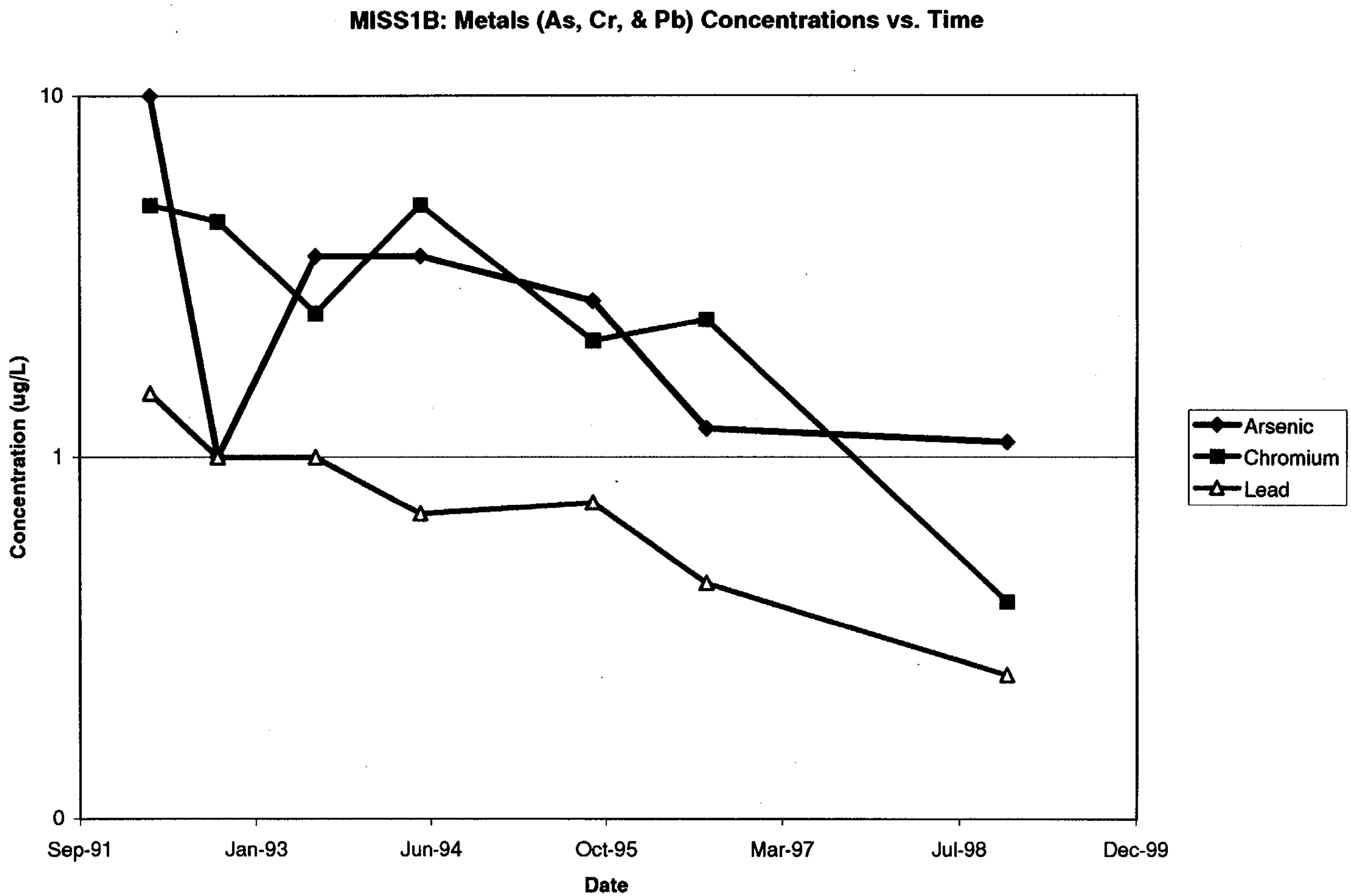
METALS (As, Cr, & Pb) CONCENTRATIONS VS. TIME


MISS1AA: Metals (As, Cr, & Pb) Concentrations vs. Time
300
250
200
150
100
50
0
Concentration (ug/L)
Sep-91
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Arsenic
Chromium
Lead

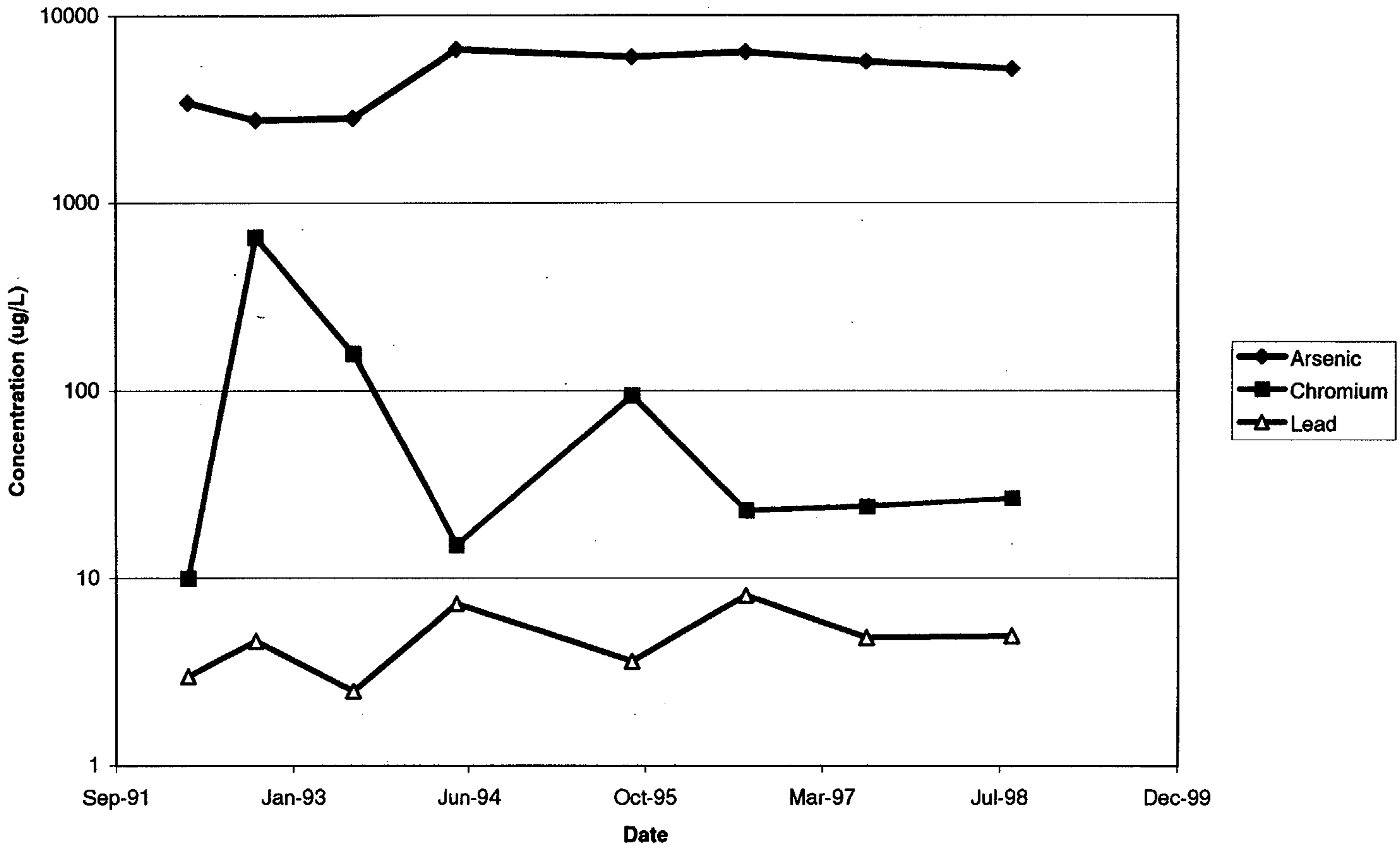
MISS1AA: Metals (As, Cr, & Pb) Concentrations vs. Time

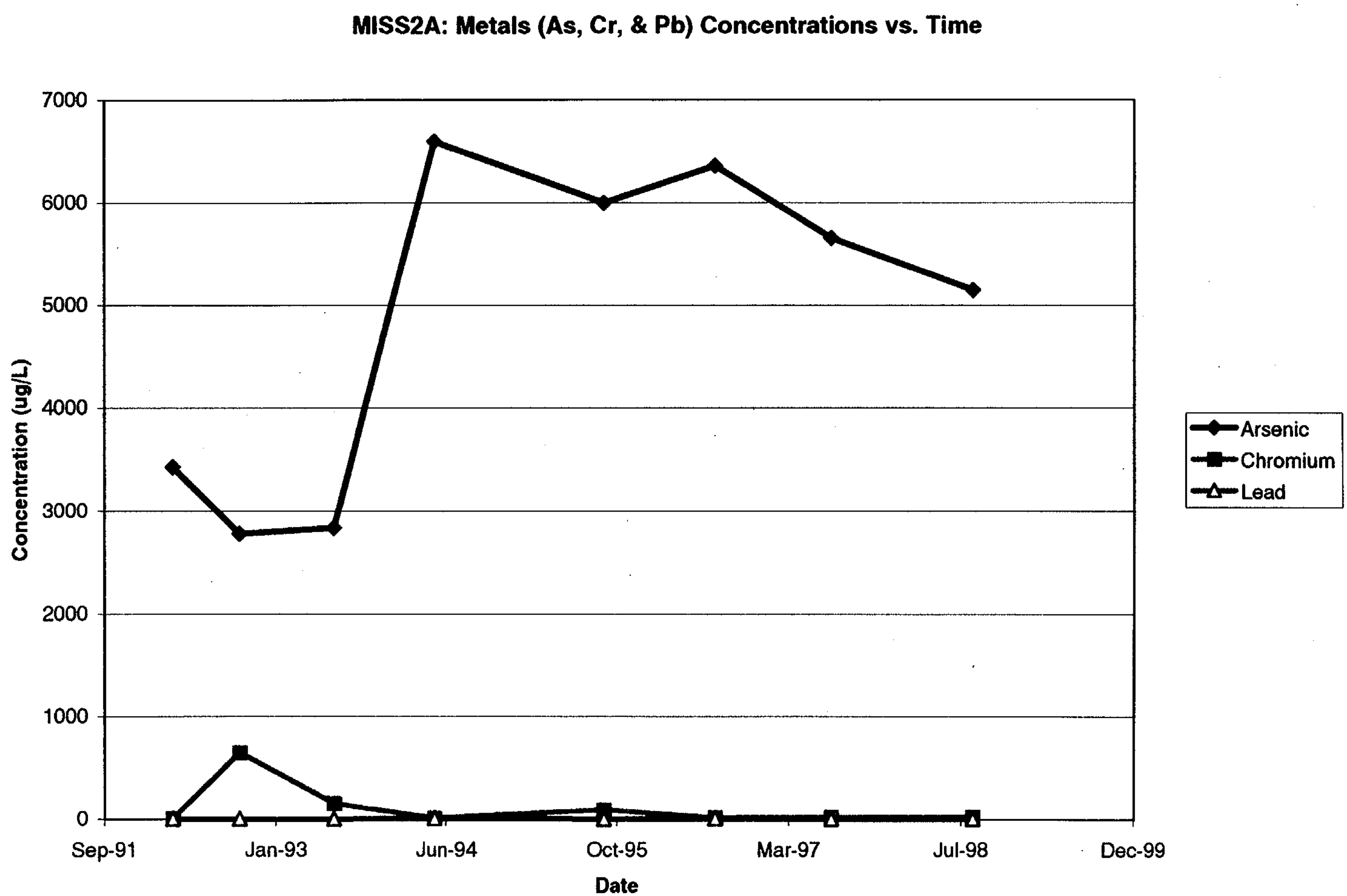



MISS1B: Metals (As, Cr, & Pb) Concentrations vs. Time
Concentration (ug/L)
0
2
4
6
8
10
12
Sep-91
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Arsenic
Chromium
Lead

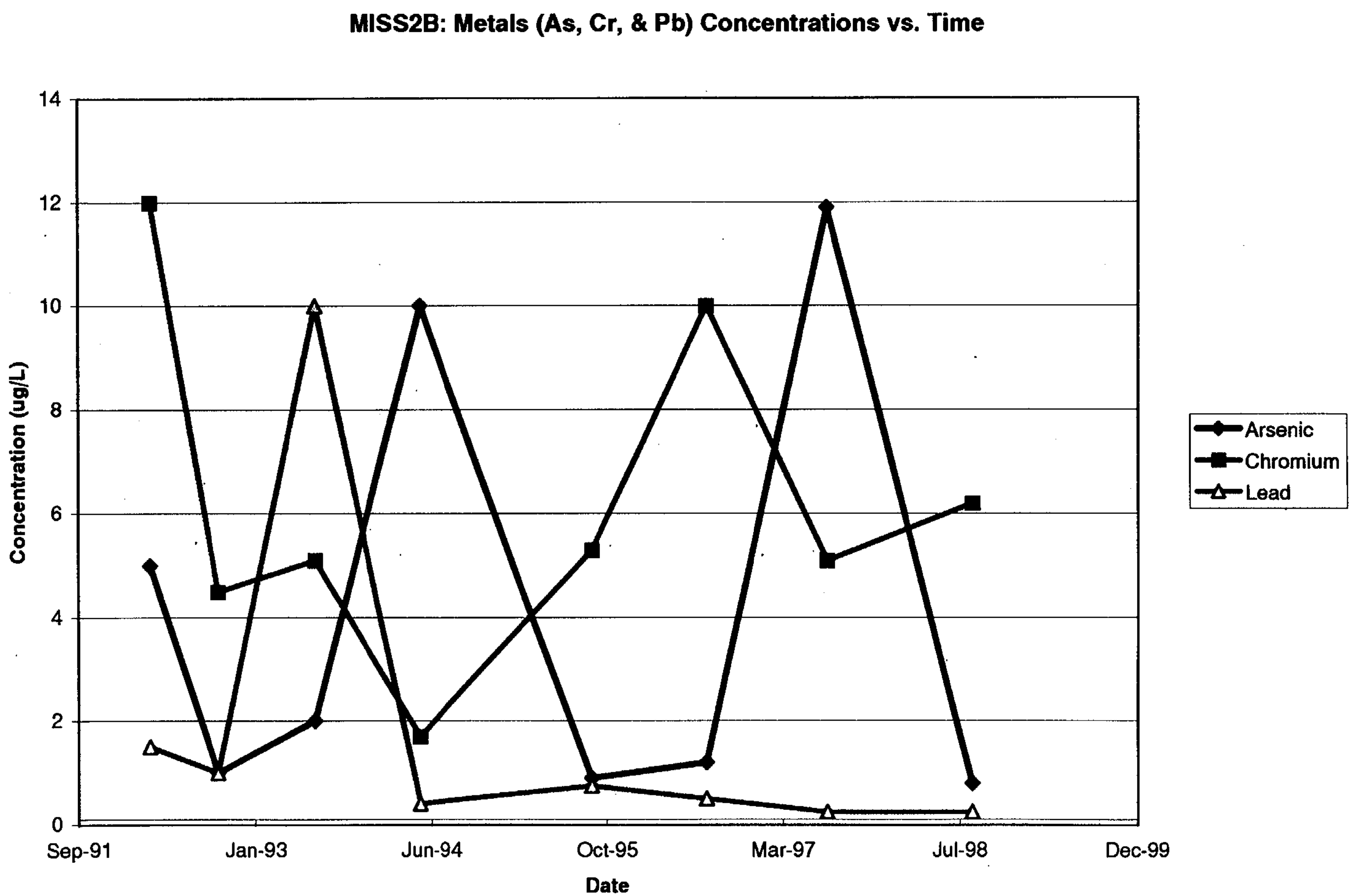

MISS1B: Metals (As, Cr, & Pb) Concentrations vs. Time
10
1
0
Concentration (ug/L)
Sep-91
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Arsenic
Chromium
Lead

MISS2A: Metals (As, Cr, & Pb) Concentrations vs. Time

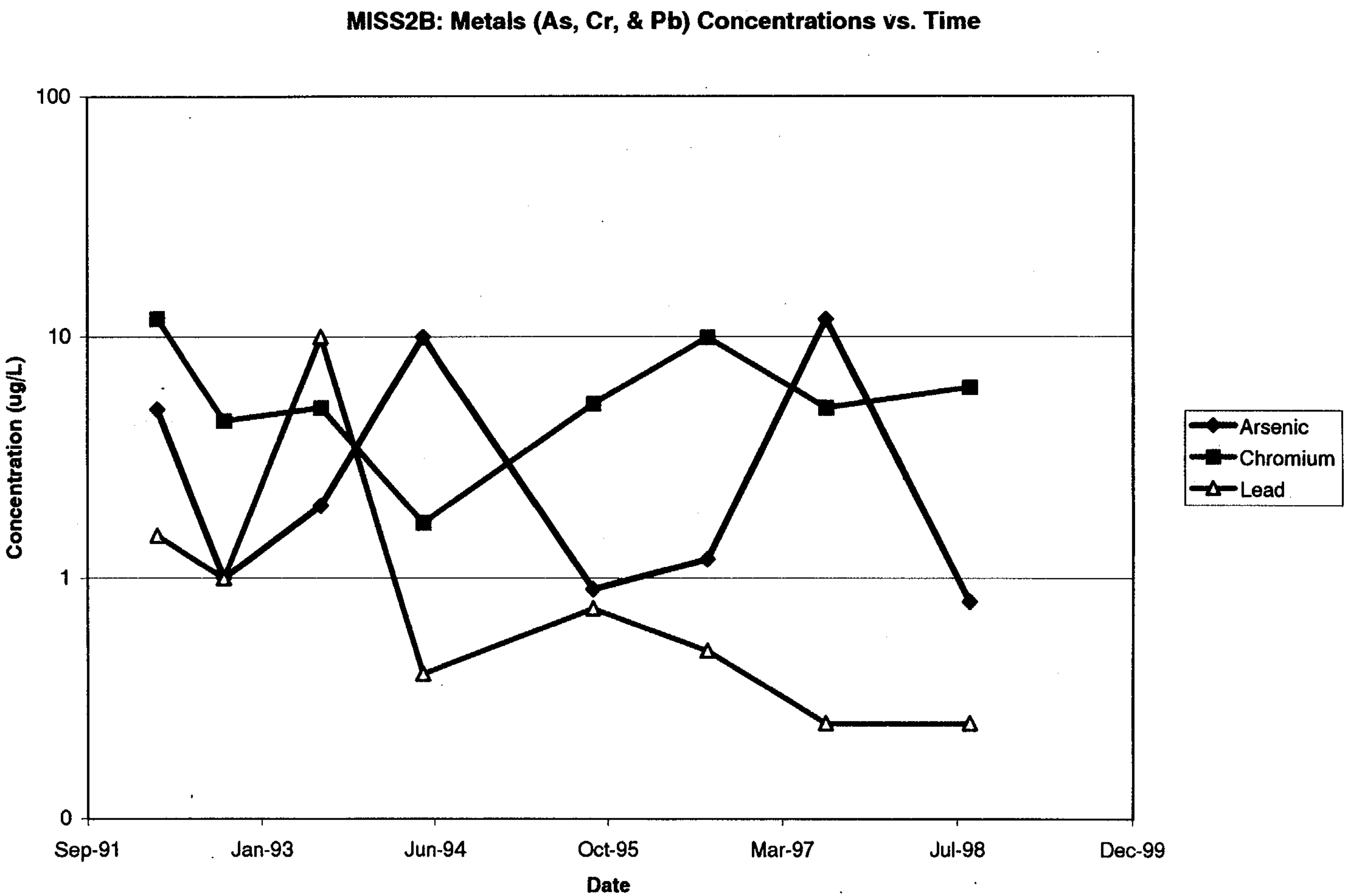




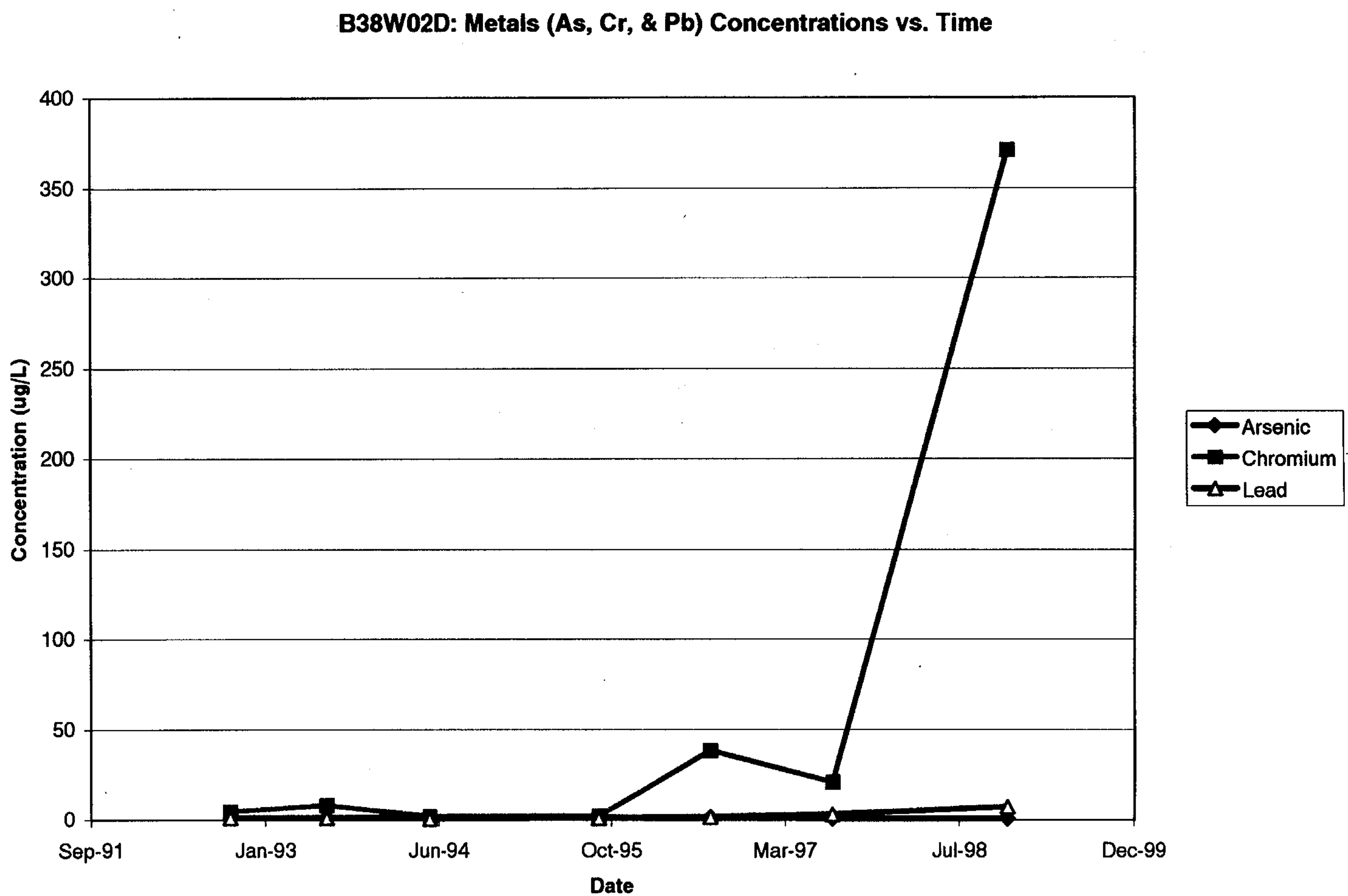
MISS2A: Metals (As, Cr, & Pb) Concentrations vs. Time
7000
6000
5000
4000
3000
2000
1000
0
Concentration (ug/L)
Sep-91
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Arsenic
Chromium
Lead

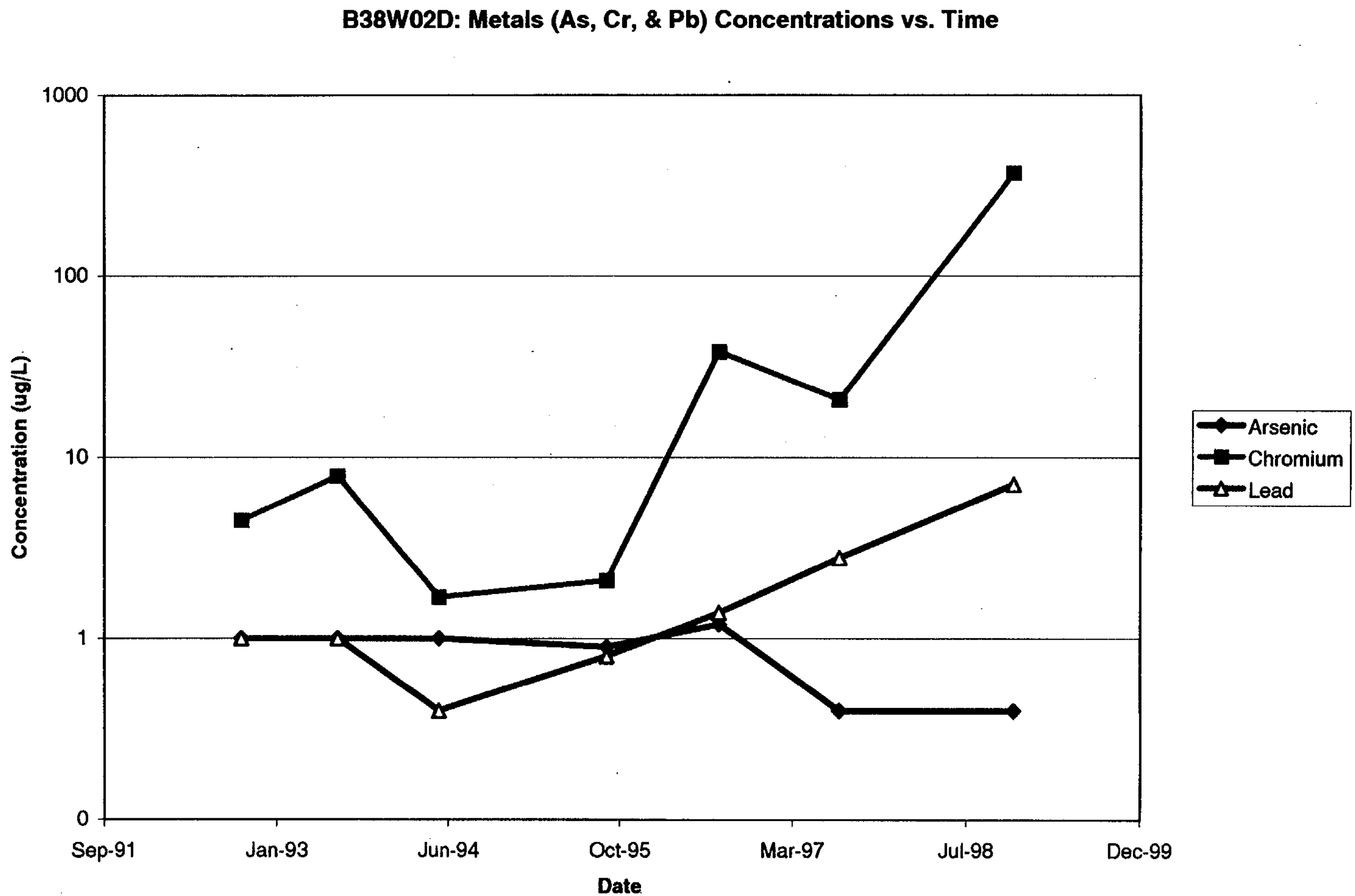


MISS2B: Metals (As, Cr, & Pb) Concentrations vs. Time
Concentration (ug/L)
14
12
10
8
6
4
2
0
Sep-91
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Arsenic
Chromium
Lead

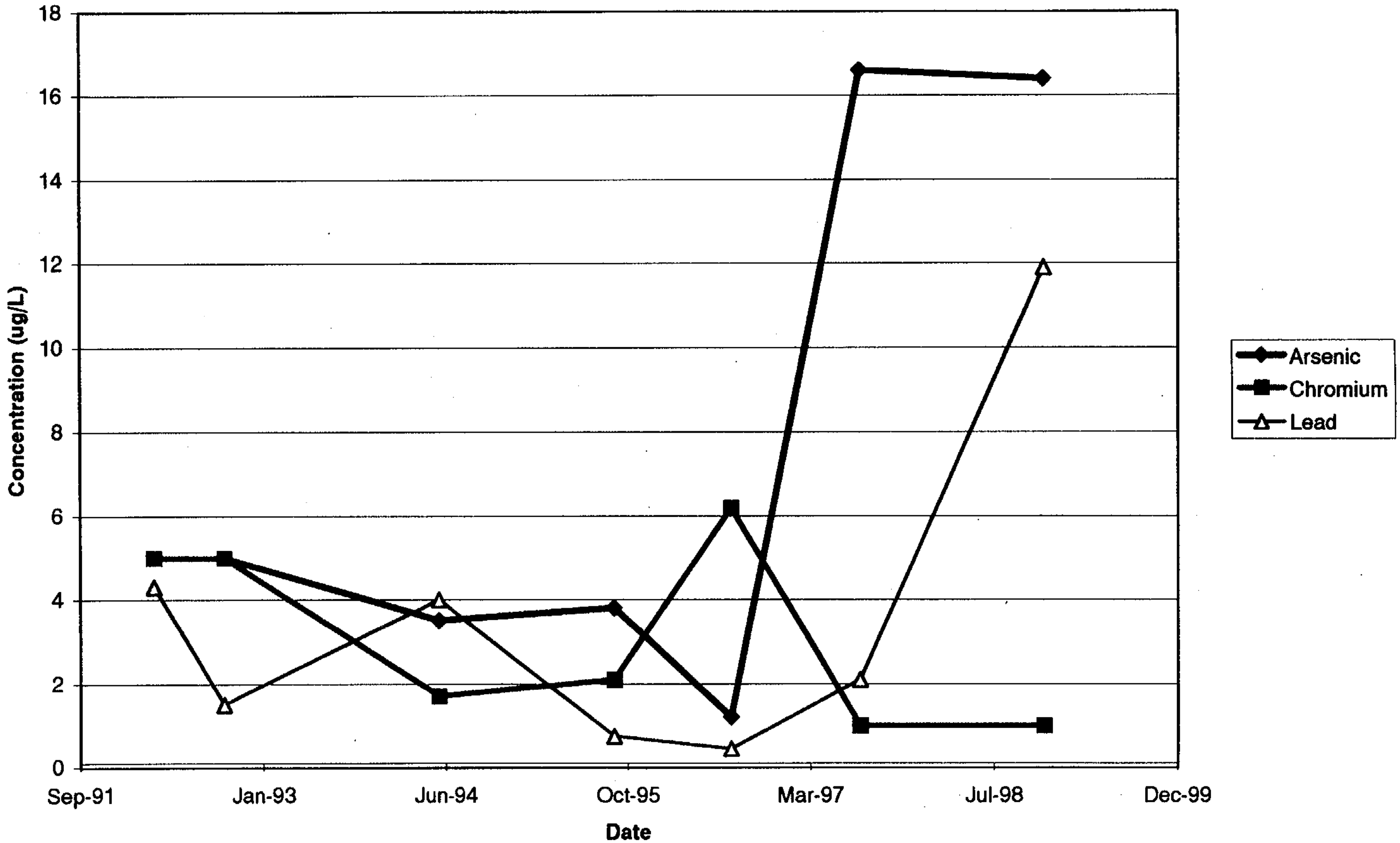


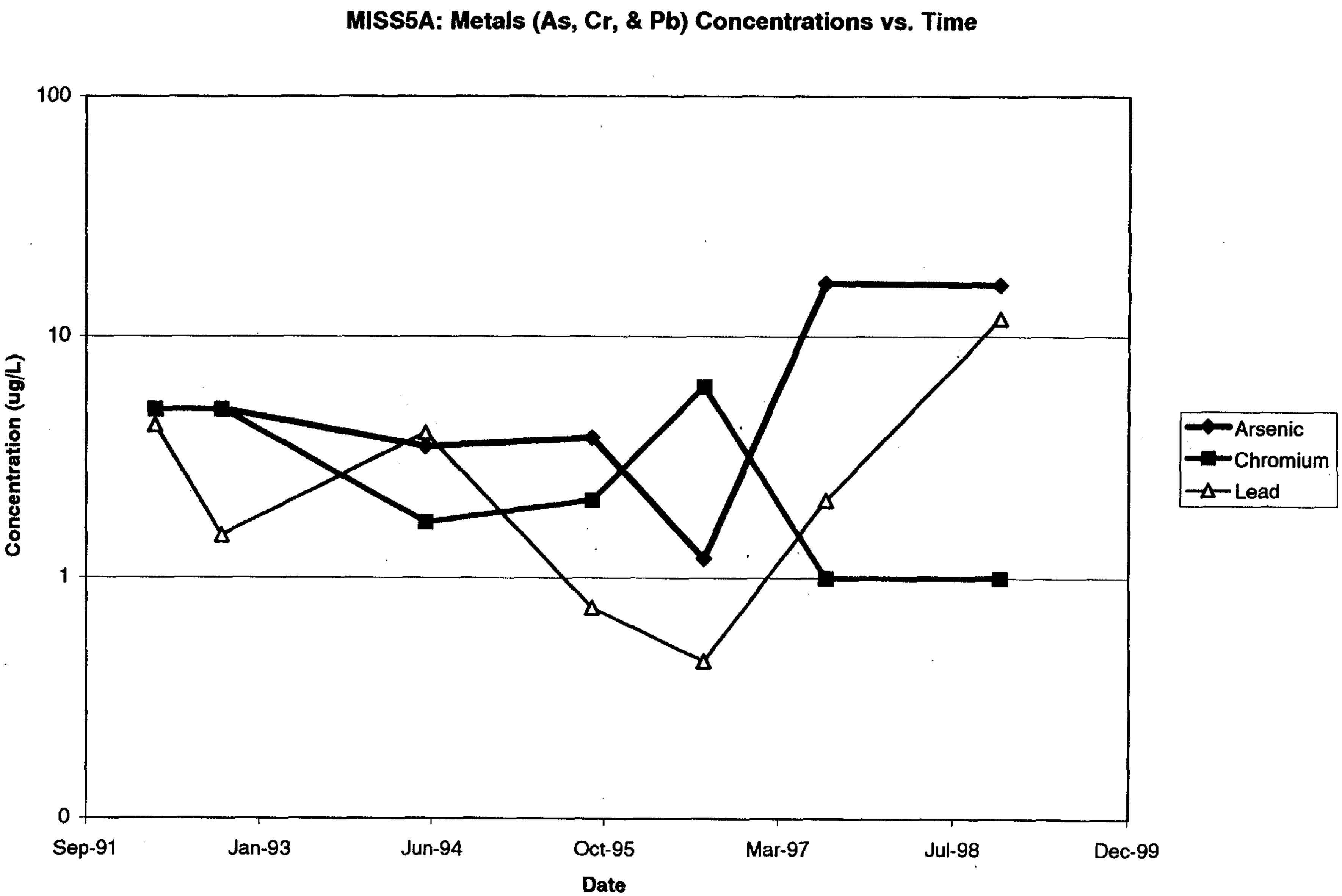
MISS2B: Metals (As, Cr, & Pb) Concentrations vs. Time
100
10
1
0
Concentration (ug/L)
Sep-91
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Arsenic
Chromium
Lead


B38W02D: Metals (As, Cr, & Pb) Concentrations vs. Time
Concentration (ug/L)
400
350
300
250
200
150
100
50
0
Sep-91
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Arsenic
Chromium
Lead

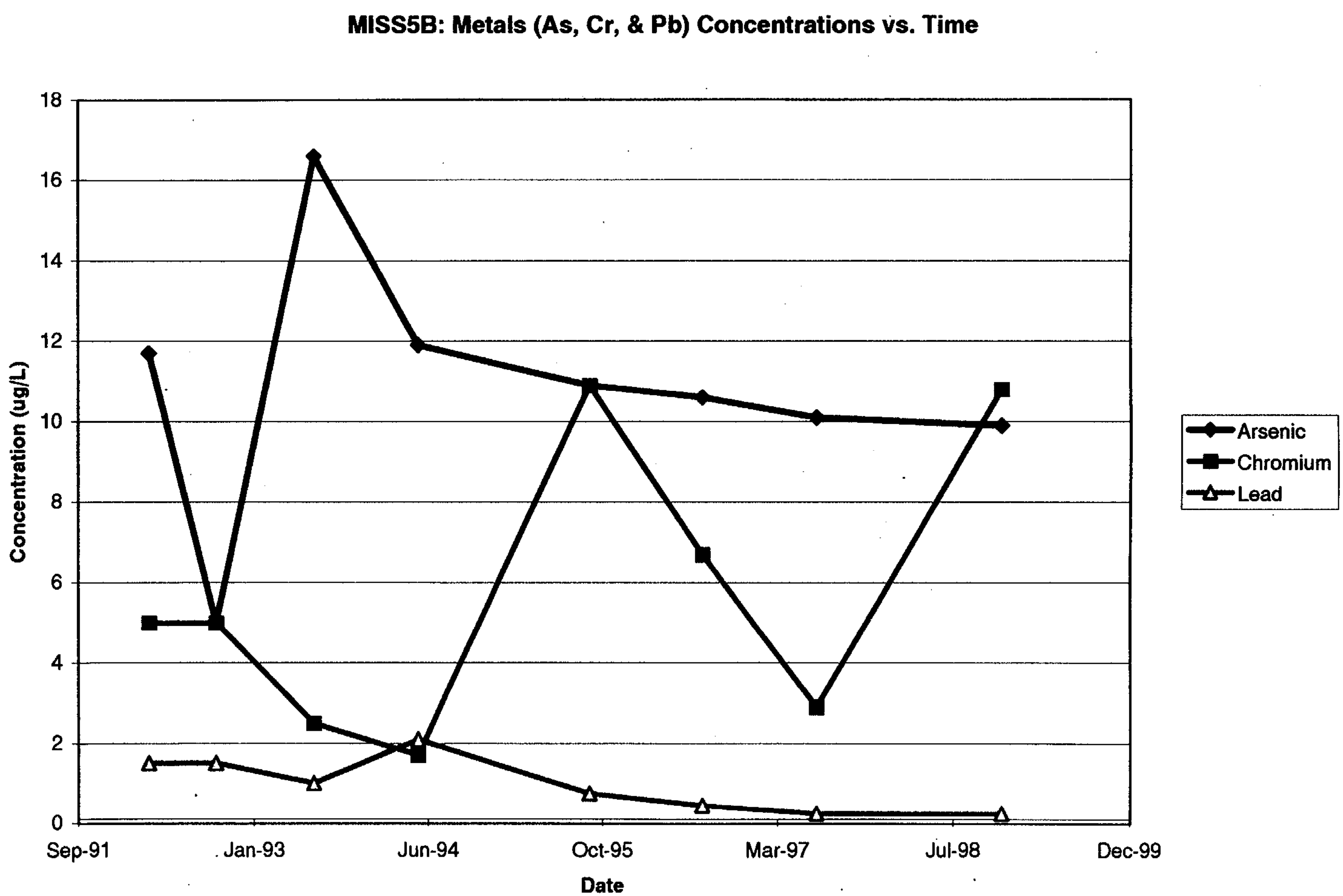

B38W02D: Metals (As, Cr, & Pb) Concentrations vs. Time
1000
100
10
1
0
Concentration (ug/L)
Sep-91
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Arsenic
Chromium
Lead

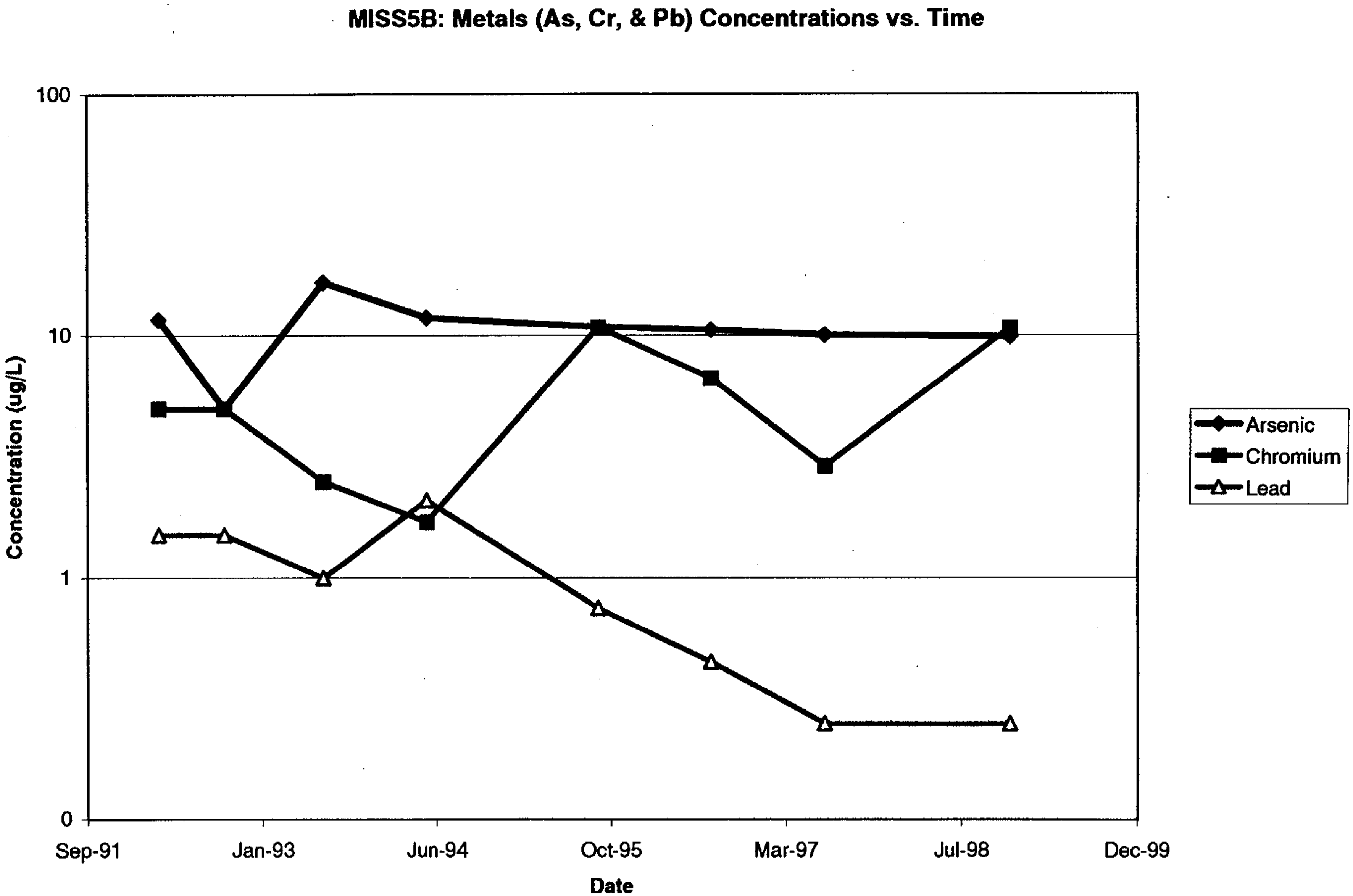
MISS5A: Metals (As, Cr, & Pb) Concentrations vs. Time



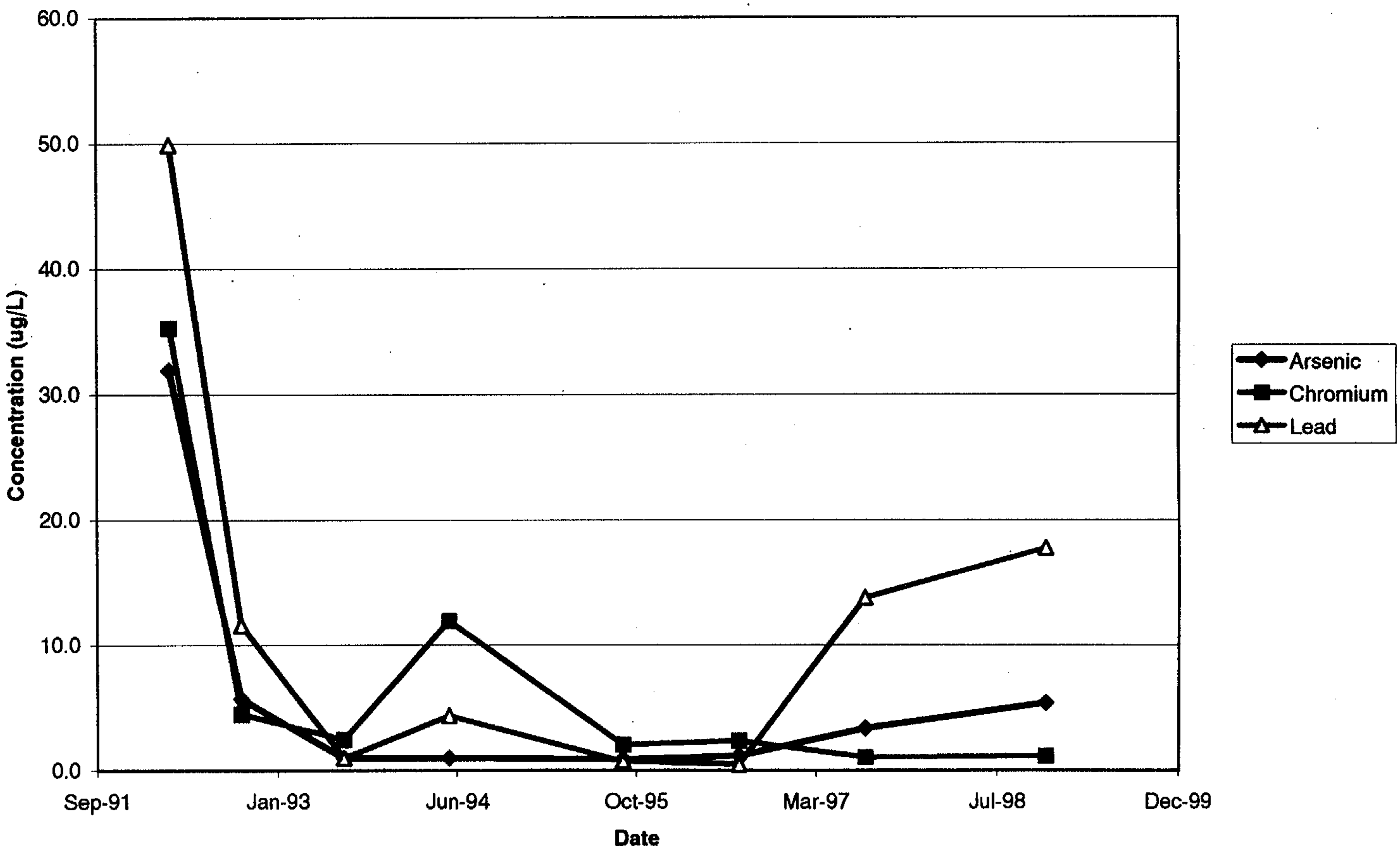


MISS5A: Metals (As, Cr, & Pb) Concentrations vs. Time
100
10
1
0
Concentration (ug/L)
Sep-91
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Arsenic
Chromium
Lead

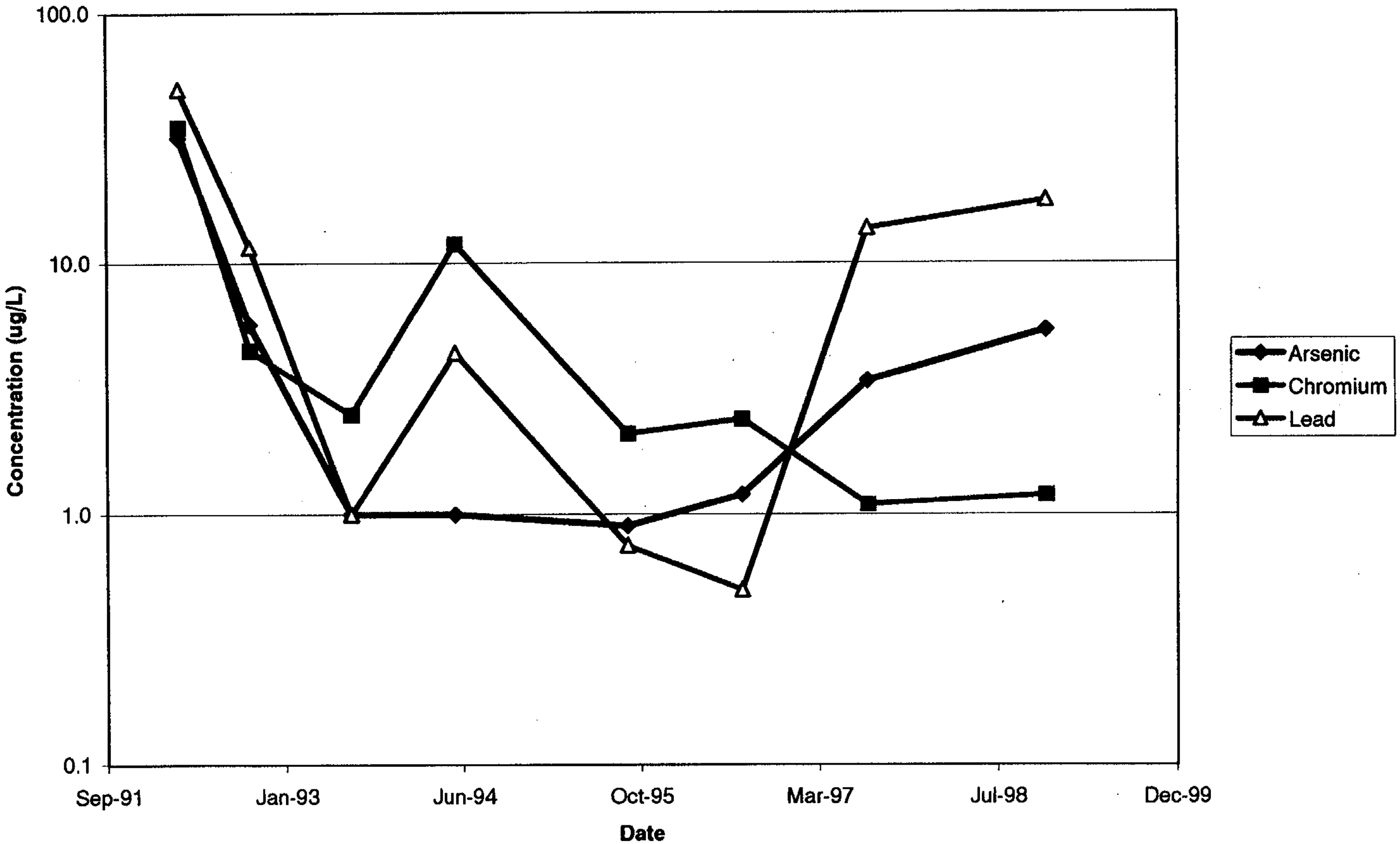

MISS5B: Metals (As, Cr, & Pb) Concentrations vs. Time
Concentration (ug/L)
18
16
14
12
10
8
6
4
2
0
Sep-91
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Arsenic
Chromium
Lead

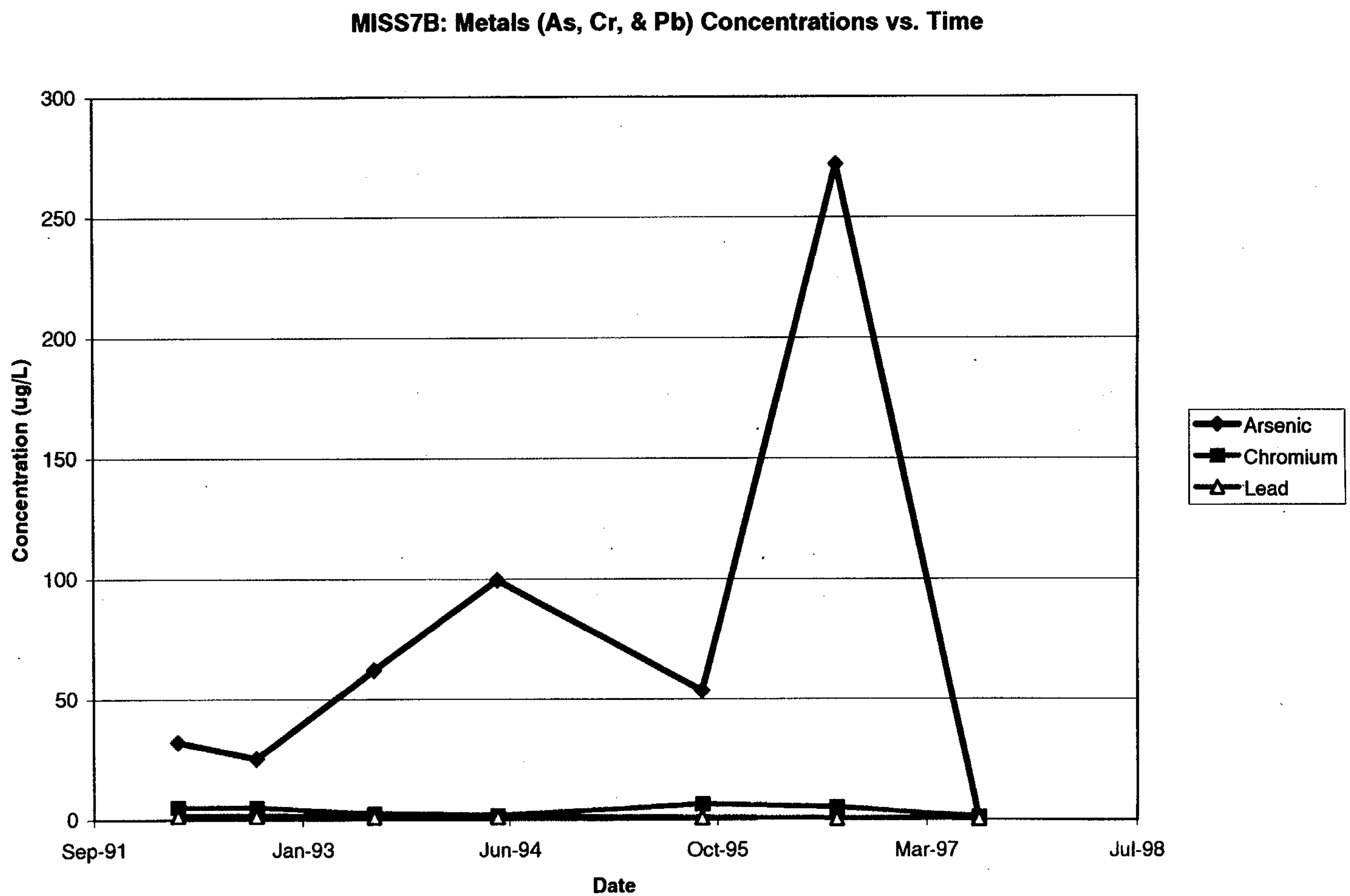

MISS5B: Metals (As, Cr, & Pb) Concentrations vs. Time
100
10
1
0
Concentration (ug/L)
Sep-91
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Arsenic
Chromium
Lead

MISS6A: Metals (As, Cr, & Pb) Concentrations vs. Time

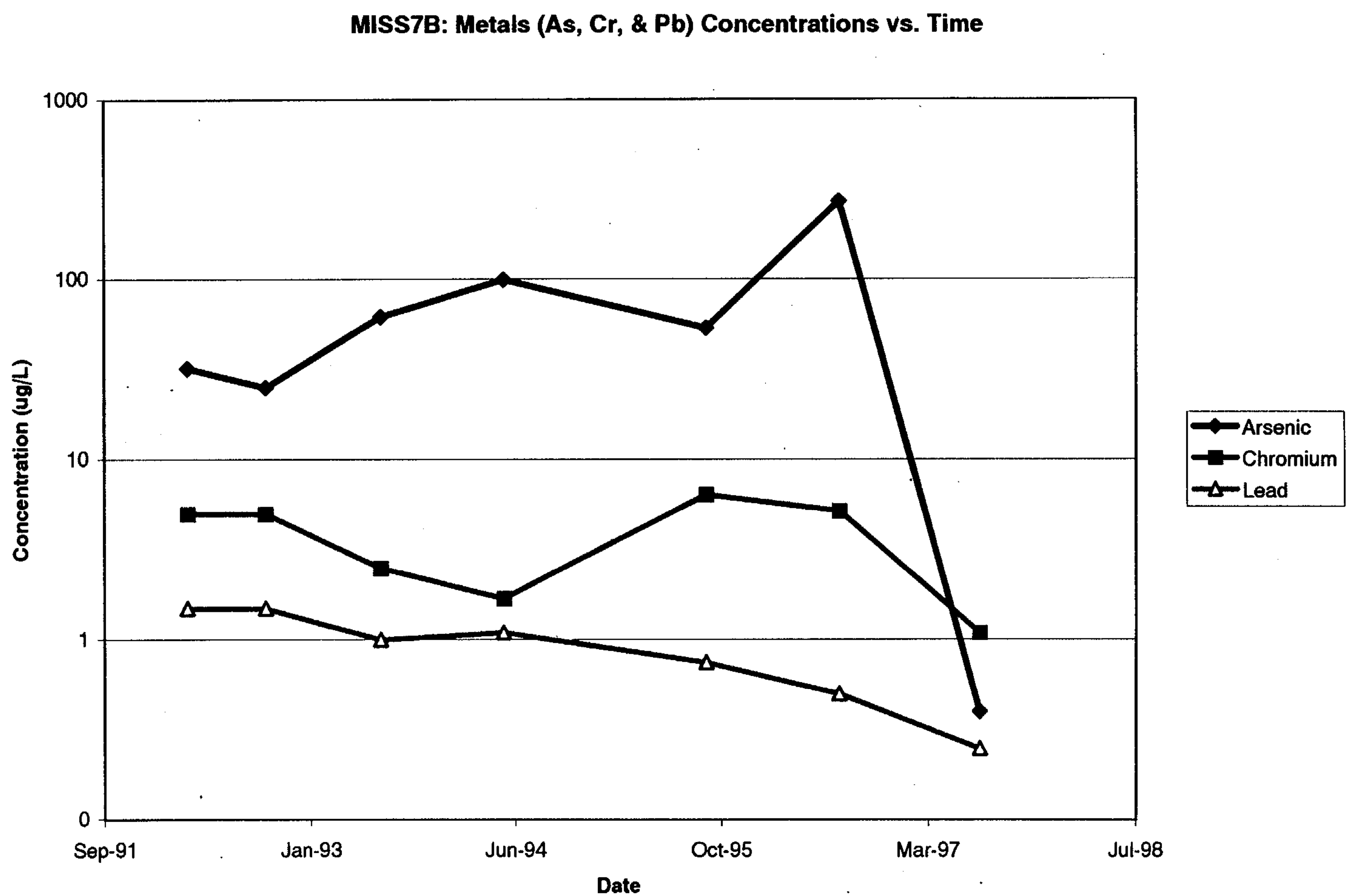


MISS6A: Metals (As, Cr, & Pb) Concentrations vs. Time

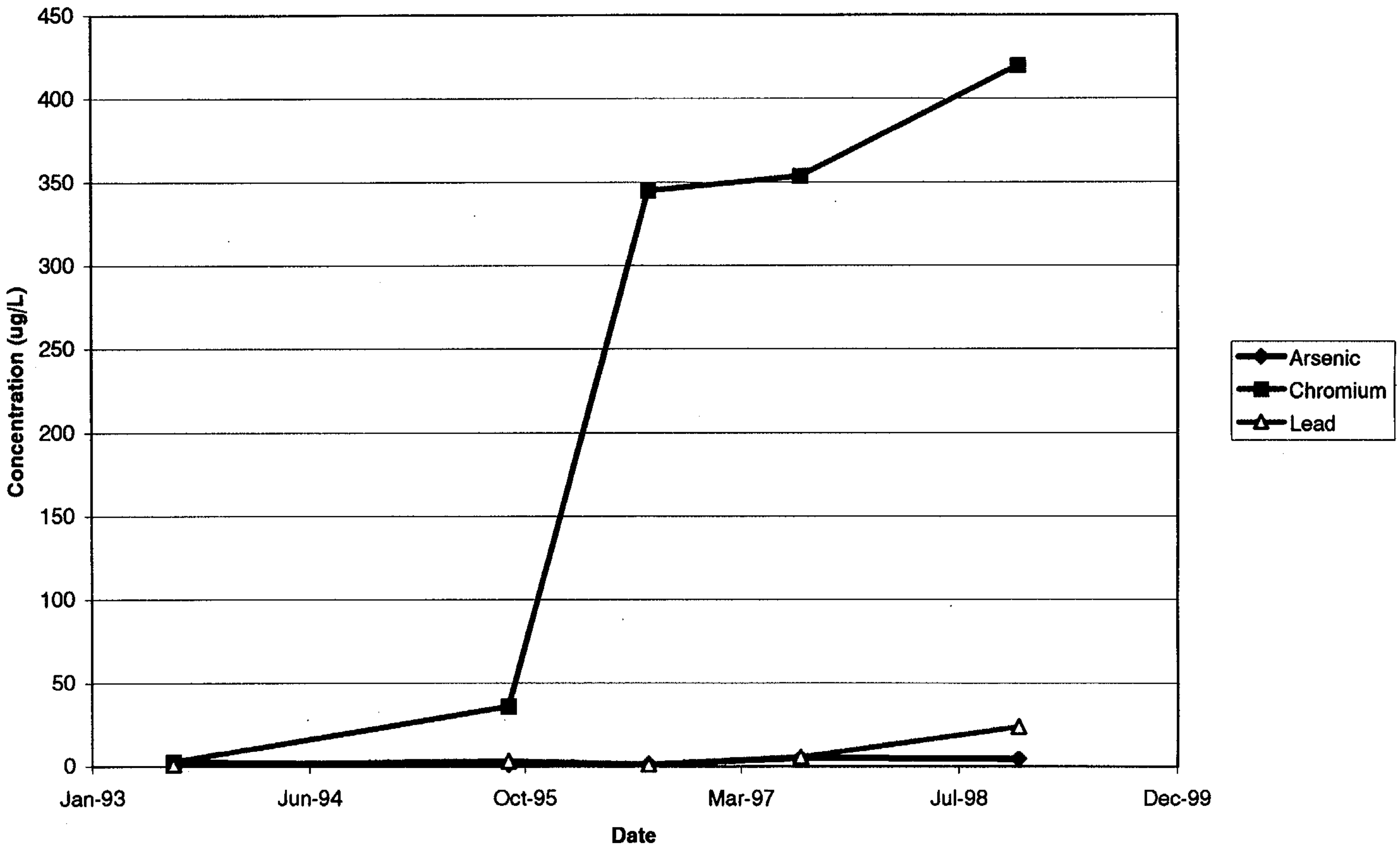




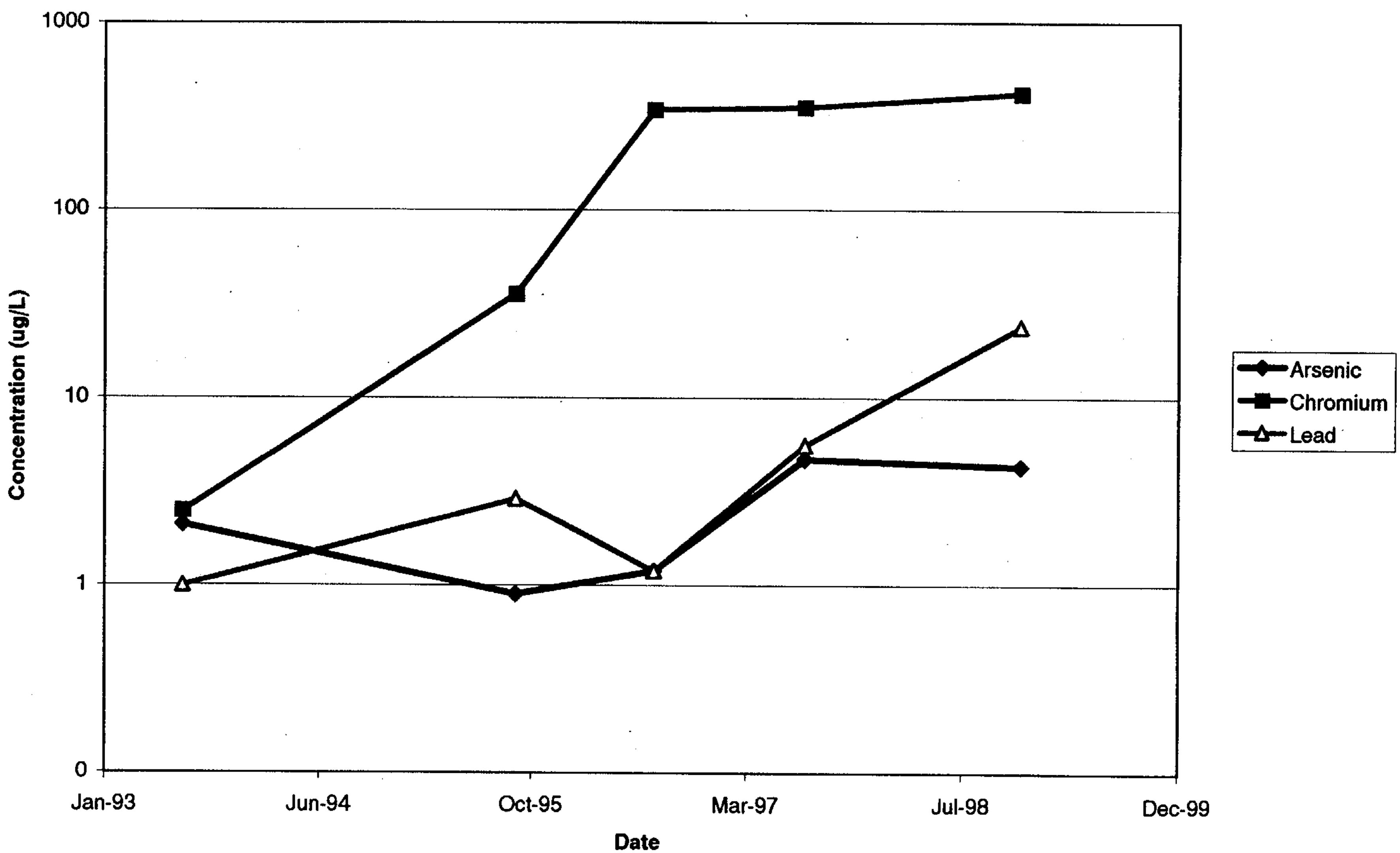
MISS7B: Metals (As, Cr, & Pb) Concentrations vs. Time
300
250
200
150
100
50
0
Concentration (ug/L)
Sep-91
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Date
Arsenic
Chromium
Lead

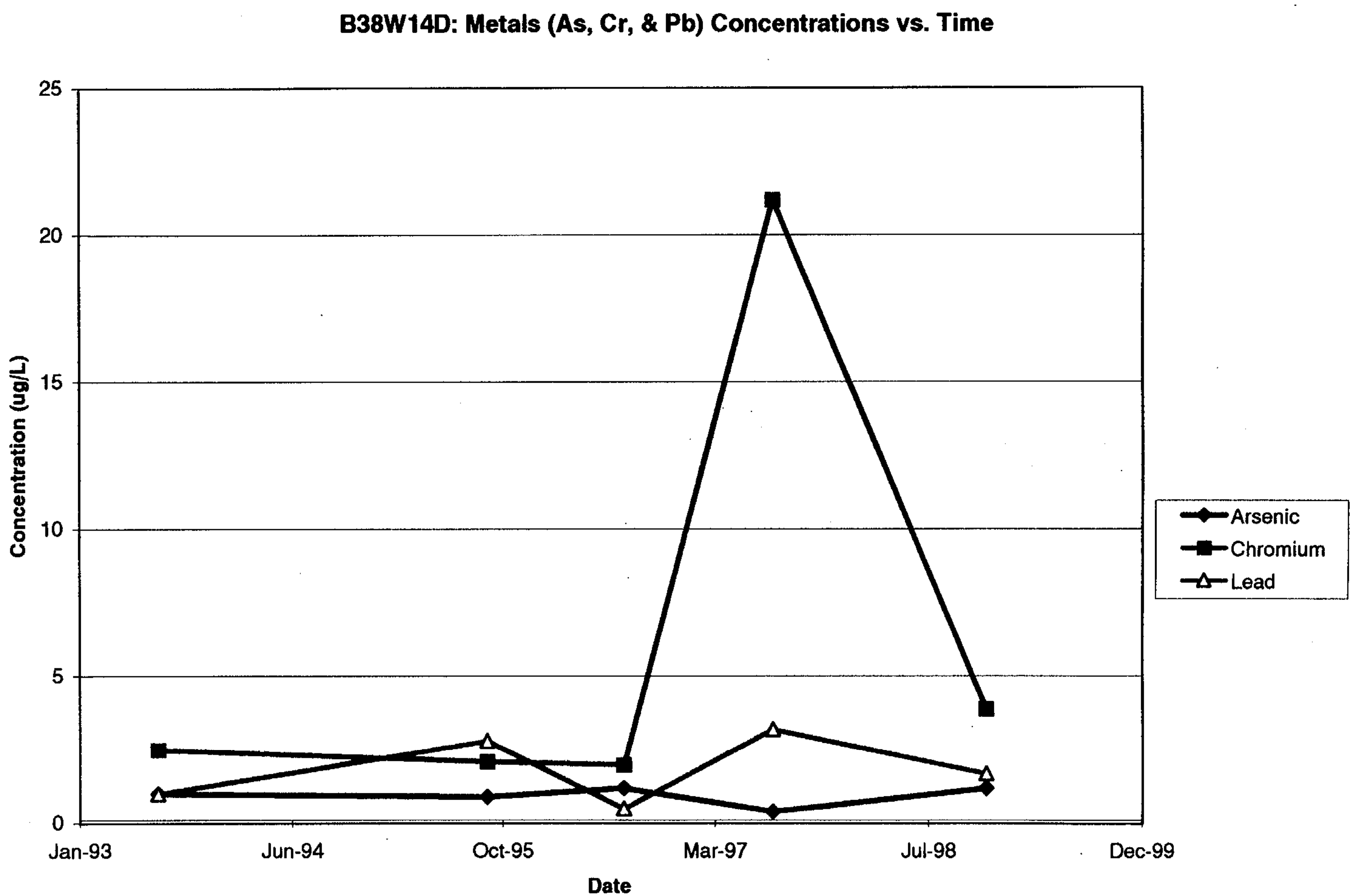

MISS7B: Metals (As, Cr, & Pb) Concentrations vs. Time
1000
100
10
1
0
Concentration (ug/L)
Sep-91
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Date
Arsenic
Chromium
Lead

B38W14S: Metals (As, Cr, & Pb) Concentrations vs. Time



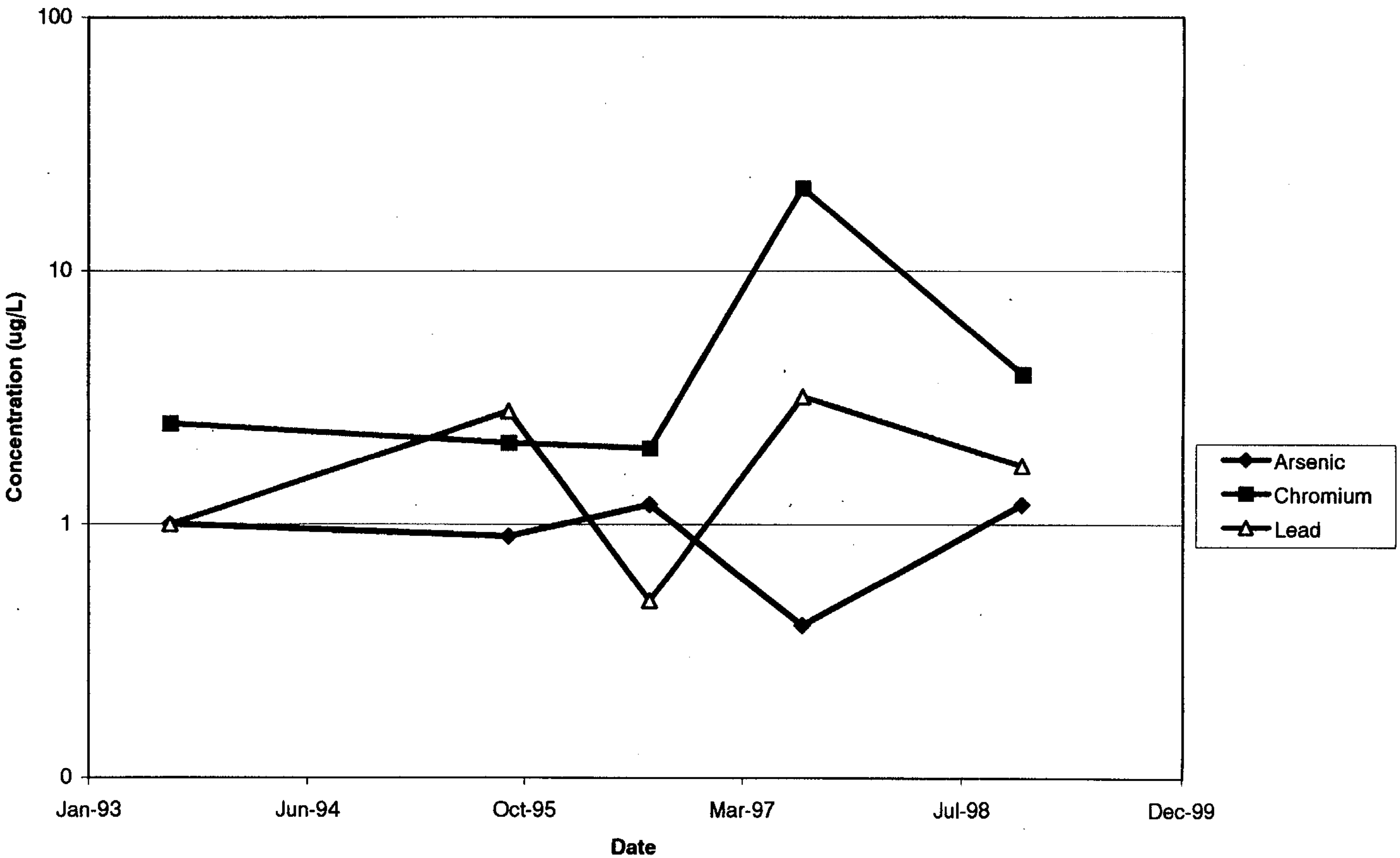
B38W14S: Metals (As, Cr, & Pb) Concentrations vs. Time



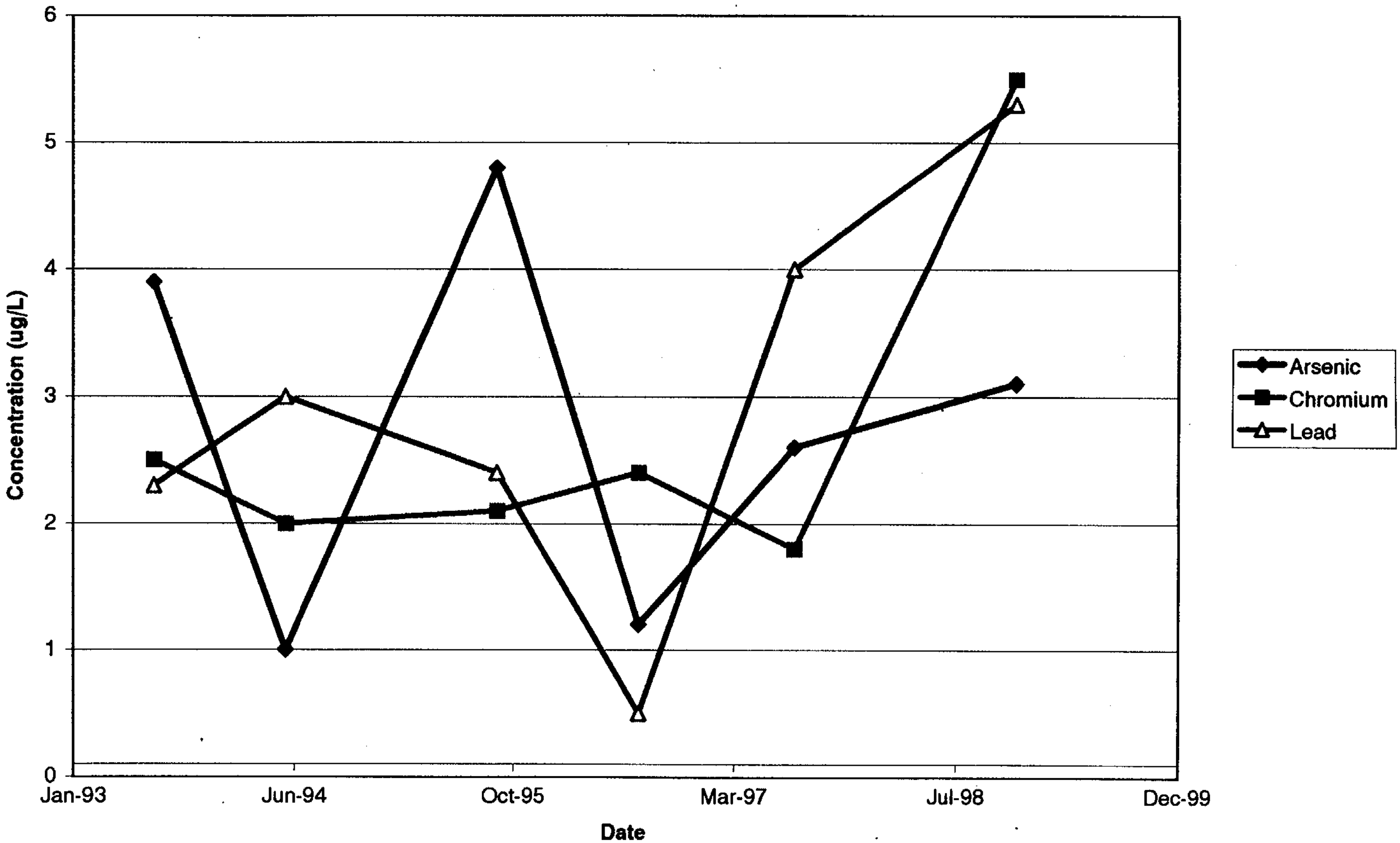


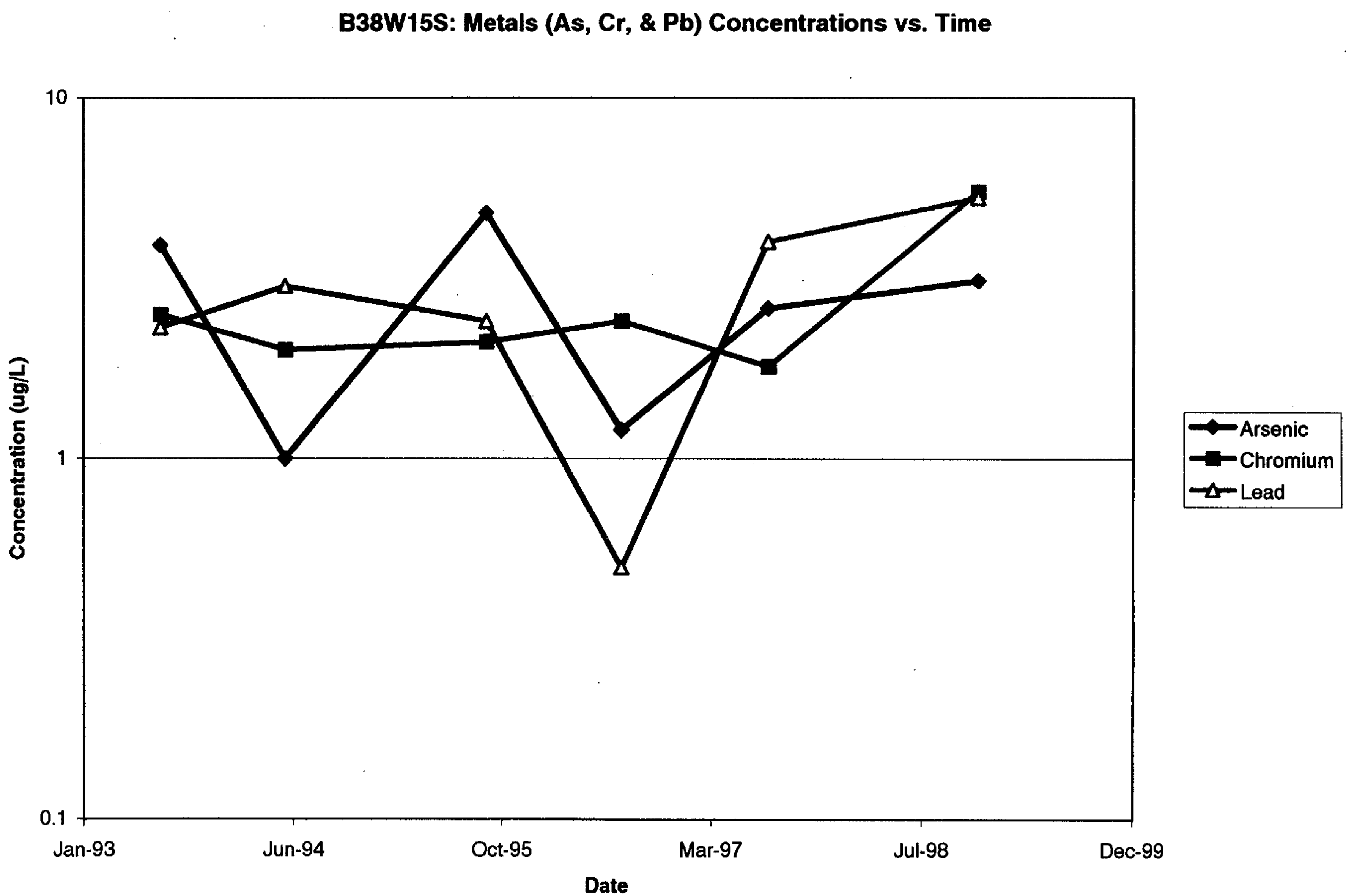
B38W14D: Metals (As, Cr, & Pb) Concentrations vs. Time
25
20
15
10
5
0
Concentration (ug/L)
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Arsenic
Chromium
Lead

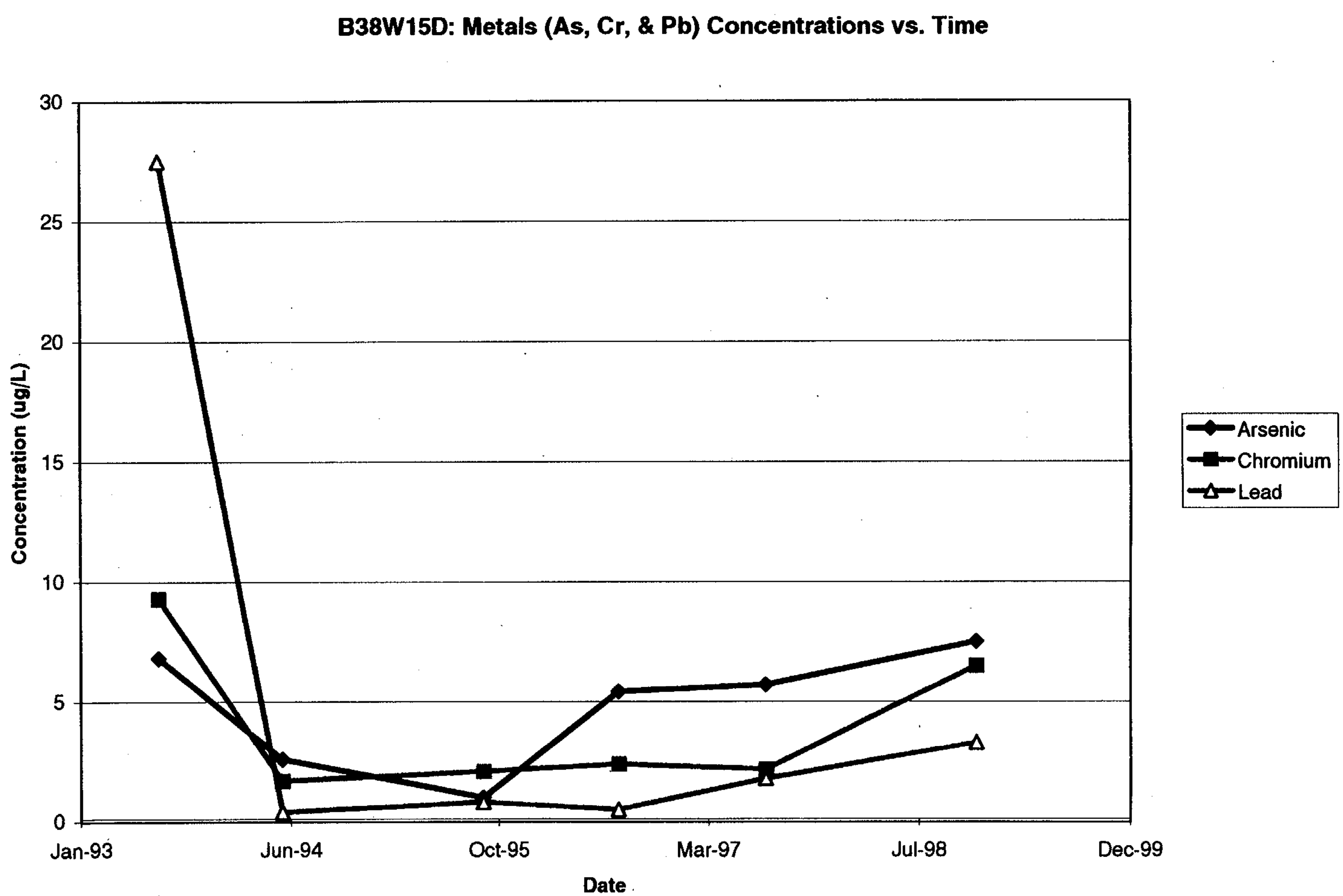
B38W14D: Metals (As, Cr, & Pb) Concentrations vs. Time

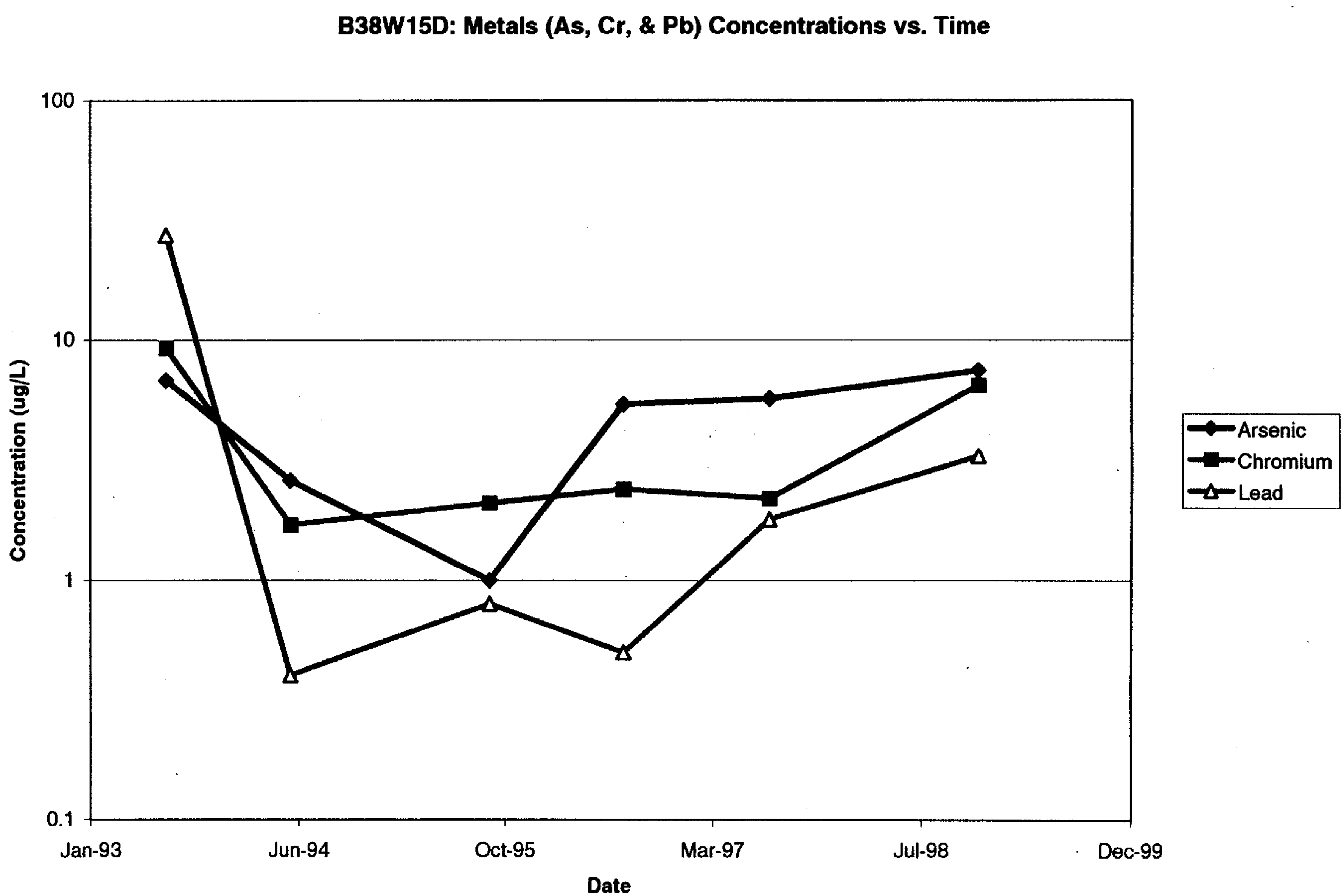


B38W15S: Metals (As, Cr, & Pb) Concentrations vs. Time

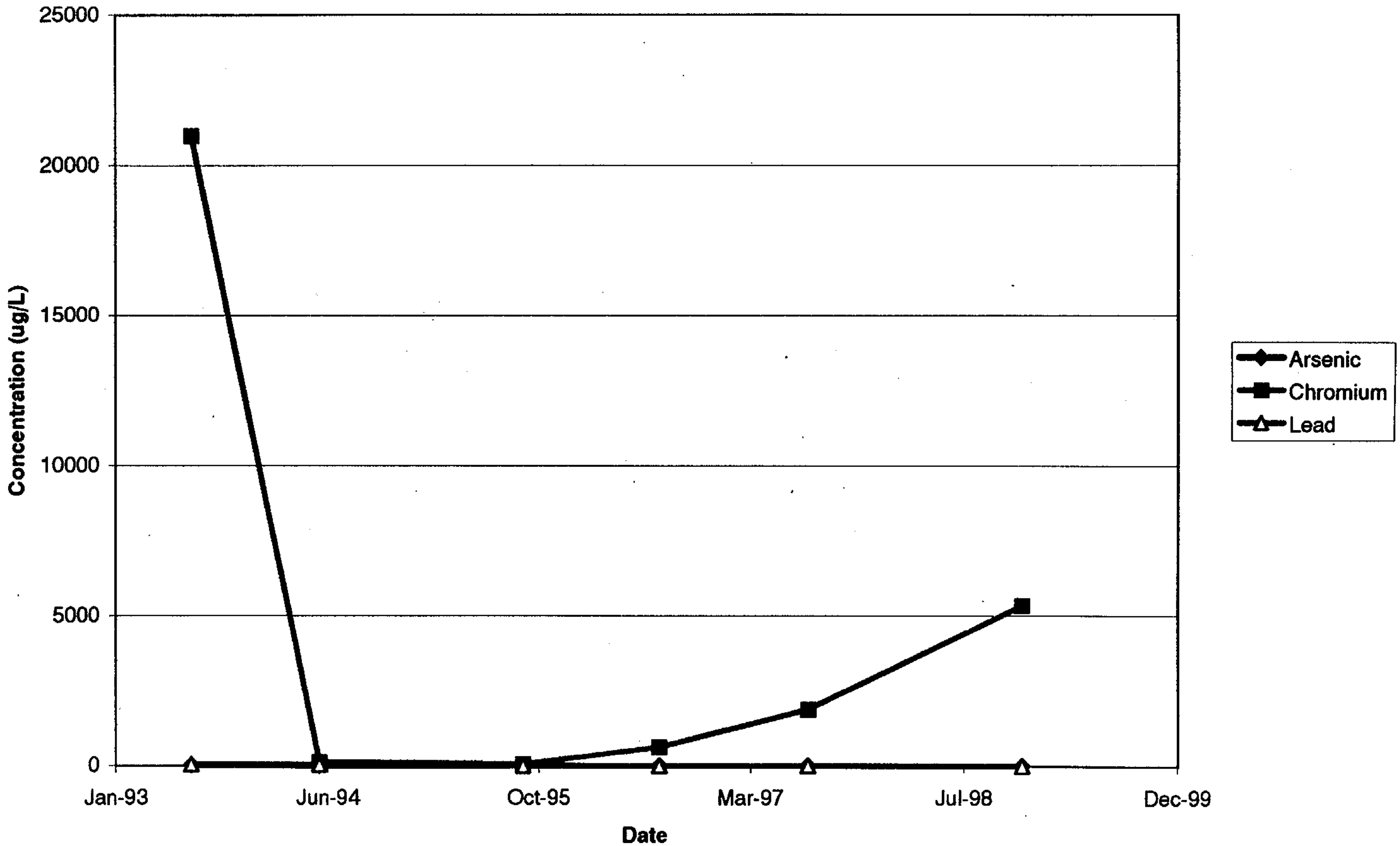


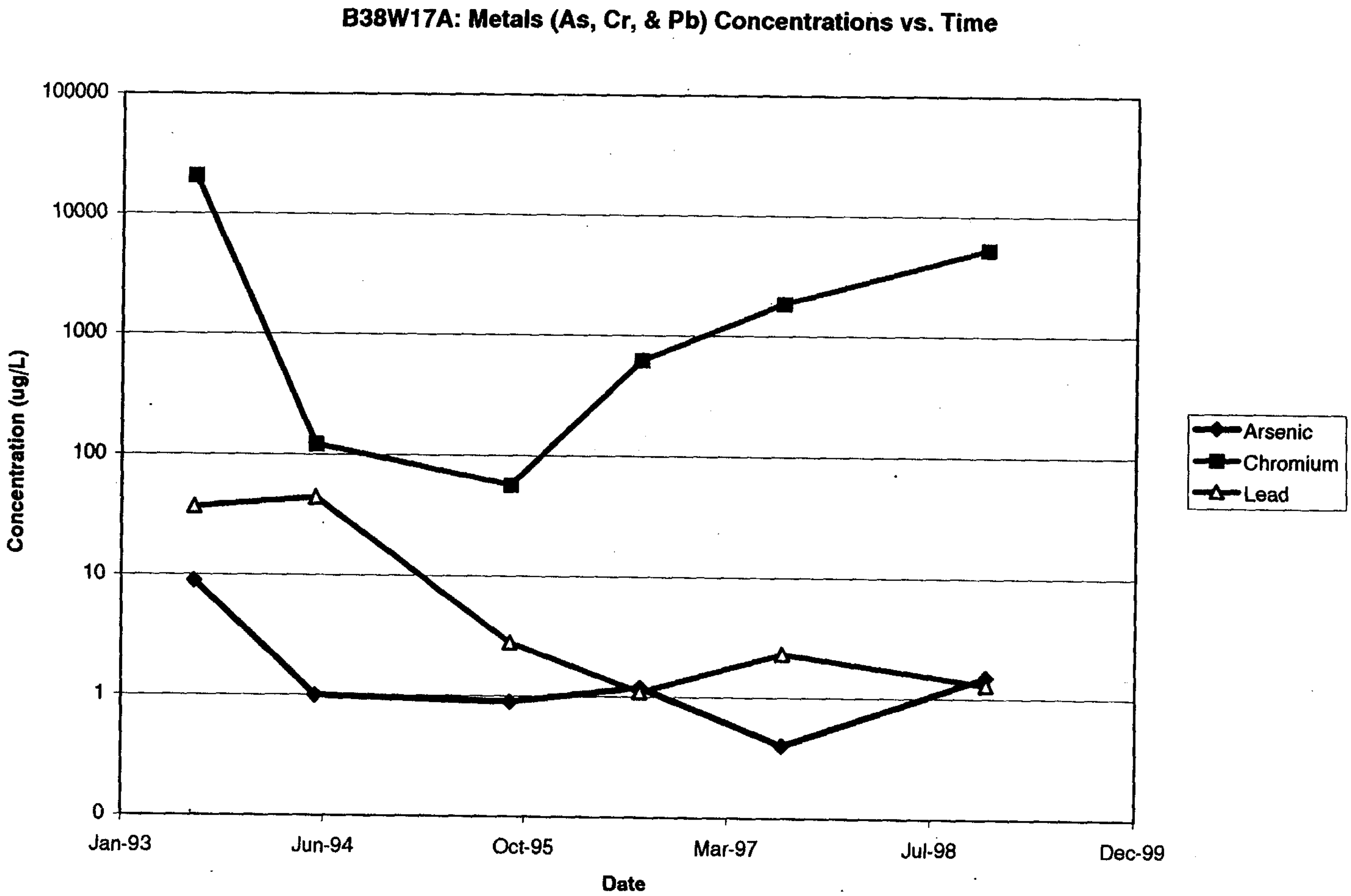

B38W15S: Metals (As, Cr, & Pb) Concentrations vs. Time
10
1
0.1
Concentration (ug/L)
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Arsenic
Chromium
Lead


B38W15D: Metals (As, Cr, & Pb) Concentrations vs. Time
30
25
20
15
10
5
0
Concentration (ug/L)
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Arsenic
Chromium
Lead


B38W15D: Metals (As, Cr, & Pb) Concentrations vs. Time
100
10
1
0.1
Concentration (ug/L)
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Arsenic
Chromium
Lead

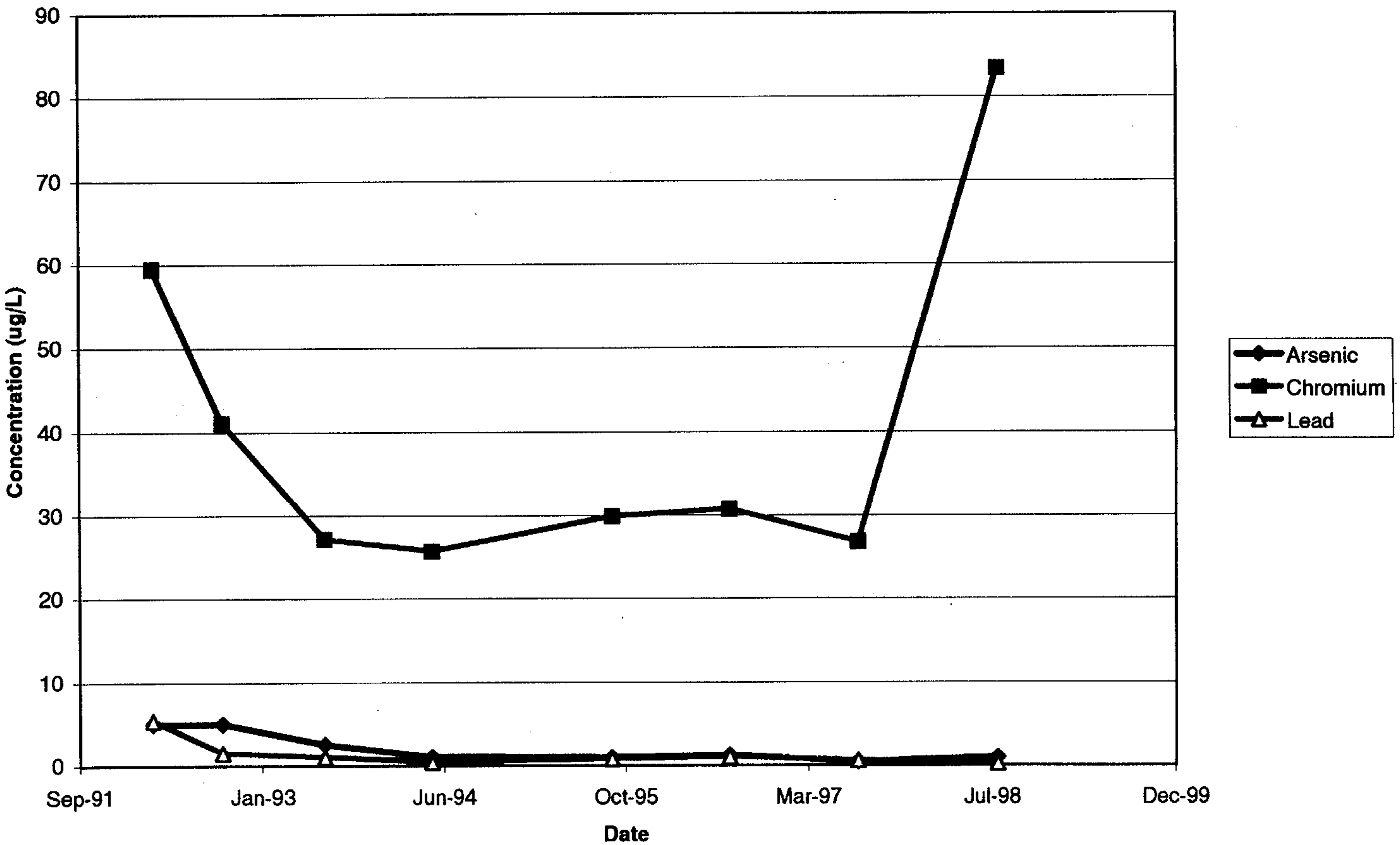
B38W17A: Metals (As, Cr, & Pb) Concentrations vs. Time

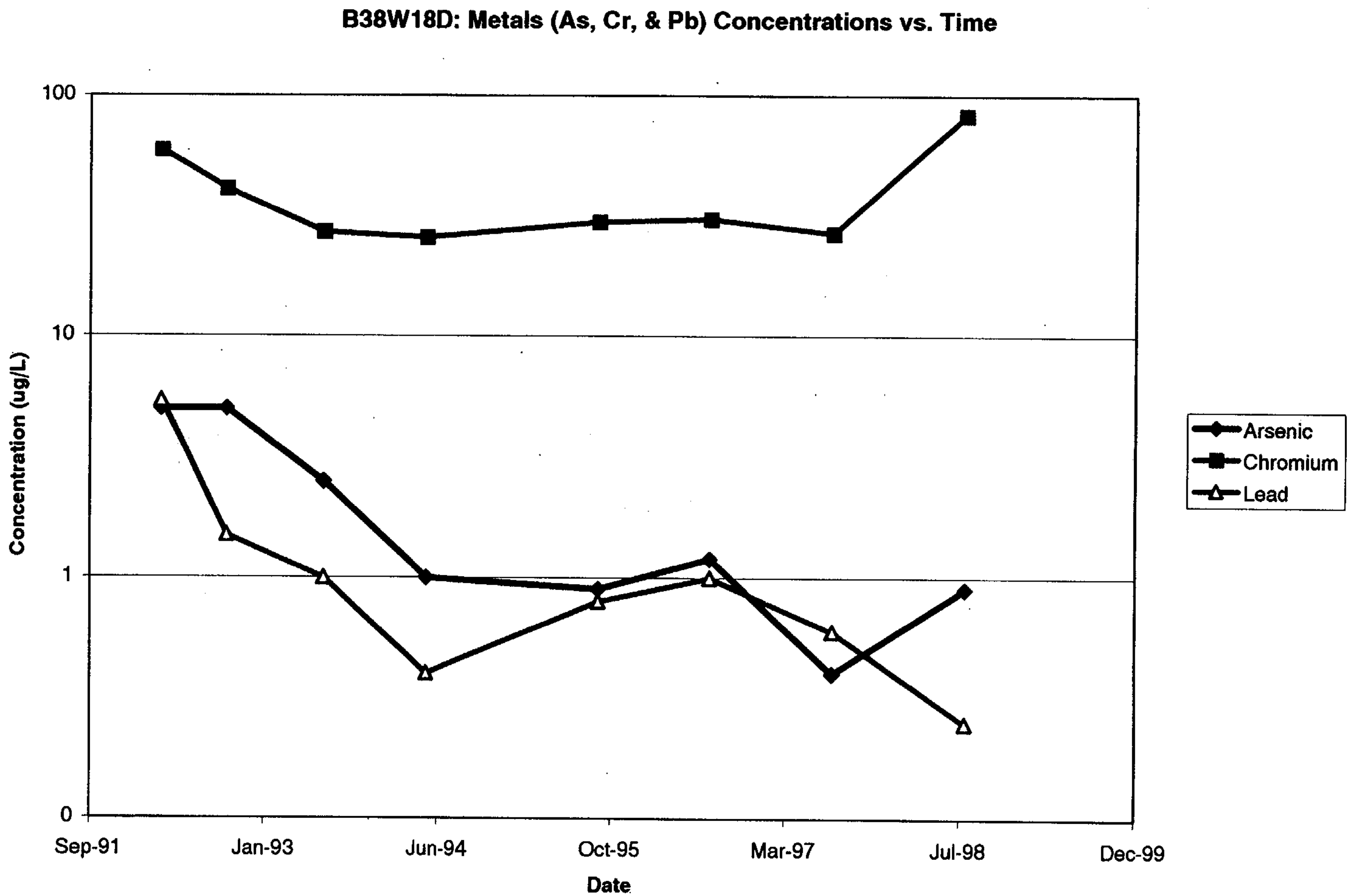




B38W17A: Metals (As, Cr, & Pb) Concentrations vs. Time
100000
10000
1000
100
10
1
0
Concentration (ug/L)
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Arsenic
Chromium
Lead

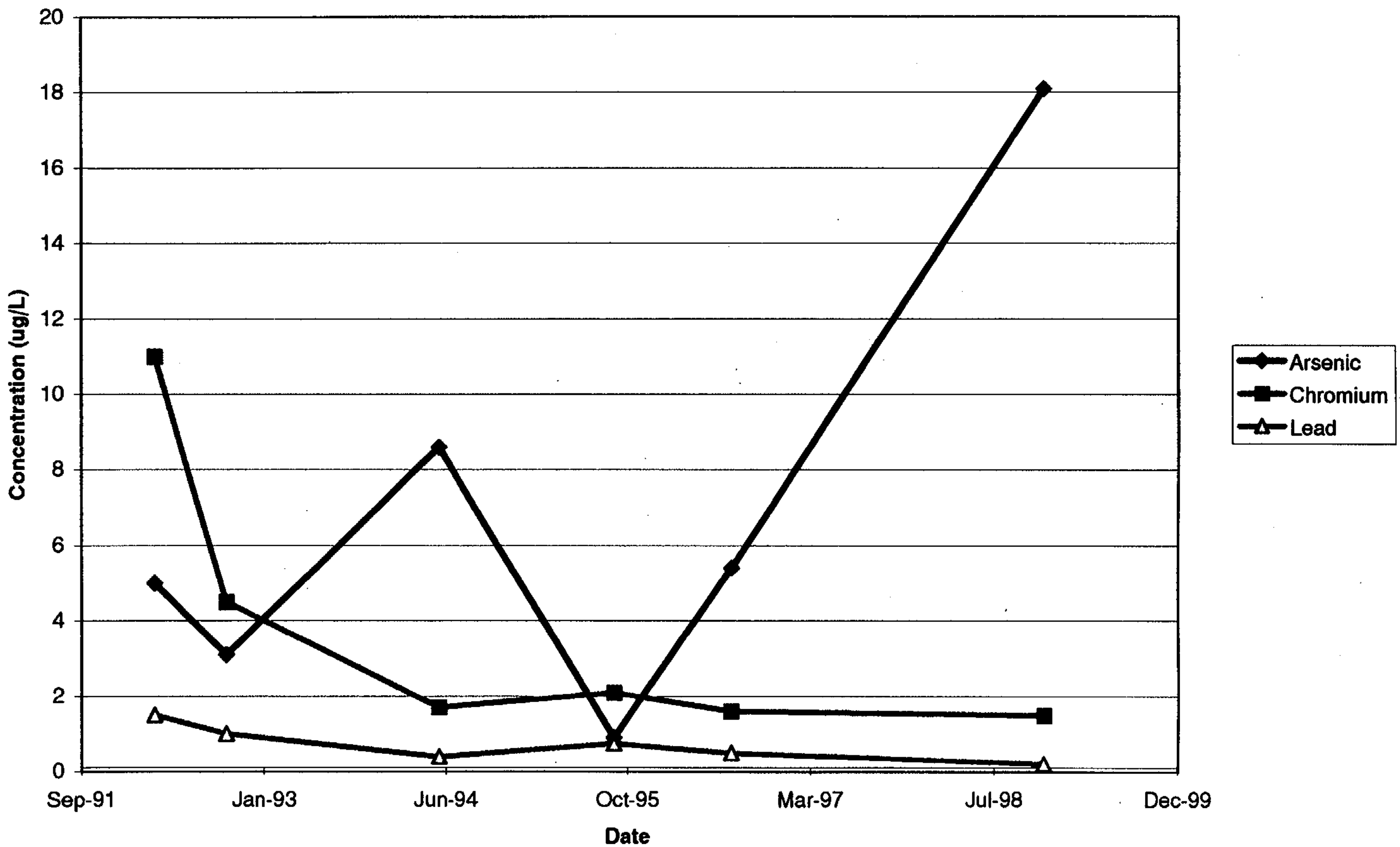
B38W18D: Metals (As, Cr, & Pb) Concentrations vs. Time

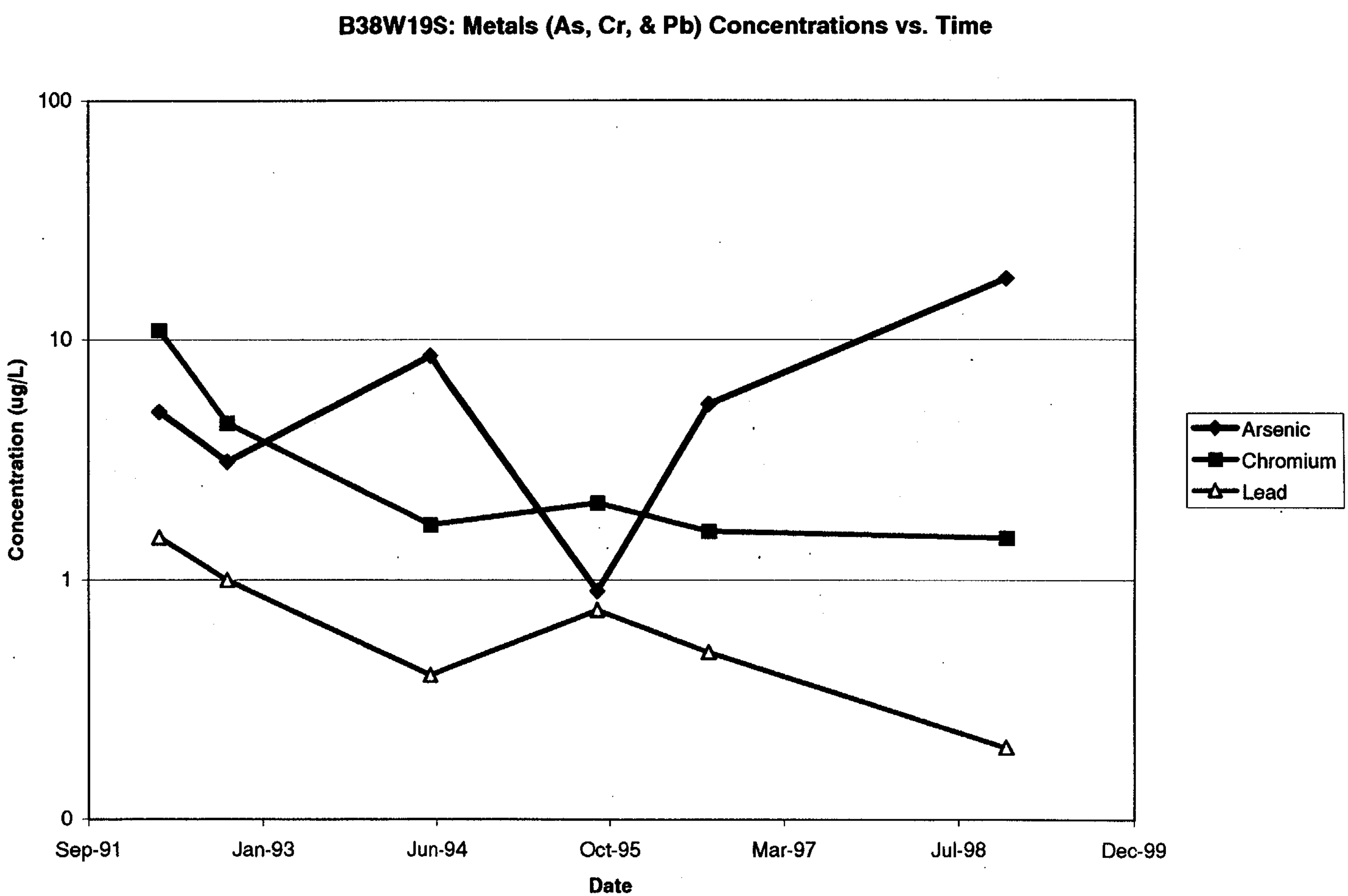


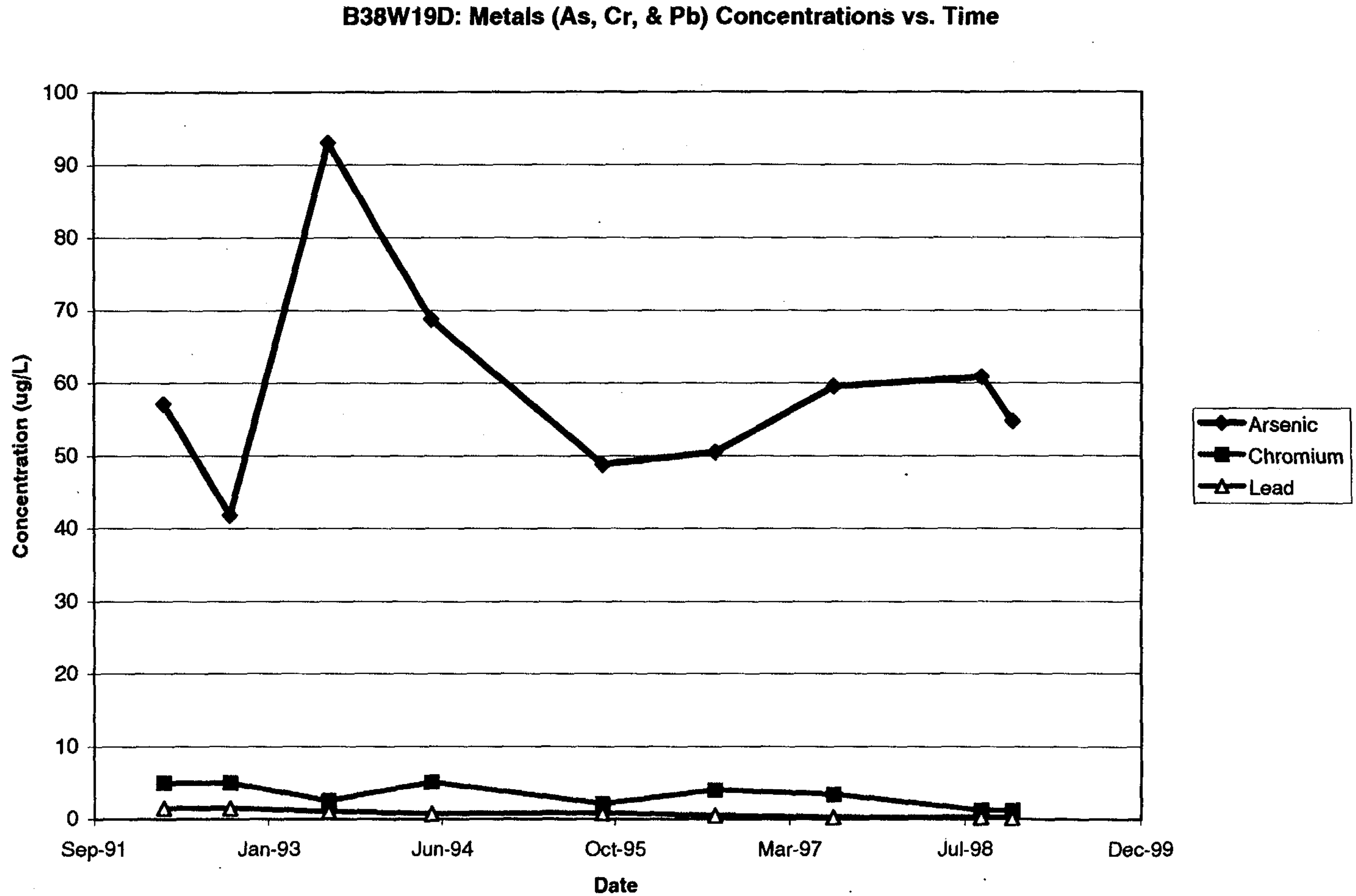


B38W18D: Metals (As, Cr, & Pb) Concentrations vs. Time
100
10
1
0
Concentration (ug/L)
Sep-91
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Arsenic
Chromium
Lead

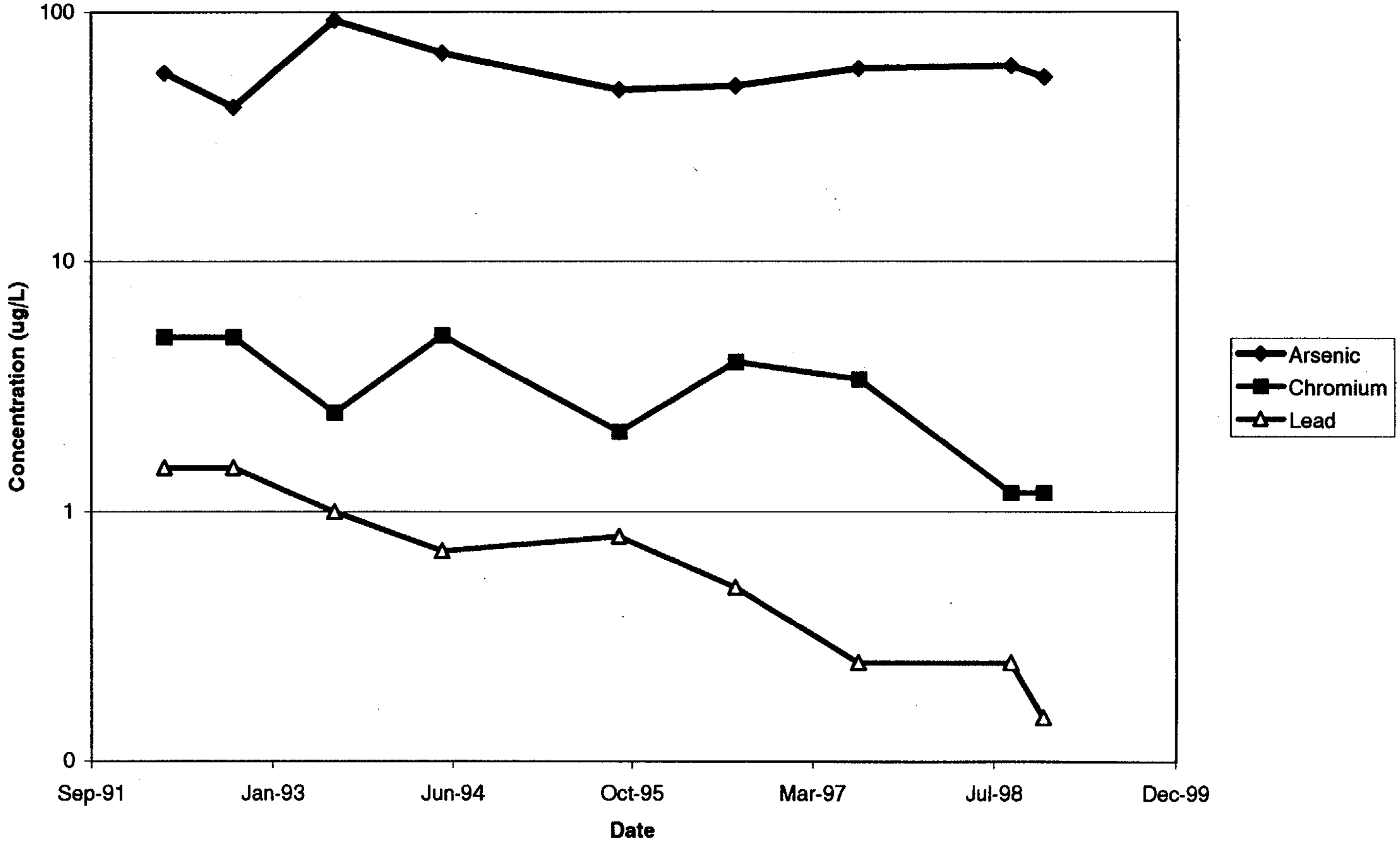
B38W19S: Metals (As, Cr, & Pb) Concentrations vs. Time



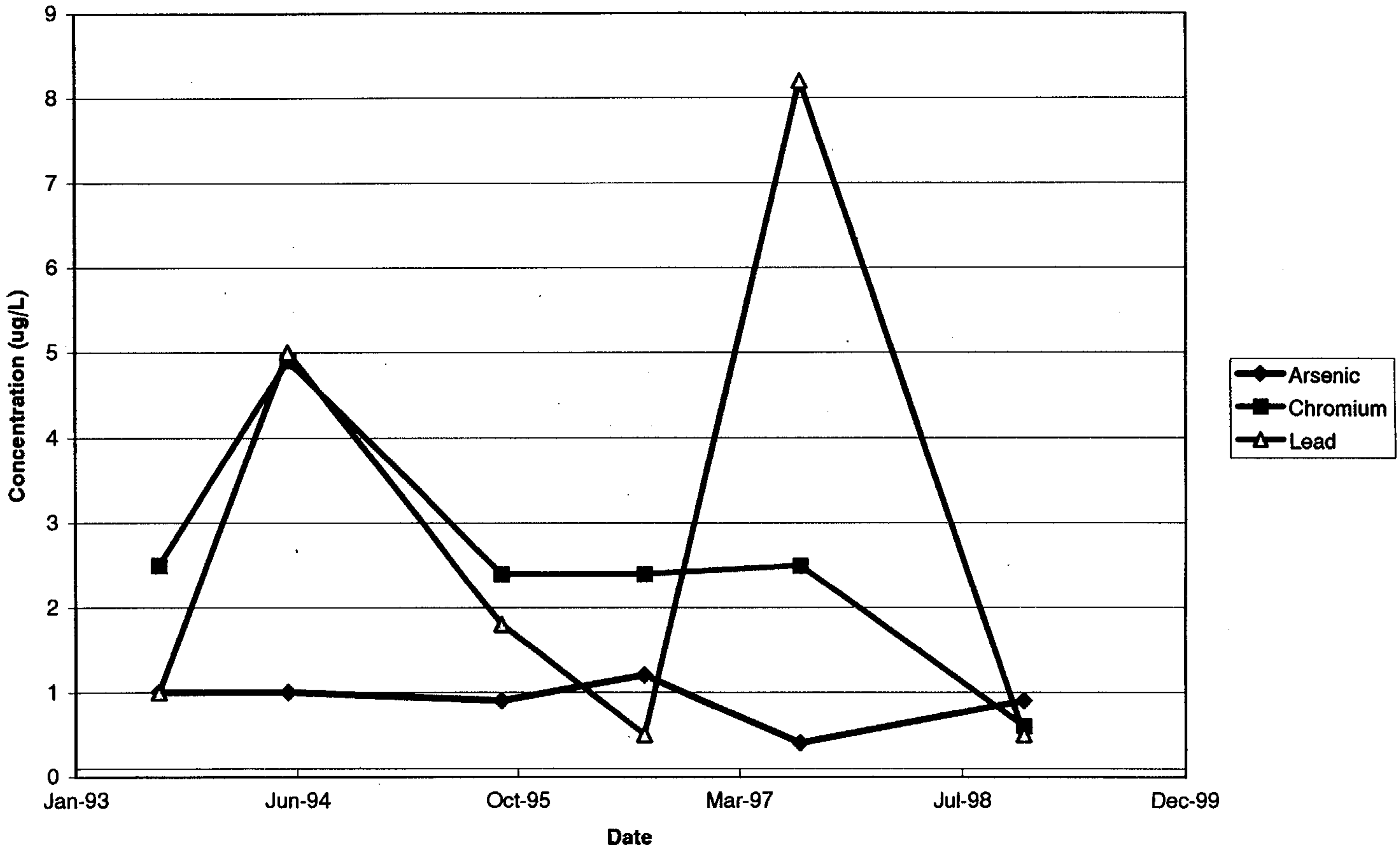

B38W19S: Metals (As, Cr, & Pb) Concentrations vs. Time
100
10
1
0
Concentration (ug/L)
Sep-91
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Arsenic
Chromium
Lead


B38W19D: Metals (As, Cr, & Pb) Concentrations vs. Time
Concentration (ug/L)
100
90
80
70
60
50
40
30
20
10
0
Sep-91
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Arsenic
Chromium
Lead

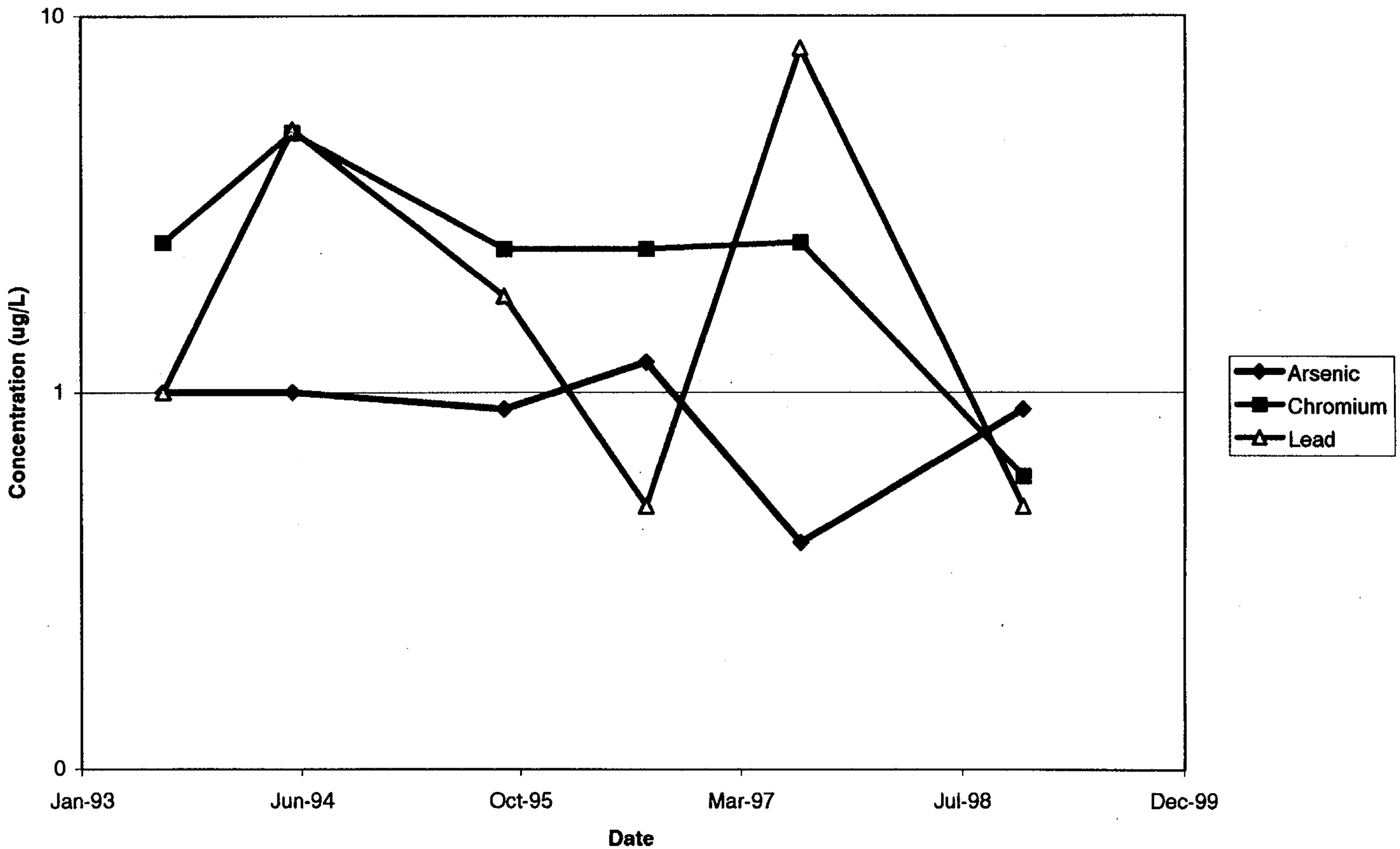
B38W19D: Metals (As, Cr, & Pb) Concentrations vs. Time

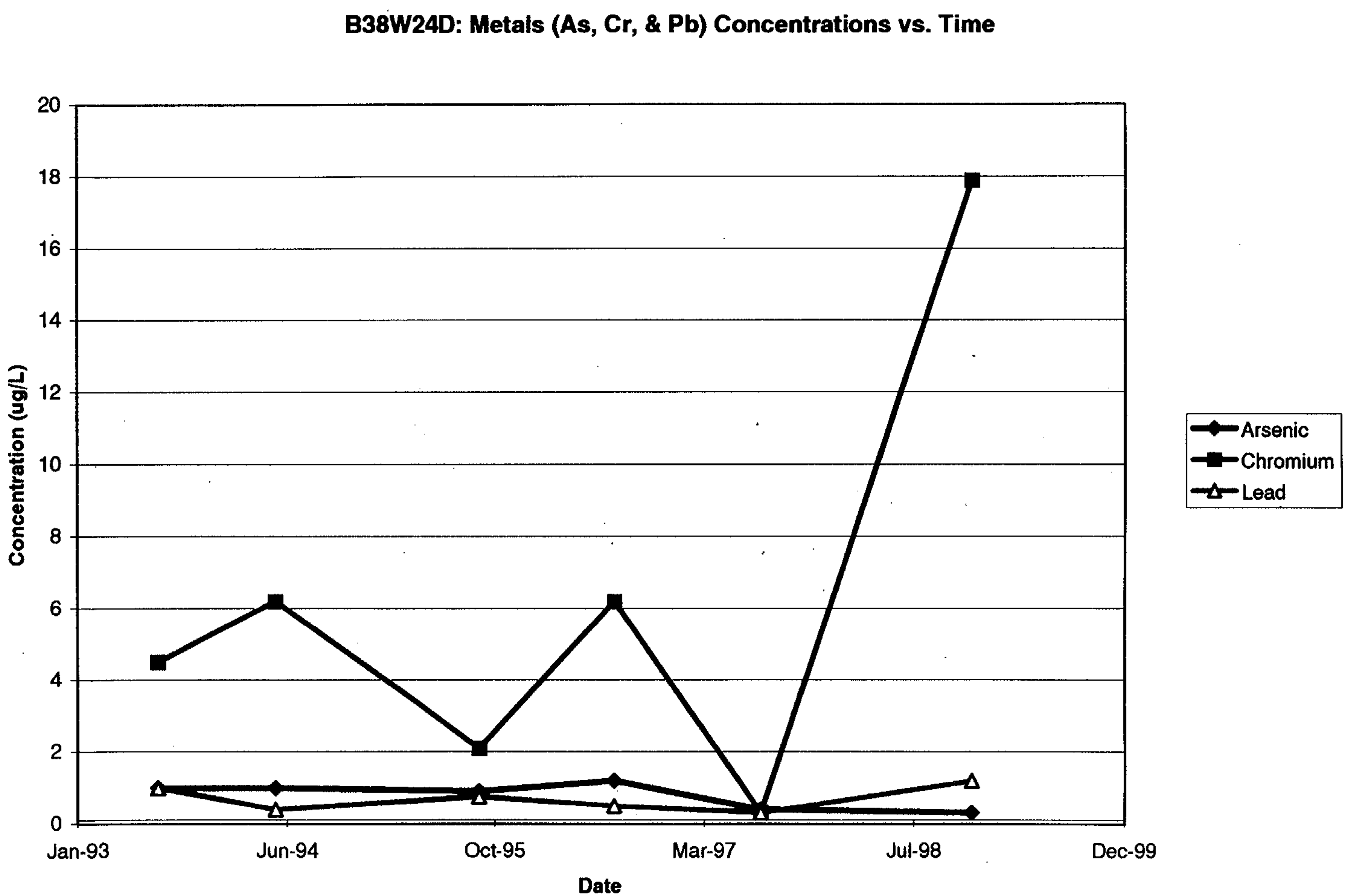


B38W24S: Metals (As, Cr, & Pb) Concentrations vs. Time

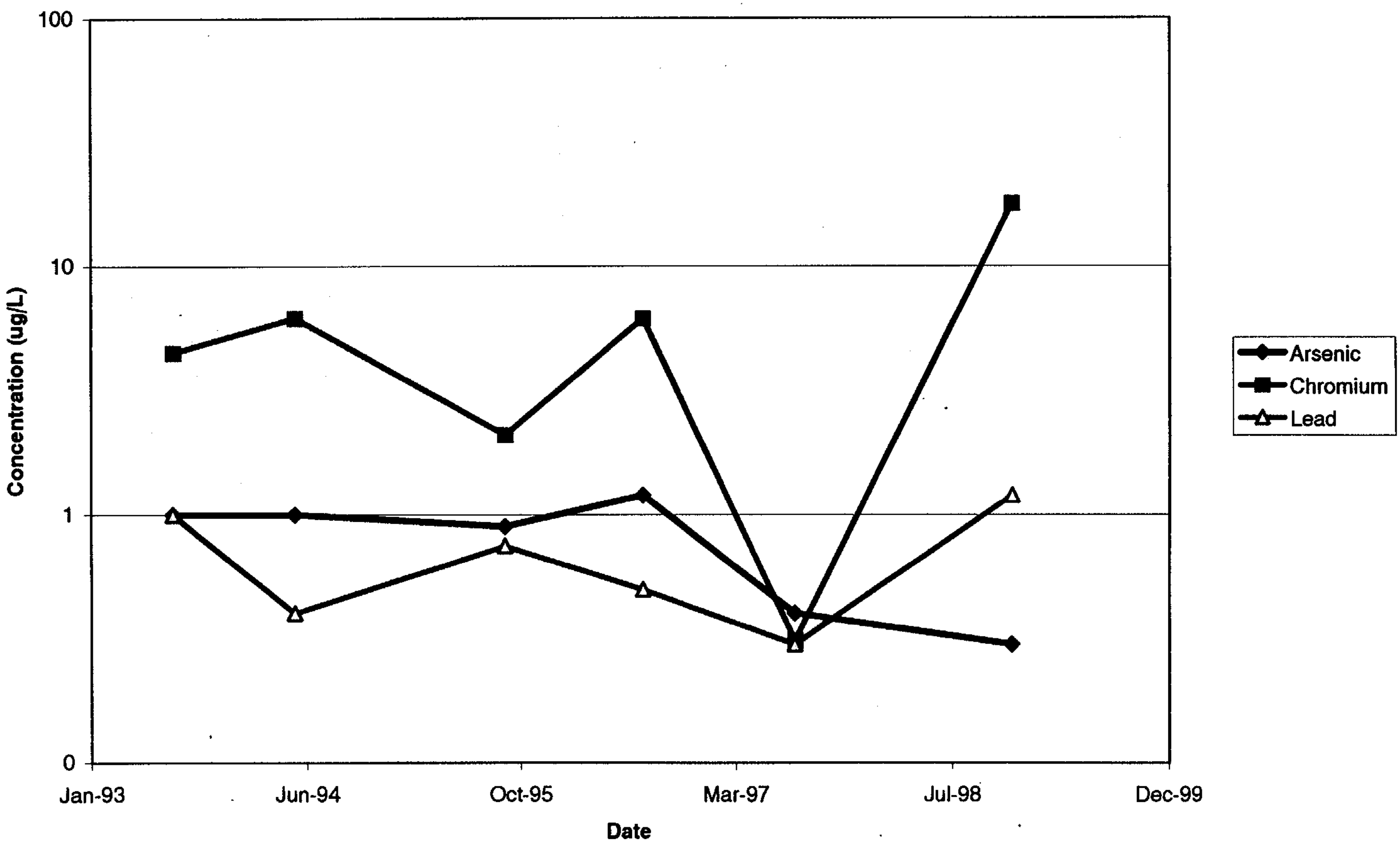


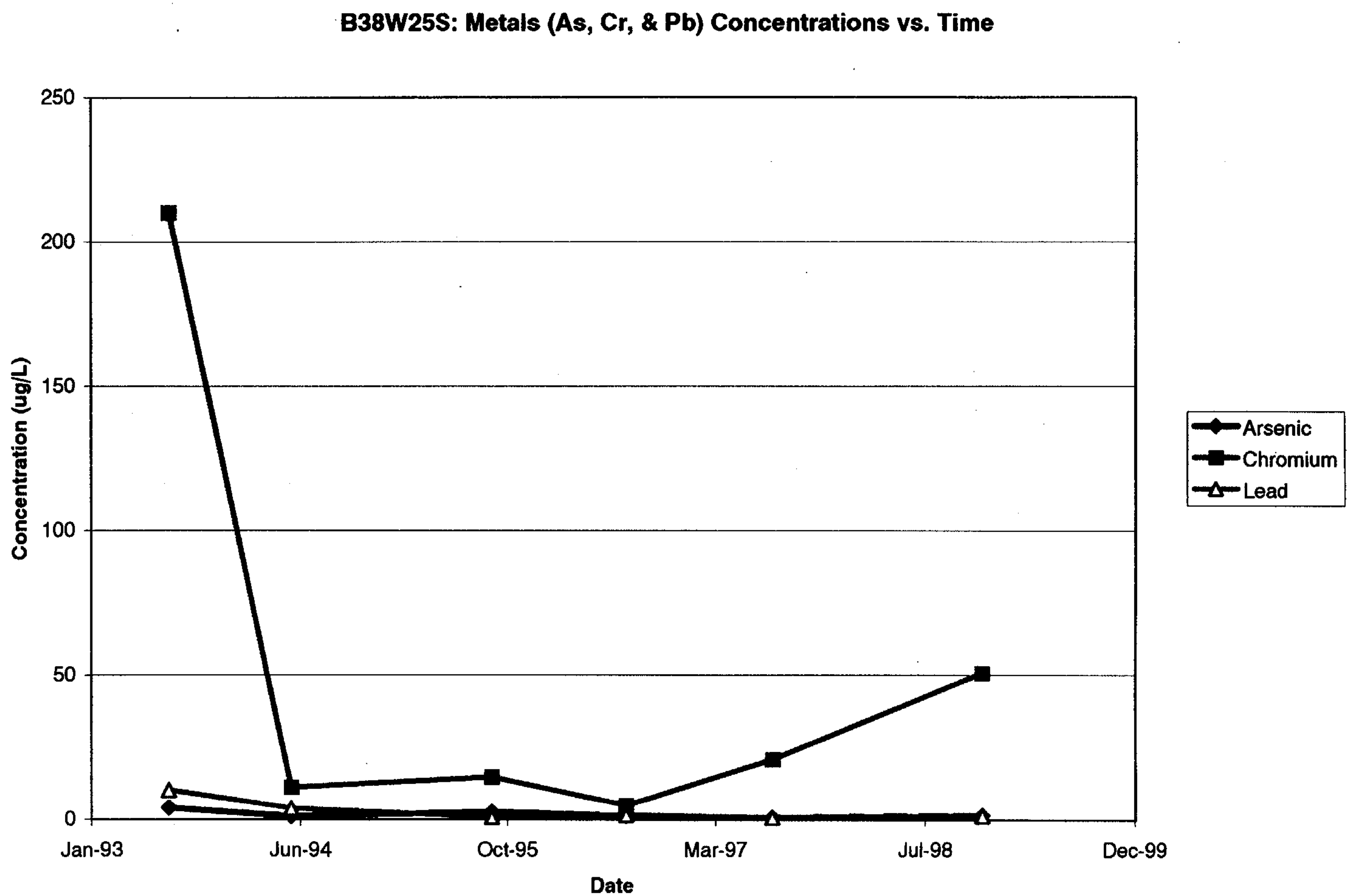
B38W24S: Metals (As, Cr, & Pb) Concentrations vs. Time



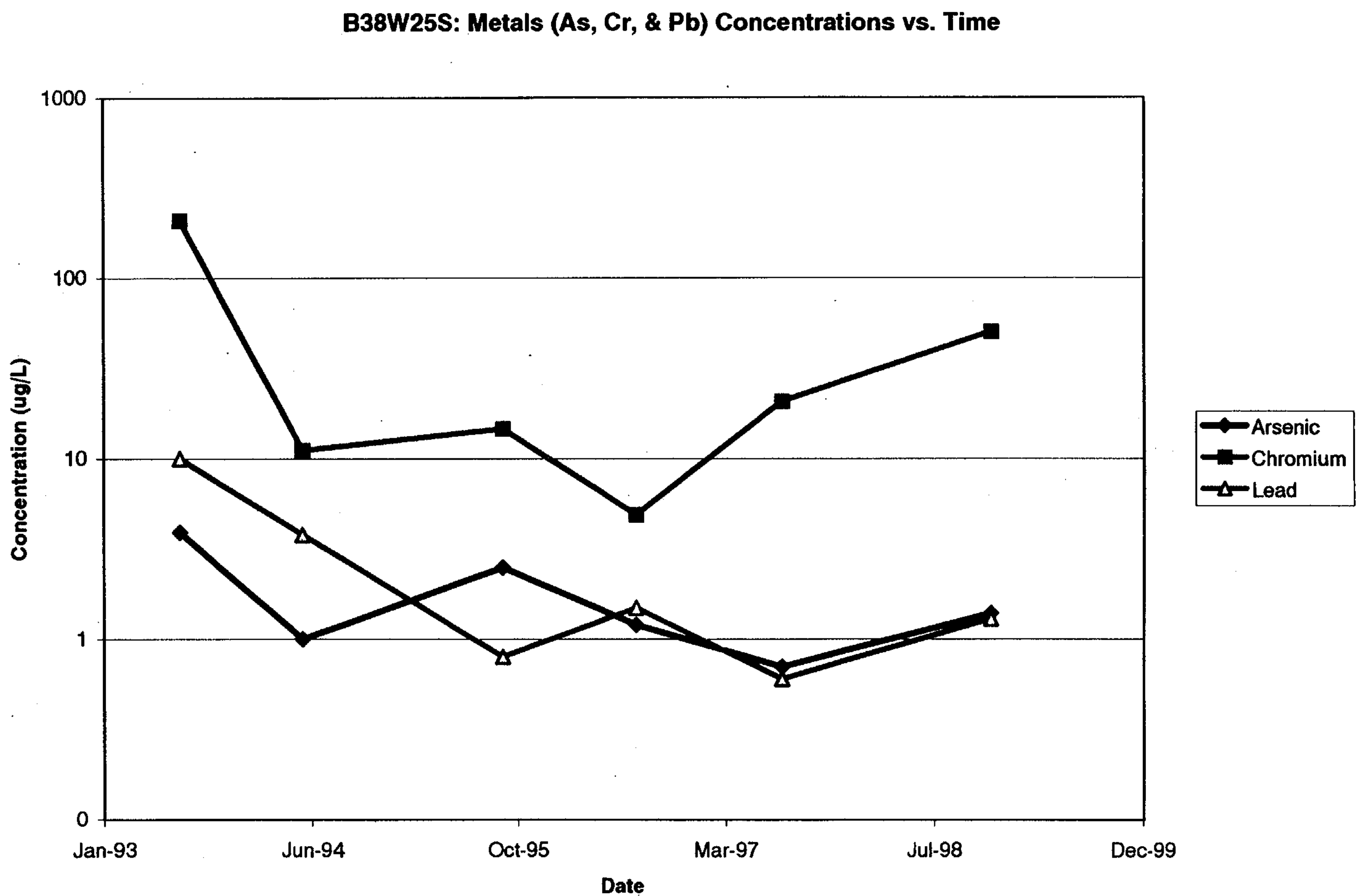

B38W24D: Metals (As, Cr, & Pb) Concentrations vs. Time
20
18
16
14
12
10
8
6
4
2
0
Concentration (ug/L)
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Arsenic
Chromium
Lead

B38W24D: Metals (As, Cr, & Pb) Concentrations vs. Time

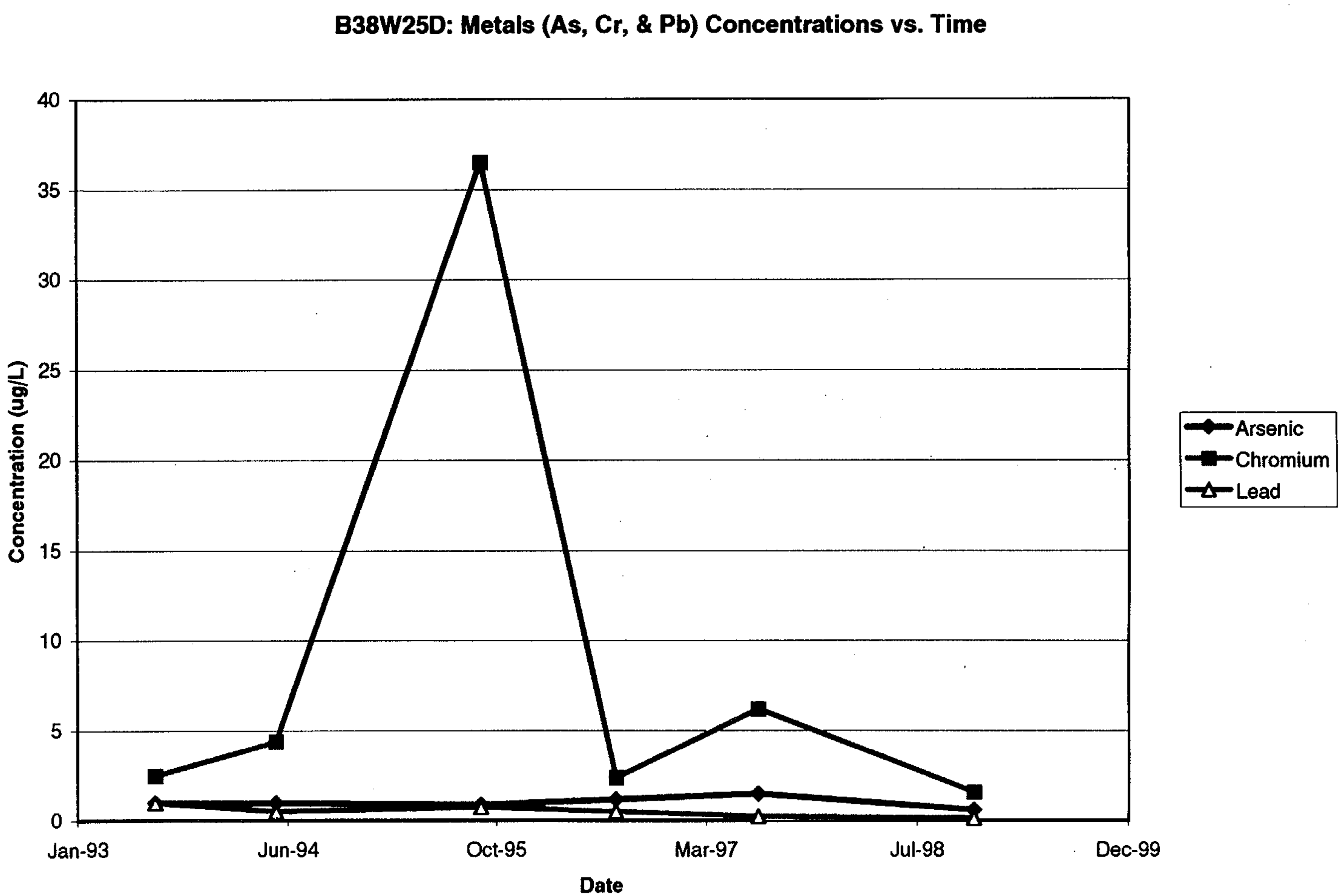




B38W25S: Metals (As, Cr, & Pb) Concentrations vs. Time
Concentration (ug/L)
250
200
150
100
50
0
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Arsenic
Chromium
Lead

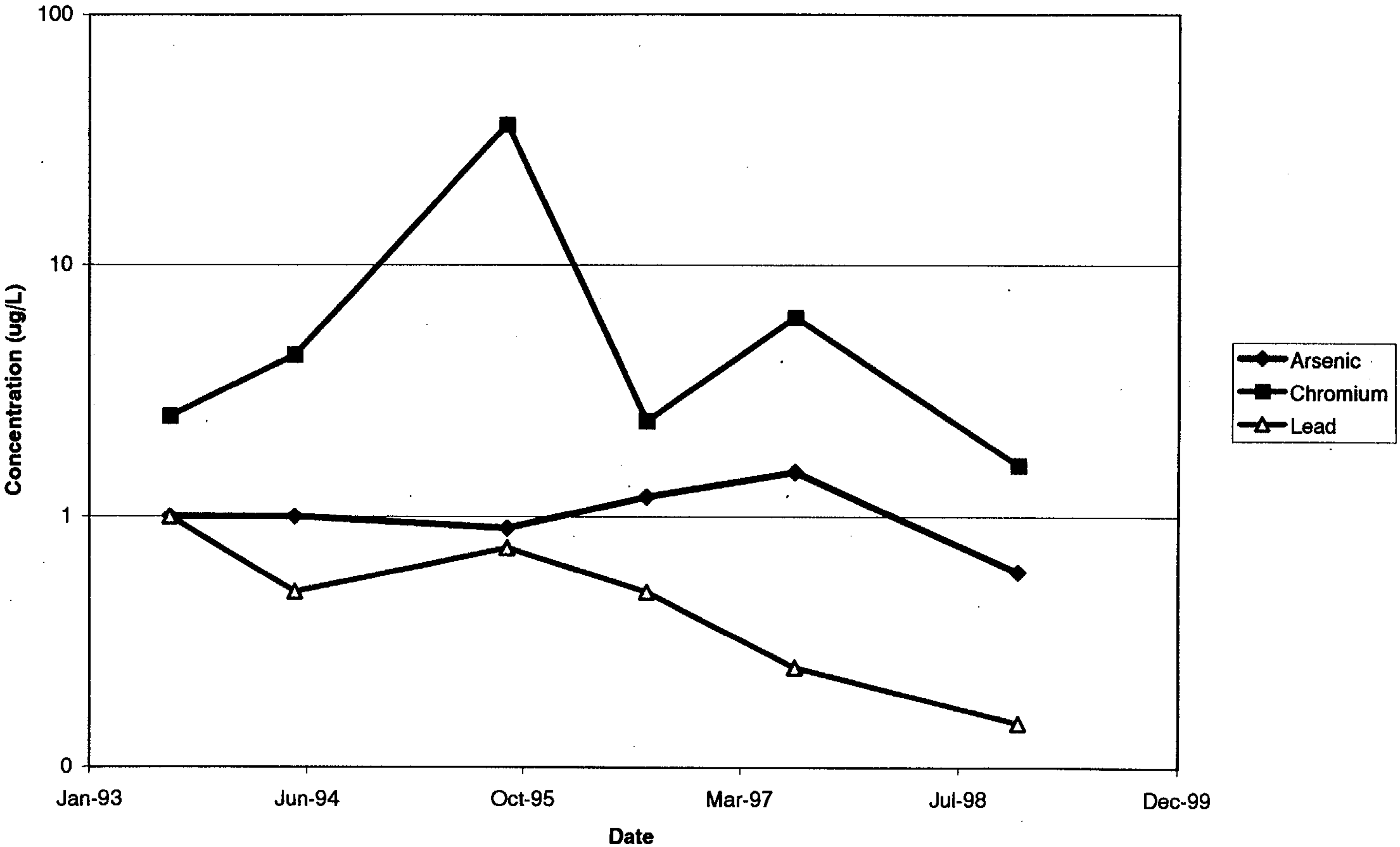


B38W25S: Metals (As, Cr, & Pb) Concentrations vs. Time
1000
100
10
1
0
Concentration (ug/L)
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Arsenic
Chromium
Lead



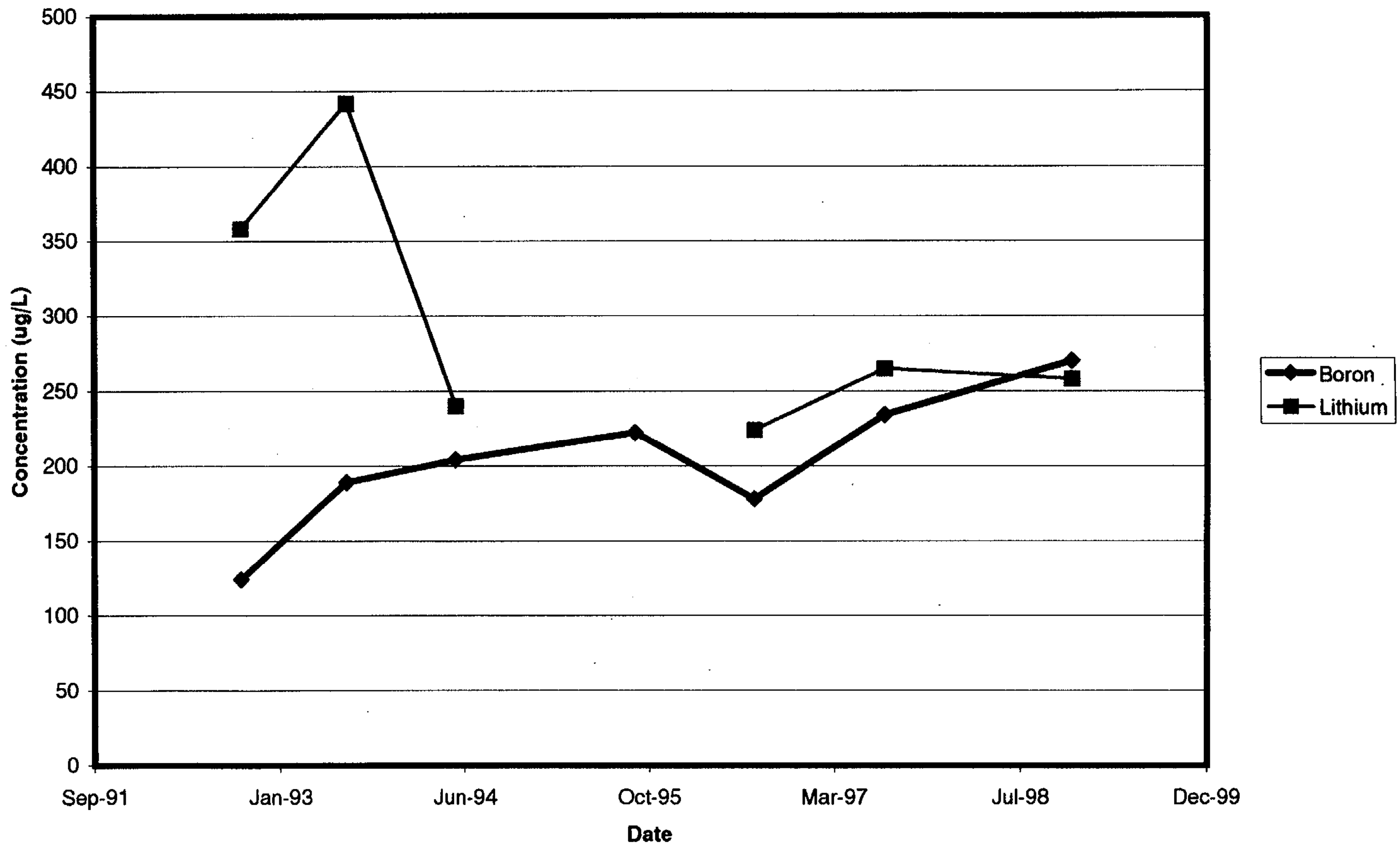
B38W25D: Metals (As, Cr, & Pb) Concentrations vs. Time
Concentration (ug/L)
40
35
30
25
20
15
10
5
0
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Arsenic
Chromium
Lead

B38W25D: Metals (As, Cr, & Pb) Concentrations vs. Time

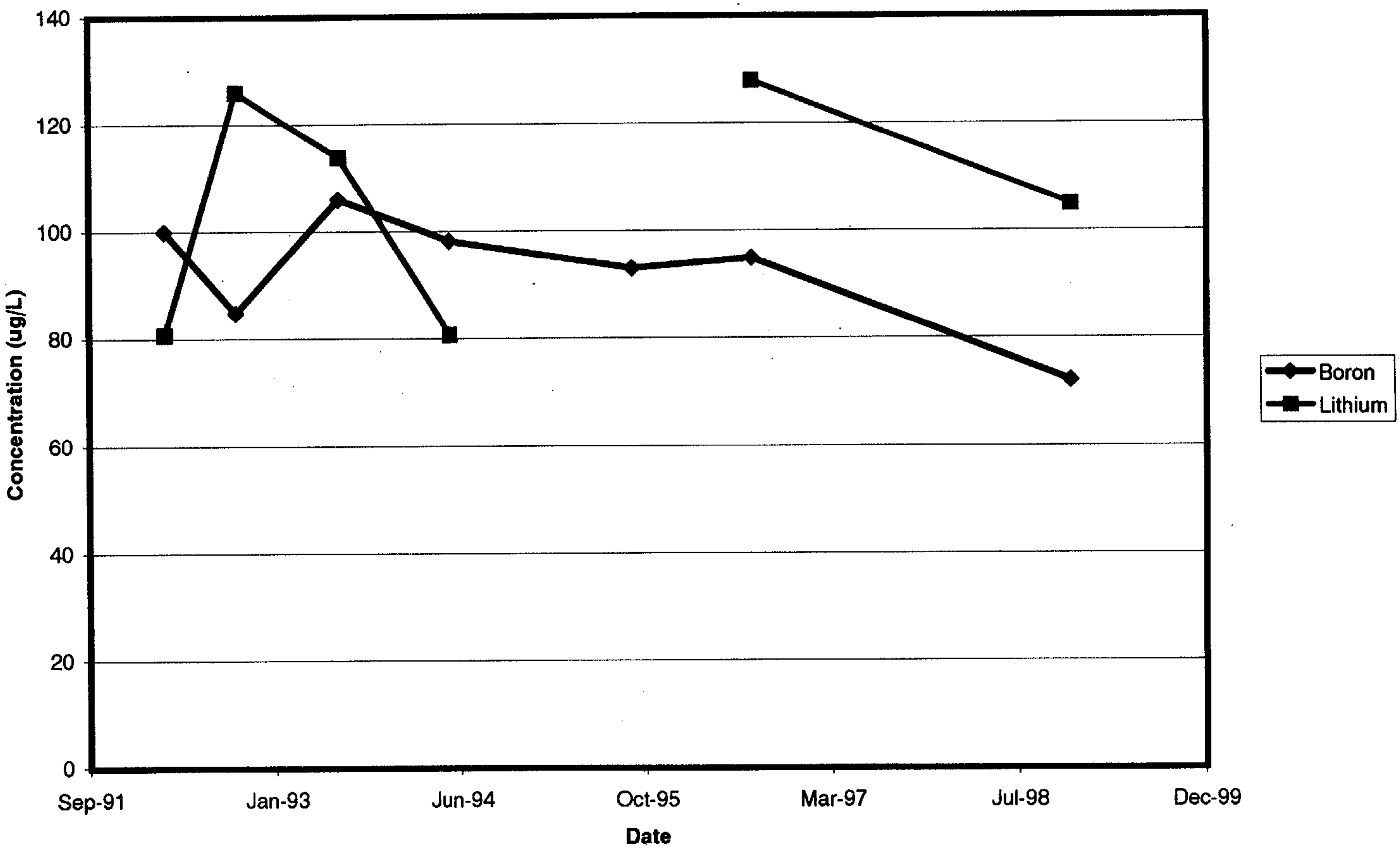


LITHIUM AND BORON CONCENTRATIONS VS. TIME

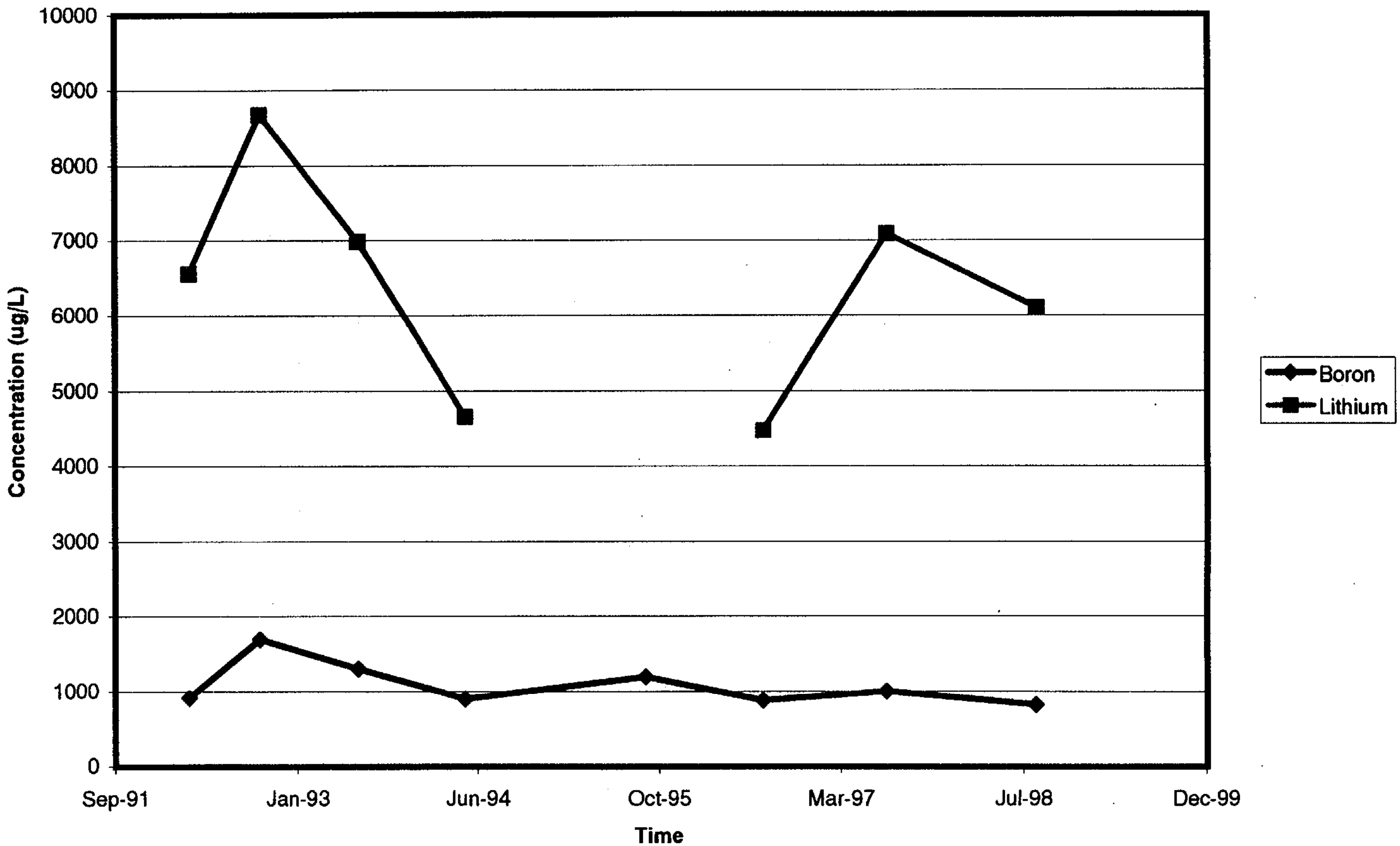
MISS1AA: Lithium and Boron Concentrations vs. Time

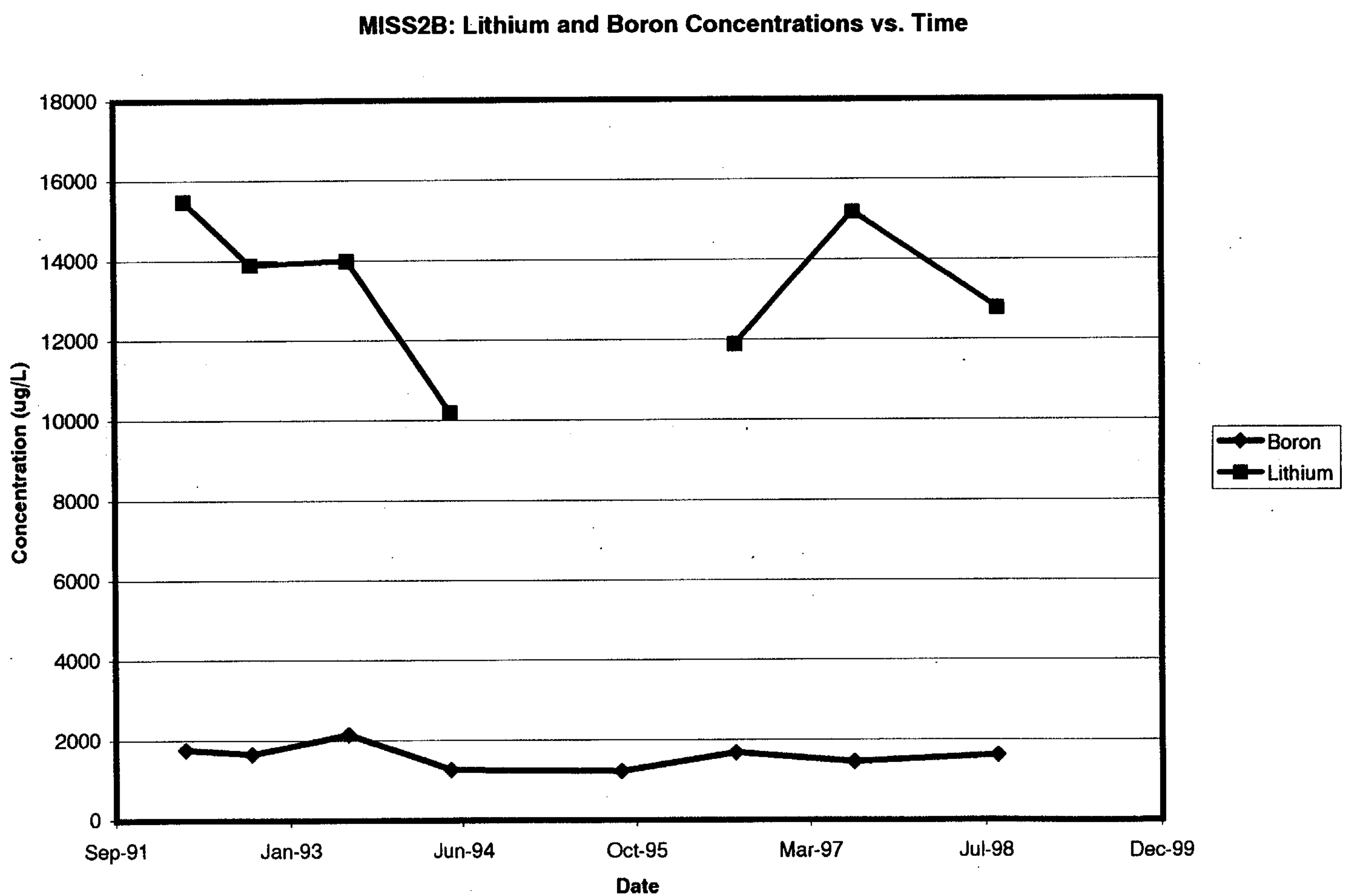


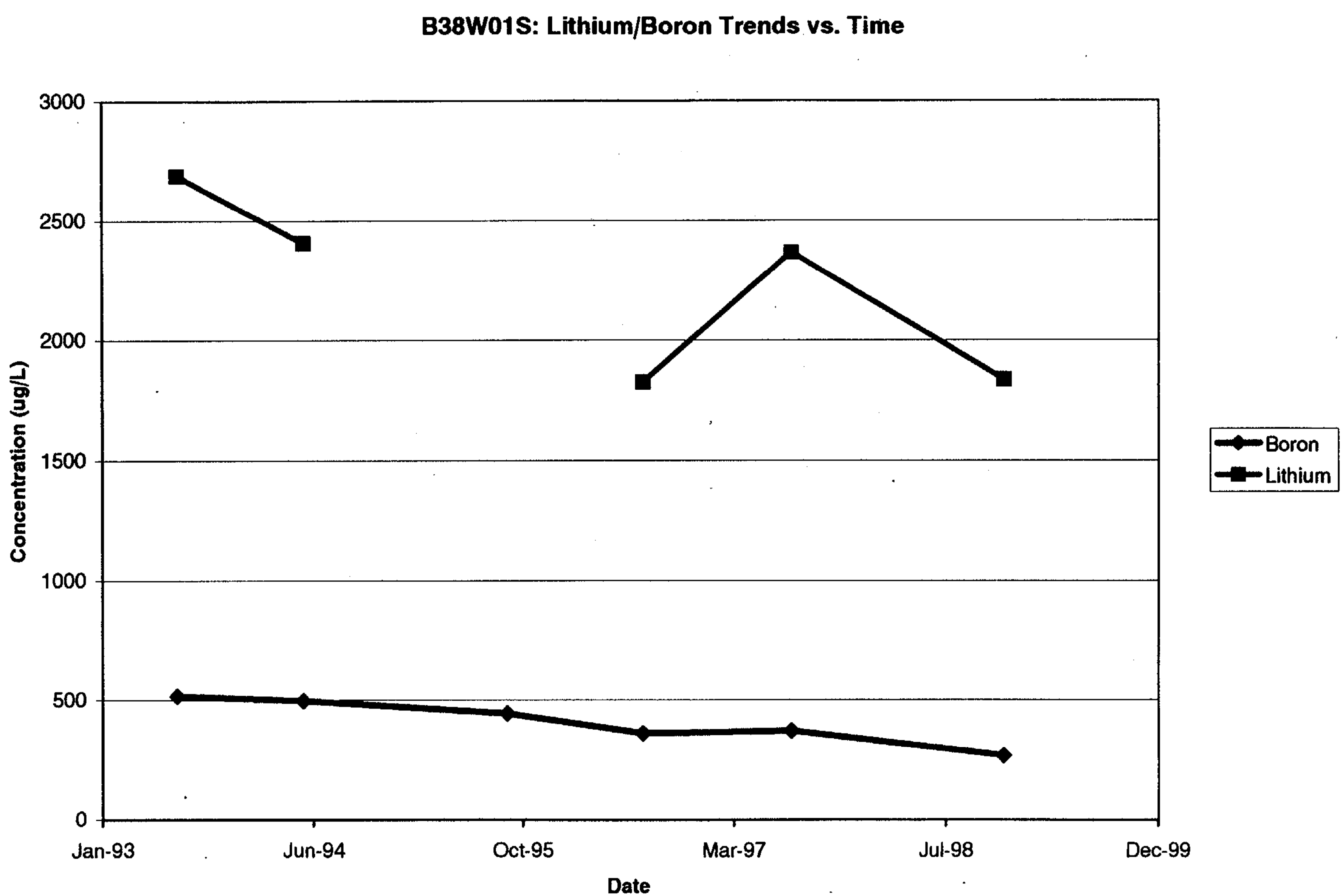
MISS1B: Lithium and Boron Concentrations vs. Time

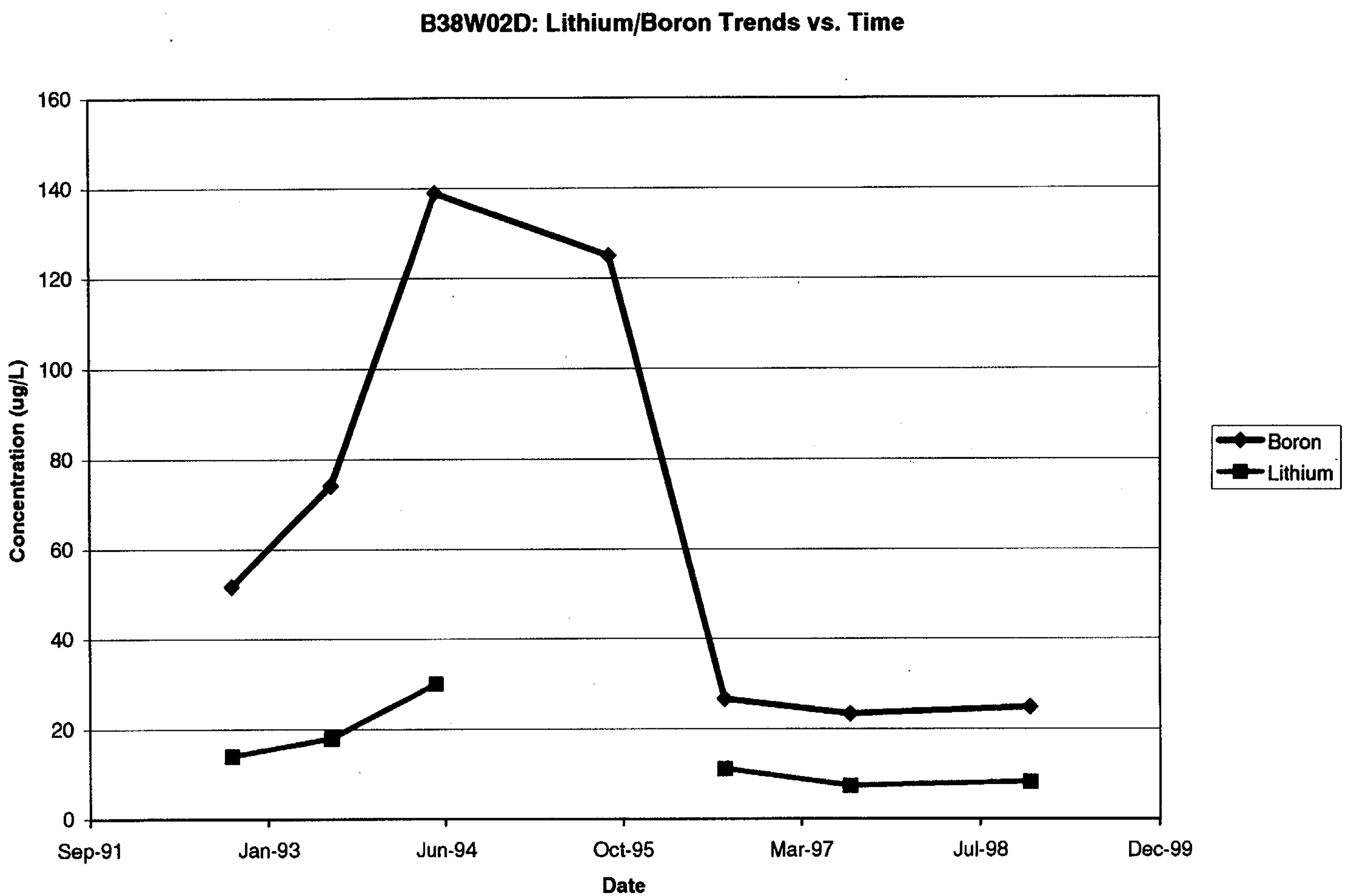


MISS2A: Lithium and Boron Concentrations vs. Time



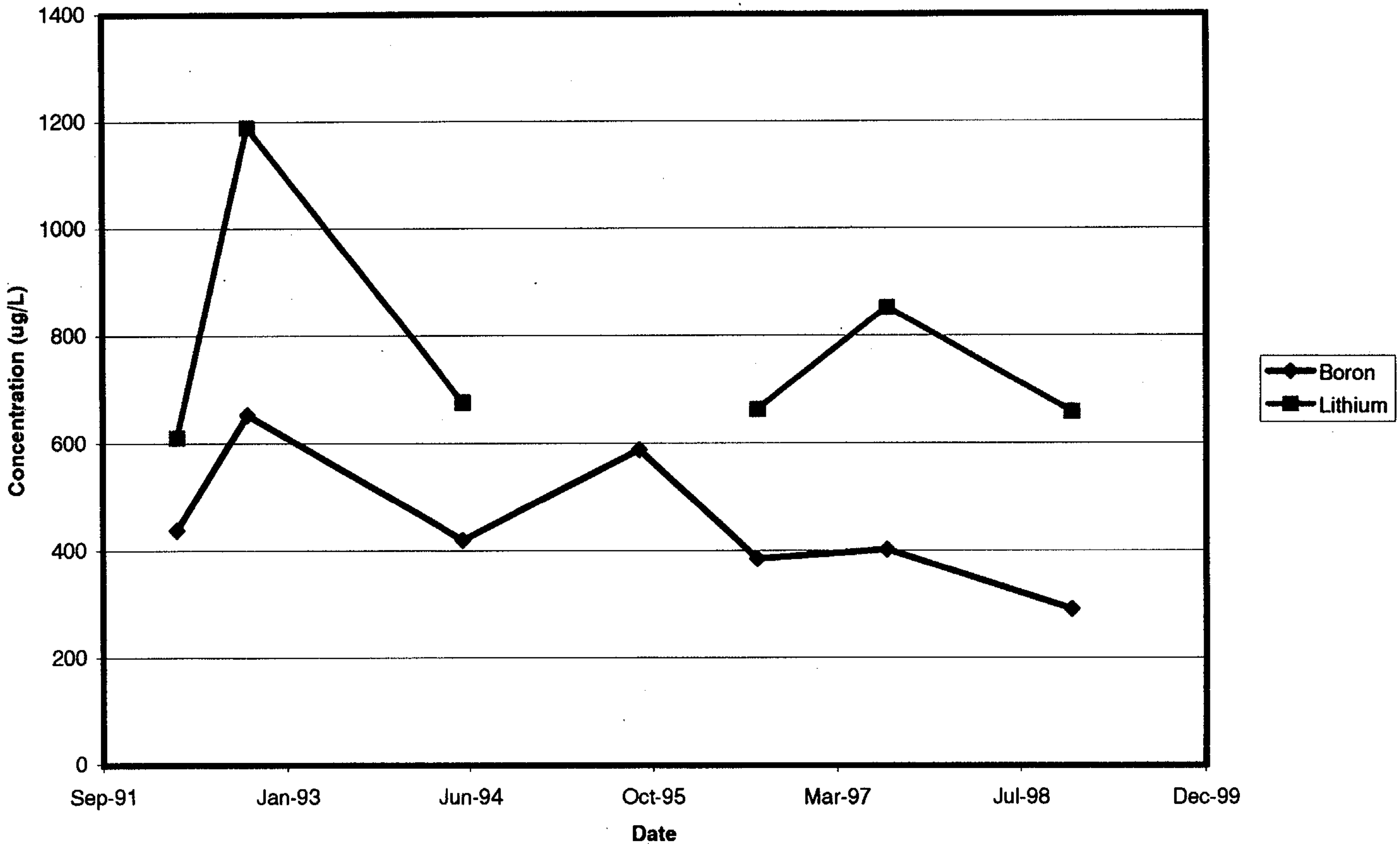

MISS2B: Lithium and Boron Concentrations vs. Time
Concentration (ug/L)
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Sep-91
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Boron
Lithium


B38W01S: Lithium/Boron Trends vs. Time
Concentration (ug/L)
3000
2500
2000
1500
1000
500
0
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Boron
Lithium

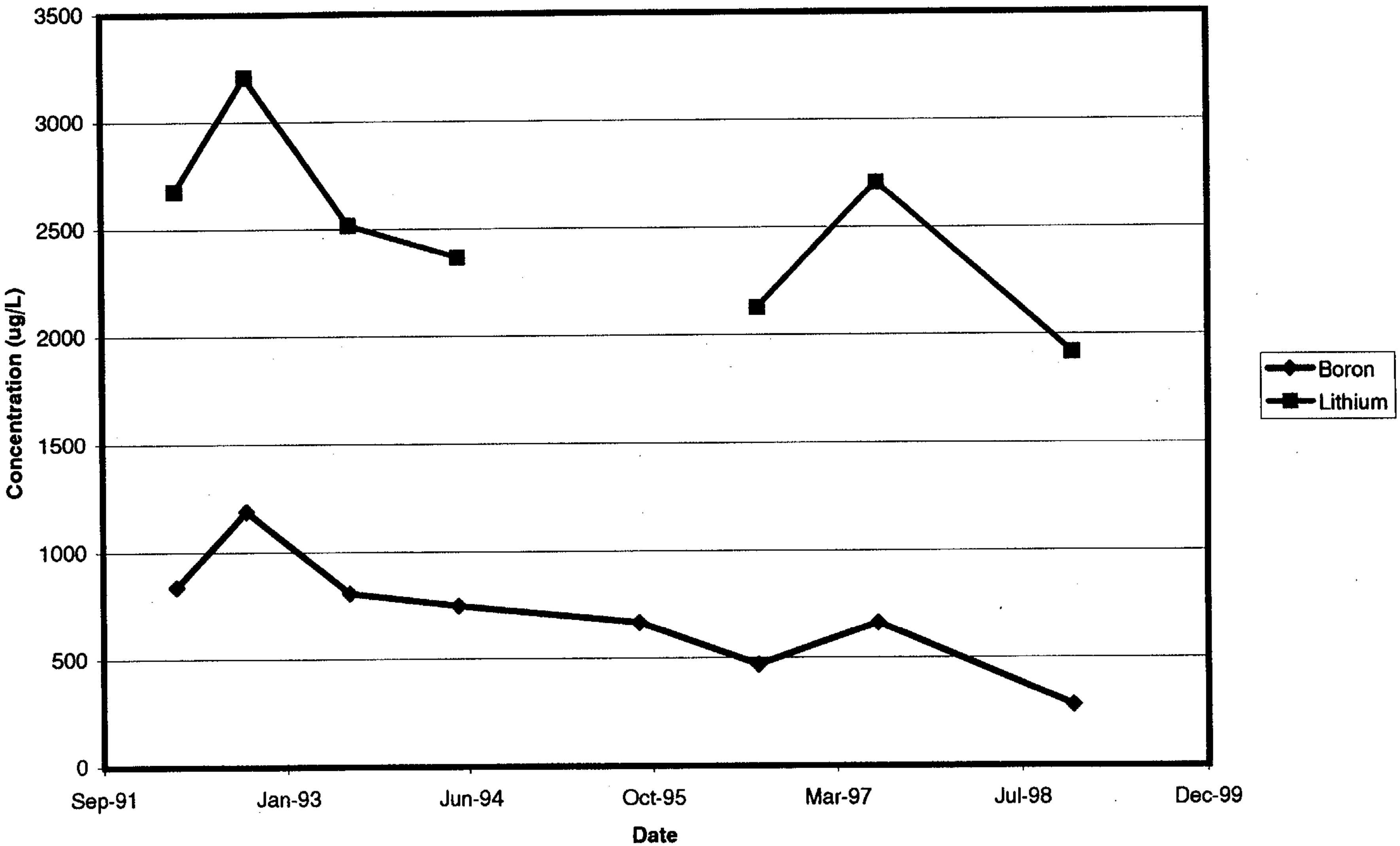


B38W02D: Lithium/Boron Trends vs. Time
Concentration (ug/L)
160
140
120
100
80
60
40
20
0
Sep-91
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Boron
Lithium

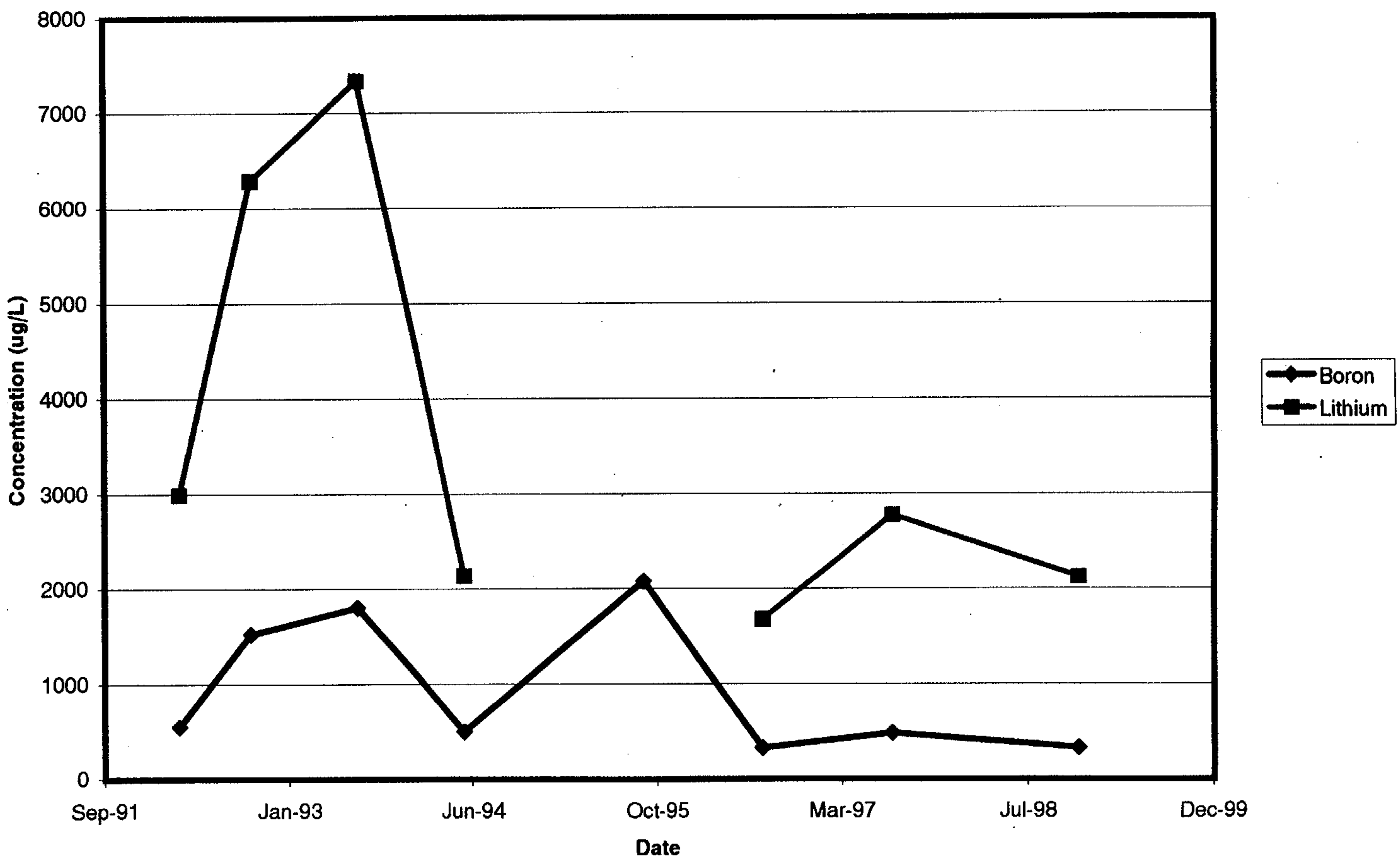
MISS5A: Lithium and Boron Concentrations vs. Time

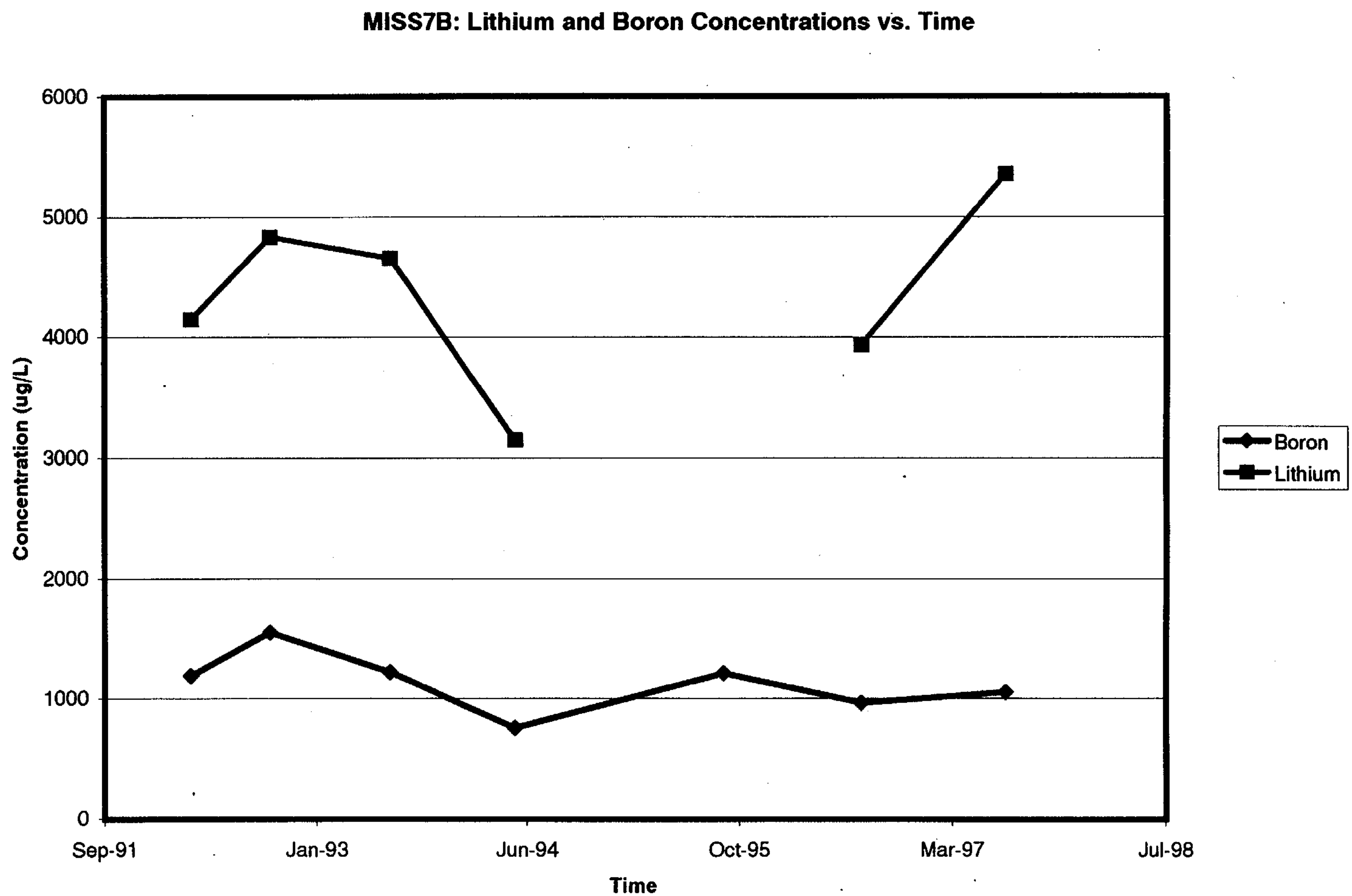


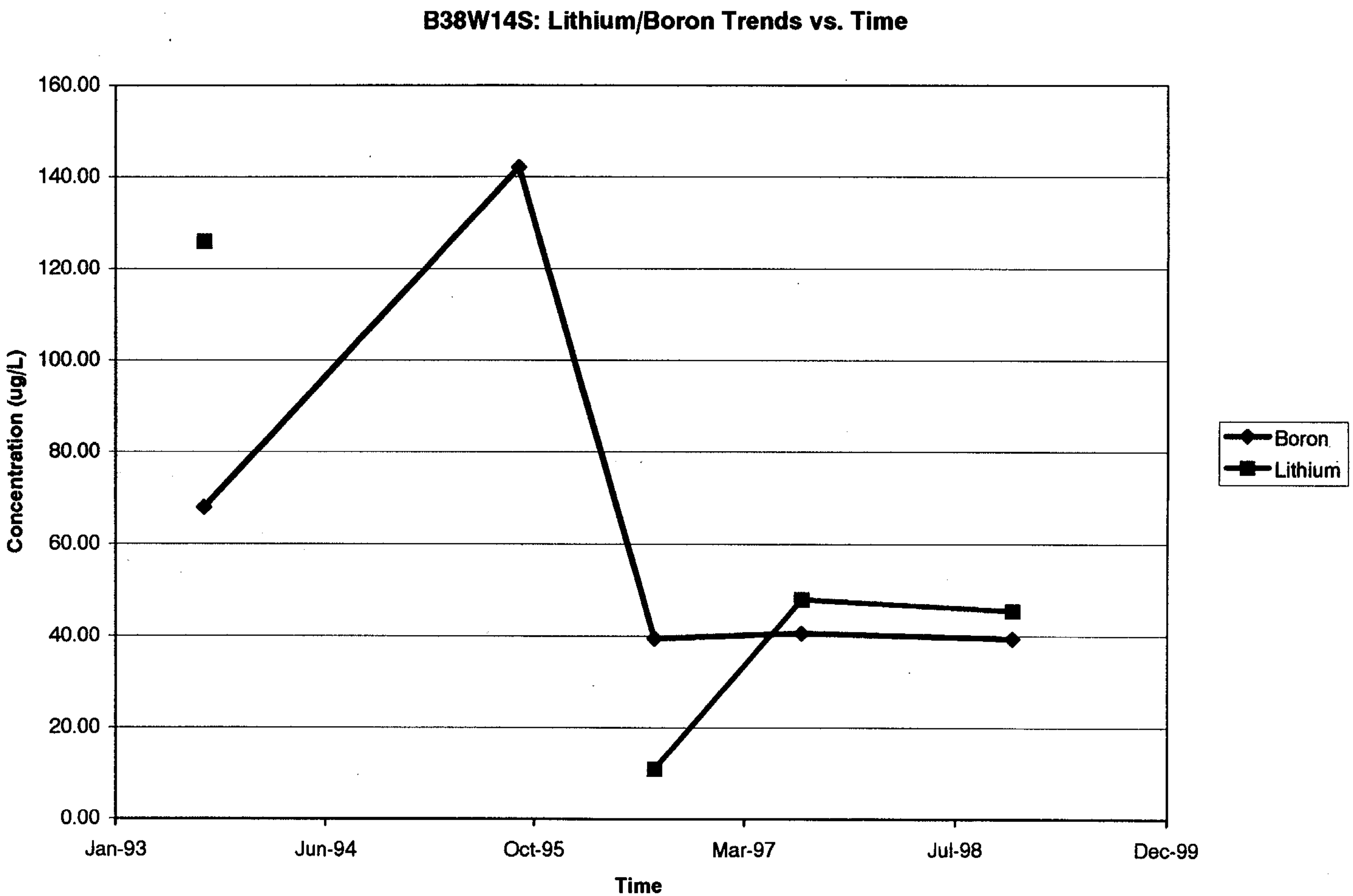
MISS5B: Lithium and Boron Concentrations vs. Time

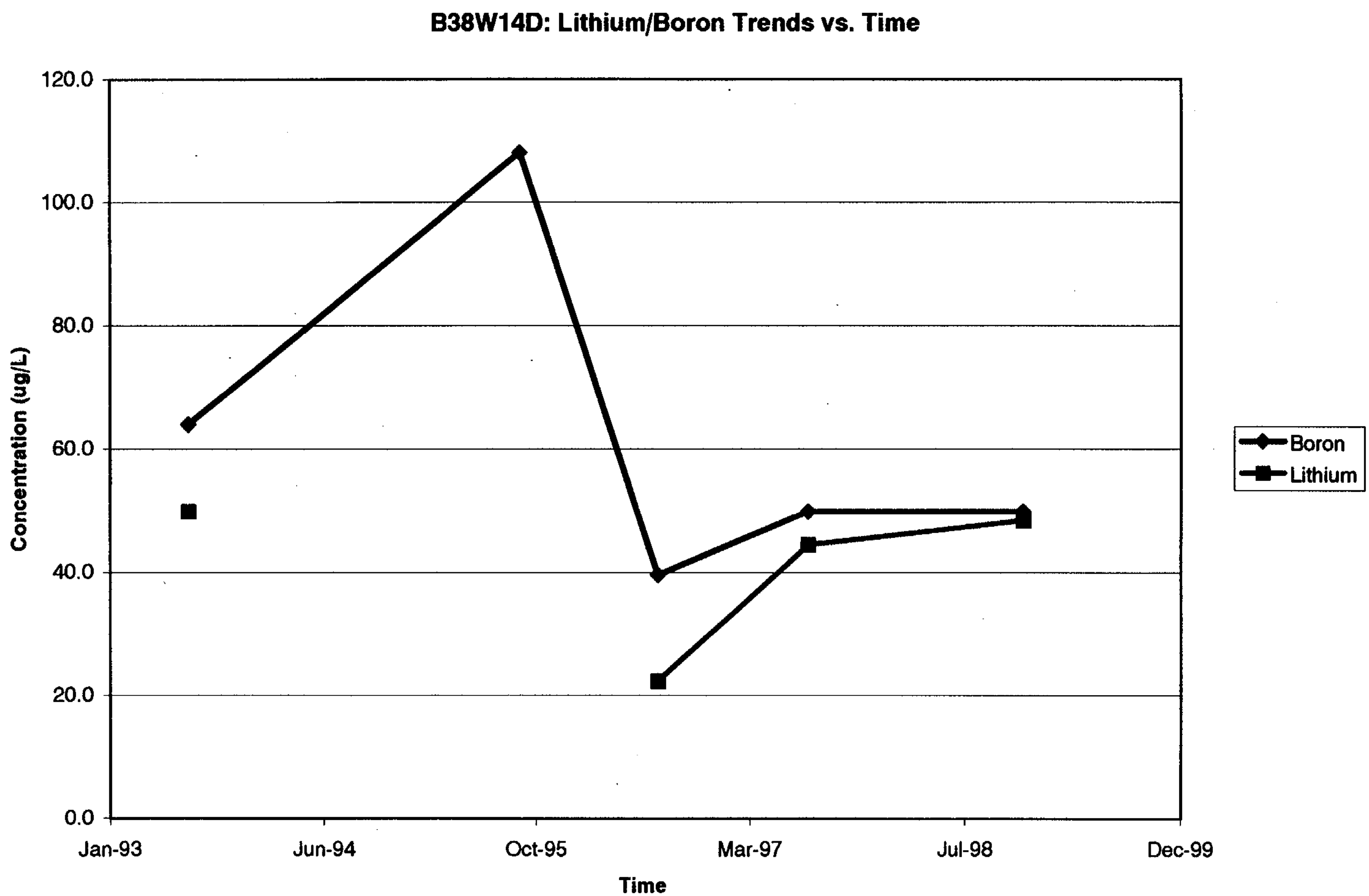


MISS6A: Lithium and Boron Concentrations vs. Time

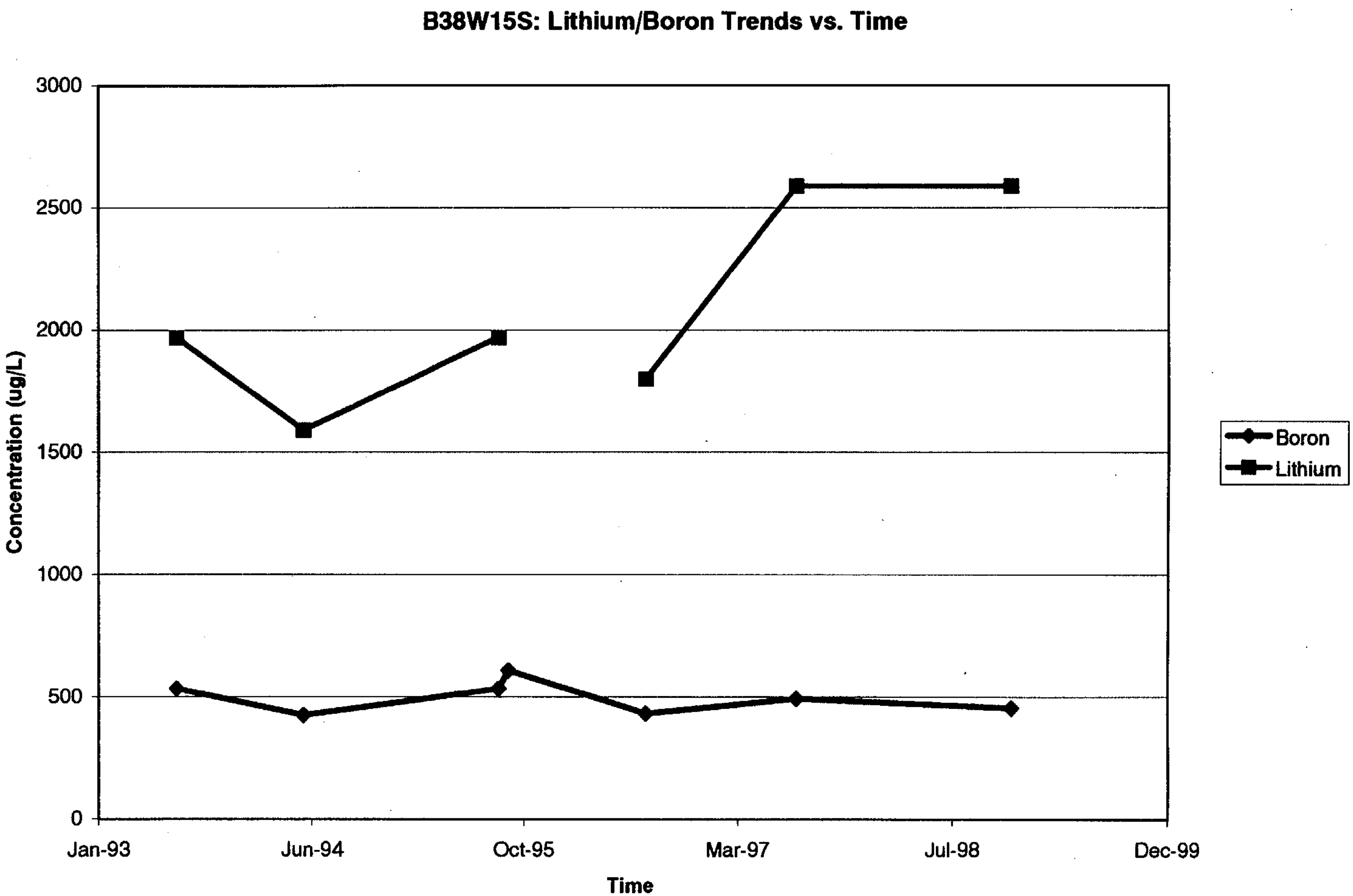


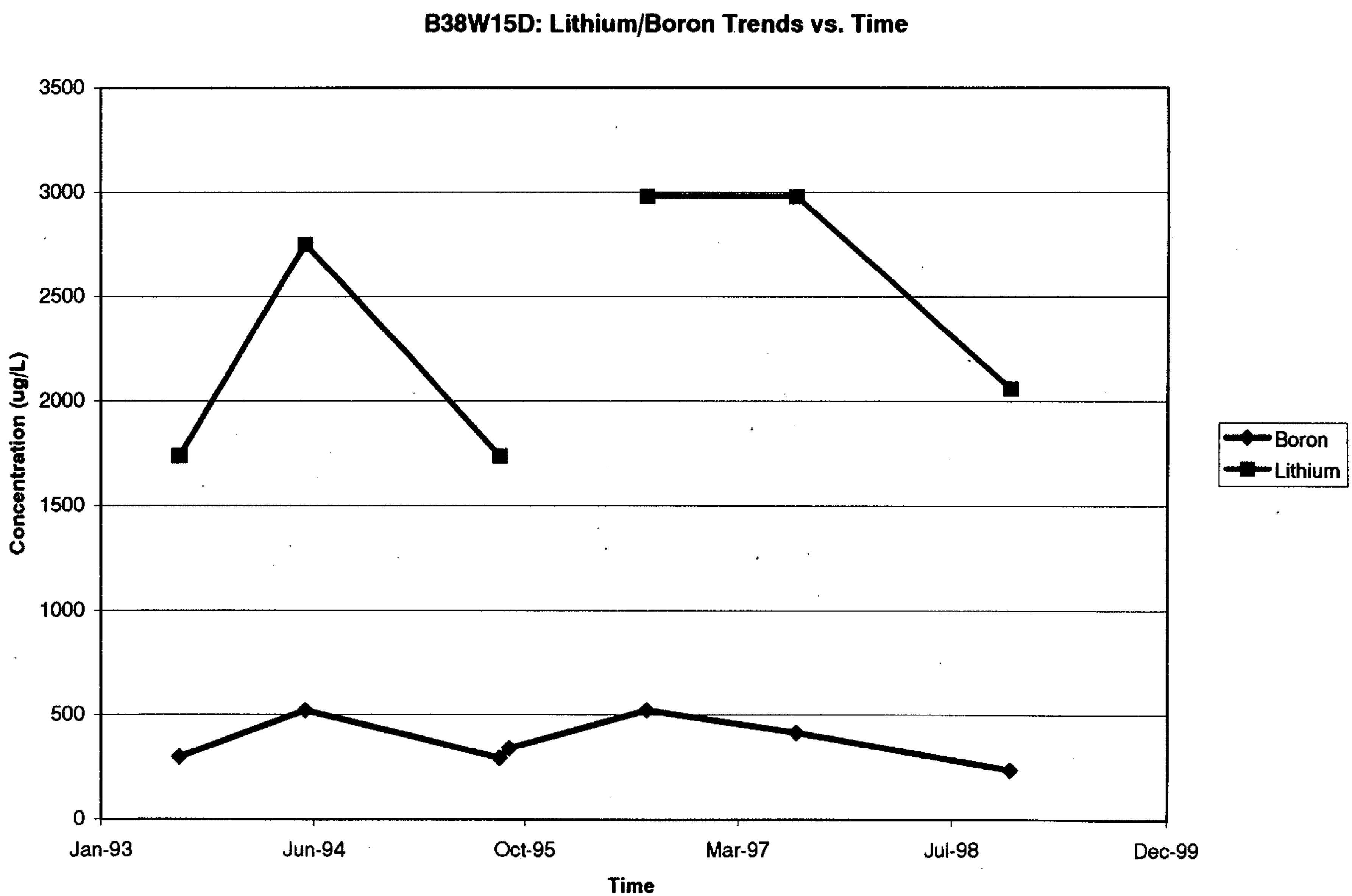

MISS7B: Lithium and Boron Concentrations vs. Time
Concentration (ug/L)
6000
5000
4000
3000
2000
1000
0
Sep-91
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Time
Boron
Lithium


B38W14S: Lithium/Boron Trends vs. Time
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Concentration (ug/L)
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Time
Boron
Lithium

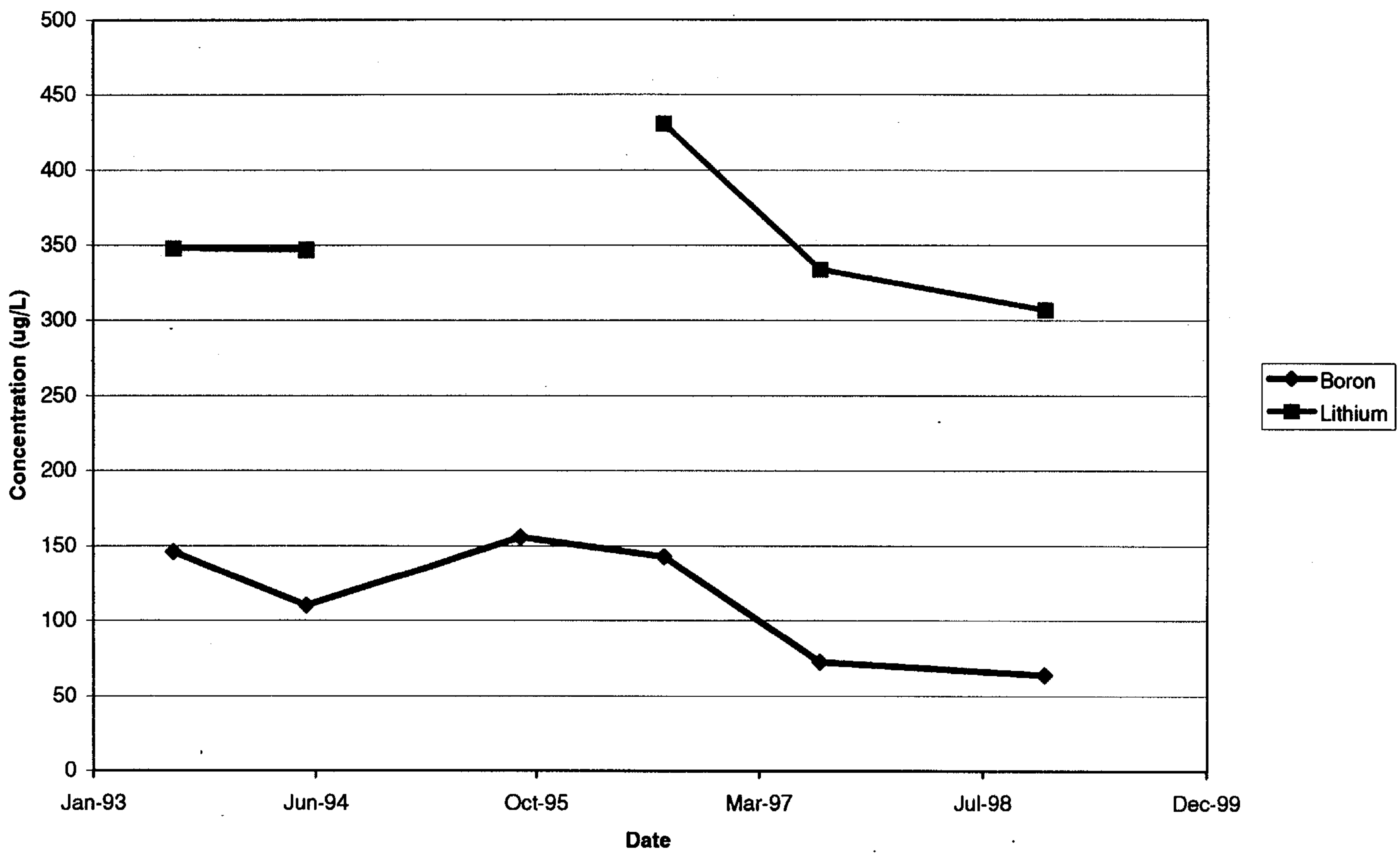


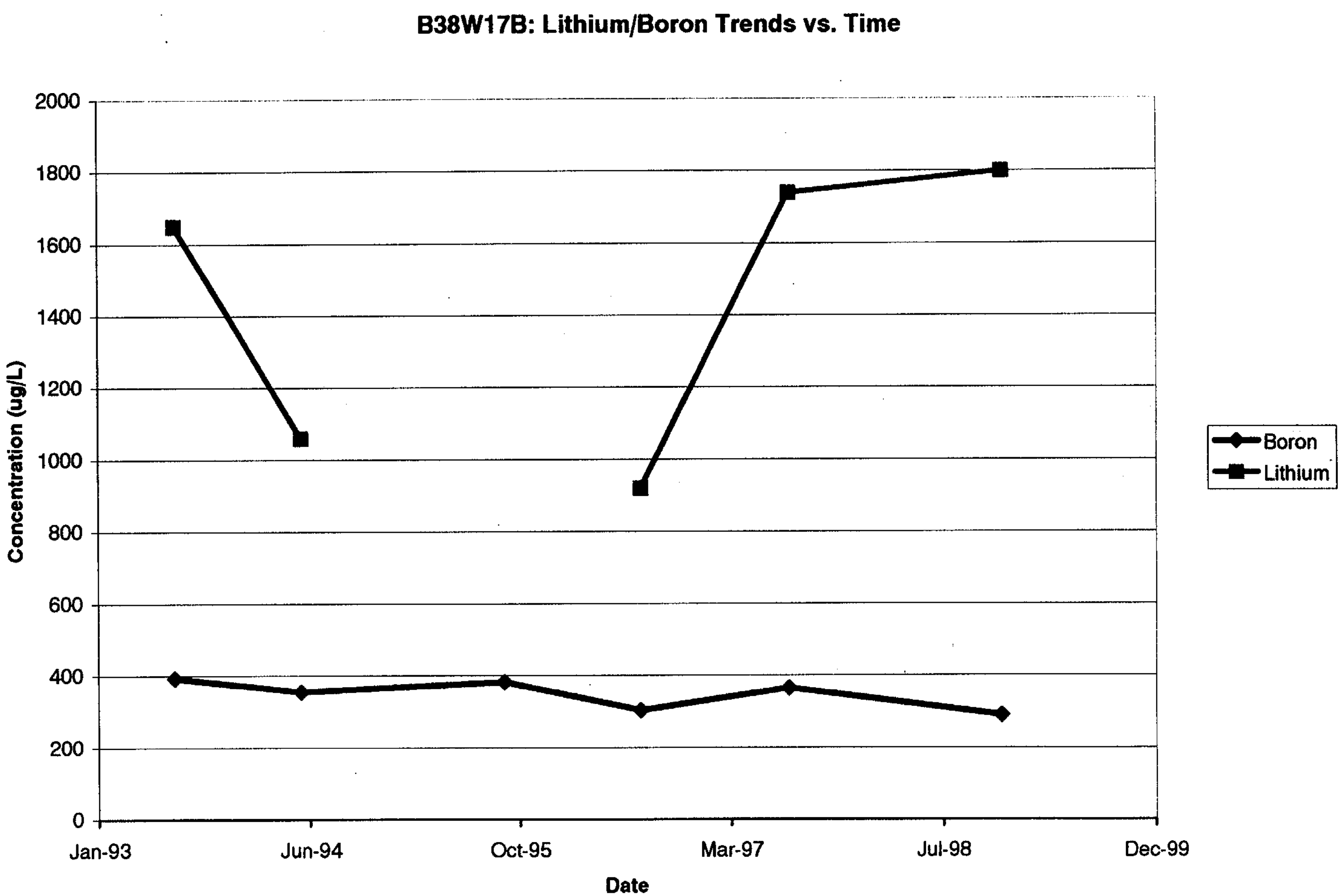
B38W14D: Lithium/Boron Trends vs. Time
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Concentration (ug/L)
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Time
Boron
Lithium

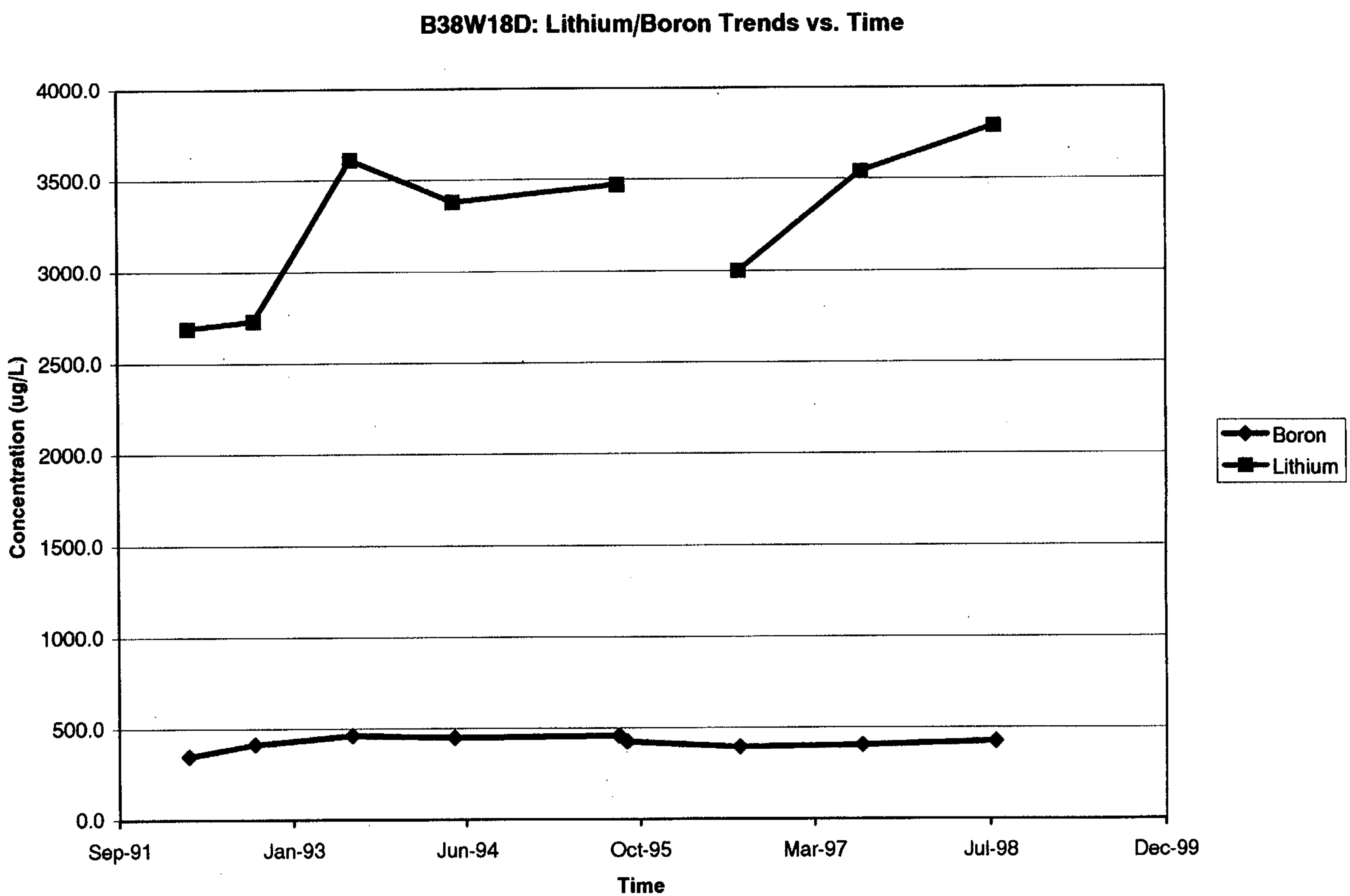

B38W15S: Lithium/Boron Trends vs. Time
3000
2500
2000
1500
1000
500
0
Concentration (ug/L)
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Time
Boron
Lithium

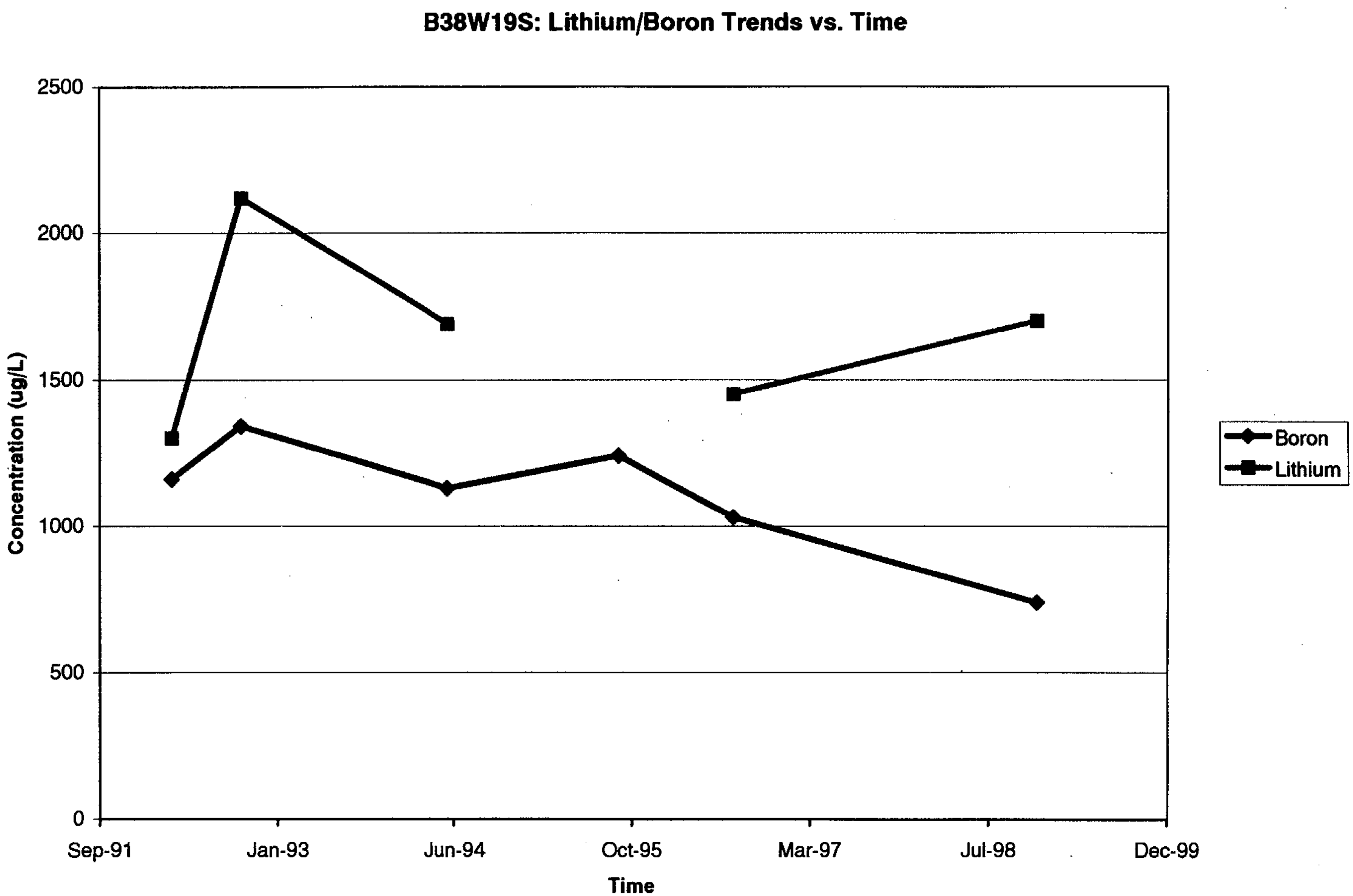

B38W15D: Lithium/Boron Trends vs. Time
Concentration (ug/L)
3500
3000
2500
2000
1500
1000
500
0
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Time
Boron
Lithium

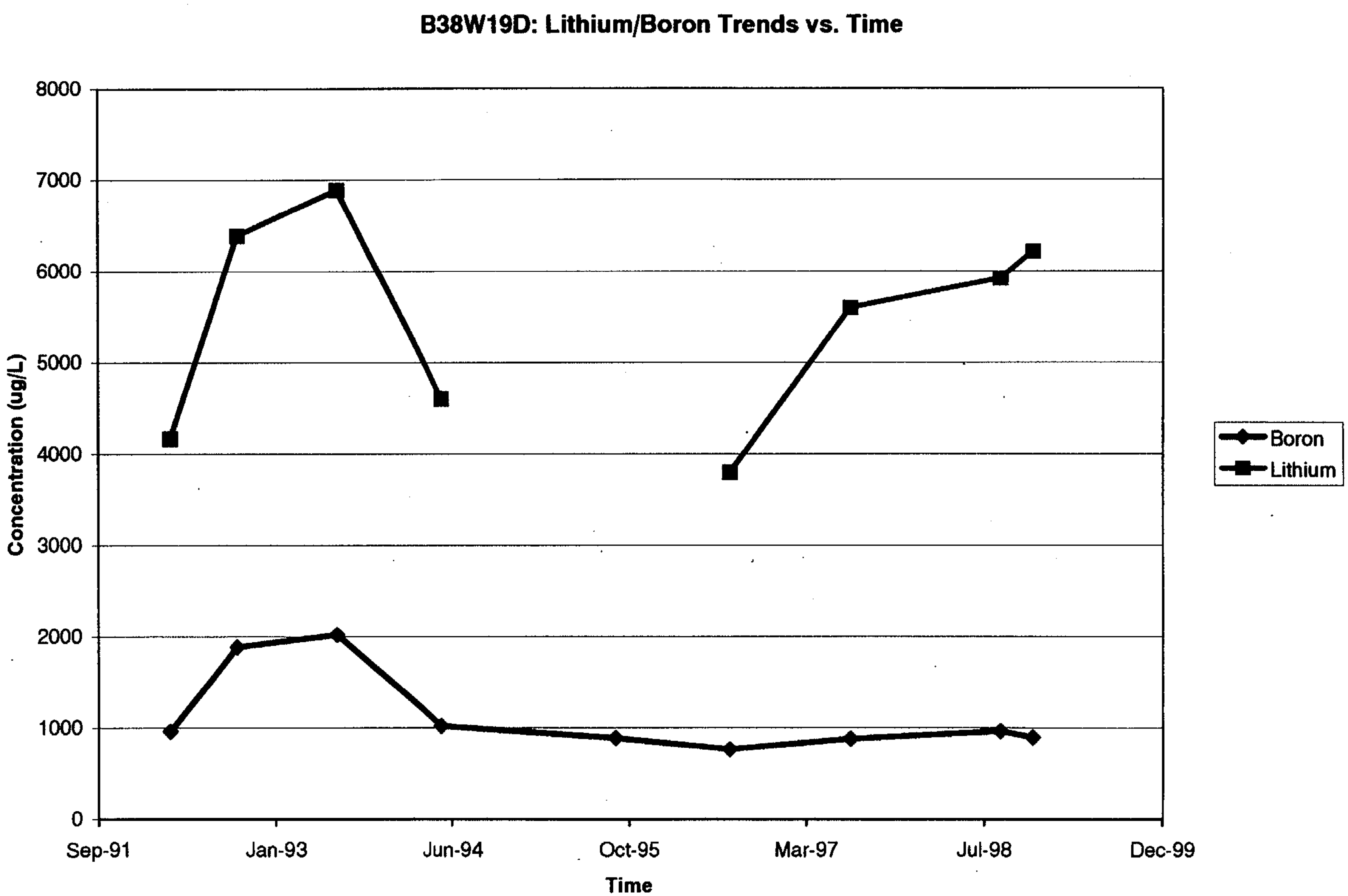
B38W17A: Lithium/Boron Trends vs. Time

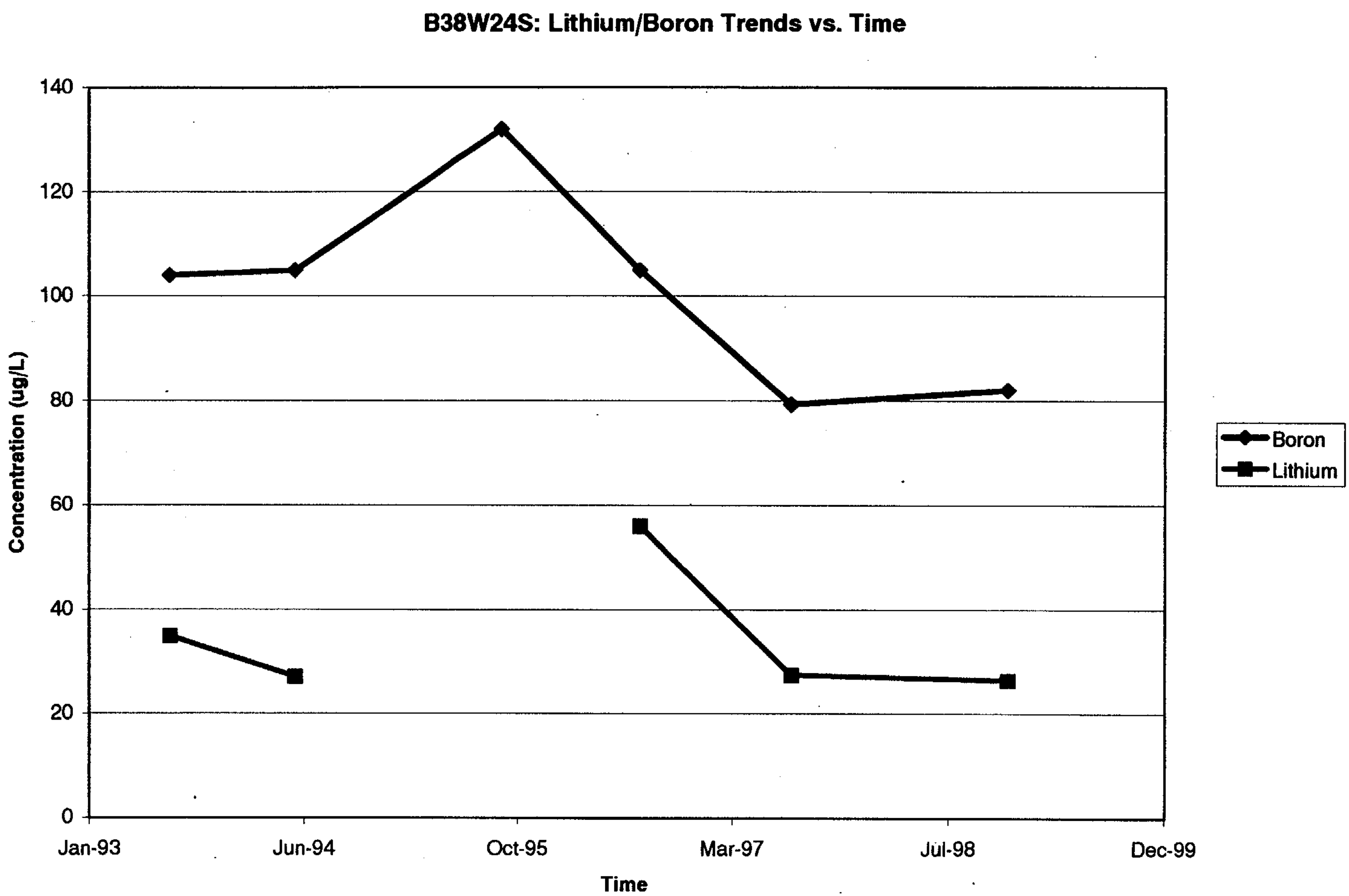



B38W17B: Lithium/Boron Trends vs. Time
Concentration (ug/L)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Boron
Lithium

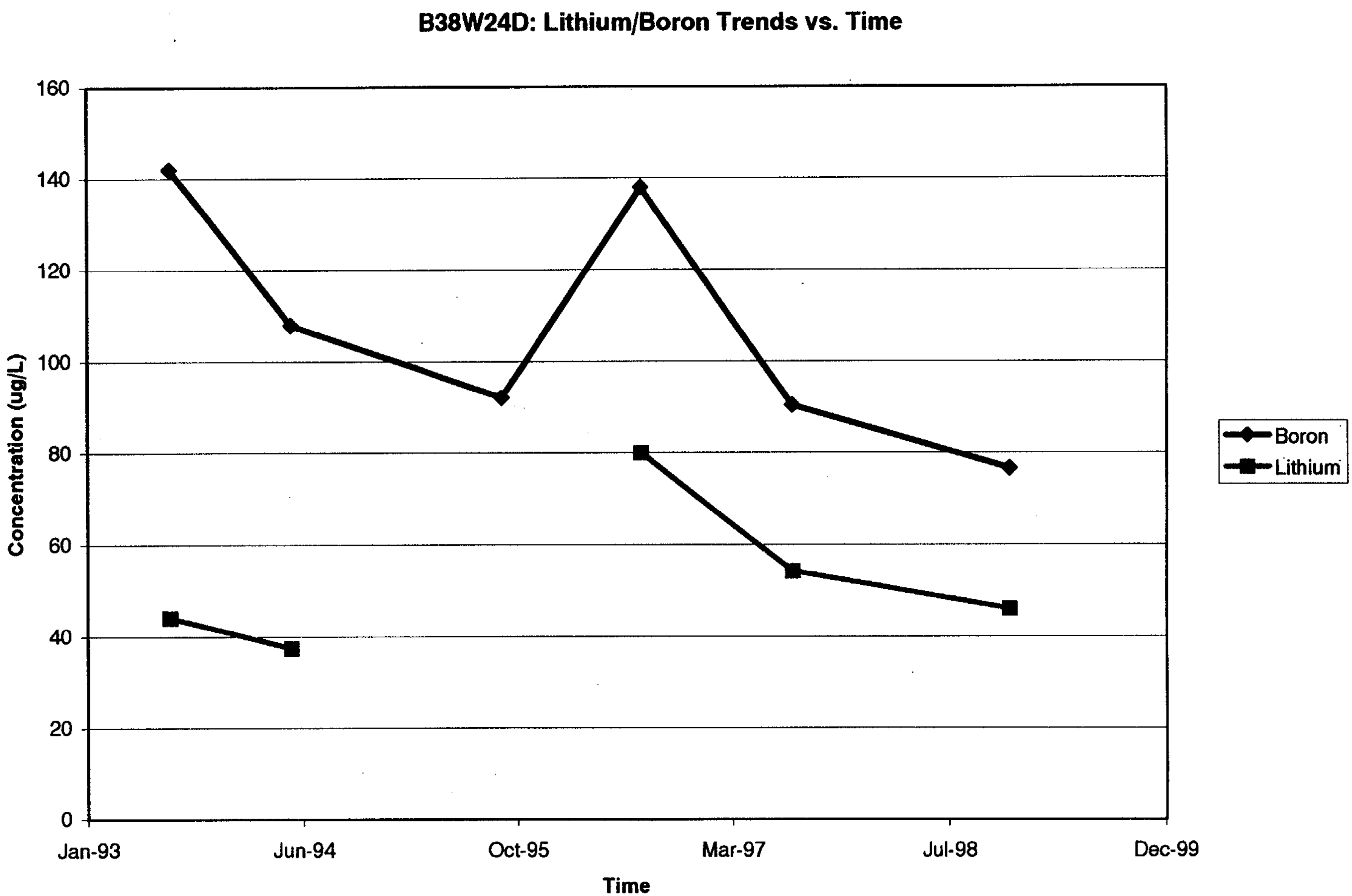

B38W18D: Lithium/Boron Trends vs. Time
4000.0
3500.0
3000.0
2500.0
2000.0
1500.0
1000.0
500.0
0.0
Concentration (ug/L)
Sep-91
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Time
Boron
Lithium

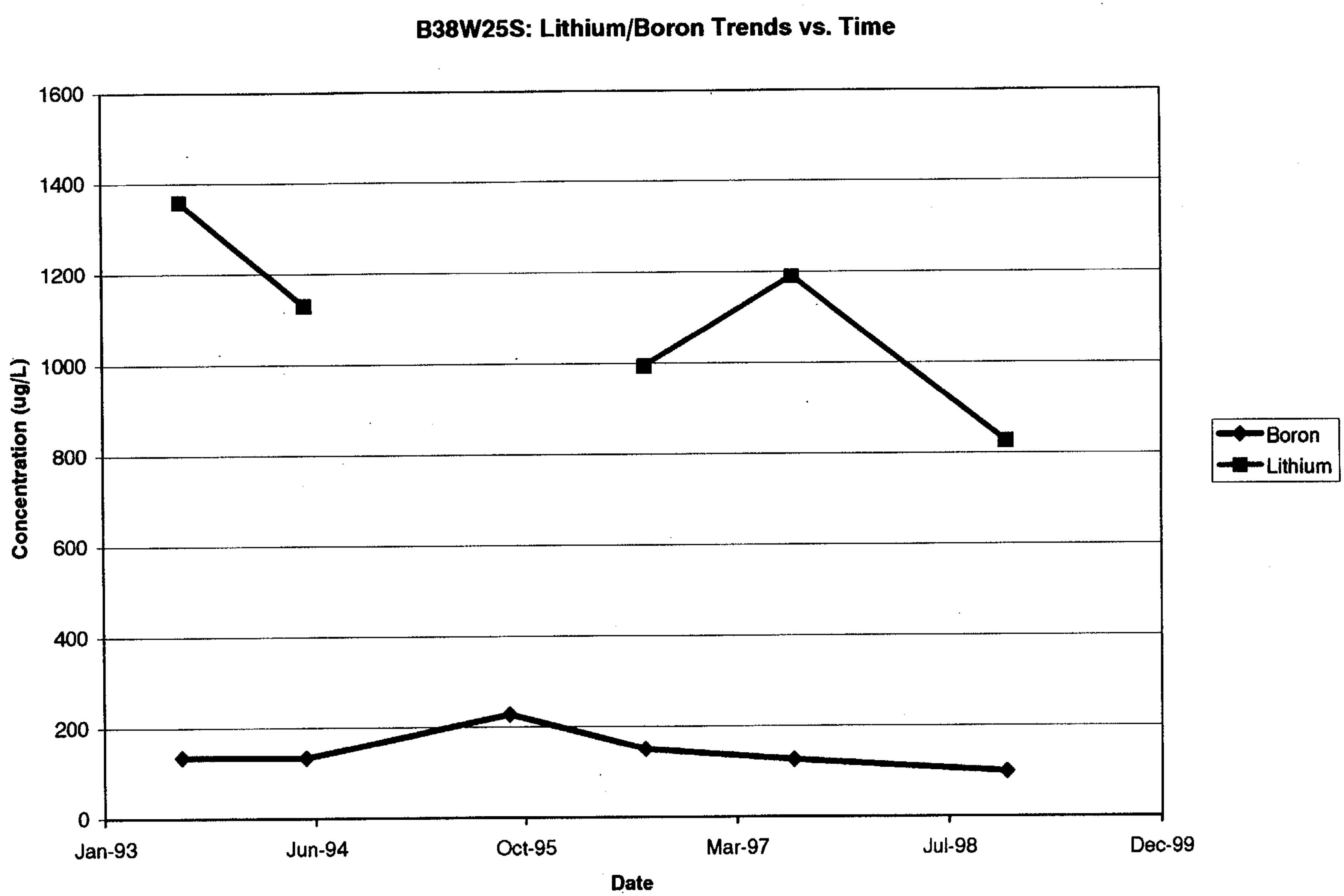

B38W19S: Lithium/Boron Trends vs. Time
2500
2000
1500
1000
500
0
Concentration (ug/L)
Sep-91
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Time
Boron
Lithium


B38W19D: Lithium/Boron Trends vs. Time
8000
7000
6000
5000
4000
3000
2000
1000
0
Concentration (ug/L)
Sep-91
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Time
Boron
Lithium

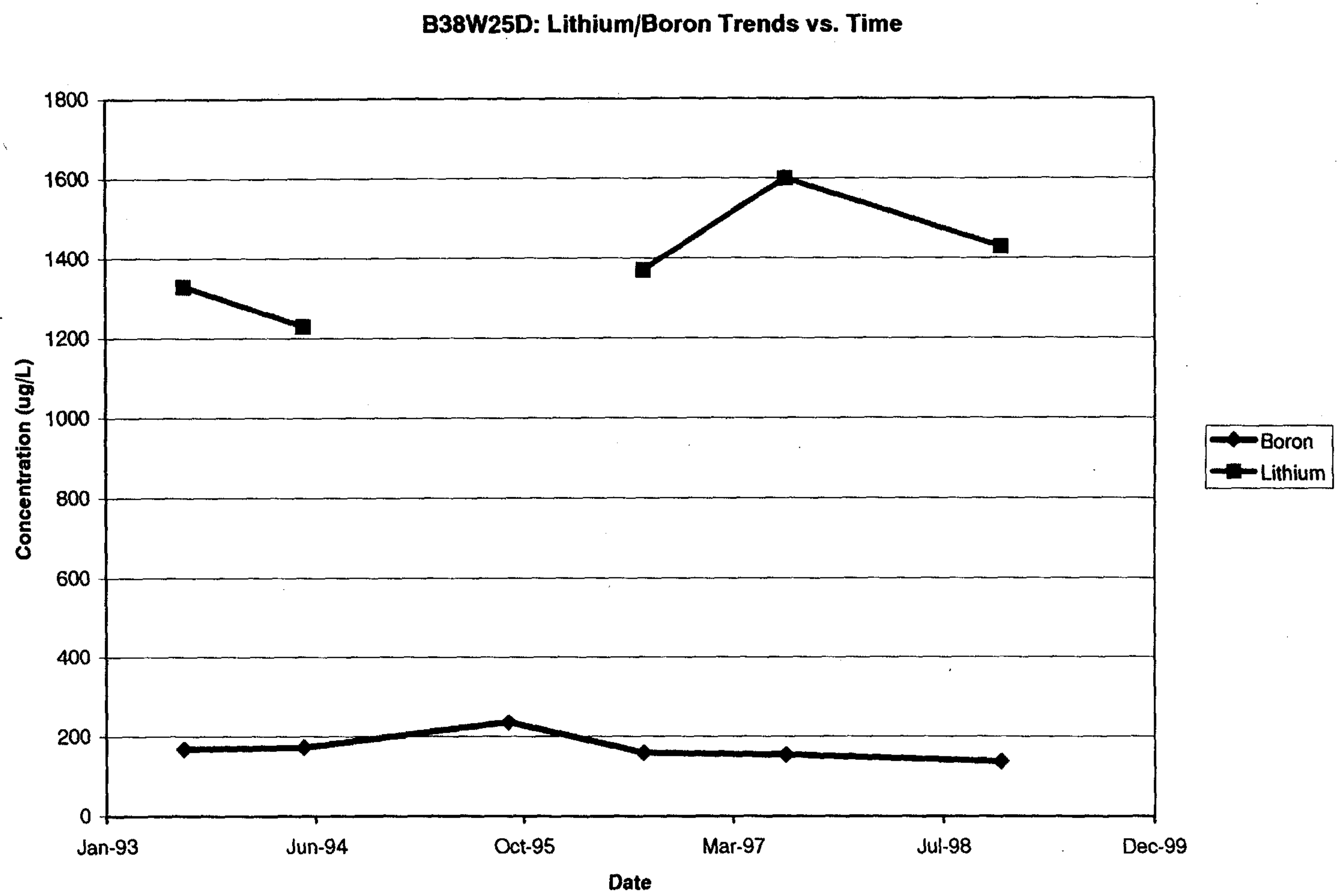


B38W24S: Lithium/Boron Trends vs. Time
140
120
100
80
60
40
20
0
Concentration (ug/L)
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Time
Boron
Lithium


B38W24D: Lithium/Boron Trends vs. Time
Concentration (ug/L)
160
140
120
100
80
60
40
20
0
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Time
Boron
Lithium



B38W25S: Lithium/Boron Trends vs. Time
1600
1400
1200
1000
800
600
400
200
0
Concentration (ug/L)
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Boron
Lithium


B38W25D: Lithium/Boron Trends vs. Time
Concentration (ug/L)
1800
1600
1400
1200
1000
800
600
400
200
0
Jan-93
Jun-94
Oct-95
Mar-97
Jul-98
Dec-99
Date
Boron
Lithium

APPENDIX E

Field Log Forms

DAILY REPORT

PROJECT : ______________________ PROJECT No. : ______________

CONTRACTOR : ______________________ DATE : ______________

DRILL I.D. : ______________________ WEATHER : ______________

BORHOLE NUMBER(S) THIS DATE : ______________________

DRILL TIME LOG

CATEGORY	TOTAL HOURS	A.M. 6	7	8	9	10	11	12	P.M. 1	2	3	4	5	6	7	8	9	10	11	12	A.M. 1	2	3	4	5	6
STANDBY																										
DRILLING - OVERBURDEN																										
DRILLING - ROCK																										
WELL INSTALLATION																										
DEVELOPMENT/TESTING																										
DOWN TIME																										
MOVING TIME																										
OTHER																										

REMARKS :

CONSUMABLE : DESCRIBE NATURE, QUANTITY, SIZE, ETC...

ITEM OR SERVICE	QUANTITY	NOTES

BOREHOLE No.	FROM FEET	TO FEET	FOOTAGE DRILLED FEET	METHOD, SIZE, ETC...

PERSONNEL TIME LOG

POSITION	NAME	HOURS
INSPECTOR		
DRILLER		
HELPER		

COMMENTS :

INSPECTOR :	CONSULTANT'S REPRESENTATIVE :
DRILLER :	CONTRACTOR'S REPRESENTATIVE :

HTRW DRILLING LOG	DISTRICT	HOLE NUMBER
1. COMPANY NAME	2. DRILLING SUBCONTRACTOR	SHEET OF SHEETS

3. PROJECT	4. LOCATION
5. NAME OF DRILLER	6. MANUFACTURER'S DESIGNATION OF DRILL
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	8. HOLE LOCATION
	9. SURFACE ELEVATION
	10. DATE STARTED / 11. DATE COMPLETED
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14. TOTAL DEPTH OF HOLE	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES			
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		

LOCATION SKETCH/COMMENTS SCALE:

PROJECT	HOLE NO.

Figure 4-2. HTRW Drilling Log

HTRW DRILLING LOG (CONTINUATION SHEET)

HOLE NUMBER
SHEET OF SHEETS

PROJECT	INSPECTOR

ELEV. (a)	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	FIELD SCREENING RESULTS (d)	GEOTECH SAMPLE OR CORE BOX NO. (e)	ANALYTICAL SAMPLE NO. (f)	BLOW COUNT (g)	REMARKS (h)

PROJECT	HOLE NO.

ENG FORM 5056A-R, AUG 94 (Proponent: CECW-EG)

Figure 4-2 (Concluded)

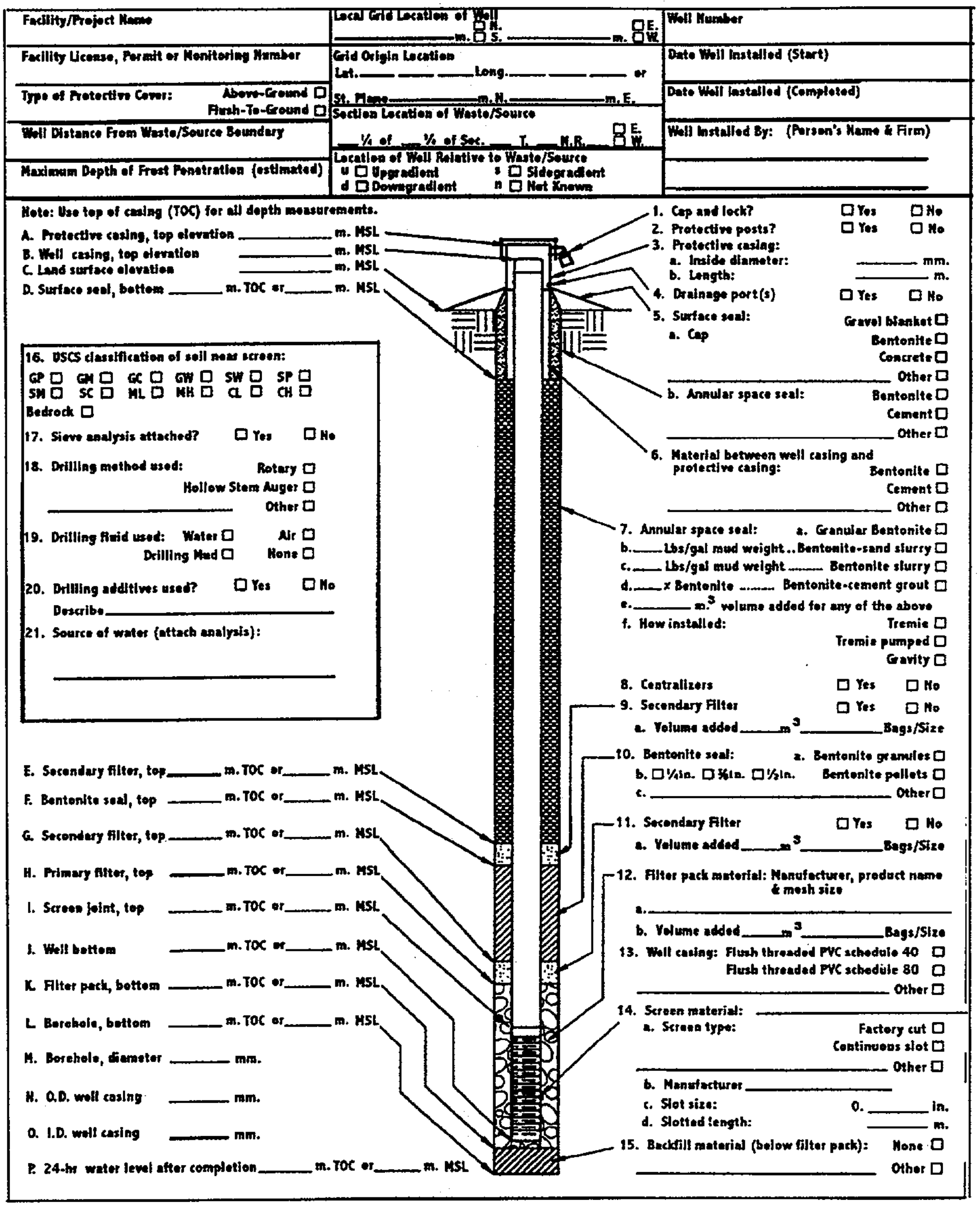


Figure 5-3. Schematic construction diagram of monitoring well

WELL DEVELOPMENT RECORD

WELL No. ____________

PROJECT : ____________ PROJECT No. : ____________ SITE LOCATION : ____________

CONTRACTOR : ____________ METHOD(S) OF DEVELOPMENT : ____________

FIELD INSPECTOR(S) : ____________

DATE	WEATHER/ TEMP.	TIME	WATER DEPTH TOP OF RISER (FT)	pH (UNITS)	TEMP. (°C)	SP. COND. (umhos)	NTU	VISUAL APPEAR., ODOR, ETC...	NOTES : GAL. REMOVED, ETC...

APPENDIX F

U.S. Environmental Protection Agency – Region II

Groundwater Sampling Procedure
Low Stress (Low Flow) Purging and Sampling

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION II

GROUND WATER SAMPLING PROCEDURE
LOW STRESS (Low Flow) PURGING AND SAMPLING

I. SCOPE & APPLICATION

This Low Stress (or Low-Flow) Purging and Sampling Procedure is the EPA Region II standard method for collecting low stress (low flow) ground water samples from monitoring wells. Low stress Purging and Sampling results in collection of ground water samples from monitoring wells that are representative of ground water conditions in the geological formation. This is accomplished by minimizing stress on the geological formation and minimizing disturbance of sediment that has collected in the well. The procedure applies to monitoring wells that have an inner casing with a diameter of 2.0 inches or greater, and maximum screened intervals of ten feet unless multiple intervals are sampled. The procedure is appropriate for collection of ground water samples that will be analyzed for volatile and semi-volatile organic compounds (VOCs and SVOCs), pesticides, polychlorinated biphenyls (PCBs), metals, and microbiological and other contaminants in association with all EPA programs.

This procedure does not address the collection of light or dense non-aqueous phase liquids (LNAPL or DNAPL) samples, and should be used for aqueous samples only. For sampling NAPLs, the reader is referred to the following EPA publications: DNAPL Site Evaluation (Cohen & Mercer, 1993) and the RCRA Ground-Water Monitoring: Draft Technical Guidance (EPA/530-R-93-001), and references therein.

II. METHOD SUMMARY

The purpose of the low stress purging and sampling procedure is to collect ground water samples from monitoring wells that are representative of ground water conditions in the geological formation. This is accomplished by setting the intake velocity of the sampling pump to a flow rate that limits drawdown inside the well casing.

Sampling at the prescribed (low) flow rate has three primary benefits. First, it minimizes disturbance of sediment in the bottom of the well, thereby producing a sample with low turbidity (i.e., low concentration of suspended particles). Typically, this saves time and analytical costs by eliminating the need for collecting and analyzing an additional filtered sample from the same well. Second, this procedure minimizes aeration of the ground water during sample collection, which improves the sample quality for VOC analysis. Third, in most cases the procedure significantly reduces the volume of ground water purged from a well and the costs associated with its proper treatment and disposal.

III. ADDRESSING POTENTIAL PROBLEMS

Problems that may be encountered using this technique include a) difficulty in sampling wells with insufficient yield; b) failure of one or more key indicator parameters to stabilize; c) cascading of water and/or formation of air bubbles in the tubing; and d) cross-contamination between wells.

Insufficient Yield
Wells with insufficient yield (i.e., low recharge rate of the well) may dewater during purging. Care should be taken to avoid loss of pressure in the tubing line due to dewatering of the well below the level of the pump's intake. Purging should be interrupted before the water level in the well drops below the top of the pump, as this may induce cascading of the sand pack. Pumping the well dry should therefore be avoided to the extent possible in all cases. Sampling should commence as soon as the volume in the well has recovered sufficiently to allow collection of samples. Alternatively, ground water samples may be obtained with techniques designed for the unsaturated zone, such as lysimeters.

Failure to Stabilize Key Indicator Parameters

If one or more key indicator parameters fails to stabilize after 4 hours, one of three options should be considered: a) continue purging in an attempt to achieve stabilization; b) discontinue purging, do not collect samples, and document attempts to reach stabilization in the log book; c) discontinue purging, collect samples, and document attempts to reach stabilization in the log book; or d) Secure the well, purge and collect samples the next day (preferred). The key indicator parameter for samples to be analyzed for VOCs is dissolved oxygen. The key indicator parameter for all other samples is turbidity.

Cascading
To prevent cascading and/or air bubble formation in the tubing, care should be taken to ensure that the flow rate is sufficient to maintain pump suction. Minimize the length and diameter of tubing (i.e., 1/4 or 3/8 inch ID) to ensure that the tubing remains filled with ground water during sampling.

Cross-Contamination

To prevent cross-contamination between wells, it is strongly recommended that dedicated, in-place pumps be used. As an alternative, the potential for cross-contamination can be reduced by performing the more thorough "daily" decontamination procedures between sampling of each well in addition to the start of each sampling day (see Section VII, below).

Equipment Failure

Adequate equipment should be on-hand so that equipment failures do not adversely impact sampling activities.

IV. PLANNING DOCUMENTATION AND EQUIPMENT

- Approved site-specific Field Sampling Plan/Quality Assurance Project Plan (QAPP). This plan must specify the type of pump and other equipment to be used. The QAPP must also specify the depth to which the pump intake should be lowered in each well. Generally, the target depth will correspond to the mid-point of the most permeable zone in the screened interval. Borehole geologic and geophysical logs can be used to help select the most permeable zone. However, in some cases, other criteria may be used to select the target depth for the pump intake. In all cases, the target depth must be approved by the EPA hydrogeologist or EPA project scientist.

- Well construction data, location map, field data from last sampling event.
- Polyethylene sheeting.
- Flame Ionization Detector (FID) and Photo Ionization Detector (PID).
- Adjustable rate, positive displacement ground water sampling pump (e.g., centrifugal or bladder pumps constructed of stainless steel or Teflon). A peristaltic pump may only be used for inorganic sample collection.
- Interface probe or equivalent device for determining the presence or absence of NAPL.
- Teflon or Teflon-lined polyethylene tubing to collect samples for organic analysis. Teflon or Teflon-lined polyethylene, PVC, Tygon or polyethylene tubing to collect samples for inorganic analysis. Sufficient tubing of the appropriate material must be available so that each well has dedicated tubing.
- Water level measuring device, minimum 0.01 foot accuracy, (electronic preferred for tracking water level drawdown during all pumping operations).
- Flow measurement supplies (e.g., graduated cylinder and stop watch or in-line flow meter).
- Power source (generator, nitrogen tank, etc.).
- Monitoring instruments for indicator parameters. Eh and dissolved oxygen must be monitored in-line using an instrument with a continuous readout display. Specific conductance, pH, and temperature may be monitored either in-line or using separate probes. A nephalometer is used to measure turbidity.
- Decontamination supplies (see Section VII, below).
- Logbook (see Section VIII, below).

- Sample bottles.

- Sample preservation supplies (as required by the analytical methods).

- Sample tags or labels, chain of custody.

V. SAMPLING PROCEDURES

Pre-Sampling Activities

1. Start at the well known or believed to have the least contaminated ground water and proceed systematically to the well with the most contaminated ground water. Check the well, the lock, and the locking cap for damage or evidence of tampering. Record observations.

2. Lay out sheet of polyethylene for placement of monitoring and sampling equipment.

3. Measure VOCs at the rim of the unopened well with a PID and FID instrument and record the reading in the field log book.

4. Remove well cap.

5. Measure VOCs at the rim of the opened well with a PID and an FID instrument and record the reading in the field log book.

6. If the well casing does not have a reference point (usually a V-cut or indelible mark in the well casing), make one. Note that the reference point should be surveyed for correction of ground water elevations to the mean geodesic datum (MSL).

7. Measure and record the depth to water (to 0.01 ft) in all wells to be sampled prior to purging. Care should be taken to minimize disturbance in the water column and dislodging of any particulate matter attached to the sides or settled at the bottom of the well.

8. If desired, measure and record the depth of any NAPLs using an interface probe. Care should be taken to minimize disturbance of

any sediment that has accumulated at the bottom of the well. Record the observations in the log book. If LNAPLs and/or DNAPLs are detected, install the pump at this time, as described in step 9, below. Allow the well to sit for several days between the measurement or sampling of any DNAPLs and the low-stress purging and sampling of the ground water.

Sampling Procedures

9. Install Pump: Slowly lower the pump, safety cable, tubing and electrical lines into the well to the depth specified for that well in the EPA-approved QAPP or a depth otherwise approved by the EPA hydrogeologist or EPA project scientist. The pump intake must be kept at least two (2) feet above the bottom of the well to prevent disturbance and resuspension of any sediment or NAPL present in the bottom of the well. Record the depth to which the pump is lowered.

10. Measure Water Level: Before starting the pump, measure the water level again with the pump in the well. Leave the water level measuring device in the well.

11. Purge Well: Start pumping the well at 200 to 500 milliliters per minute (ml/min). The water level should be monitored approximately every five minutes. Ideally, a steady flow rate should be maintained that results in a stabilized water level (drawdown of 0.3 ft or less). Pumping rates should, if needed, be reduced to the minimum capabilities of the pump to ensure stabilization of the water level. As noted above, care should be taken to maintain pump suction and to avoid entrainment of air in the tubing. Record each adjustment made to the pumping rate and the water level measured immediately after each adjustment.

12. Monitor Indicator Parameters: During purging of the well, monitor and record the field indicator parameters (turbidity, temperature, specific conductance, pH, Eh, and DO) approximately every five minutes. The well is considered stabilized and ready for sample collection when the indicator parameters have stabilized for three consecutive readings as follows (Puls and Barcelona, 1996):

+0.1 for pH
+3% for specific conductance (conductivity)
+10 mv for redox potential
+10% for DO and turbidity

Dissolved oxygen and turbidity usually require the longest time to achieve stabilization. The pump must not be removed from the well between purging and sampling.

13. Collect Samples: Collect samples at a flow rate between 100 and 250 ml/min and such that drawdown of the water level within the well does not exceed the maximum allowable drawdown of 0.3 ft. VOC samples must be collected first and directly into sample containers. All sample containers should be filled with minimal turbulence by allowing the ground water to flow from the tubing gently down the inside of the container.

    Ground water samples to be analyzed for volatile organic compounds (VOCs) require pH adjustment. The appropriate EPA Program Guidance should be consulted to determine whether pH adjustment is necessary. If pH adjustment is necessary for VOC sample preservation, the amount of acid to be added to each sample vial prior to sampling should be determined, drop by drop, on a separate and equal volume of water (e.g., 40 ml). Ground water purged from the well prior to sampling can be used for this purpose.

14. Remove Pump and Tubing: After collection of the samples, the tubing, unless permanently installed, must be properly discarded or dedicated to the well for resampling by hanging the tubing inside the well.

15. Measure and record well depth.

16. Close and lock the well.

VI. FIELD QUALITY CONTROL SAMPLES

Quality control samples must be collected to determine if sample collection and handling procedures have adversely affected the quality of the ground water samples. The appropriate EPA Program Guidance should be consulted in preparing the field QC sample requirements of the site-specific QAPP.

All field quality control samples must be prepared exactly as regular investigation samples with regard to sample volume, containers, and preservation. The following quality control samples should be collected during the sampling event:

- Field duplicates
- Trip blanks for VOCs only
- Equipment blank (not necessary if equipment is dedicated to the well)

As noted above, ground water samples should be collected systematically from wells with the lowest level of contamination through to wells with highest level of contamination. The equipment blank should be collected after sampling from the most contaminated well.

VII. DECONTAMINATION

Non-disposable sampling equipment, including the pump and support cable and electrical wires which contact the sample, must be decontaminated thoroughly each day before use ("daily decon") and after each well is sampled ("between-well decon"). Dedicated, in-place pumps and tubing must be thoroughly decontaminated using "daily decon" procedures (see #17, below) prior to their initial use. For centrifugal pumps, it is strongly recommended that non-disposable sampling equipment, including the pump and support cable and electrical wires in contact with the sample, be decontaminated thoroughly each day before use ("daily decon").

EPA's field experience indicates that the life of centrifugal pumps may be extended by removing entrained grit. This also permits inspection and replacement of the cooling water in centrifugal pumps. All non-dedicated sampling equipment (pumps, tubing, etc.) must be decontaminated after each well is sampled ("between-well decon," see #18 below).

17. **Daily Decon**

A) Pre-rinse: Operate pump in a deep basin containing 8 to 10 gallons of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.

B) Wash: Operate pump in a deep basin containing 8 to 10 gallons of a non-phosphate detergent solution, such as Alconox, for 5 minutes and flush other equipment with fresh detergent solution for 5 minutes. Use the detergent sparingly.

C) Rinse: Operate pump in a deep basin of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.

D) Disassemble pump.

E) Wash pump parts: Place the disassembled parts of the pump into a deep basin containing 8 to 10 gallons of non-phosphate detergent solution. Scrub all pump parts with a test tube brush.

F) Rinse pump parts with potable water.

G) Rinse the following pump parts with distilled/ deionized water: inlet screen, the shaft, the suction interconnector, the motor lead assembly, and the stator housing.

H) Place impeller assembly in a large glass beaker and rinse with 1% nitric acid (HNO_3).

I) Rinse impeller assembly with potable water.

J) Place impeller assembly in a large glass bleaker and rinse with isopropanol.

K) Rinse impeller assembly with distilled/deionized water.

18. **Between-Well Decon**

A) Pre-rinse: Operate pump in a deep basin containing 8 to 10 gallons of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.

B) Wash: Operate pump in a deep basin containing 8 to 10 gallons of a non-phosphate detergent solution, such as Alconox, for 5 minutes and flush other equipment with fresh detergent solution for 5 minutes. Use the detergent sparingly.

C) Rinse: Operate pump in a deep basin of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.

D) Final Rinse: Operate pump in a deep basin of distilled/deionized water to pump out 1 to 2 gallons of this final rinse water.

VIII. FIELD LOG BOOK

A field log book must be kept each time ground water monitoring activities are conducted in the field. The field log book should document the following:

- Well identification number and physical condition.
- Well depth, and measurement technique.
- Static water level depth, date, time, and measurement technique.
- Presence and thickness of immiscible liquid layers and detection method.
- Collection method for immiscible liquid layers.
- Pumping rate, drawdown, indicator parameters values, and clock time, at three to five minute intervals; calculate or measure total volume pumped.
- Well sampling sequence and time of sample collection.
- Types of sample bottles used and sample identification numbers.
- Preservatives used.
- Parameters requested for analysis.
- Field observations of sampling event.
- Name of sample collector(s).
- Weather conditions.
- QA/QC data for field instruments.

IX. REFERENCES

Cohen, R.M. and J.W. Mercer, 1993, DNAPL Site Evaluation, C.K. Smoley Press, Boca Raton, Florida.

Puls, R.W. and M.J. Barcelona, 1996, Low-Flow (Minimal Drawdown) Ground-water Sampling Procedures, EPA/540/S-95/504.

U.S. EPA, 1993, RCRA Ground-Water Monitoring: Draft Technical Guidance, EPA/530-R-93-001.

U.S. EPA Region II, 1989, CERCLA Quality Assurance Manual.

APPENDIX G

ASTM D-4646 – Standard Test Method for 24-h Batch Type Measurement of Contaminant Sorption by Soils and Sediment

Designation: D 4646 – 87[ε1]

AMERICAN SOCIETY FOR TESTING AND MATERIALS
1916 Race St., Philadelphia, Pa. 19103
Reprinted from the Annual Book of ASTM Standards, Copyright ASTM
If not listed in the current combined index, will appear in the next edition.

Standard Test Method for 24-h Batch-Type Measurement of Contaminant Sorption by Soils and Sediments[1]

This standard is issued under the fixed designation D 4646; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

[ε1] NOTE—Title editorially corrected in June 1989.

1. Scope

1.1 This test method describes a procedure for determining the sorption affinity of waste solutes by unconsolidated geologic material in aqueous suspension. The waste solute may be derived from a variety of sources such as wells, underdrain systems, or laboratory solutions such as those produced by waste extraction tests like the Method D 3987 shake extraction method.

1.2 This test method is applicable in screening and providing relative rankings of a large number of geomedia samples for their sorption affinity in aqueous leachate/geomedia suspensions. This test method may not exactly simulate sorption characteristics that would occur in unperturbed geologic settings.

1.3 While this procedure may be applicable to both organic and inorganic constituents, care must be taken with respect to the stability of the particular constituents and their possible losses from solution by such processes as degradation by microbes, light, or hydrolysis. This test method should not be used for volatile chemical constituents (see 6.1).

1.4 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 1129 Definitions of Terms Relating to Water[2]

D 1193 Specification for Reagent Water[2]

D 2216 Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures[3]

D 3987 Test Method for Shake Extraction of Solid Waste with Water[4]

D 4319 Test Method for Distribution Ratios by the Short-Term Batch Method[3]

3. Terminology

3.1 *Definitions*—For definition of terms used in this test method refer to Definitions D 1129.

3.1.1 *solute*—chemical species (for example, ion, molecule, etc.) in solution.

3.1.2 *sorbate*—chemical species sorbed by a sorbent.

3.1.3 *sorbent*—a substance that sorbs the solute from solution (for example, soil, sediment, till, etc.).

3.1.4 *sorption*—depletion of an amount of solute initially present in solution by a sorbent.

3.1.5 *sorption affinity*—the relative degree of sorption that occurs by a geomedia.

3.1.6 *unconsolidated geologic material* (geomedia)—a loosely aggregated solid natural material of geologic origin (for example, soil, sediment, till, etc.).

3.2 *Descriptions of Terms Specific to This Standard:*

3.2.1 *distribution coefficient*, K_d—is defined identically to R_d, except it is considered to be an equilibrium value and independent of the concentration of solute (that is, linear sorption curve).

3.2.2 *distribution ratio* (R_d)—the ratio of the concentration of solute sorbed on the soil or other geomedia divided by its concentration in solution. A 24-h R_d is the analogous ratio evaluated after 24 h of contact of the solute with the geomedia. The R_d value is calculated as follows:

$$R_d = \frac{\text{(mass of solute sorbed per unit mass of geomedia)}}{\text{(mass of solute in solution per unit volume of solution)}} = \frac{\mu g/g}{\mu g/mL} = \frac{mL}{g}$$

The dimensions of R_d reduce to units of volume per mass. It is convenient to express R_d in units of millilitres (or cubic centimetres) of solution per gram of geomedia. Dissimilar R_d values may be obtained if different initial solute concentrations are used, depending on the sorption behavior of the solute and the properties of the geomedia (that is, nonlinear sorption curve). This concentration dependency may be absent where the solute concentrations are sufficiently low or the characteristics of the particular solute-sorbent combination yield R_d values that are independent of the concentration of solute (that is, linear sorption curve).

4. Summary of Test Method

4.1 Distilled water, natural water, waste leachate, or other

[1] This test method is under the jurisdiction of ASTM Committee D-34 on Waste Disposal and is the direct responsibility of Subcommittee D34.02 on Physical and Chemical Characterization.

Current edition approved March 3, 1987. Published April 1987. Originally published as ES 10 – 85. Last previous edition ES 10 – 85.

[2] *Annual Book of ASTM Standards*, Vol 11.01.

[3] *Annual Book of ASTM Standards*, Vol 04.08.

[4] *Annual Book of ASTM Standards*, Vol 11.04.

aqueous solution containing a known concentration of a solute is mixed with a known amount of unconsolidated geologic material (geomedia) for 24 h. Changes in solute concentrations are used to calculate a distribution ratio (R_d).

5. Significance and Use

5.1 This test method is meant to allow for a rapid (24 h) index of a geomedia's sorption affinity for given chemicals or leachate constituents. A large number of samples may be run using this test method to determine a comparative ranking of those samples, based upon the amount of solute sorbed by the geomedia, or by various geomedia or leachate constituents. The 24-h time is used to make the test convenient and also to minimize microbial degradation which may be a problem in longer-timed procedures. Due to this time constraint, the final (24-h) concentration should not be confused with that of an equilibrium or steady-state concentration. While R_d values are directly applicable for screening and comparative ranking purposes, their use in predictive field applications generally requires the assumption that $R_d = K_d$; the validity of this assumption must be carefully evaluated by qualified personnel.

5.2 While this test method may be useful in determining 24-h R_d values for nonvolatile organic constituents, interlaboratory testing has been carried out only for the nonvolatile inorganic species, arsenic and cadmium. However, the procedure has been tested for single laboratory precision with polychlorinated biphenyls (PCBs) and is believed to be useful for all stable and nonvolatile inorganic, and organic constituents. This test method is not considered appropriate for volatile constituents.

5.3 The 24-h time limit may be sufficient to reach a steady-state R_d. However, to report this determination as a steady-state R_d (that is, $R_d = K_d$), the relevant time studies must be carried out to document the development of steady-state conditions within the 24-h time period. Tests exceeding the 24-h time period are beyond the scope of this test method. Refer to Test Method D 4319, for an alternate procedure of longer duration.

6. Interferences

6.1 When dealing with solutes of unknown stability either in contact with the geomedia or when used as blanks, care must be taken to determine if volatilization, hydrolysis, photodegradation, microbial degradation, oxidation-reduction (that is, Cr^{3+} to Cr^{6+}) or other physicochemical processes are operating at a significant rate within the time frame of the procedure. The stability and hence loss from solution may affect the outcome of this procedure if the aforementioned reactions are significant. The compatibility of the method and the solute of interest may be assessed by determining the differences between the initial solute concentration (see 9.8) and the final blank concentration of the solute (see 9.15). If this difference is greater than the expected precision of the method (10 %), then the R_d value generated may be unreliable and must be carefully evaluated.

7. Apparatus

7.1 *Agitation Equipment*—The agitation equipment to be used is the rotary solid waste extractor[5] specified in Method D 3987.

7.2 *Phase Separation Equipment*—A filtration apparatus made of materials compatible with the solutions being filtered and equipped with a 0.45-µm pore size membrane filter, or a constant temperature centrifuge capable of separating particles with diameters greater than 0.1 µm (see Section 9). If organic compounds are being measured, the filtration apparatus, centrifuge tubes etc., should be compatible with the compounds being measured (that is, glass or stainless steel). Sorption of solute onto the filtration membrane may be significant for some solutes, and must be evaluated by the use of blanks through all steps of the procedure.

7.3 *Containers*—Round, wide-mouth bottles compatible with the rotary extractor (Method D 3987) and of composition suitable to the nature of the solute(s) under investigation and the analysis to be performed will be used. For nonvolatile inorganic constituents, high-density, linear polyethylene bottles should be used with the size of the bottle dictated by sample size, and the need for the solution to occupy 70 to 80 % of the container volume (that is, 125 mL, 250 mL, or 2-L bottles for sample sizes of 5, 10, or 70 g respectively). For nonvolatile organic constituents, TFE-fluorocarbon, glass bottles, or stainless steel containers with water-tight closures made of chemically inert materials should be used with size requirements being the same as for nonvolatile inorganics. Containers should be cleaned in a manner consistent with the analyses to be performed. Samples of the solutions to be analyzed should be stored in similar chemically compatible bottles.

7.4 *Balance*, having a minimum capacity of 70 g and a sensitivity of ±0.005 g shall be used.

8. Reagents

8.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the American Chemical Society, where such specifications are available.[6] Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

8.2 *Purity of Water*—Unless otherwise indicated, references to water shall be understood to mean Type IV reagent water of Specification D 1193.

9. Procedure

9.1 Geomedia samples are spread out on a flat surface, no more than 2 to 3 cm deep, and allowed to air dry for 7 days or until constant weight (a change that is less than 5 %/24-h period) is achieved (do *not* oven dry).

9.2 After the sample has air dried, it is passed through a

[5] Diamondstone, B. T., Burke, R. W., and Garner, E. L., "Improved Leach Measurements on Solid Wastes," *ASTM Standardization News*, June 1982, pp. 28–33.

[6] "Reagent Chemicals, American Chemical Society Specifications," Am. Chemical Soc., Washington, DC. For suggestions on the testing of reagents not listed by the American Chemical Society, see "Reagent Chemicals and Standards," by Joseph Rosin, D. Van Nostrand Co., Inc., New York, NY, and the "United States Pharmacopeia."

2-mm screen sieve. Large aggregates are to be crushed, without grinding, using a clean mortar and a rubber-tipped pestle.

9.3 Mix the sieved material until the sample is homogeneous. Use a riffle splitter, or other unbiased splitting procedure, to obtain subsamples of appropriate size.

9.4 Remove subsamples and determine the moisture content of the air-dried sample (refer to Method D 2216).

9.5 Determine the mass of geomedia sample, corrected for moisture content:

Determination of air-dried soil mass equivalent to the desired mass of oven-dried soil:

$$A = M_s[1 + (M/100)]$$

where:

A = air dry soil mass,
M_s = mass of oven-dried soil desired, and
M = moisture, %.

9.6 Place between 5 and 70 g (oven-dried basis) of the weighed air-dried sample into the appropriate container. The samples should be weighed to a minimum of three significant figures.

9.7 Add to the container an amount of solute solution necessary to yield a 1:20 soil-to-solution ratio. This is determined on the oven-dried basis:

Determination of solution volume needed per sample for a soil-to-solution ratio of 1:20:

$$V = (M_s \times 20)/\rho$$

where:

ρ = density of solution, g/cm^3,
V = volume of solution per sample, cm^3, and
M_s = mass of soil to be used, g, (oven-dried basis).

9.8 Retain a separate, appropriately preserved aliquot of the initial solute solution for analysis.

9.9 Close the container and place it on the rotary extractor (Method D 3987).

9.10 Agitate continuously for 24 ± 0.5 h at 29 ± 2 r/min at room temperature (22 ± 5°C).

9.11 Open the container. Note the temperature of the solution and any changes in the sample or solution (that is, color, odor, etc.).

9.12 Separate the solution phase from the majority of the solid phase by decantation.

9.13 Filter the solution phase through a 0.45-µm pore size membrane filter (see 7.2), or centrifuge a subsample at the predetermined rate of rotation and time for the centrifugation equipment employed at constant temperature (the temperature recorded after 24 h):

$$t = 9/2\left(\frac{\eta}{\omega^2 r_p^{\,2}(\rho_p - \rho)}\right)\ln(R_b/R_t)$$

where:

ω^2 = $\frac{4\pi^2(r/min)^2}{60}$ = angular velocity,
r_p = particle radius, cm,
η = viscosity of water, 8.95×10^{-3} g/s-cm at 25°C,
ρ_p = particle density,
ρ = density of solution,
r/min = revolutions per minute,
R_t = distance from center of centrifuge rotor to top of solution in centrifuge tube, cm,
R_b = distance from center of centrifuge rotor to bottom of centrifuge tube, cm, and
t = time, min.

To remove particles >0.1-µm radius and 2.65-g/cm^3 density from solution:

$$t = \left(\frac{3.71 \times 10^8}{(r/min)^2}\right)\ln(R_b/R_t)$$

Note that if filtration is used, the affinity of the filtration membrane for the solute must be evaluated. Failure to do so, may lead to erroneous results.

9.14 After a clear solution has been obtained, place an aliquot in an appropriate container (see 7.3), and analyze or store in a refrigerator at 4 ± 2°C until analyzed.

9.15 Each geomedia sample is to be subjected to the procedure in three or more replicates. The number of blanks (that is, solute solution without geomedia) carried through all steps of the procedure should be a minimum of 5 % of the total number of geomedia samples, but not less than three.

TABLE 1 Summary of Interlaboratory Testing for the 24-h Batch-Type R_d Determination

Initial Concentration, µg/mL	Soil 1 10	Soil 1 200	Soil 2 100	Soil 3 100	Soil 4 100
Cadmium Carbonate (as $CdCO_3$):					
$\bar{X}$ R_d, mL/g	1568	96.3	69.50	69.74	28.94
Standard deviation, mL/g	±156	±6.32	±7.73	±7.87	±2.64
Coefficient of variation, %	9.95	6.56	11.13	11.29	9.14
Number of replicates	12	12	10	12	9
Arsenic (as KH_2AsO_4):					
$\bar{X}$ R_d, mL/g	15.42	2.75	4.95	3.25	2.99
Standard deviation, mL/g	±0.92	±0.85	±0.27	±0.26	±0.20
Coefficient of variation, %	5.99	30.9	5.53	7.88	6.52
Number of replicates	12	12	12	12	12

10. Calculation

10.1 Calculate the distribution ratio as follows:

$$R_d = \frac{(A - B)V}{(M_s)B}$$

where:

A = initial concentration of the solute defined as the mean concentration of the blanks, µg/mL,
B = final concentration of the solute after 24 h in contact with the geomedia, µg/mL,
V = volume of solution used, mL,
M_s = mass of soil expressed on an oven-dried basis, g, and
R_d = distribution ratio, mL/g.

TABLE 2 Summary of Single Laboratory for an Organic Solute

Initial Concentration, µg/mL	Soil 1 [A] 0.216 (0 % Acetone)	Soil 1 [B] 0.187 (20 % Acetone)	Soil 2 [C] 0.216 (0 % Acetone)	Soil 2 [D] 0.187 (20 % Acetone)
PCBs (as Arodor 1242):				
$\bar{X}$ R_d, mL/g	798	78.62	23.83	2.28
Standard deviation, mL/g	±18.41	±3.45	±1.48	±0.11
Coefficient of variation, %	2.31	4.39	6.21	4.82
Number of replicates	4	4	4	4

[A] Soil 1—Catlin silt loam.
[B] Soil 2—Sangamon paleosol.
[C] Soil 3—Kaolinite clay.
[D] Soil 4—Vandalia till, unaltered phase.

11. Report

11.1 The R_d value must be clearly marked as nonequilibrium 24-h distribution ratio.

11.2 Both the initial solute concentration (*A* in 10.1) and the final solute concentration (*B* in 10.1) must be reported.

11.3 The initial and final solute concentration for each blank (solution without geomedia) must be reported.

11.4 The mass of the sorbent (M_s in 10.1), volume of solution (*V* in 10.1), and the room temperature at which the rotary extractor was operated must be reported.

11.5 Report the temperature of the solution and any changes noted in 9.11.

11.6 Note and report negative R_d values when and if they occur. Negative R_d values may occur if the geomedia contains the test solute prior to the application of the method.

11.7 It is suggested that the pH of the sorbent-solute mixture be determined prior to separating the sorbent from the liquid and reported where feasible.

12. Precision and Bias

12.1 An interlaboratory round-robin test was conducted at a soil-to-solution ratio of 1:20 using 70.0 g of soil. Intralaboratory testing using a 1:20 soil-to-solution ratio was carried out with no significant loss of precision for soil masses of 5.00, 10.0, and 70.0 g. Therefore, it is specified that the soil-to-solution ratio be 1:20 with the working mass of soil (on an oven-dried basis) between 5 and 70 g.

12.2 *Precision:*

12.2.1 The precision of this test method is limited by the ability to obtain a homogeneous sample of geomedia, and the precision of the various methods used to carry out the procedure (that is, mass determinations, initial and 24-h concentration of constituents).

12.2.2 A comprehensive overall precision statement, covering all species, is not feasible. Interlaboratory testing of this procedure, using cadmium and arsenic as sorbates, with five independent laboratories, and single laboratory testing with PCBs indicated that a coefficient of variation of less than 10 % is obtainable.

12.2.3 For a summary of interlaboratory testing for the 24-h batch-type R_d determination see Table 1.

12.2.4 For a summary of single laboratory testing for an organic solute see Table 2.

12.3 *Bias*—A determination of the bias for this procedure is not possible since no standard soil or alternate technique exists.