DRAFT
TECHNICAL MEMORANDUM
SOURCE AREA INVESTIGATION

Superfund Records Center
SITE: Centredale Manor
BREAK: 3.4
OTHER: 29566

TECHNICAL ASSISTANCE

CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

RESPONSE ACTION CONTRACT (RAC), REGION I

For
U.S. Environmental Protection Agency

By
Tetra Tech NUS, Inc.

EPA Contract No. 68-W6-0045
EPA Work Assignment No. 106-ANLA-016P
TtNUS Project No. N4104

January 2002

Stephen S. Parker
Project Manager

George D. Gardner, P.E.
Program Manager

SDMS DocID 29566

TABLE OF CONTENTS
DRAFT TECHNICAL MEMORANDUM – SOURCE AREA INVESTIGATION
TECHNICAL ASSISTANCE
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

SECTION PAGE

EXECUTIVE SUMMARY

1.0 PROJECT INTRODUCTION 1-1

2.0 SITE BACKGROUND INFORMATION 2-1
- 2.1 Site Location and Description 2-1
  - 2.1.1 Site Description 2-1
  - 2.1.2 Historical Description 2-3
- 2.2 Previous Environmental Investigations 2-5
  - 2.2.1 Woonasquatucket River Sediment/Water Quality Analysis – OEME, July 1998 2-5
  - 2.2.2 Expanded Site Inspection (ESI) Centredale Manor – Weston, March 1999 2-7
  - 2.2.3 Emergency Response Actions 2-9
  - 2.2.4 USGS Water-To Vapor Diffusion Study 2-11
  - 2.2.5 Woonasquatucket River Sediment Investigation – TtNUS June, 2000 2-12
- 2.3 Previous Geologic Investigations 2-12
  - 2.3.1 Brook Village Area 2-13
  - 2.3.2 Centredale Manor Area 2-14
  - 2.3.3 Geophysical Surveys 2-16
- 2.4 Centredale Manor Restoration Project Source Area Investigation 2-17

3.0 FIELD SAMPLING ACTIVITIES 3-1
- 3.1 Surface Geophysical Surveys 3-1
- 3.2 Soil and Bedrock Borings and Well Installations 3-2
  - 3.2.1 DPT Piezometers and Water Level Monitoring 3-2
  - 3.2.2 Overburden Wells/Borings 3-3
  - 3.2.3 Cluster Borings and Monitoring Wells 3-5
- 3.3 Water Level Monitoring 3-9
- 3.4 NAPL Sampling 3-9
- 3.5 Groundwater Sampling 3-10
  - 3.5.1 Initial Groundwater Sampling 3-11
  - 3.5.2 Subsequent Groundwater Sampling 3-11
- 3.6 Hydraulic Conductivity Tests 3-11

TABLE OF CONTENTS (cont'd)
DRAFT TECHNICAL MEMORANDUM – SOURCE AREA INVESTIGATION
TECHNICAL ASSISTANCE
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

SECTION			PAGE
4.0	FINDINGS OF THE INVESTIGATION		4-1
	4.1	Soil Conditions	4-1
		4.1.1 Soil Characterization: Site Overburden Geology	4-1
		4.1.2 Headspace Screening for Total VOCs	4-4
		4.1.3 Laboratory Analysis of Subsurface Soil Samples Collected	4-6
	4.2	Surface Geophysical Studies	4-12
	4.3	Bedrock Evaluation	4-13
	4.4	Groundwater Evaluation	4-16
		4.4.1 Flow Directions and Surface Water-Groundwater Interactions	4-16
		4.4.2 Hydraulic Conductivity, Hydraulic Gradient, and Groundwater Velocity	4-19
		4.4.3 Laboratory Analysis of Groundwater Samples Collected	4-21
		4.4.4 Conceptual Contaminant Flow with Groundwater	4-26
5.0	SUMMARY		5-1
	REFERENCES		

TABLES

NUMBER	
3-1	Summary of Soil Samples Collected
3-2	Summary of Groundwater Samples Collected
4-1	Jar Headspace Results
4-2a	Summary of Detected Dioxins and Furans in Subsurface Soils
4-2b	Summary of Detected Volatile Organic Compounds in Subsurface Soils
4-2c	Summary of Detected Semi-Volatile Organic Compounds in Subsurface Soils
4-2d	Summary of Detected Pesticides and Polychlorinated Biphenyls in Subsurface Soils
4-2e	Summary of Metals Detected in Subsurface Soils
4-3	Hydraulic Conductivity in Shallow Overburden Single Well Pump Test Results
4-4	Hydraulic Conductivity in Moderate to Deep Overburden Single Well Pump Test Results
4-5	Hydraulic Conductivity in Bedrock - Slug Test and Single Well Pump Test Results
4-6	Hydraulic Conductivity in Bedrock - Packer Test Results
4-7	Vertical Hydraulic Gradients
4-8a	Summary of Detected Dioxins and Furans in Groundwater
4-8b	Summary of Detected Volatile Organic Compounds in Groundwater
4-8c	Summary of Detected SVOCs, PCBs, and Pesticides in Groundwater
4-8d	Summary of Metals and Wet Chemistry Parameters Detected in Groundwater

TABLE OF CONTENTS (cont'd)
DRAFT TECHNICAL MEMORANDUM – SOURCE AREA INVESTIGATION
TECHNICAL ASSISTANCE
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

FIGURES

NUMBER

E-1	Site Features
1-1	Location Map
1-2	Site Features
2-1	Base Map
2-2	Centredale Manor Source Area, Aerial Photo February 7, 1962
2-3	Centredale Manor Source Area, Aerial Photo March 9, 1970
2-4	Summary of Historical Activity and Features
3-1	Geophysical Investigation Lines
3-2	Locations of Borings, Wells, and Piezometers
4-1	Selected Contaminants in Subsurface Soil
4-2	Geophysical Investigation Lines
4-3	Topography of Bedrock
4-3a	Geologic Cross-Section A-A'
4-4	Bedrock Fracture Orientations
4-5	Water Table Contours, March 30, 2001
4-6	Water Table Contours, May 4, 2001
4-7	Comparison of Water Elevations in the Raceway at SP-01 and the Aquifer at P-14, and in the Raceway at SP-02 and in the Aquifer at P-15
4-8	Comparison of Water Elevations in the Woonasquatucket River at SP-04 and the Aquifer at P-16, and in the River at SP-03 and the Aquifer at P-17
4-9	Water Table Contours, November 1, 2001
4-10	Deep Overburden Contours, November 1, 2001
4-11	Bedrock Groundwater Contours, November 1, 2001
4-12	Selected Contaminants in Groundwater

APPENDICES

A	Boring Logs Installed during the Source Area Investigation
B	Details of Well Installations
C	Analytical Results for Soil Samples Collected
D	Analytical Results for the Groundwater Samples Collected

EXECUTIVE SUMMARY

This Technical Memorandum has been prepared to describe the sampling and analysis program and findings of the Source Area Investigation (SAI) for the Centredale Manor Restoration Project Site located in North Providence, Rhode Island.

The scope of work for the SAI was to determine the nature of the contamination in the soils of the source area, describe the hydrogeological setting and groundwater flow, and determine the nature and extent of groundwater contamination at and adjacent to the Centredale Manor and Brook Village properties.

Chlorinated volatile organic compounds (VOCs), particularly trichloroethene (TCE) and tetrachloroethene (PCE) were found in the shallow soils and fill material present throughout the site in the borings installed. Highest concentrations of these contaminants were found in soils at one specific location (MW-05), in the Brook Village Parking area, very close to the Woonasquatucket River. Trichlorophenol (TCP), dioxin, and hexachloroxanthene (HCX) were all found at elevated concentrations in soils at this location as well. Other contaminants, including polychlorinated biphenyl compounds (PCBs), aromatic VOCs, phthalates, polynuclear hydrocarbons (PAHs) and metals were all found at lower concentrations in shallow soils and fill across the site, fill is present to an estimated depth of 2-12 feet below ground surface.

Subsurface soils at the site are largely composed of silty sands and gravels, between 40 and over 70 feet in thickness. These overburden materials are not likely to retard or particularly direct migration of contaminants, whether they are dissolved in groundwater or being carried as immiscible liquids.

The bedrock evaluations indicate that the source area is situated above a north-south trending bedrock valley. There are two low points in this valley, at elevations of less than 28 feet. One is under the Narragansett Electric right of way, west of Brook Village and the river. The other is under the Centredale Manor building and the wetland area between the ends of Grover and Steere Streets.

Groundwater flow through the shallow overburden is to the south, with an eastward trend during high water stages in the river. Groundwater flow through the deep overburden and bedrock

beneath the northern and central portions of the site is generally to the southeast, and the easterly component to flow diminishes as groundwater reaches Cap Area 1.

Based on observations from the eight well clusters during quiescent conditions, it appears there are no strong, pervasive, downward vertical gradients that could drive dissolved contaminants from the shallow subsurface through the overburden and into the bedrock at the site. However there does appear to be a direct hydraulic connection between the overburden and bedrock beneath much of the site. Therefore, shallow fractures in the schist, gneiss, and granite may act as pathways for moving contaminants from the overburden into the bedrock. However, it appears the bedrock fractures generally have small apertures and transmit small to negligible quantities of water.

Groundwater contamination at the site was dominated by chlorinated VOCs and TCP. The highest concentrations of contaminants in groundwater were again attributed to PCE, TCE and TCP, all found at MW-05S, where these contaminants were also detected in soils. PCE and TCE were both found in the hundreds of ppb in the deep overburden and bedrock wells (MW-02 and MW-13) on the southeast edge of the source area. Low concentrations of PCE and TCE were also detected in bedrock and deep overburden wells at MW-04 at the southern end of the source area, and in the deep overburden well at MW-12, southwest of the source area. Lower concentrations of these and other VOCs were found in most of the shallow groundwater wells in the source area. Other groundwater contaminants detected included phthalates, lead and nickel, as well as a compound known as caprolactam.

The high concentrations of PCE, TCE, TCP, and dioxin at MW-05S are co-located with a groundwater mound that seems to be present in this area during most of the year. Whether the mound and the contaminant set are related is unknown, but the mound may be influencing the flow path of the contaminants at this location slightly, as the westward gradient from the mound to MW-05 acts against an eastward groundwater flow gradient that presents itself during periods of high river stages.

If a sufficient quantity of PCE-rich liquid was released in this area, DNAPL may have accumulated at the base of the bedrock valley approximately 200 ft west of MW-05S, under the Narragansett Electric ROW. Over time, part or all of the DNAPL accumulating in this topographic low may have entered the bedrock, provided the fracture openings were sufficiently

wide. These fractures could have carried the contaminants to the southeast toward the MW-13 and MW-02 clusters, where PCE and TCE were also detected at moderate concentrations.

However, records from development of the Centredale Manor building indicate that drums and contaminated soils were removed during the construction of the foundation of this building. These contaminants, now removed from the site, may have once presented a more localized source of contaminants to wells MW-02 and MW-13.

Regardless, the southern perimeter wells appear to be intercepting dissolved TCE and PCE contamination migrating south, but more predominantly southeastward through the bedrock valley and shallow bedrock via the southeastward flow of the groundwater. Whether the MW-05 area is a single large source of these contaminants, or if this is only a supplement to other sources that are or were present elsewhere, is unknown at this time.

1.0 PROJECT INTRODUCTION

This Technical Memorandum has been prepared to describe the sampling and analysis program and findings of the Source Area Investigation (SAI) for the Centredale Manor Site located in North Providence, Rhode Island. This work was authorized initially under Work Assignment Number 043-TATA-016P and then transitioned into W. A. 106-ANLA-016, Contract No. 68-W6-0045.

The scope of work for the SAI was to determine the extent of the source area of contamination, hydrogeological setting of the site, groundwater flow, and the extent of groundwater contamination at and adjacent to the Centredale Manor and Brook Village properties. Regional location of the Centredale Manor Restoration Project Site is presented as Figure 1-1. The "source area" defined for this investigation is depicted in Figure 1-2.

This Source Area Investigation used existing information, and augmented that information with new data to define sources of contamination and estimate contaminant discharges into the surface waters and wetlands. This is accomplished by provision of a conceptual groundwater model, showing input and output locations, and also showing where contaminants could enter the river system. Data were collected so as to determine where groundwater contamination is present, where it is likely to travel over time, and to identify if and what type of a remedial action is necessary. The data were collected such that the analytical results could be used to support full human health and ecological risk assessments if these are found to be needed in the future. Analytical data generated by this investigation were compiled into an existing database for future evaluation purposes.

Data quality objectives and other quality control information for this project are provided in the Quality Assurance Project Plan, Centredale Manor Restoration Project, North Providence, Rhode Island, TtNUS November 2000, and its revisions (QAPP). The QAPP provides the basis for collection of data, analytical specifications, collection procedures and other technical details pertaining to data collections and documentation.

This technical memorandum includes five sections: this introduction; the Site Background, including a brief summary of existing data; the sampling and analysis program performed for this study; the findings of the investigation; and the summary and conclusions from the study. The chemical data from samples collected are presented in Appendices A through D.

2.0 SITE BACKGROUND INFORMATION

This section presents background information for the Centredale Manor Site, including a site description, site history, and a summary of previous investigations. This section includes information previously obtained from the study area by EPA during the Woonsocket River Sediment/Water Quality Analysis (EPA, July 1998) and from an Expanded Site Investigation (ESI) of the Centredale Manor Site, North Providence, Rhode Island, performed by Roy F. Weston, Inc. (Weston, March 1999). Other data collected by the EPA Emergency Response Program and other efforts are also included.

2.1 Site Location and Description

This section presents a description of the Centredale Manor Restoration Project source area, the focus of the current study.

2.1.1 Site Description

The Centredale Manor is a multi-unit apartment complex that houses elderly adults. It is located at 2074 Smith Street (Route 44) in Centredale, a village of North Providence, Rhode Island. Figure 1-1 depicts the location of the site. The Centredale Manor apartment building and the adjacent apartment building known as "Brook Village", are located on the site of the former Metro-Atlantic Chemical Corporation, which operated from the 1940s to the 1970s in a former mill complex on the site. Parking lots, roadways, lawn areas, and two high-rise residential buildings currently comprise the source area. The Woonasquatucket River flows north to south on the west boundary of the Centredale Manor and Brook Village properties. The remains of a raceway for the former mill complex are present on the eastern boundary of the site. The Centredale Manor Restoration Project Site, as discussed in this report, includes all contaminated areas within this area as well as any other location where contamination from this area has migrated or any area from which this contamination originated.

A map showing current conditions of the source area is presented as Figure 2-1. The source area is defined for the purposes of this investigation to be inclusive of tax lots 14-200 and 14-250 in the City of North Providence, as well as a portion of tax lot 12-560. Historical

records identify the former Metro Atlantic Chemical Corp. facility and New England Container Drum recycling facility as having occupied Lots 14-200 and 14-250. An air photo survey shows filling and land clearing to have taken place on these lots. However, in addition, some ground disturbance and fill activities appear to have occurred on the north end of Lot 12-560, which abuts lot 14-250. Currently, Cap Area 1 covers portions of both lots 12-560 and 14-250 while Cap Area 2 is located on the south portion of lot 12-200. The location of these areas is depicted in Figure 2-1.

Historical records of Metro Atlantic Chemical researched by Weston (March 1999) indicate that the site manufactured hexachlorophene and that shipments of trichlorophenols were made to this location. The mill complex was destroyed by fire in 1972. In 1978, Brook Village was constructed, followed by Centredale Manor in 1982. During construction of Centredale Manor, 400 drums and 6,000 cubic yards of contaminated soil were removed from the site. Labels indicated that the drums contained caustics, halogenated solvents, PCBs, and inks.

A Preliminary Assessment (PA) performed on the site in August 1986, by NUS/FIT determined that surface water, soil, and sediment at the Site were potentially impacted. Performance of a Supplemental Site Investigation (SSI) was recommended. The SSI was performed by NUS/FIT in 1990. During this SSI, elevated concentrations of VOCs, SVOCs, pesticides/PCBs, and metals were detected in 10 soil samples collected from the Site. Weston found additional rusted empty drums on the Site near the Woonasquatucket River in October 1995, while performing a Site Inspection Prioritization (SIP) investigation of the property (Weston, 1999).

A study conducted in June 1996 by the EPA Narragansett Laboratories and the Providence Urban Initiative Program (EPA, 1998) determined that elevated levels of dioxins were present in fish collected from the river. A subsequent study of the Woonasquatucket River conducted by the USEPA OEME in June 1998 found elevated concentrations of dioxins and PCBs in sediments from portions of the river and impoundments adjacent to and downstream of Centredale Manor (EPA, July 1998). Soil and sediment sampling conducted by EPA START personnel in September 1998 found dioxins at concentrations up to 10.1 ppb in sediments collected from the exposed bottom of the former Allendale Pond (Weston, March, 1999). Allendale Pond is an impoundment located immediately downstream of the Centredale Manor Site. The Mill dam that contained Allendale Pond was breached in 1991, exposing the

contaminated sediments. Further sampling conducted in February 1999 on the Centredale Manor property also found elevated concentrations of dioxins in soils and sediment.

Additional historical information on the Woonasquatucket River and Centredale Manor Site is available in the Expanded Site Inspection Report, prepared by Weston (March, 1999).

2.1.2 Historical Description

An Aerial Photographic Analysis was performed on the source area by EPA Office of Research and Development (July, 2000). Aerial photos from 1939 to 2000 were reviewed and interpreted to identify "landscape morphology, patterns of hazardous waste disposal and other observable activities and conditions of environmental significance". Figure 2-2 and 2-3 present aerial photographs taken in 1962 and 1970 respectively. Figure 2-4 depicts a summary of former site structures and features described in this section.

The analysis highlights the existence of the building complex reportedly occupied by Metro Atlantic Chemical Corporation in the north portions of the source area and varying degrees of disturbance and disposal advancing into wetlands south from that facility with time. The 1951 photo shows the presence of a probable drum recycling facility at the south end of the complex, immediately north of the current location of the Centredale Manor north parking lot. Later photos show additional buildings adjacent (south) of that facility in the current location of that parking lot. The Sanborn atlas map dated 1956 concurs with the identification of these buildings.

The photos from the 1950s and 1960s show that the former mill complex was located to the north of the existing Centredale Manor north parking lot, east of the existing Brook Village building. A smaller building was located on the space currently occupied by Brook Village, along with parking areas. The raceway, located on the east boundary of the source area, is visible as a maintained structure only in the area adjacent to the original mill building, and gives way to an apparently unimproved ditch or creek north of the drum recycling building.

In the photos taken in the 1950s, there is evidence of two waste disposal areas to the immediate west and south of the drum recycling building, in the vicinity of the Centredale

Manor building and north parking lot. Drainage from the facility is evident leading west in the 1951 photo. Drainage from the waste piles to the south appear to be to the east and to the adjacent raceway. The beginnings of waste disposal is also evident in this period at the current location of the south parking lot for Centredale Manor, with drainage into the Woonasquatucket River.

Photos from the 1960s show indications of unknown activity in the location of the current south parking areas of Brook Village. This includes stained soils (possibly from westerly drainage from the drum recycling building), stacked drums and a building that first appears on the 1965 photo. This building is not present in the 1970 photo, but indications of stained soils and drums are still evident. These photos also show impoundments in the current location of the Centredale Manor parking area and Cap Area 2.

Figure 2-2 is the aerial photograph taken of the Centredale Manor Site subarea on February 7, 1962. This photo features several of the historical buildings and structures formerly present on the Centredale Manor property in addition to evidence of activities taking place on the site. This photograph shows evidence of six vertical tanks present in the northern portion of the area in addition to a possible outfall on the east side of the older building. Three locations of probable stacked drums are labeled as DR-6, DR-7 and DR-8. Respectively, these three areas contained 99, 108 and 72 drums. South of DR-8, areas of grading scars are evident where liquid wastes were previously photographed (1956) being spread on the ground and covered with earthen materials (July 2000).

A large amount of waste disposal is evident across the site between 1962 and 1970. This is particularly evident in the area between the North parking area and the southern limit of the source area, defined by the current location of Cap Area 1. In the 1962 and 1965 photos, grading scars are evident in the current location of the Centredale Manor building. An unidentified building is shown in the 1970 photo in the southern portion of Cap Area 2. Extensive waste, grading scars and disturbed soils are evident in the current location of the northern half of Cap Area 2 in the 1963 photo, and in a strip along the west side of a roadway leading across the current location of the south parking area to the current location of Cap Area 1 throughout the period between 1962 and 1970.

Figure 2-3 is another aerial photograph taken of the Centredale Manor Property on March 9, 1970. The north and central portions of the subarea contain five areas with stains and one area with a possible stain. These portions of the site also contain three impoundments, labeled IM-1, IM-2 and IM-3. The extreme southern portion of the subarea contains a large deposit of probable solid waste along both sides of the southernmost extent of the subarea access road. The area west of the subarea access road contains three groupings of stacked probable drums, DR-10, DR-11 and DR-12, each consisting of 144, 383 and 640 drums respectively.

The photo presented for 1979 shows cessation of waste-related activity, and sparse vegetation across the previously disturbed area. This photo also shows Brook Village developed with parking areas.

2.2 Previous Environmental Investigations

This section describes previous environmental investigations of the Centredale Manor Property. These reports were reviewed in order to prepare the QAPP and to design the Source Area Investigation described in this Technical Memorandum.

2.2.1 Woonasquatucket River Sediment/Water Quality Analysis – OEME, July 1998

EPA OEME conducted a study of river sediment and water in 1998. This investigation involved collection and analysis of sediments for dioxin, 1,2,4,5,7,8-hexachloro(9H)xanthene (HCX), polyaromatic hydrocarbons (PAHs), PCBs, pesticides, total organic carbon (TOC), total metals, and acid volatile sulfide/simultaneous extracted metal analysis (AVS/SEM) of copper, zinc, lead, cadmium, nickel, and mercury. Surface water was analyzed for dissolved oxygen, temperature, conductivity and pH. The purpose of the investigation was to determine the source of dioxins, HCX, and other contaminants previously detected in fish tissue by OEME in June 1996. Sediment and surface water samples were collected from seven impoundments of the Woonasquatucket River formed by the Esmond, Allendale, Lymansville, Manton, Dyerville, Olneyville, and the Lonigan dams. The samples were collected in depositional areas of the impoundments that had silt or clay bottoms (sediments in the Allendale Pond impoundments were exposed at the time since the dam had breached in 1991).

Dioxins and HCX were detected at all seven sample locations. The highest dioxin concentrations were detected in the sediments of the Allendale Pond and Lymansville Pond impoundments that are located adjacent to and downstream of the Centredale Manor Site, respectively. Metals were detected at all sites in varying concentrations and frequencies. The greatest cyanide concentrations (in descending order of concentration) were detected at the Esmond, Lymansville, and Allendale Pond impoundments. The highest concentrations of PAHs were detected in the Allendale Pond impoundment. The highest concentrations of PCBs were detected (in descending order of concentration) at the Dyerville, Lymansville, and Allendale dams.

The results for 2,3,7,8-tetrachloro-*p*-dioxin indicated the presence of a contamination source between the Esmond and Allendale dams that was once associated with the manufacturing of 2,4,5-trichlorophenol and hexachlorophene. Historical records indicate that the former Metro Atlantic Chemical Company received shipments of trichlorophenol and manufactured hexachlorophene at the Centredale Manor Site.

Human health and ecological risk screens were performed using the analytical results of the OEME sediment sample analysis. Contaminants of Concern (COCs) identified in the sediment samples included PCBs, PAHs, and dioxins. Results of the human health risk screen indicated that below the Allendale dam, benzo(a)pyrene and dioxins might contribute equally to total cancer risks. At the Lymansville dam, where the greatest dioxin concentrations were detected in the 1998 study, the majority of the cancer risk is posed by dioxin. However, these risks were low given that the contaminants were located at the bottom of the impoundments, limiting a person's frequency of exposure. Because these same concentrations would pose a health hazard if they were present in a residential setting, EPA recommended that additional data for shoreline sediment samples be collected in high access areas to more accurately assess exposure to recreational users of the river.

The results of the ecological risk screen indicated that the greatest risk of metal toxicity to benthos was at the Dyerville dam location. PCB, PAH, and dioxin concentrations in sediments appeared to represent a risk of chronic exposure to benthic and pelagic communities in the River. Because the sediment sampling data were limited in lateral and vertical extent,

additional sampling was recommended to better define the extent of the contamination and the corresponding ecological risks it imposed on the river's aquatic habitat.

2.2.2 Expanded Site Inspection (ESI) Centredale Manor - Weston, March 1999

The ESI performed by Weston (Weston, March 1999) for the Centredale Manor Site reviewed the history of environmental contamination at the Centredale Manor Site. The ESI stated that the Site was the former location of the Atlantic Chemical Company and New England Container, Inc., which was a drum recycling facility. Over 400 drums were identified on the site during the period from 1977 through 1981. Records show that approximately 60 drums were re-located from a wetland adjacent to the Woonasquatucket River and approximately 150 drums were observed along the bank of the river. Approximately 10 open drums containing sulfuric acid were removed during this period.

During construction of the Centredale Manor apartment complex in 1982, approximately 400 drums and 6,000 yards of contaminated soil were removed for disposal. Additional suspected buried drums were identified in the western portion of the property during a ground-penetrating radar survey performed in 1986. A preliminary assessment (PA) performed on the site in August 1986, by NUS/FIT determined that surface water, soil, and sediment were potentially impacted. The SSI was performed by NUS/FIT in 1990. The study detected elevated concentrations of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides/PCBs, and metals in 10 soil samples collected. Weston found additional rusted empty drums on the Site near the Woonasquatucket River in October 1995, while performing a Site Inspection Prioritization (SIP) investigation of the property.

Weston collected nine sediment samples as part of the SIP, including three from the river and six from the wetland area. Analytical results indicated the presence of elevated concentrations of VOCs, SVOCs, and metals at concentrations greater than or equal to three times the reference sample concentrations. No pesticides or PCBs were detected in these samples.

In response to the subsequent discovery of dioxin in fish tissue samples, and the OEME sediment and water quality investigation findings, Weston initiated an ESI of the Centredale Manor Site under the direction of EPA. The ESI was initiated in June 1998, to address the

presence of dioxins/furans and hexachloroxanthene (HCX) contamination on the Site, the extent of contamination in areas of potential human exposure, and potential source areas located upstream of the Site. This was the first investigation to analyze for the presence of dioxins and HCX on the Centredale Manor Site.

On September 5, 1998, START personnel collected five soil samples from the Centredale Manor property, one soil sample from the Brook Village property, 35 sediment samples from the Woonasquatucket River, and four sediment samples from the former drainage canal. Analysis of these samples indicated that SVOCs, pesticides, PCBs (Aroclor 1254), dioxins and HCX were detected at concentrations exceeding reference values in various sediment samples collected along the Woonasquatucket River downstream of the Centredale Manor property.

Pesticides, PCBs, dioxins, and HCX were detected at concentrations exceeding reference values in the drainage channel and downstream sediment samples.

The highest concentration of dioxins was identified along the drainage channel adjacent to the Centredale Manor property. The maximum dioxin concentration detected during the 1998 START project in the Woonasquatucket River was found in a sediment sample collected from Allendale Pond (10.1 ppb). Dioxin concentrations detected in sediment samples collected upstream from the Centredale Manor Site were significantly lower than those collected adjacent to and downstream of the Site.

The greatest number and highest concentration of SVOCs were detected in the sample collected farthest downstream, whereas elevated concentrations of PCBs were detected only in samples collected from Allendale Pond. Pesticide compounds, PCBs, and various dioxin compounds were detected at concentrations greater than three times the reference values in sediment samples collected along the Woonasquatucket River upstream of the Centredale Manor property. Seventeen of the SVOCs were detected at the highest concentrations in sample SD-37, which was collected approximately 1.8 miles upstream of the Centredale Manor property. The highest PCB concentration (7,800 ppb) found during this study was detected in a sample collected upstream of the Centredale Manor Site.

2.2.3 Emergency Response Actions

In 1999, the IT Group (IT) provided support for EPA emergency response actions at the site. During these actions, an extensive investigation was performed on surface soils at the source area. In addition, residential and sediment samples were collected downstream of the source area for analysis of dioxins and other contaminants.

Surface and some subsurface soil samples were collected from the source area using hand augers and direct-push sampling techniques. Surface soil samples were collected to determine immediate risk to public health and the environment. Data from the surface soil samples were used to identify areas where contaminants were present at unacceptable concentrations. These areas were subsequently covered with a temporary cap system to prevent contact and reduce potential for downstream erosion of contaminated sediments and soils.

Subsurface soil samples were also collected at a subset of the surface soil locations. At most locations, concentrations of contaminants decreased with depth, but due to limitations of the sampling approach, the vertical extent of fill or of contamination were not reached. The subsurface data reported by IT (March 16, 2000) show concentrations of PCBs in excess of 1000 mg/kg and concentrations of dioxins above 10 ug/kg in subsurface soils. In addition, VOCs, SVOCs and metals were found above the Rhode Island Department of Environmental Management (RIDEM) standards for residential soil.

The following VOCs exceeded the RIDEM residential soil standards in subsurface soils (collected below two feet below ground surface).

- benzene,
- 1,2 dichloroethene,
- chlorobenzene,
- tetrachloroethene,
- trichloroethene,

- toluene, and
- xylene (total).

VOCs were detected at high concentrations in subsurface soils in the northeast corner of Cap Area 2 (CMS-417), and in the northernmost of two borings installed in the north parking lot of Centredale Manor (CMS-419). Slightly elevated concentrations of VOCs were detected in two borings (CMS-405 and -408) installed in the southeast corner of the south parking lot for Centredale Manor. Traces of VOCs were detected in surface soils collected at CMS -060, located on the east bank of the Woonasquatucket River at the south parking lot for Brook Village. Historical air photos for all of these locations show previous storage or disposal activities, and/or locations of geophysical anomalies.

The following SVOCs exceeded the RIDEM residential soil standards in subsurface soils (collected below 2 feet below ground surface): benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, chrysene, dibenzo(a,h) anthracene, indeno(1,2,3-cd)pyrene, napthalene, and bis(2-ethylhexyl)phthalate. Low concentrations (below 10 ug/kg) of these SVOCs were detected in surface and subsurface soils across the source area. Elevated concentrations of phthalates and naphthalene were found in surface soils at stations CMS-417 and 405. These two stations also showed high concentrations of VOCs.

Elevated concentrations of arsenic, beryllium, lead and thallium were found in surface and subsurface soils across the site. Most notable were lead concentrations exceeding 1000 mg/kg in subsurface soils at CMS-405 and 237 (co-located with a set of geophysical anomalies in the south parking lot of Centredale Manor) and at CMS 419 (former location of drum storage).

Elevated concentrations of PCBs (mostly Aroclor 1254) were found in surface and subsurface soils across the source area. PCB concentrations greater than 100 mg/kg were found in subsurface soils in two specific locations: one is the northern section of what is now Cap Area 1, co-located with a series of geophysical anomalies, and the second is the east side of the north parking area for Centredale Manor, immediately south of what is believed to be the location of the former drum recycling facility (refer to Section 5.2.2.1).

Dioxins, including 2,3,7,8-TCDD, were found in surface soil and sediment of what is now Cap Area 1, in the pond, and in wetlands downstream of the Source area. To a lesser extent, TCDD was also detected in surface soils of Cap Area 2. Dioxins were detected at location CMS-060, situated on the east bank of the Woonasquatucket River at the south parking lot for Brook Village, and immediately to the northeast of the parking lot.

2.2.4 USGS Water-To Vapor Diffusion Study

In September 1999, the USGS installed water-to vapor VOC diffusion samplers in the bottom sediments of the Woonasquatucket River and Raceway that bound the site. In addition, samplers were also placed in some of the canals that intersect the wetlands to the south of the source area.

In accordance with the USEPA Region I standard air screening method (USEPA, 1998) samples were screened on site for VOCs. Samples were analyzed for the target compounds benzene, toluene, ethylbenzene, xylenes, chlorobenzene, tetrachloroethene, 1,1,1-trichloroethane, and trichloroethene, and reported values in parts per billion by volume.

This diffusion study found relatively high concentrations of TCE and PCE (maximums of 182,000 ppbv and 1,390,000 ppbv respectively) in samplers installed in the Woonasquatucket River channel adjacent to the two southern most parking areas for Brook Village. Relatively low concentrations (10-100 ppbv) of these compounds were detected in almost all samplers installed in the Woonasquatucket river sediments, with the exception of those installed upstream of the Brook Village building. Most of the samplers installed in the raceway detected no contamination, although notable concentrations of PCE and TCE were detected in samplers installed adjacent to the Centredale Manor building, and in those installed near the terminus of Redfern Street. TCE and PCE were also detected at concentrations exceeding 1000 ppbv in the so-called cross channel that bounds the southern edge of Cap Area 1. Similar results were reported for samplers installed in the sediments of downstream portions of the Woonasquatucket River and the Lower Mill Raceway, which together bound a small island-like formation south of Cap Area 1. Most of the other installed samplers detected no other target compounds.

Water flow during the period of collection was variable with two separate high flow periods: September 10, 1999 and again on September 16-17, 1999. It is not known what effect, if any, this flow regime had on the testing conducted.

The water-to-vapor diffusion findings indicated a widespread presence of TCE and PCE in the subsurface sediments. These sediment VOCs are possibly interchanging with the waters of the Woonasquatucket River. The relative concentrations reported by USGS indicate a possible discharge area near the two southernmost parking areas for Brook Village, and a more diffuse presence of these contaminants south of the source area.

2.2.5 Woonasquatucket River Sediment Investigation- TtNUS June, 2000

In October 1999, TtNUS conducted an investigation of the sediment in the Woonasquatucket River from the Centredale Manor property south to the Lymansville Dam. Samples were collected for SVOCs, PCBs, pesticides, metals and dioxins. HCX was also identified in the samples from this data set and reported as a tentatively identified compound from the dioxin analysis. Data collected as part of previous investigations were used to develop a comprehensive database to evaluate extent of contamination in the river system. The findings indicated that dioxins and PCBs are present in the river and pond sediments. Concentrations of these contaminants appeared to be higher in depositional areas, and decreased with increased distance from the source area. Highest concentrations of dioxin were found in the sediments immediately south of the source area in the Allendale Pond and associated wetlands.

2.3 Previous Geologic Investigations

The geology of the underlying materials at the source area has been evaluated during three separate, limited investigations prior to the SAI. Geotechnical borings were installed by Allstate Drilling (Allstate) in 1975 and American Drilling and Boring Co. Inc. (American) in 1976, apparently within the footprint of the Brook Village building at the north end of the source area to support the building's design and construction. Geotechnical borings and test pits were performed in 1981 by Guild Drilling Co. Inc. (Guild) and Allstate, and 1982 by GZA Consultants (GZA), apparently within the footprint of the Centredale Manor Building to support the design

and construction of that building. Finally, In March 1999, Goldman Environmental Consultants (GEC) installed borings finished as monitoring wells in the Brook Village parking areas to investigate possible releases from a UST on the south side of the Brook Village building.

2.3.1 Brook Village Area

The Brook Village geotechnical borings (Allstate and American) were compared with those installed by GEC. The findings of each group were evaluated with the consideration that each set of borings were installed for different purposes using different drilling techniques. Allstate installed five shallow geotechnical borings for building footings in 1975 to depths between 11.5 feet and 16 feet below ground surface (bgs) using drive and wash techniques. American Drilling and Boring installed six borings in 1976 within the same area to depths between 36 feet and 60.4 feet bgs also using drive and wash techniques. In 1999, GEC installed seven borings in the Brook Village parking areas to depths between 11 and 15 feet bgs using hollow stem augers.

The logs provided by Allstate show fill to approximately 4 feet bgs, peat and silt to 6 feet bgs, and a mixture of sand, gravel and silt to approximately 12 feet bgs. Some of the logs provided by American drilling show the presence of fill in the upper 4 feet of material, and a mix of sand and gravel with silt to varying depths. In some of these logs more sand was encountered at depths between 15 and 30 feet or deeper: one boring log indicates the presence of sand and gravel mix to a depth of 60 feet bgs. Rock was cored in one boring between 45.5 feet and 50.5 feet bgs. This was the only attempt made to confirm bedrock. Refusal was encountered in two other of the six borings at 46 feet bgs and 60.4 feet bgs. The remaining three logs from borings installed by American show boring completion between 31.5 and 36.5 feet bgs. Boring logs provided by GEC also indicate fill present to approximately 3 to 6 feet bgs, and identify sand, silt and gravel between the fill at depths between 7 and 14 feet bgs. Below 14 feet, GEC identifies the geologic material as till; however, base on the boring log information, it is unclear how till was defined. Although the blow counts were relatively higher in this material, the presence of gravel may have repelled the split barrel samplers. Blow counts are similar in these boring logs as compared to those provided by American, although those logs do not identify the material below 14 feet as till.

2.3.2 Centredale Manor Area

A series of geotechnical borings and test pits (Guild, Allstate, and GZA) were installed in 1981 and 1982 to evaluate the subsurface conditions and to support design of the Centredale Manor building. This information was reviewed to develop a better understanding of the geology of the source area. A fragment of a report by GZA (January 20, 1982) with Responsiveness Documents (GZA, April 14, 1999) provides an evaluation of these boring logs. Figures accompanying this information did not show locations of most of the borings or test pits, however, because these explorations were performed to support building design, it is presumed that the investigations were performed within the existing footprint of the Centredale Manor building.

The following information is summarized from that report:

Fill

Overlying the entire site is a loose to very dense, predominately granular fill consisting of a mixture of sand, gravel silt, and trash. Occasional pieces of wood and metal were encountered. Fill thickness appears to vary from 2 to about 6 feet, and averaged about 4 feet. Penetration test "N" values range from 8 to greater than 50 blows per foot.

Organic Silt

Based on the test pit explorations, the fill is believed to be underlain by a layer of black organic silt. This deposit is described as varying from a peat to a fine sand, some silt, and is about 1 to 2 feet thick.

Gravel/Sand

The test pit information and the test boring data indicate that the organic deposit is underlain by a layer of granular material ranging from a gravel, some sand with cobbles, to a sand, some gravel, with trace non-plastic fines. "N" values ranged from 11 to 45 blows per foot indicating a medium to dense consistency. The thickness of the

layer ranged from 6.5 to 14.5 feet, placing the bottom of the layer at depths of 10 to 21 feet bgs.

Fine Sand/Silt

Underlying the sandy gravel is a very loose to loose material varying from a fine sand, some silt, to a silt and sand. The borings indicate that this deposit occurs as a continuous layer between 4 to 12 feet in thickness. "N" values ranged from 3 to 11 blows per foot.

Sand/Gravel

Underlying the fine silt/sand strata is a medium-dense to dense, stratified, fine to coarse sand, little to some fine gravel with trace silt. In two of the borings, layers of fine sand/silt were encountered below 45 feet. The thickness of these strata is undetermined, since the borings were terminated in this material. Refusal was encountered in borings B-3 and B-4 at depths of approximately 21 to 26 feet, respectively. Based on other boring data and on the fact that cobbles were observed in the upper gravel/sand unit, refusal was not interpreted as a conclusive indication of bedrock.

Groundwater Condition

At the time of the exploration, groundwater was encountered in all of the borings at depths ranging from 1 to 4.5 feet, which correspond to elevations between 92 and 94 feet above msl (no datum provided). These measurements agree with surveyed water elevations in the adjacent river and marshes (elevation 93.8) shown on a topographic plan prepared by Capoto and Wick Ltd. dated October 1981.

This assessment did not include observations noted in the test pit logs of chemical and oil odors. Such odors were reported in all strata to a depth of up to five feet bgs in one test pit. In a second test pit, a sweet chemical odor was noted in the organic silt stratum between 1 to

3.25 feet bgs, and an oil odor was noted in the sandy gravel stratum found between 3.25 feet msl, and at the bottom of the test pit.

2.3.3 Geophysical Surveys

Two geophysical surveys were conducted in April 1999 and in July 1999 at the Centredale Manor and Brook Village properties to supplement those conducted in 1986. These were performed to determine if there were indications of buried objects that may be contributing to the on-site contamination. The results of the surveys are summarized in the Final Report for Centredale Manor, prepared by Lockheed Martin (September 13, 1999). The first survey found a number of locations of potential concern, however, follow up investigations discounted many of these locations as being related to underground utilities (fire hydrants, electrical lines and road boxes, etc). The GPR and EM data indicated that the other locations of potential concern may be the result of mixed metallic fill and/or construction debris.

The report states that 13 significant undetermined EM anomalies were identified. The GPR signature characteristics indicated that these features could consist of metallic fill or construction debris. These are located primarily in two groups: one group of five anomalies is present in the north end of what is currently Cap Area 2, which is an area where drum storage and waste disposal is evident on historic air photos. Another group of four anomalies is present at the south end of the south parking lot and Cap Area 1, and correlates with an area where evidence of solid waste is noted on historic air photos. Two of these anomalies located in the south parking lot of Centredale Manor were reported to have the highest potential for containing buried bulk metallic materials. Three anomalies are located across the southern portion of Cap Area 2 and the South parking lot, and one is located east of Brook Village, at the former location of a series of vertical tanks observed on air photos taken between 1965 and 1962. However, the single anomaly in the north of the source area is very likely to be a foundation for these tanks, buildings, or the raceway structure, which were also present in this area.

GPR cross sectional profiles collected in the Brook Village parking areas indicated a sequence of stratified materials that may suggest the presence of alluvial deposits from a paleochannel.

2.4 Centredale Manor Restoration Project Source Area Investigation

As described in Section 2.2.6 of this Technical Memorandum, dioxins and other contaminants may have been transported from the Centredale Manor Site by the Woonasquatucket River and deposited in adjacent and downstream areas. Additionally, contamination still exists in the source area of the site, described in Section 2.1. To date, RIDOH still maintains a consumption advisory on all fish caught from the River due to high dioxins concentrations.

Existing information collected regarding site contamination was insufficient to adequately characterize the risks to human health and the environment from dioxins, HCX, and other contaminants (metals, PCBs, and PAHs) in the soil and groundwater at the source area. Additionally, there are indications that contaminants in soils may be migrating from the soils in the source area to the river or wetlands downgradient of the site. Therefore, EPA initiated this expanded source area investigation to support risk characterization and remedial processes.

In summary, the Centredale Manor Restoration Project Source Area Investigation (the subject of this Technical Memorandum) was conducted to investigate the source area for the Centredale Manor and Brook Village properties in order to obtain data to evaluate site-related soil and groundwater contamination and migration pathways. These findings may be used in the future to support possible preparation of a human health risk assessment, and possible engineering evaluations for remedial alternatives.

3.0 FIELD SAMPLING ACTIVITIES

This section describes the field data collection activities that were performed as part of the Centredale Manor Restoration Project Source Area Investigation. Additionally, this section provides a description of how these tasks were performed based upon regulatory action limits and data objectives. All data collection efforts were conducted in accordance with the Quality Assurance Project Plan for the Centredale Manor Restoration Project (TtNUS, 3/01 as amended), along with supporting documents and standard operating procedures (SOPs). Figures 3-1 and 3-2 depict the locations surveyed and sampled by TtNUS during this investigation.

Field investigation activities included:

- Surface geophysical surveys
- Soil and bedrock borings and well installations (including soil sampling and analysis and borehole geophysics)
- Water level monitoring
- Groundwater sampling and analysis
- Hydraulic conductivity testing

3.1 Surface Geophysical Surveys

Surface geophysical surveys were conducted by Hager Geosciences, Inc. (HGI) in the site vicinity, including ground penetrating radar (GPR), 2-D resistivity imaging, and seismic refraction. Figure 3-1 presents traverse lines for these surface geophysical investigations. These surveys provided data to characterize overburden materials, estimate depth of fill and depth to bedrock, and characterize the general bedrock surface configuration. These data were also used to assist in refining the positioning of monitoring wells installed during this investigation, and provided information to refine the site conceptual model.

A test of the various GPR systems was initially conducted, which consisted of examining the resolution and depth penetration afforded by antennae of frequencies 35, 40, 80, 200 and 400 MHz, and comparing the relative benefits of data collected in continuous and point modes. Overall, the 35 MHz antenna provided best information for the depth to the bedrock surface

and deep stratigraphic features, while the 200 MHz antenna was better able to resolve near-surface stratigraphy.

Seismic refraction was conducted using compressional (P-) wave sources to confirm depth to bedrock. Geophone spacing between 5 and 10 feet, in combination with off-end shots of greater than 75 feet, provided sufficiently large geometry to record the bedrock horizon refractor.

The third phase of the surface geophysical surveys included an investigation into the potential use of resistivity methods at the Centredale Manor Site. HGI performed a series of tests using a Swift Sting® resistivity unit configured for a dipole-dipole electrode array. Two locations were chosen for investigation, one on the northern-capped area and the other parallel to its eastern margin (Not shown on Figure 3-1).

Following the completion and evaluation of the initial surface geophysical work described above, additional geophysical work was considered for the SAI, including the use of square array azimuthal resistivity to provide data for estimating bedrock fracture orientation in the area. However, the low density of subsurface data significantly limited the utility of the resistivity method, therefore, this additional survey was not performed.

3.2 Soil and Bedrock Borings and Well Installations

Subsurface investigation activities described in this section include: installation of a series of piezometers and surface water gauges; advancement of overburden and bedrock borings; installation of overburden and bedrock monitoring wells; collection and analysis of soil samples during boring advancement; and borehole geophysics performed following bedrock coring.

3.2.1 DPT Piezometers and Water Level Monitoring

As part of the initial drilling activities, a network of piezometers and surface water gauges were installed using direct push technique (DPT). Using DPT methods, 21 small diameter (1-inch) piezometers with screened lengths of 5 feet were installed in the source area during this program. Piezometer locations are indicated in Figure 3-2. The piezometers were advanced

and screened in the shallow water table aquifer strictly for the purpose of providing groundwater table elevation measurements. These data were evaluated to better define the groundwater table configuration at the site. These installations were not used for soil or groundwater sample collection purposes.

Recording electronic transducers were installed at selected piezometer for the purpose of long-term groundwater level monitoring at the site. In addition, three surface water gauges were also installed in the Woonasquatucket River and in the Centredale raceway (locations indicated in Figure 3-2). Water table elevation measurements from these installations and from an existing USGS gauging station in the Woonasquatucket River were monitored continuously over time using In-Situ® data recorders. These water level monitoring efforts are discussed further in Section 3.3 of this report.

3.2.2 Overburden Wells/Borings

Soil borings were advanced and overburden monitoring wells were installed in the vicinity of the former raceway to the east of the source area, as well as within the source area. These drilling, soil sampling, and well installation activities are discussed below.

Raceway borings and Monitoring Wells

Five soil borings were advanced in the former raceway, to the east of the source area. Figure 3-2 depicts the raceway boring locations (MW-01, MW-02, MW-03 and SB-02, SB-03). The exact locations for these borings were determined in the field using the historic aerial photographs and landmarks, such that the borings were installed as close as possible to the former centerline of the former raceway watercourse. These borings were installed in order to determine the presence and thickness of fill in the former raceway and to provide data for evaluation of the nature and extent of soil contamination in the former raceway.

At each location, continuous subsurface soil samples were collected to the bottom depth of fill. These samples were collected using a 3-inch diameter split barrel sampling tool from 1-foot intervals beginning at 1-foot bgs. The soils were classified using the Unified Soil Classification System (USCS). The classification of geologic materials assisted in evaluating the presence

of potential confining layers and/or preferential pathways for groundwater transport. This information also may be used to support a possible future conceptual design for the restoration of the raceway as a drainage channel. The samples of fill were collected and analyzed for the following parameters: VOC screening using jar headspace, and laboratory analysis for VOCs, SVOCs, pesticides/PCBs, metals, and dioxins.

The borings were continued beyond the depth of fill to a minimum of 20 feet bgs to characterize the upper unconsolidated overburden. Continuous soil samples were collected and screened using the jar headspace technique for total volatile organics compounds (VOCs). These samples were also classified using the USCS. Headspace screening results for VOCs in soils were used to identify zones of highest potential contamination. These data, in conjunction with the soil characterization and visual observations of staining or other evidence of potential contamination (i.e. odor), were used to determine the vertical position of well screens such that the screens would most likely intersect soils suspected to carry contaminants within the groundwater.

Three shallow groundwater monitoring wells were installed in selected raceway borings (MW-01, MW-02, MW-03) to provide data to evaluate groundwater flow direction and potential groundwater contamination in the vicinity of the former raceway. Multiple zones of potential contaminants were not identified in the shallow portion of the soil column in a single boring, therefore only one well was installed in each raceway location.

Boring logs and well installation details are provided in Appendices A and B, respectively.

Source Area Shallow Borings and Monitoring Wells

Four shallow borings were advanced adjacent to suspected contaminant sources as shown on Figure 3-2 (MW-06, MW-07, MW-08, and MW-09). The exact locations of these borings were determined in the field to coincide with areas of ground disturbance visible in historic aerial photographs and adjacent to (but not overlapping) geophysical anomalies described in Section 2. As with the raceway borings, these borings were advanced to determine the thickness of fill in the source area, as well as to provide data to evaluate the nature and vertical extent of soil contamination at and above the water table. The soils were classified

using the USCS. The description of geologic materials assisted in evaluating the presence of potential confining layers and/or preferential pathways for groundwater transport.

During advancement of the source area borings, continuous samples of subsurface soil were collected to the depth of the bottom of fill using a 3-inch diameter split barrel sampling tool. Approximately 8 feet bgs was the lowest depth at which fill was encountered. The samples were collected at 1-foot intervals beginning at a point immediately below the cap materials or parking lot bedding materials. Samples of soil presumed to be fill or identified as fill were analyzed for the following parameters: VOC screening using jar headspace, and laboratory analysis for VOCs, SVOCs, pesticides/PCBs, metals, and dioxins.

The borings were continued beyond the depth of fill to a minimum of 20 feet bgs to characterize the upper unconsolidated overburden. Continuous samples were collected and screened using the jar headspace technique for total VOCs. Screening results were used to identify zones of highest potential for contamination within each boring. These data, in conjunction with the soil characterization and visual observation of staining or other evidence of potential contamination were used to determine the vertical position of well screens. The portion of the saturated zone that had the highest likelihood of contamination was selected for the screened interval. Multiple separate zones of suspected contamination were not found in any single boring, so no additional wells were installed at that time.

The four shallow source area borings were finished as monitoring wells (MW-06, MW-07, MW-08, and MW-09). Boring logs and well installation details are provided in Appendices A and B, respectively.

3.2.3 Cluster Borings and Monitoring Wells

Boring and monitoring well clusters were installed around the perimeter of the source area and in "downgradient" and "discharge" areas. Drilling, soil sampling, geophysical activities, and well installation activities are discussed below.

Perimeter Borings and Monitoring Wells

Four clusters of two to three monitoring wells per cluster (one bedrock well, plus one to two overburden wells, depending on saturated thickness of the overburden) were installed in areas around the perimeter of the source area [MW-10 (clustered with an existing well on town property) MW-11, MW-12 and MW-13]. Two of the well clusters (MW-11 and MW-12) are located to the west and southwest of the source area (opposite side of the Woonasquatucket River) and two well clusters (MW-10 and MW-13) are located to the east of the source area (opposite side of the raceway). The original proposed locations for these wells were revised based on an evaluation of Phase 1 data, including geophysical survey results and a meeting with the EPA. The final locations are depicted on Figure 3-2.

These borings/wells adjacent to the source area were advanced to provide confirmation of depths to bedrock, and to provide water level measurement points for the evaluation of vertical and horizontal groundwater gradients surrounding the source area, in bedrock, as well as in shallow and deep overburden. These wells were also used for groundwater sampling purposes in order to provide groundwater quality data for the source area perimeter.

Continuous soil samples that were collected during the advancement of the initial boring of each cluster were evaluated in the field using VOC headspace screening techniques, and were described using the USCS soil classification system. These evaluations were used to select the screened intervals for the overburden wells. Soil samples were not collected from these locations for laboratory chemical analysis.

Bedrock was cored at each cluster location to an estimated depth of 30 feet below the top of rock. One "open hole" bedrock groundwater monitoring well was installed at each well cluster, following the collection of field data, including packer tests conducted during drilling. Other field data collected included visual observations of fractures and weathering in the rock core, drilling rates, and loss or gain of water during bedrock drilling.

Borehole geophysical surveys were also conducted within each bedrock hole of the well clusters. The objectives of the borehole geophysical surveys were: to determine the orientation of linear features in the boreholes; to determine the zones that produce water

under static and stressed conditions; and to measure natural gamma radiation. Borehole geophysics activities generated heat pulse flow meter logs, caliper logs, natural gamma logs, and borehole acoustic televiewer logs for each bedrock borehole.

"Downgradient Area" or "Discharge Area" Borings and Monitoring Wells

Five clusters of two to three monitoring wells per cluster were installed in areas downgradient of hot spots within the source area. These rationale for the locations of these well clusters are discussed below:

- MW-04 Cluster — South end of Cap Area 1, one bedrock well, two overburden wells. Location of elevated concentrations of TCE and PCE in vapor diffusion samples collected by USSGs
- MW-05 — Single shallow well west of Brook Village parking lot 3, near location of high concentrations of TCE and PCE in vapor diffusion samples collected by USGS
- MW-02 Cluster — Two overburden wells at downgradient end of bedrock valley identified by seismic refraction
- MW-14-Cluster — One deep overburden well clustered with existing well GEC-6, hydraulically downgradient of hot spot identified at MW-05 during flood conditions.
- MW-15-Cluster — One deep overburden well clustered with existing well GEC-2, hydraulically downgradient of the former mill complex during normal river conditions.

Well locations are depicted in Figure 3-2.

These borings/wells were advanced to provide information on extent of contamination in soils and groundwater, to confirm depths to bedrock, and to provide water level measurement points for evaluating vertical and horizontal groundwater gradients in these areas south of the source area, within bedrock and in shallow and deep overburden. These wells were also used for groundwater sampling purposes, in order to provide data on groundwater quality in these areas.

Continuous soil samples that were collected during the advancement of the initial boring installed at each cluster were evaluated in the field using VOC headspace screening techniques, and were described using the USCS soil classification system. This information, as well as total saturated thickness and predicted vertical gradients, were used to determine the well screen locations and to determine the number of wells per cluster.

Continuous samples for laboratory chemical analysis were also collected from the initial boring installed at each cluster; however, laboratory samples were collected only to the bottom of fill as identified by the supervising geologist. Laboratory analysis of these soils were performed to identify potential source-area-related contaminants that may be present in shallow soils in this area. Continuous soil samples were collected using a 3-inch diameter split barrel sampling tool and were analyzed for VOCs, SVOCs, pesticides/PCBs, metals, and dioxins, in addition to VOC headspace field screening. Continuous samples of soil below fill were collected for VOC headspace screening and USCS soil classification only, as stated above.

Bedrock was cored at MW-04 to an approximate depth of 30 feet below the top of rock. One "open hole" bedrock groundwater monitoring well was installed in this boring, following the collection of field data, including packer tests conducted during drilling, and other field data such as visual observations of fractures and weathering in the rock core, drilling rates, and loss or gain of water during bedrock drilling.

As in the perimeter area wells discussed above, borehole geophysics were also conducted within the bedrock hole at MW-04 in the southern area. Again, the objectives of these borehole geophysical activities were to determine the orientation of linear features in the borehole, to determine the zones that produce water under static and stressed conditions, and to measure natural gamma radiation. The perimeter area well borehole geophysics activities also generated heat pulse flow meter logs, caliper logs, natural gamma logs, and borehole acoustic televiewer logs for each bedrock borehole.

3.3 Water Level Monitoring

Two long-term water level monitoring programs at the site including one high water table event and one low water table event.

The high water table activities included one 6-week event of groundwater and surface water elevation monitoring between March and May 2001. The low water table activities included one 4-week event in October 2001. For each event, recording electronic transducers were installed at selected piezometer and monitoring well locations for the purpose of long-term groundwater level monitoring at the site. Three surface water gauges were installed in the Woonasquatucket River and in the Centredale Raceway (approximate locations indicated in Figure 3-2) which were also monitored. Surface water elevation measurements from these installations and from an existing USGS gauging station in the Woonasquatucket River provided data on the water table configuration, on shallow and deep hydraulic heads at the site, and vertical gradients between shallow and deep aquifers (overburden and bedrock) within the study area over the selected 4-week time period (during the low water table season).

Because the second monitoring event was implemented after the installation of several bedrock and deep overburden monitoring wells, selected bedrock and deep overburden installations were also instrumented with recording electronic transducers, in addition to the water table wells/piezometers measured during the first event. Specific wells/piezometers that were instrumented and measured during the spring event were selected following evaluation of Phase 1 data.

3.4 NAPL Sampling

Shallow monitoring wells were installed in the source area borings in order to evaluate the presence of possibly high concentrations of contaminants. Based on the anomalies identified by geophysical surveys performed in this area in 1999, it was suspected that some of the borings could be advanced into areas where NAPL is present. Therefore, an allowance was made within the work scope to collect samples of this material during either the soil sampling efforts (during soil boring/well installation activities) or during the groundwater sampling effort, or both, depending on the conditions encountered.

During advancement of the boring at MW-05, a small amount (less than 16 ounces) of a suspected NAPL layer was contacted at approximately 4 to 6 feet bgs. The soil sample from this zone was collected for laboratory analysis of VOCs, SVOCs, pesticides/PCBs, total metals, and dioxins, as available volume allowed. While analytical results of VOC concentrations indicated the presence of separate phase product in the soil sample, the well screened across this zone did not collect any NAPL that was measurable with electronic phase indicators. Groundwater was carefully collected several times using bailers following well installation, and the groundwater was inspected fully for the presence of NAPL, however none was visible. Groundwater samples were later collected for chemical analysis using low-flow methods. Analysis of these samples did indicate presence of contamination at concentrations indicating a possible separate phase. Findings are further discussed in Section 4.0.

3.5 Groundwater Sampling

Two events of groundwater sampling and analysis were conducted from monitoring wells within the study area. The groundwater analytical data were used to support the evaluation of the nature and extent of source-area-related contamination, and to evaluate the impact of contaminated groundwater discharge to surface waters (Woonasquatucket River and the raceway) in the vicinity of the source area and in downgradient areas.

During both events, groundwater samples were collected using low-flow sampling methods, and were analyzed for VOCs, SVOCs, pesticides/PCBs, metals (total and dissolved), dioxins, alkalinity, sulfides, and total organic carbon (TOC). These groundwater sample parameters were selected based on the type of contaminants that were historically detected in the source area or in the adjacent Woonasquatucket River, and/or based on contaminants typically associated with the previous industries that were active at the source area, based on historical records.

Although groundwater in the vicinity of the study area is classified as "GB" (not used for drinking water purposes), this and other groundwater data may, at a later date, be used in a human health risk assessment for other possible exposure scenarios.

Table 3-2 presents a summary of groundwater samples collected. Each groundwater sampling event is summarized below.

3.5.1 Initial Groundwater Sampling

The initial groundwater sampling event was conducted after completion of raceway borings and monitoring wells, and the source area borings and monitoring wells (seven shallow overburden wells). Groundwater samples were collected from each monitoring well using low-flow sampling methods, and were analyzed for VOCs, SVOCs, pesticides/PCBs, metals (total and dissolved), dioxins, alkalinity, sulfides, and TOC.

3.5.2 Subsequent Groundwater Sampling

The second groundwater sampling event was conducted after the completion of all drilling activities, and included all monitoring wells installed before and after the initial sampling event (seven shallow overburden wells and new 26 wells, including shallow overburden, deep overburden, and bedrock wells). In total, 33 wells were sampled during the second sampling event. Groundwater samples were collected from each monitoring well using low-flow sampling methods, and were analyzed for VOCs, SVOCs, pesticides/PCBs, metals (total and dissolved), dioxins, alkalinity, sulfides, and TOC.

3.6 Hydraulic Conductivity Tests

Hydraulic conductivity tests were performed at each overburden monitoring well to provide data to evaluate groundwater flow conditions in the water-bearing zones of each well. The data generated from these tests were used to define the water-yielding characteristics of each formation, to develop groundwater velocity values, and to estimate the rate of groundwater movement across and away from the study area.

Constant discharge hydraulic conductivity tests were performed where possible (i.e., at well locations of sufficient hydraulic conductivity, as determined during well development activities). These tests were performed by pumping at a given rate and measuring drawdown in the well until steady-state drawdown conditions occurred, or after a maximum of 15 minutes.

Slug tests were used in place of pump tests at wells screened in materials of lower hydraulic conductivity. Slug tests were performed by inserting or withdrawing a solid slug from the well, inducing a nearly instantaneous change in water level within the well. The rate of recovery of the water level to static conditions was measured.

Hydraulic conductivity estimates in bedrock wells were based on packer tests conducted during bedrock drilling activities.

Hydraulic conductivity tests are discussed in Section 4.

4.0 FINDINGS OF THE INVESTIGATION

The findings of the Source Area Investigation are presented in this section. The data collected during this source area investigation are discussed in this section in conjunction with data collected during previous investigations described in Section 2. The findings are presented for evaluation of soils (4.1), for evaluation of subsurface materials using surface geophysics (4.2), evaluation of the bedrock at and near the source area (4.3), and evaluation of the groundwater (4.4).

4.1 Soil Conditions

The soil conditions at the site were evaluated through the completion of borings and soil sample collection as discussed in Section 3. The soils were physically characterized through evaluation of continuous split barrel samples, and described in boring logs using the USCS (Section 4.1.1). Headspace VOC screening was performed on all soil samples collected (Section 4.1.2), and selected samples were submitted for laboratory analysis (Section 4.1.3).

Physical and chemical characteristics of soils are described specific to the four-character location identifier (MW-01, MW-02 etc). At some locations, additional borings were installed and given a letter suffix pertinent to the final use. For example, MW-07D is so identified because it was installed at the MW-07 location, and finished as a deep overburden well. Boring logs presented in the appendices and summary tables presented in this section may be cross-referenced using the four-character location number. The letter suffix is not necessary to correlate the soil descriptions on the logs.

4.1.1 Soil Characterization: Site Overburden Geology

The discussion of the overburden geology at the Site provided in this Section is based solely on the borings advanced by TtNUS during this program. Figure 3-2 presents the locations of these borings and monitoring wells. A summary of the previous geological investigations completed by others is provided in Section 2.0 of this report and in Section 5.0 of the Quality Assurance Project Plan (TtNUS, 2001). Logs from borings installed during this source area investigation are provided in Appendix A. This assessment does not include observations noted in the boring logs of chemical and oil odors, staining, sheens, or other evidence of contamination. Such

observations were reported on the boring logs remarks column, and are described elsewhere in this section.

The overburden geology within the Site consists of five units separated for this discussion based on significant changes in grain size and/or potential importance in regards to hydrogeologic impact. These units are: fill, silt or organic silt/wetland deposits, sand & gravel glacial outwash deposits, a second discontinuous silt or fine sandy silt deposit, and till. Each of these units is discussed in more detail below.

Fill

Overlying the majority of the Site is a loose to very dense, predominately sediment fill consisting of unsorted silt, sand, and gravel. Trace amounts of man-made debris or anthropogenic materials are encountered in this fill at most of the onsite borings and at MW-10 along the perimeter of the Site. Examples of the man-made debris noted within the borings include wood, metal, brick, glass, plastic, paper, vitrified clay fragments, asphalt fragments, coal or charcoal and slag. At borings advanced through the two cap areas such as MW-02, MW-04, MW-06, MW-07, and MW-09, the fill is overlain by approximately 1.3 – 1.5 feet of "clean cover" material consisting of mostly fine to medium sand, trace silt and gravel. This material overlies woven geotextile fabric that typically overlies another 6 to 12 inches of clean cover fill. Fill thickness appears to vary significantly from one location to another with a maximum thickness of approximately 9 feet at MW-02S located within the former raceway. Six to 8 feet of fill is fairly common at the onsite borings although the composition of the fill varies. At some locations, such as MW-05S, MW-11, MW-12, and MW-13 no man-made debris was noted and the fill was composed of reworked sand and gravel roadbase materials and/or topsoil.

Silt/Organic Silt/Wetland Deposits

Fine grained deposits consisting primarily of silt and fine sand-size particles with varied amounts of organic matter are found underlying the fill at some locations including SB-14-271, MW-02, MW-07, and MW-08. These relatively thin beds of fine grained sediments appear to have been deposited in former wetland areas that were later filled in with the materials described above. At borings SB-02 and SB-03 advanced within the former raceway wetland, the organic-rich silt is the surficial sediment unit directly beneath the water. At some of these locations, such as MW-15, fine

bedding was noted within the unit and may be related to a second fine grained unit described below. This deposit is described as varying from silt with trace amounts of fine sand and organic fibers to silty, fine sand and ranges in thickness from 0.2 feet of organic silt bordering on peat at MW-08 to 2.7 feet at SB-14-271.

Sand and Gravel

The boring data indicate that the most prevalent sedimentary unit at the Site consists of relatively coarse grained sediments ranging from fine to coarse gravel and cobbles to poorly graded, silty, fine to medium sands. Relatively small lenses of silty fine sand and sandy silt were identified at some of the borings within this unit, but they appear to be discontinuous. Cobbles and boulders were encountered either individually or in layers up to 5 feet thick. These deposits match the Valley Train stratified glacial outwash deposits mapped at the quadrangle scale by Smith (USGS, 1956). These sediments show a moderate to high degree of rounding indicating substantial water-born transport. These deposits underlie both the fill and the finer grained wetland deposits and overlie the majority of the glacially-carved bedrock valley throughout the Site.

The thickness of this unit ranges from 12.5 feet at MW-02 to 43 feet at MW-15, and extends well beyond the Study area according to the Surficial Geology map of the Providence Quadrangle (USGS, 1956).

Fine Sand and Silt

Lying either within or beneath the coarse grained sand and gravel unit is a dense fine grained unit varying from a fine sand, some silt to a silt with trace fine sand and trace clay. This unit was often found to be thinly laminated with rhythmic bedding indicated by color changes from either light gray to dark gray, or from yellow-orange to tan. This bedding pattern may suggest a relatively short-term presence of a glacial lake or pond in which seasonal depositional variations created varve-like patterns in the sediment. This unit is only found in MW02, MW06, MW-11, and MW-14 and it is noted at different depths and elevations. These variations may indicate either the presence of a fairly small scale water body, or partial erosion by subsequent higher energy depositional events. A drop stone noted within the fine grained deposit at MW-14 also suggests the presence of a glacial lake or pond. The thickness of this unit ranges from 2 feet at MW-06

where it was found at a shallow depth within the sand and gravel unit, to 11.75 feet at MW11 where it was noted below the sand and gravel unit directly overlying a possible till unit.

Possible Till

Underlying the coarse grained sand and gravel unit in most locations is a dense to very dense, unsorted mixture of grain sizes that may represent a basal till. At MW-11, this unit underlies the rhythmically bedded fine-grained unit. This unit primarily consists of fine to coarse sand, little to some fine to coarse sub-angular to sub-rounded gravel with little to some silt. Individual cobbles and boulders up to 5 feet in diameter were encountered within this unit. At MW13, saprolitic green schist fragments similar to the underlying bedrock were noted within this unit slightly above the top of bedrock. The thickness of the possible till unit ranges from 3.25 feet at MW11 to 40.5 feet at MW-02. (The thickness of this unit at MW-02 was atypical compared to the other borings.) This unit may represent the ground moraine till as mapped by Smith in 1956 for the Providence, RI Surficial Geology quadrangle map (USGS, 1956). Smith notes that "The till in the western part of the quadrangle is derived from crystalline bedrock. Although it has a wide range of grain size, the percentage of silt-and clay-sized material is relatively small" which is consistent with the findings from the boring program.

4.1.2 Headspace Screening for Total VOCs

Each sample collected with the split barrel sampling device was screened using a headspace technique to estimate total VOCs. Results of the headspace screening are presented on Table 4-1.

Borings were installed and samples were collected with the intent to supplement existing data. For example, headspace samples were collected from MW-07 in January 2001 to a depth of 18 feet bgs, but MW-07D was later installed in June 2001, and headspace samples were collected from 18 feet bgs to the bottom of that boring. As a result, a "continuous" log of soil conditions was compiled for each boring cluster location.

As described in Section 3, the VOC headspace screening was used in conjunction with soil characterization information to select screen intervals for each monitoring well, if one was to be installed. Selected screen zones are presented with the headspace screening data on

Table 4-1. Full details of well installations are provided in Appendix B. Wells were not installed in borings SB-02 and SB-03, due to proximity to other wells planned.

Both a photoionization detector (PID) and a flame ionization detector (FID) were used for headspace screening to determine total VOCs. The FID will respond to methane, which naturally occurs in old wetland soils, such as are present in the upper 8 feet in most borings at this site. The PID will not detect methane, but is sensitive to moisture, and may give erroneous readings in wet and humid conditions. Finally, the FID is more likely to detect some of the more volatile compounds such as vinyl chloride and other light fractions. To effectively evaluate this information, consistency in the readings of the two instruments and these other factors must both be considered.

Samples collected from borings installed in the raceway provided elevated FID readings; however, in the upper 12 to 20 feet some of these values did not correlate with elevated PID readings. Locations with higher FID results indicate the presence of methane in the soils. The FID readings that did correlate with the PID readings suggest the presence of VOC contaminants. The most consistent PID and FID readings occurred in the raceway borings occurred in MW-01S and MW-03S at depths between 10 and 20 feet bgs.

Consistent correlation of FID and PID readings occurred in MW-04, at depths from 5 to 11 feet, 21 to 27 feet, and 43 to 47 feet bgs. These results indicate VOC contaminants at these different depths, although at varying concentrations. Consistency among instrument readings is also noted in the samples collected from MW-05, where the soils were heavily stained and appeared saturated with chemical residue. Instrument agreement is also noted at MW-02D, MW-06S, MW-08S, MW-10B, and in the deeper samples collected from MW-13B, MW-14M and MW-15D, again indicating VOC contamination.

At 30-feet bgs at MW-07D, a PID reading was detected which was likely to be due to water vapor in the sample, because no reading was registered with the FID.

The headspace screening indicates the presence of low concentrations of VOCs in most of the shallow soils in the raceway borings. However, PID readings in this area are likely to be more reliable than FID readings due to the presence of methane in these wetland soils, which may have influenced the FID results.

Headspace results also indicates presence of VOCs in the shallow soils at MW-04D, MW-05S, MW-06S, MW-08S, and MW-15D. The highest readings were detected in soils collected from MW-05S, but soils from MW-06S and MW-08S also produced readings in the hundreds of ppm. Lower readings were detected in deep soils at MW-04D, MW-10B and MW-13B. Sporadic readings indicating possible traces of VOCs were detected in soils at MW-11M and MW-12B.

4.1.3 Laboratory Analysis of Subsurface Soil Samples Collected

Samples of subsurface soils were collected for laboratory analysis of contaminants as described in Section 3 of this report.

Subsurface soil samples were collected and analyzed for parameters described in Section 3. The dioxin analysis was performed by Triangle Laboratories under DAS subcontract No. S99-RAC1-150. The analysis of soil for VOCs was performed by Katahdin Analytical Services under DAS Subcontract No. S99-RAC1-151. Analysis of soils for SVOCs, Pesticides, PCBs and metals was performed by various laboratories through the EPA Contract Laboratory Program (CLP).

Tier II data validation following EPA Region I Guidelines was conducted by TtNUS for metals, VOCs, SVOCs, PCBs and pesticides on DAS and CLP laboratory data from the sampling event. Tier III data validation was performed by EPA for the dioxins data results. Data validation resulted in the qualification of some data. Qualification of data is described in data validation memoranda submitted to EPA.

Some compounds have estimated values or raised detection limits due to blank contamination or dilutions. Overall, the data were found to be of sufficient and acceptable quality to be used for the purposes of quantified risk analysis under the Risk Assessment Guidance for Superfund (RAGS) document and its amendments.

Figure 4-1 depicts locations of selected contaminants detected in subsurface soils as described in this Section. The contaminants depicted on this figure were selected based on frequency of occurrence in soil and other media, and on concentrations found. Table set 4-2a through 4-2e present a compilation of all the contaminants detected in the subsurface soil samples collected.

Complete analytical results for the parameters tested for in subsurface soils are presented in Appendix C.

Dioxins

Dioxins are a group of anthropogenic chemical compounds formed as by-products through a number of activities including combustion, certain types of herbicide and bactericide manufacture, chlorine bleaching of pulp and paper, and other industrial processes.

Table 4-2a presents a summary of the dioxin compounds detected in the subsurface soil samples collected as part of the source area investigation. As shown in Table 4-2a and in Appendix A, there are a number of related compounds known as dioxins and furans that are detectable by the analytical method used for this project. The 2,3,7,8-TCDD compound is believed to be the most toxic, but the others can contribute to this overall toxicity as well.

Dioxin analytical results are typically expressed in a Toxicity Equivalency Quotient concentration, or TEQ. The TEQ considers all the related compounds and their relative toxicity. The concentration of each compound is multiplied by a toxicity factor. The 2,3,7,8-TCDD toxicity factor is 1 and the other dioxins or furans toxicity factors range from 0 to 0.5 (OSWER, 1998). Other reports have stated that 2,3,7,8-TCDD generally constitutes 95 percent to 100 percent of the TEQ. Therefore, due to the toxicity of 2,3,7,8-TCDD, the TEQ values are dominated by this compound.

Table 4-2a shows concentrations of dioxin TEQ at or below 1 part per billion (ug/kg) in these soils at all locations sampled during the source area investigation with three exceptions: MW-01, at 2 to 4 feet below ground surface (bgs) (1.1 ppb), MW-15 at 4 to 6 feet bgs, (duplicate samples resulting in 2.6 ppb and 1.5 ppb), and MW-05 at 4 to 6 feet bgs (20.5 ppb). The concentration detected at MW-05 is dominated by 2,3,7,8-TCDD, but this sample also contains a high value for a related compound, tentatively identifies as, 1,2,4,5,7,8-Hexachloro(9H)xanthene (HCX).

HCX results are reported from the dioxin analysis. HCX was requested as an additional target compound for EPA Method 8290 (dioxin and furans analysis). However, because there is no

commercial standard available for this compound, the laboratory reported HCX as a "tentatively identified compound" (TIC) and the identifications and concentrations are approximated.
HCX was identified and quantitated using the masses, ratios, and retention time information provided by EPA Region VII based on the following reference presented at the Pittcon 99 (poster presentation): "Industrial Marker By-Products Found with 2,3,7,8-Tetrachlorodibenzo-p-dioxin" Jeffrey C. Archer, Terry A. Crone; USEPA Region VII.

Both HCX and 2,3,7,8-TCDD are believed to be by-products from the synthesis of 2,4,5-trichlorophenol (Viswanathan and Kleopfer, 1986). The compound 2,3,7,8-TCDD has historically been associated as a by-product of the purification of 2,4,5-trichlorophenol. The purified form of 2,4,5-tricholorophenol was historically used to manufacture hexachlorophene, a popular bactericide (USEPA, 1980).

Volatile Organic Compounds (VOCs)

A number of VOCs were found in the shallow soils at the site. The text below highlights the major trends noted in review of the data collected. Detected VOC compounds are presented in Table 4-2b, and a complete list of the data collected is provided in Appendix C.

Both chlorinated and aromatic VOCs were found in the soils, but the chlorinated VOCs were most predominant particularly, at MW-05, MW-06, MW-08 and MW-14.

In general, VOCs were not detected in the deep soils, with a few minor exceptions: Tetrachloroethene (PCE) was detected in one sample of a duplicate pair collected from the MW-02 location, at a depth of 64 to 66 feet bgs (28 ug/kg). Chloroethane was also detected in soil collected from MW-15 at approximately 52 to 53 feet bgs (22 ug/kg).

At MW-07, elevated concentrations of toluene were noted between 3 to 4 feet bgs. This is noteworthy primarily because the chlorinated VOC contaminants prevalent at other locations were not found at this location. However, quantitation limits in the soil samples from this location were high, likely due to a higher than usual amount of organic matter in the soils. Similarly at MW-08, elevated concentrations of xylenes were noted throughout the soil samples collected, and the chlorinated VOCs were not very prevalent.

Shallow soils at MW-06 and MW-14 were noted to contain chlorinated solvents at concentrations exceeding 1000 ug/kg, which was not surprising due to the proximity of these borings to suspected waste disposal areas (Section 2). These contaminants were found throughout the upper soils at MW-06, but were limited to the 0 to 1-foot sample at MW-14. The highest concentrations of VOCs were found in MW-05 soils. The contaminants at this location were dominated by the presence of PCE (300,000 ug/kg) and trichloroethene (TCE) (26,000 ug/kg). The highest concentrations detected were found at this location at depths between 4 and 8 feet bgs. During sampling, the soils in these locations were noted by the supervising geologist to be heavily stained, almost to the point of being saturated.

These findings are supported by previously analyzed subsurface soil samples, in which the same types of VOCs were detected (IT, 2000). In addition, TCE and PCE were previously detected in passive gas samplers in river sediments close to the location of MW-05S and the MW-04 well cluster (USGS, 2000).

Detected concentrations of PCE and TCE are depicted on Figure 4-1. These contaminants were selected for mapping due to their prevalence and concentration in soils at the source area.

Semivolatile Organic Compounds (SVOCs)

SVOCs in subsurface soils at the site included a wide range of contaminants including poly aromatic hydrocarbons (PAH) compounds, phthalates, phenols, and chlorinated phenols. The text below highlights the major trends noted in review of the data collected. Detected SVOCs are presented in Table 4-2c, and a complete list of the data collected is provided in Appendix C.

PAH compounds were detected in most soil samples collected, as is typical in industrial and commercial areas that are subjected to pavement, filling, and combustion exhaust. However, the highest concentrations of PAHs were found in the soils at MW-05. Elevated concentrations were also found in the soils at SB-02 and SB-03, located in the former raceway discharge creek.

Elevated concentrations of phthalates were found in the soils at several of locations. The highest concentrations of phthalates were detected in the soil samples collected from MW-06 (41,000 ug/kg bis(2-ethylhexyl)phthalate) and MW-07 (20,000 ug/kg bis(2-ethylhexyl)phthalate). Lower concentrations (between 3,000 and 6,000 ug/kg bis(2-ethylhexyl)phthalate) were

detected in the soils collected from SB-02 and SB-03, as well as MW-03, which is also located in the former raceway discharge creek.

Elevated concentrations of 2,4,5-trichlorophenol were detected in the soils collected at MW-05 (16,000 ug/kg, at a depth of 2-4 feet bgs). Lower concentrations of this compound were detected at two other locations, MW-14 (69 ug/kg) and MW-01S (73 ug/kg), both of which are located to the southeast of MW-05. Detected concentrations of 2,4,5 trichlorophenol (TCP) are depicted on Figure 4-1. This contaminant was selected for mapping due to its concentration in soils at the source area.

Pesticides and PCBs

Pesticides and polychlorinated biphenyls (PCBs) were detected throughout the shallow subsurface soils at the site. The text below highlights the major trends noted in review of the data collected. Detected pesticides and PCB compounds are presented in Table 4-2d, and a complete list of the data collected is provided in Appendix C.

Pesticides were found in most samples collected at trace or low concentrations. These results are not atypical in shallow soils, particularly in soils of a river basin such as is present at this site. Routine spraying of insecticides from local sources as well as from the air over the past 50 years would likely account for widespread low concentrations of some of these persistent contaminants.

However, elevated concentrations of 4,4-DDE and dieldrin were detected in a duplicate sample of subsurface soils collected from MW-06, from 2 to 4 feet bgs (DDE - 220/400 ug/kg, and dieldrin - 260/520 ug/kg). Additionally, the results from samples collected at SB-02 indicate an unusually high number of pesticides detected in the soils, indicating a possible former pesticide discharge or other source of contamination at this location.

PCBs were found at varying concentrations throughout the site in the shallow subsurface soils. Aroclor 1254 is the predominant PCB mix present in soil samples, with elevated concentrations (up to 8,800 ug/kg) in soils from SB-02, MW-06 and MW-14. Lower Aroclor 1254 concentrations were detected in soils from MW-01, MW-02, MW-03, MW-07, MW-08, and MW-09.

The distribution of other PCB mixtures on site may suggest some differentiation in the PCB contamination detected. Aroclor 1016 and Aroclor 1260 were both found in soils on the west side of the site, at MW-06 and MW-08 at concentrations at or near 1,000 ug/kg. Aroclor 1248 was found at concentrations of 1,000-3,000 ug/kg in soils collected at SB-02 and at lower concentrations at MW-02, which are both located on the east side of the site in the former raceway discharge creek. Other Aroclors were generally not detected at the locations where Aroclor 1254 was found.

Metals

Metals were detected throughout the shallow subsurface soils at the site. Metals are typically present in soils as the breakdown products of the parent bedrock and from ubiquitous pollutants, but they may also represent site specific contaminants. For the purposes of this data review, the metals results were compared with the Direct Exposure Criteria for Soils, presented in the RIDEM Site Remediation Regulations (RIDEM 1996). The text below highlights the exceedances of either of those criteria for soils on land used for residential and/or industrial purposes. This comparison is only used as a screening tool for discussion purposes, there is no intent on enforcement based on these results alone. Detected metals are presented in Table 4-2e, and a complete list of the data collected is provided in Appendix C.

Exceedances of the RIDEM Direct Exposure Criteria for soils are noted for antimony, arsenic, beryllium, lead, manganese, and thallium. Arsenic is present in the soils at concentrations up to 9.5 mg/kg. The residential direct exposure criteria for arsenic is set at 1.7 mg/kg, which is quite low, and difficult to achieve even in some naturally occurring soils. The criteria for arsenic in industrial soils are set at 3.8 mg/kg, which is only slightly higher than residential soils. The concentrations of arsenic detected in the subsurface soils at the site are not limited to any specific location, and there are no particularly elevated concentrations co-located with either lead or the pesticides detected.

The residential criteria for lead is 150 mg/kg. Lead was detected at concentrations exceeding this criteria at MW-06 (up to 204 mg/kg), MW-08 (up to 387 mg/kg at 2 to 4 feet bgs), and SB-02 (up to 211 mg/kg, at 2 to 4 feet bgs). No exceedances of the industrial criteria for lead (500 mg/kg) were noted.

The distribution of the remaining metals exceeding the RIDEM criteria did not suggest a correlation with any particular contaminant group. However, soil samples from SB-02, exhibited the maximum detection for both thallium (11.7 mg/kg, 2 to 4 feet bgs) and antimony (18.5 mg/kg, 4 to 6 feet bgs).

4.2 Surface Geophysical Studies

Two surface geophysical studies have been performed at the Centredale Manor Restoration Project site. In 1999, Roy F. Weston conducted Electromagnetic (EM) Terrain Conductivity methods and Ground Penetrating Radar (GPR) to locate possible buried waste containers (discussed in Section 2 of this report). During this Source Area Investigation, TtNUS contracted with Hager Geoscience Inc, to perform seismic refraction and GPR surveys to confirm some of the findings of the previous geophysical study, and to evaluate depth to bedrock, topography of bedrock, and overburden stratigraphy. This section describes the findings of these evaluations pertaining to the overburden at the source area. The findings that pertain to the bedrock are summarized in Section 4.3 of this report.

During February and April, 1999, Roy F. Weston used EM and GPR to locate buried objects as described above. They identified 13 geophysical anomalies that probably represent "mixed metallic fill or construction debris" (Figure 4-2). Two of the four anomalies beneath the Centredale Manor South Parking Lot were thought to have the greatest potential for containing "buried bulk metallic materials". The study also identified what they described as a northeast-trending, sand and gravel-filled paleo-channel at 3.5 to greater than 8 feet beneath the Brook Village South Parking Lots. Because this, if present, may represent a preferential pathway for contaminants, additional studies were conducted in an attempt to confirm the presence of this paleo-channel.

The GPR survey conducted by Hager GeoScience in July and August 2001 identified two overburden units in the source area. The upper unit covers the entire source area and ranges from 7 feet to 17 feet thick. It is thickest in the vicinity of the MW-02 well cluster and the Centredale Manor South Parking Lot. The bottom of the upper unit in these two areas coincides with a 1 to 4 - foot thick layer of orange sand and silt which separates overlying brown, black, and gray sandy fill and sand from underlying sands and gravel. The GPR data collected by

Hager GeoScience did not support the existence of a significant northeast-trending paleo-channel beneath the Brook Village Parking Lots.

The Hager Geoscience Inc. geophysical study only detected three geophysical anomalies, none of which were identified in the previous study (See Figure 4-2). One of the three areas where anomalous GPR signals were observed was along the northern boundary of the Centredale Manor North Parking Lot, near P-06 and MW-01S. The other two anomalies were situated between the southeast corner of the Centredale Manor Building and the Centredale Manor South Parking Lot.

Discrepancies in results between the two geophysical studies may be due to differences in survey methodologies. The Roy F. Weston surveys were limited to the portions of source area that were cleared in 1999, and were carried out on a series of rectangular grids with closely-spaced grid lines (distances between grid lines were 10 to 25 feet). By contrast, the Hager GeoScience surveys encompassed a larger area, and used widely-spaced traverses that did not follow a grid in order to better define overburden stratigraphy. Furthermore, the Roy F. Weston study used EM and GPR methods to identify anomalies, while the Hagar GeoScience study relied on GPR data alone. Finally, the Roy F. Weston GPR data was collected using a 500 MHz antenna, while the Hagar GeoScience GPR data was collected using a combination of 35 and 200 MHz antennas. Since the Roy F. Weston surveys collected data along more closely-spaced traverses, it is not surprising they identified a larger number of anomalies.

4.3 Bedrock Evaluation

Hagar GeoScience developed a model of the bedrock surface from site boring logs and more than 700 GPR and seismic refraction data points. Figure 4-3 depicts the bedrock topography interpreted from this model, as corrected using borings that encountered bedrock. Figures 4-3 and 4-3a present a cross section of the overburden and bedrock evaluated in this source area investigation.

The data indicate that the Centredale Manor site is situated above a north-south trending bedrock valley. In the northern part of the site from Smith Street to the southern edge of the Brook Village parking lots, the deepest portion of the valley lies 0 to 200 feet west of the Woonasquatucket River. South of the Brook Village parking lots the base of the valley

meanders southeastward beneath Cap Area 2, where it bifurcates around a large bedrock knob located under the Centredale Manor South Parking Lot and Cap Area 1. The deepest branch of the valley runs to the east beneath the Centredale Manor Building and the eastern edge of Cap Area 1. The shallower offshoot of the valley runs just west of the river beneath the railroad right-of-way. Geophysical data are sparse south of Cap Area 1, but it appears the two branches rejoin south of Cap Area 1, and the centerline of the valley trends to the south beneath the river and railroad right-of-way.

Five perimeter boreholes were logged with a heat-pulse flowmeter, 3-arm caliper probe, natural gamma probe, and acoustic televiewer to provide a better understanding of the character of the bedrock. These perimeter boreholes included MW-10B and MW-13B (situated along the eastern boundary of the source area), MW-04B (located inside the southern boundary), and MW-11B and MW-12B (outside the western boundary). Figure 4-4 presents the locations of these wells with interpreted bedrock fracture strike and dip angles.

When the boreholes were drilled, the bedrock in MW-04B, MW-12B, and MW-13B was classified as gray to green schist, and the bedrock in MW-11B was classified as gray to green gneiss. Acoustic televiewer logging confirmed the presence of foliated bedrock in all four wells. Moreover, the geophysical logs indicate the foliations in all four wells strike northwest and dip at a moderate angle to the northeast.

Most of the fractures in MW-11B, MW-12B, and MW-13B follow the foliation orientation. The mean fracture/foliation strike in each well is N 43° W, N 66° W, and N 69° W, respectively. The mean dip is 30° NE, 26° NE, and 33° NE, respectively. Furthermore, there is relatively little variability in the fracture/foliation orientations within each well (variances were 0.046, 0.042, and 0.041, respectively).

As in MW-11B, 12B, and 13B, the mean fracture/foliation orientation in MW-04B strikes northwest and dips moderately to the northeast (N 76° W, 35° NE). However, fracture orientations are more variable in this well (variance = 0.143). Only 7 of the 15 fractures actually strike northwest and dip to the northeast. Two fractures strike northwest and dip to the southwest, five fractures strike northeast and dip to the northwest, and one fracture strikes northeast and dips steeply to the southeast.

Unlike the other four wells, the bedrock in MW-10B consists of granite. Furthermore, the rock is not foliated, it contains relatively few fractures, and none of the fractures dip to the northeast. Only four fractures were detected in MW-10B, and their mean orientation is N 2° E, 31°W.

Fracture depths and apparent widths are also unique in MW-10B with respect to the other wells. The four fractures in MW-10B occur in a narrow 4.5-foot interval near the top of rock, and their apparent apertures range from 0.36 to 4.20 inches. By contrast, the 72 fractures exposed in MW-04B, MW-11B, MW-12B, and MW-13B occur at various depths throughout each well, and all of the fractures have small (less than 1-inch) apertures. In fact, only one of these fractures is more than 0.50 inches wide, and 57 fractures (79 percent) are less than 0.05 inches wide.

Groundwater flow in all five wells was only detected in the upper 2.5 to 10 feet of bedrock, and it was always greatest in the upper 2.5 to 5 feet of rock, even though most of the fractures occur below this depth interval. Flows ranging from below 0.02-0.43 gallons per minute (gpm) were detected in the upper 10 feet of bedrock. Below this depth, flow rates were always less than the 0.02 gpm detection limit of the heat-pulse flowmeter.

Fracture orientations were also measured in a large bedrock outcrop located approximately 500 feet northeast of the northern boundary of the site (Figure 4-4). Most of the bedrock in this outcrop consists of greenish-gray schist. Near the western end of the outcrop, the schist is in contact with pinkish granite. The bedrock appears to be similar to the Sneech Pond schist and Esmond granite as described by Quinn (1959).

Two sets of fractures were observed in the granite. One set strikes N 40° W and dips 60° NE. The other set comprises a 6-inch wide, near-vertical, weathered zone. The strike of this near-vertical zone could not be determined. Two fracture zones were also noted in the schist. The first is a breccia zone that discharges water. The breccia zone has an arched (antiformal) shape, and its hinge line strikes N 30° W and dips 30° NE. The second fracture zone in the schist occurs near the eastern end of the outcrop. One of the fractures in this zone strikes N 50° W, dips 45° NE, and has evidence of chemical alterations. Other fractures in this zone have an average strike of S 80° W and an average dip of 30° N.

The strike and dip of the fractures in the schist are consistent between the outcrop and the boreholes: they generally strike to the northwest and dip at a moderate angle to the northeast.

By contrast, the fracture orientations in the outcropping granite were unlike those found in MW-10B. One of the fracture sets in the outcropping granite follows the general fracture orientation in the schist, and the other has a unique near-vertical apparent dip.

4.4 Groundwater Evaluation

This section describes the findings of the groundwater investigations performed as a part of the source area investigation. This section focuses on groundwater movement, and then discusses contaminants and possible transportation through the subsurface materials.

4.4.1 Flow Directions and Surface Water-Groundwater Interactions

Interpretation of groundwater flow at the Centredale Manor Restoration Project Source Area is based on overburden and bedrock borings described in Section 4.1, geophysical surveys described in Sections 4.2 and 4.3, and hydraulic conductivity tests described in this section, along with water level measurements taken during the spring and fall of 2001.

Between March 21 and May 9, 2001, water level data were collected from the USGS Woonasquatucket River gauging station at the northern end of the site, and from data-logging pressure transducers installed in the river, raceway, and 21 shallow overburden peizometers. Water levels at the gauging station were recorded every 15 minutes, and those in the piezometers were recorded every 30 minutes throughout the period of record. Water levels were manually measured in the river, raceway, and shallow overburden piezometers on March 29, April 12, and May 4 to confirm proper functioning of the pressure transducers.

On March 30, 2001 water levels in the river and aquifer reached a local maximum from a 3-inch precipitation event that commenced the same day. Figure 4-5 was constructed from water level measurements taken between 7:30 PM and 8:30 PM when water levels in the river and aquifer peaked. Apparently, during heavy precipitation events such as this, there is a strong easterly component to groundwater flow, and river water discharges to the aquifer everywhere except in the immediate vicinity of a small groundwater mound, located beneath the parking lots for Brook Village. This groundwater mound is near the eastern bank of the Woonasquatucket River where high concentrations of VOCs were detected in the bottom sediments (USGS, 2000). The

local groundwater high may be due to perched groundwater conditions or a buried discharge pipe.

Figure 4-6 shows the water table on May 4, 2001 more than 20 days after any significant precipitation. This figure indicates that during times of relative quiescence: 1) groundwater flow is generally southward, 2) groundwater discharges to the river in the northern and central portions of the site, and 3) river water discharges to the aquifer at the southernmost end of the site. The groundwater mound was more pronounced on May 4, and it appears groundwater near the mound discharged to the river at all times between March 21 and May 9, 2001.

Water elevations in two raceway locations were compared to those in adjacent shallow overburden piezometers to further evaluate surface water-groundwater interactions. Figures 4-7a and 4-7b provide a comparison of water levels in the raceway at SP-01 and SP-02 with those in the aquifer at the nearest monitoring points (P-14 and P-15). These figures show that water levels in the aquifer near P-14 and P-15 were always higher than water levels in adjacent portions of the raceway. In other words, groundwater always discharged to the raceway in the vicinity of SP-01 and SP-02 from March 21 through May 9, 2001.

Surface water-groundwater interactions were more complex at the north of the site near the USGS gauging station on the Woonasquatucket River. Figure 4-8a compares water levels at the gauging station with those in the nearest shallow overburden piezometer (P-16). In the vicinity of the gauging station, groundwater discharged to the river at all times except during the two very heavy precipitation events in March. During these two events, water levels in the river near the gauging station rose above those in the aquifer and flow direction reversed, sending water from the river into the aquifer.

By contrast, water levels in the river near the southern boundary of the site at SP-03 were always higher than water levels in the nearest shallow overburden piezometer (P-17) (See Figure 4-8b). Although the record for SP-03 does not begin until April 2, it appears the flow direction did not reverse along this stretch of the river during the two March precipitation events. That is, it appears the Woonasquatucket River near SP-03 continuously lost water to the aquifer from March 21 through May 9, 2001. Two observations support this assertion. First, water levels in the river near SP-03 probably increased faster and higher than water levels in the aquifer during the two storm events, as observed at SP-04. Second, water levels at SP-03 were

much higher than water levels in P-17 only two days after the March 30 event when water levels in the river were still recovering from the storm, and they remained much higher until the end of the period of record.

The fast response to and recovery from precipitation events observed in the shallow piezometers suggests the shallow subsurface is highly permeable. The only location where the response to precipitation was relatively slow was in the immediate vicinity of P-01.

In summary, water level monitoring in the spring of 2001 demonstrated that the shallow groundwater beneath the Centredale Manor site generally flows southward. Furthermore, there is a strong easterly component to flow during heavy precipitation events, and there appears to be a mound of groundwater beneath the Brook Village parking lots. Groundwater from the mound discharged to the river during the entire period of record that included two heavy precipitation events and a prolonged dry spell. The raceway at the southern end of the site gained water and the river at the southern end of the site lost water during this same period of time. Along the central and northern portions of the site, the river gained water except during very heavy precipitation events. During heavy precipitation events, the entire stream reach along the site loses water to the aquifer, except in the immediate vicinity of the groundwater mound.

As described in Section 3 of this report, monitoring wells were installed at the site in the summer of 2001 in the shallow overburden, deeper overburden, and bedrock. Water levels in these wells, along with water levels in the river and selected piezometers were monitored from October 4 through November 1, 2001 using data logging pressure transducers. Water levels were also measured manually at these locations on October 4 and November 1. Shallow overburden, deep overburden, and bedrock groundwater contour maps were constructed from the November 1 data, which represents conditions 6 months after the earlier monitoring round and at least 1 month after any significant precipitation. As shown in Figure 4-9, the water table configuration during static conditions in the fall mimics that observed in the spring. Hence, the flow directions and groundwater-river interactions described for May 4 apply to November 1. The only significant differences between the May 4 and November 1 images are that water levels are consistently lower across the site in the fall, as expected, and the groundwater mound was not as pronounced. Although the groundwater mound was barely perceptible on

November 1, it was much more apparent in October 4 when water levels at P-2 were 3 feet higher than on November 1, 2001.

Figure 4-10 illustrates a horizontal slice through the subsurface at an elevation of 50 feet mean sea level (msl). The yellow region represents the lateral extent of the overburden at this elevation. The hatched green contour lines within the yellow area indicate the elevation of the bedrock valley floor beneath the overburden. The thick black contour lines crossing the valley are the groundwater contours in the overburden at 50 feet elevation. Groundwater at this elevation follows a relatively simple course, moving through the valley from the north to the south, and flowing around the bedrock knob that lies beneath the Centredale Manor south parking lot and Cap Area 1.

The direction of groundwater flow in the bedrock approximates that in the deep overburden (compare Figures 4-10 and 4-11). In other words, flow beneath the northern and central portions of the site is generally to the southeast, and the easterly component to flow diminishes as groundwater reaches Cap Area 1.

4.4.2 Hydraulic Conductivity, Hydraulic Gradient, and Groundwater Velocity

The hydraulic conductivity of the overburden was estimated from single-well pump test data collected from eight shallow wells and nine moderate to deep wells (see Tables 4-3 and 4-4). Measured hydraulic conductivity in the shallow overburden (under 14.5 feet bgs) ranged from 4 to 55 feet per day (ft/d), with a mean value of 23 ft/d. The two locations with the lowest conductivity (MW-02S and MW-08S) were characterized by the most silt- and organic-rich soils. Measured hydraulic conductivity in the deeper overburden (23-70 feet bgs) ranged from 10 to 190 ft/d, with a mean value of 58 ft/d. Again, the more silt-rich samples (MW-02D, MW-04D, MW-07D, MW-10D, and MW-15M) had the lowest hydraulic conductivity.

Hydraulic conductivity in the bedrock were evaluated from single well pump test, slug test, and packer test data. Hydraulic conductivity calculated from slug test and pump test data were in good agreement and ranged between 0.2 to 18.8 ft/d (See Table 4-5). Values derived from the packer test data were significantly lower (Compare Tables 4-5 and 4-6). The lower values are likely the result of the packer tests missing the uppermost bedrock in each borehole. The upper

3 to 10 feet of bedrock in each borehole was not subjected to packer testing, and the heat pulse flowmeter results indicate most of the flow in the bedrock occurs in the uppermost 2.5 to 10 feet.

Vertical hydraulic gradients were estimated from October 4 and November 1, 2001 water level measurements. As shown in Table 4-7, measured vertical gradients were generally negligible or quite small. In several instances the differences between measured groundwater elevations in nested wells was less than three-hundredths of a foot (0.03 feet). When measurements are this similar, it is difficult to ascertain whether the observed differences are due to actual head differences or to measurement imprecision. For the purposes of this discussion, it is assumed that differences of less than three-hundredths of a foot do not represent measurable differences in hydraulic head.

There were no measurable vertical gradients within the overburden at MW-10 and MW-13 along the eastern margin of the site. MW-02, which is also near the eastern margin, was the only location where a downward vertical gradient was observed within the overburden. Near the southern end of the site at MW-04, and along the river at MW-07 and MW-14, the gradient was upward from the deep to the shallow overburden. On the western side of the river at MW-11, the gradient was flat on October 4, and slightly upward on November 1, 2001.

Upward gradients existed between the deep overburden and the bedrock at MW-11 and MW-12 on the western side of the river. Downward gradients between these units were observed near the northeastern and south-central portions of the site, at MW-10 and MW-04, respectively. Near the southeastern edge of the site at MW-13, the gradient from the bedrock to the overburden was flat on October 4 and slightly upward on November 1, 2001.

Based on observations from these eight well clusters during quiescent conditions, it appears there are no strong, pervasive, downward vertical gradients that could drive dissolved contaminants from the shallow subsurface through the overburden and into the bedrock at the site. A small downward gradient within the overburden was detected at MW-02, and small downward gradients between the deep overburden and bedrock were observed at MW-4 and MW-10. Otherwise the gradients were flat or upward.

Horizontal hydraulic gradients were also estimated from the fall water level data. The average horizontal gradient in the shallow overburden along a 950-foot flow path from P-21 to P-15 was

approximately 0.0037 on May 4, and 0.0032 on November 1, 2001. The horizontal gradient in the deep overburden along a 960-foot flow path between MW-14M and MW-04D was roughly 0.0033 on November 1. The horizontal gradient in the bedrock, measured along a 920-foot flow path extending from the 94.5 feet bedrock groundwater contour to MW-04B, was approximately 0.0035 on November 1, 2001.

Measurements of horizontal hydraulic gradients (*i*), were used in conjunction with estimates of mean hydraulic conductivity (K), and effective porosity (n_e) to calculate groundwater velocities in the overburden and bedrock. Representative values of n_e for the overburden sands and fractured bedrock were taken from Dominico and Schwartz (1998). Assuming i = 0.0032, K = 23 ft/d, and n_e = 0.35, the average groundwater velocity in the shallow overburden is 0.21 ft/d. The average velocity in the deeper overburden is more than twice as fast (0.55 ft/d, assuming i = 0.0033, K = 58 ft/d, and n_e = 0.35), and the average velocity in the bedrock is faster still (approximately 27 ft/d, assuming i = 0.0038, K = 7 ft/d, and n_e = 0.001). The difference in average groundwater velocity between the shallow and deep overburden is primarily due to the difference in mean hydraulic conductivity. The much higher velocity in the bedrock, despite its relatively low hydraulic conductivity, is due to its lower effective porosity. There is a great deal of uncertainty in the velocity estimate for the bedrock, because there is a great deal of uncertainty in the effective porosity of the bedrock. (Measures of n_e in bedrock are highly variable and scale-dependent.) Nevertheless, published n_e values for fractured crystalline rocks are orders of magnitude lower than for sands and gravels, so despite the uncertainty, it appears the groundwater velocity is much faster in the bedrock than it is in the overburden.

4.4.3 Laboratory Analysis of Groundwater Samples Collected

Groundwater samples were collected and analyzed for parameters described in Section 3. The dioxin analysis was performed by Triangle Laboratories under DAS subcontract No. S99-RAC1-150. The analysis for sediment for VOCs, SVOCs, PCBs, pesticides and metals and water quality parameters was performed under the EPA Contract Laboratory Program (CLP) laboratories.

Tier II data validation following EPA Region I Guidelines was conducted by TtNUS for metals, VOCs, SVOCs, PCBs and pesticides, and metals on laboratory data from the sampling event. Tier III data validation was performed by EPA for the dioxins data results. Data validation

resulted in the qualification of some data. Qualification of data is described in data validation memoranda submitted to EPA. Tier I validation was performed on the of water quality parameters data for these samples (sulfides, TOC, and alkalinity).

Some compounds have estimated values or raised detection limits due to blank contamination or dilutions. Overall, the data were found to be of sufficient and acceptable quality to be used for the purposes of quantified risk analysis under the Risk Assessment Guidance for Superfund (RAGS) document and its amendments.

Table 4-8 presents a summary of the groundwater results. This table is separated into groups a, b, c, and d, each providing data from the different contaminant groups (dioxins, VOCs, SVOCs/PCBs/pesticides, and metals), respectively. The first page of group presents results of samples collected in February 2001, and the remainder of that table presents the results from analysis of samples collected in August 2001. Figure 4-12 depicts locations of selected contaminants detected in groundwater as described in this Section. The contaminants presented on Figure 4-12 were selected based on frequency of detection in groundwater and other media, and based on concentrations detected. Complete analytical results for the groundwater samples collected are presented in Appendix D of this technical memorandum.

Dioxins

As noted in the soil discussion, dioxins are a group of anthropogenic chemical compounds formed as by-products through a number of activities including combustion, certain types of herbicide manufacture, chlorine bleaching of pulp and paper, and other industrial processes.

Table 4-8a presents a summary of the dioxin compounds detected in the groundwater samples collected as part of the source area investigation.

As discussed in Section 4.1, there are a number of related compounds known as dioxins and furans that are detectable by the analytical method used for this project. This discussion focuses on 2,3,7,8-TCDD, which is believed to be the most toxic, and which was found repeatedly in groundwater and soil at this site.

As shown in Table 4-8a, 2,3,7,8-TCDD was detected at trace concentrations in samples collected from wells MW-01S, MW-02S, and MW-03S and MW-09S during both February and August 2001. Trace concentrations were near or below 10 picograms per liter (pg/l)(parts per quadrillion). Trace concentrations were also detected during August in samples taken from shallow wells MW-08S, and GEC-6, and from deep wells MW-02D, MW-04D, and MW-07D.

2,3,7,8-TCDD was not detected in bedrock wells or offsite wells, with one exception: a trace of 2,3,7,8-TCDD was detected in the sample taken from MW-12B. In MW-05S, 2,3,7,8-TCDD was detected at a concentration of 4,180 pg/l. Other dioxins and furans were also detected in this sample, providing a TEQ of 4,400 pg/l.

The compound 1,2,4,5,7,8-hexachloro(9H)xanthene (HCX) was also sought in the dioxin analysis. HCX was requested as an additional target compound for EPA Method 8290 (dioxin and furans analysis). However, because there is no commercial standard available for this compound, it was agreed that the laboratory report HCX as a "tentatively identified compound" (TIC) and approximate the identifications and concentrations. However, HCX was not found as a TIC in any of the groundwater samples collected in February or August 2001.

Volatile Organic Compounds (VOCs)

VOCs detected in groundwater samples collected are summarized on Table 4-8b. VOCs in groundwater at the site were dominated by the presence of tetrachloroethene (PCE) and trichloroethene (TCE). Both of these chlorinated VOCs, as well as various other VOCs, were found at low to moderate concentrations in many of the wells that were screened in the shallow overburden in historically active areas of the site. These wells include MW-03S, MW-06S, MW-07S, MW-08S, MW-09S.

The highest concentrations of VOCs detected were found at MW-05S, with PCE at a concentration of 61,000 ug/l. Other VOCs detected in samples from this well included cis-1,2-dichloroethene (1200 ug/l), methyl acetate (430 ug/l), and TCE (2500 ug/l). Other VOCs may have been present in this well, but were likely obscured by the high quantitation limits due to the elevated concentration of PCE.

Elevated concentrations of PCE were also noted in MW-02M (110 ug/l) MW-02D (700 ug/l) MW-13D (220 ug/l) and MW-13B (340 ug/l). Low concentrations of TCE and PCE were noted in samples collected from MW-04S, MW-04B and MW-04D, at the south end of the source area. These findings suggest the movement of this contaminant to the south with groundwater flow as discussed elsewhere in this section.

Semivolatile Organic Compounds (SVOCs), and Pesticides/PCBs

SVOCs, pesticides/PCBs detected in groundwater samples collected from the site are summarized in Table 4-8c. Few SVOCs were detected, and, with a few exceptions, those detected were found at trace concentrations, as discussed below. No pesticides/PCBs were found in the groundwater samples.

Elevated concentrations of a chlorinated phenol compound reported as 2,4,6-trichlorophenol were detected in groundwater collected from MW-05S (2900 ug/l). MW-05S is the same well in which the highest concentrations of PCE and TCE were found, and is the location where 2,4,5-trichlorophenol was reported in soils. 2,4,6-Trichlorophenol was not detected in samples collected at other wells, with the exception of MW-08 (2 ug/l), well to the south of MW-05. MW-05S also was the only location where a related compound, 2,4-dichlorophenol, was detected, although at a much lower concentration (60 ug/l).

Since both 2,4,5-trichlorophenol and 2,4,6-trichlorophenol are isomer compounds with the same mass, the only difference in the analysis is the retention time. The small difference of 0.1 minutes in the retention times is easily obscured by a large peak resulting from the high concentration. The fact that the 2,4,5 isomer was reported in the soil samples, and the 2,4,6 isomer was reported in the groundwater samples underscores the similarity between the two. Additional validation work would be required to determine which isomer is actually occurring at the site.

Elevated concentrations of a compound called caprolactam was found in one deep well, MW-10B (490 ug/l). Caprolactam ($C_6H_{11}NO$) is a compound used in the manufacture of nylon multifilament. In its manufactured form, it is a white, hygroscopic, crystalline solid or leaflet material that is highly soluble in water. Physical properties include: bp = 180°f; mp = 70°f; mol wt = 113.16; and log K_{ow} = -0.19 (EPA 1988). Presence of caprolactam in MW-10B is notable,

mostly because of the elevated concentration detected, and the location of this well at the northern end of the site. Because this compound was not detected in any of the wells within the source area yet was found in the northern perimeter well, its occurrence suggests prior manufacture or use of this compound on properties hydraulically upgradient (to the north) of the site.

Other SVOCs in groundwater included trace and low concentrations of bis(2-ethyl-hexyl)phthalate, detected at three shallow overburden wells (MW-01S, MW-03S, and MW-08S) and one deep overburden well (MW-13D). SVOCs also included trace concentrations of two PAH compounds, detected at MW-05S, MW-06S and MW-08S, and trace concentrations of 4-methylphenol at MW-05S, MW-07S, and MW-08S.

Metals

The metals detected in groundwater samples collected from the site are summarized in Table 4-8d. Most data were found to be within normal elements for overburden and bedrock aquifers, although some notable occurrences are described below:

Lead, previously detected at elevated concentrations in the soils, was found at only slightly elevated concentrations in the groundwater. These included both the filtered (27 ug/l)and unfiltered (37 ug/l) samples collected from MW-03S in August, 2001, and the filtered (2.3 ug/l) and unfiltered (17 ug/l) samples collected from MW-08 in February, 2001. Lower, but detectable concentrations (below 5 ug/l) of lead were detected in water samples collected at MW-08S and MW-09S in August 2001.

Nickel was also found at elevated concentrations in groundwater at specific locations. At MW-10D, nickel was found in field duplicate samples at concentrations between 153 to 158 ug/l (unfiltered) and 145 to 152 ug/l (filtered). Nickel was also found at a concentration of 82.6 ug/l in the filtered sample collected from MW-13B. Also found in the filtered sample from MW-13B well was an elevated concentration of chromium (114 ug/l). However, these findings were not supported by the results of the unfiltered samples which showed no detections of either metal.

The presence of lead and nickel at the concentrations found does not pose an immediate threat, as the groundwater classification in this area is GB - not usable for potable purposes without

treatment. However, the presence of the elevated concentrations of lead in shallow overburden aquifer at the source area indicates leaching of lead into the groundwater. The presence of nickel in the deep overburden well at MW-10 is notable, primarily because caprolactam was found in the bedrock well at this location. The elevated nickel at the locations of MW-13 and MW-10, but nowhere else on the source area, might support the possibility of a contaminant source intruding from the east.

4.4.4 Conceptual Contaminant Flow With Groundwater

Site boring logs suggest there is a direct hydraulic connection between the overburden and bedrock beneath much of the site. Therefore, shallow fractures in the schist, gneiss, and granite may act as pathways for moving contaminants from the overburden into the bedrock. However, it appears the bedrock fractures generally have small apertures and transmit small to negligible quantities of water. Moreover, the borehole flowmeter and packer test data indicate most of the flow in the bedrock is restricted to the upper 2.5 to 10 feet of rock.

There do not appear to be strong vertical hydraulic gradients within the source area driving dissolved contamination into the deep overburden, or into or out of the rock. DNAPL (Dense Non-Aqueous Phase Liquid) may be a more significant source of groundwater contamination in the deep overburden and bedrock. When a DNAPL is spilled on the ground surface or released beneath it, the liquid will migrate downward through the unsaturated zone toward the water table, primarily by gravity-driven flow. If the DNAPL reaches the water table, it will continue to move downward through the water column under the influence of gravity, migrating laterally along the top of any low permeability units it encounters along the way. Downward migration may cease if the low permeability stratum is continuous; otherwise, the DNAPL will eventually spill over its edge and continue to migrate downward. Since the direction of DNAPL transport is driven primarily by gravity and the occurrence of relatively high and low permeability features, it may or may not coincide with the direction of groundwater flow.

As described in Section 4.4.3, there appears to be a contaminant source near MW-05. This is likely to constitute a DNAPL, since tetrachloroethene (PCE) concentrations in the groundwater at this location exceed 40 percent of its pure phase solubility. If a sufficient quantity of PCE-rich liquid was released in this area, DNAPL may have accumulated at the base of the bedrock valley approximately 200 feet west of MW-05. Over time, part or all of the DNAPL accumulating

in this topographic low may have entered the bedrock, provided the fracture openings were sufficiently wide. The other contaminants detected in the water at MW-05S included TCE, trichlorophenol, and some dioxins.

Water level information from the piezometers and the surface water stations indicate that there is a hydraulic pressure from the river into the aquifer, certainly during high water periods, and this appears to reverse during low water periods. However, this dynamic, while it would not wholly prevent contaminant migration from the shallow overburden at the source area into the river, it may direct that contamination towards the raceway discharge creek to east or south of the source area.

PCE concentrations in MW-02D, MW-13D and MW-13B (well to the southeast of MW-05) were high, but not high enough to infer the presence of a nearby DNAPL source. However, records indicate that drums and contaminated soils were removed during construction of the Centredale Manor building, and these may have previously been another source for contamination in this area.

Based on the information available to date, these wells, particularly MW-13, are likely to be intercepting dissolved groundwater contamination migrating southeastward through the bedrock valley and shallow bedrock through the southeastward flow of the groundwater as described in Sections 4.4.1 and 4.4.2 of this report. Whether there is a single large source of these contaminants originating near MW-05S, or if others are or were present at the current location of the Centredale Manor Building, or within the anomalies identified by the geophysics, is unknown at this time.

Other shallow groundwater wells contained lower concentrations of PCE and other contaminants. This lesser contamination is likely to be related to other disposal actions and may not be directly related to the source that appears to be present at MW-05S.

5.0 SUMMARY

This section presents a summary of the findings of the Source Area Investigation. These findings are based on the data collected during this investigation, taken in context with the findings of previously published reports regarding the Source Area.

Contaminants Detected

Chlorinated VOCs, particularly trichloroethene (TCE) and tetrachloroethene (PCE) were found in the shallow soils and fill in the borings installed. The highest concentrations of these contaminants were found in the shallow overburden soils at MW-05. In addition, trichlorophenol (TCP) was found at elevated concentrations in soils at this location as well. Other contaminants, including chloroethane, toluene, PAHs, phenols, phthalates, and PCBs were detected at various locations in soils across the source area. Dioxins were found at or below 1 ppb in shallow soils, although at MW-05, the 2,3,7,8-TCDD dioxin was detected at 20 ppb. Hexachloroxanthene, a related compound was also tentatively identified at elevated concentrations in soils at this location.

MW-05 was installed south of the Brook Village building in order to determine a possible source of TCE and PCE found in water-to-vapor diffusion samplers installed in the sediment of the river (USGS, 2000). Results from these devices did successfully direct this investigation to the location of a hot spot, but other elevated contaminant levels detected at other locations on site did not particularly correlate to other contaminant sources.

2,3,7,8-TCDD was detected at trace concentrations in groundwater samples collected from shallow and deep overburden wells, and from one bedrock well, MW-12B. However, the most notable concentration was in the sample collected from MW-05S, where 2,3,7,8-TCDD was detected at a concentration of 4.1 ng/l (parts per trillion). Other dioxins and furans were also detected in this sample, providing a TEQ of 4.4 ng/l.

VOCs in groundwater at the site were dominated by the presence of PCE and TCE. Both of these chlorinated VOCs, as well as various other VOCs, were found at low to moderate concentrations in many of the wells that were screened in the shallow overburden in historically active areas on the site, but highest concentrations again were found in MW-05S, south of the

Brook Village building. Elevated concentrations of PCE were also noted in deep wells to the south east of MW-05.

Trichlorophenol (TCP) was also detected at elevated concentrations in the groundwater collected at MW-05S. It is noted that 2,4,5-trichlorophenol was reported in soil samples collected and 2,4,6-trichlorophenol was reported in the groundwater samples collected from MW-05S. These samples were analyzed by different labs, but there are strong similarities in the isomers. They have the same mass, and the only notable difference between them is limited to the retention times (0.1 minutes) during analysis. The difference in the retention times is easily obscured by a large peak resulting from the high concentration, and one may have easily been mistaken for the other.

Elevated concentrations of a compound called caprolactam was found in one deep, northern perimeter bedrock well, MW-10B (490 ug/l). Caprolactam ($C_6H_{11}NO$) is a compound used in the manufacture of nylon multifilament. The compound was not detected in any of the wells within the source area, and therefore this occurrence suggests prior manufacture or use of this compound on properties hydraulically upgradient (to the north).

Contaminant Transport

Subsurface soils at the site are largely composed of silty sands and gravels. These overburden materials, characterized during the installation of the borings are not likely to retard migration of contaminants, whether they are dissolved in groundwater or being carried as immiscible liquids. There is a fill layer present at most locations. Various concentrations of contaminants were found within this fill layer, but only one significant "hot spot" was found, at MW-05. Because the overburden was largely homogenous, no distinct preferential migration paths were identified.

The elevated concentrations of PCE, TCE, TCP, as well detected concentrations of dioxins in groundwater, are co-located with a groundwater mound that seems to be present in this area during most of the year. Whether the mound and the contaminant set are related is unknown, but the mound may be influencing the flow path of the contaminants at this location slightly, as the westward gradient from the mound to MW-05 acts against an eastward groundwater flow gradient that presents itself during periods of high river stages.

Surface geophysical surveys conducted at the site indicate the presence of several subsurface anomalies. These anomalies may correspond to materials in the fill that is pervasive under the source area (up to 8 to 10 feet thick). This fill has been identified in records and historical aerial photographs. Based on prior geophysical data, Weston (1999) speculated that a significant paleochannel may be present in the subsurface materials that would provide a preferential pathway for contaminants dissolved in groundwater. Geophysical data from this source area investigation could not verify the presence of such a channel. However, while data from borings do indicate that the entire geologic valley is comprised of a series of paleochannels separated by sand and silty sand, it does not appear that there is any identifiable preferential pathways for ground water to flow through the overburden.

The bedrock evaluations indicate that the source area is situated above a north-south trending bedrock valley. There are two low points in this valley, at elevations of less than 28 feet msl. One low is located under the Narragansett Electric right of way, west of Brook Village and the river. The other low is located under the Centredale Manor building and the wetland area between the ends of Grover and Steere Streets. A large bedrock knob is located under the Centredale Manor South Parking Lot and Cap Area 1. Bedrock under the site is predominately schist, and a granite formation appears in one boring and in an outcrop to the northeast of the site.

Fractures in the schist strike northwest and dip runs 26° - 35° down in a northeast direction. Fractures in the granite are more variable, with some similar to those in the schist, but others striking northeast, and dipping steeply southeast. The bedrock evaluated seemed to carry little water, particularly in the deeper zones tested.

Groundwater flow appears to be from north to south with an easterly trend during high river water events. This was particularly evident during significant rain events in the spring of 2001. Groundwater discharges to the raceway discharge creek consistently, and seems to have an exchange with the river, accepting water during high water events, and losing water to the river during more dry periods.

Groundwater flow through the deep overburden and bedrock beneath the northern and central portions of the site is generally to the southeast, and the easterly component to flow diminishes as groundwater reaches Cap Area 1.

Based on observations from the eight well clusters during quiescent conditions, it appears there are no strong, pervasive, downward vertical gradients that could drive dissolved contaminants from the shallow subsurface through the overburden and into the bedrock at the site. A small downward gradient within the overburden was detected at MW-02, and small downward gradients between the deep overburden and bedrock were observed at MW-4 and MW-10. Otherwise, the gradients were flat or upward.

The average groundwater velocity in the shallow overburden is estimated at 0.21 ft/d. The average velocity in the deeper overburden is estimated to be more than twice as fast (0.55 ft/d) and the average velocity in the bedrock is estimated to be faster still (approximately 27 ft/d). The difference in average groundwater velocity between the shallow and deep overburden is primarily due to the difference in mean hydraulic conductivity. The much higher velocity in the bedrock, despite its relatively low hydraulic conductivity, is due to its lower effective porosity.

Site boring logs suggest there is a direct hydraulic connection between the overburden and bedrock beneath much of the site. Therefore, shallow fractures in the schist, gneiss, and granite may act as pathways for moving contaminants from the overburden into the bedrock. However, it appears the bedrock fractures generally have small apertures and transmit small to negligible quantities of water. Moreover, the borehole flowmeter and packer test data indicate most of the flow in the bedrock examined is restricted to the upper 2.5 to 10 feet of rock.

Conclusions

The presence of the high concentrations of the contaminants at the particular location of MW-05S is unexplained by the findings and review of the historical records. There were no buried objects found in the vicinity during the geophysical studies, and there is no known upgradient source. Most of the disposal noted in the air photos is to the south and east of this location. There are anecdotal indications that a discharge pipe from a manufacturing process may have once been present at this location, however, this was not confirmed by any first hand accounts.

There do not appear to be strong vertical hydraulic gradients within the source area driving dissolved contamination into the deep overburden and into or out of the rock. However, there appears to be a contaminant source near MW-05. Concentrations indicate that there is likely to be DNAPL at this location, although none was detected. If a sufficient quantity of PCE-rich

liquid was released in this area, DNAPL may have accumulated at the base of the bedrock valley approximately 200 feet west of MW-05, under the Narragansett Electric ROW. Over time, part or all of the DNAPL accumulating in this topographic low may have entered the bedrock, provided the fracture openings were sufficiently wide. These fractures could have carried the contaminants to the southeast toward the MW-13 and MW-02 clusters, where PCE and TCE were also detected at moderate concentrations.

Finally, historical records indicate drums and contaminated soils were removed during the construction of the Centredale Manor building. These materials, or the other anomalies nearby may have or may still constitute other contaminant sources impacting the wells at the MW-02 and MW-13 clusters. Based on the information available to date, these wells, particularly MW-13, are likely to be intercepting dissolved groundwater contamination migrating southeastward through the bedrock valley and shallow bedrock through the southeastward flow of the groundwater. Whether there is a single large source of these contaminants originating near MW-05S, or if other sources are or were present elsewhere, is unknown at this time.

Other shallow groundwater wells contained lower concentrations of PCE and other contaminants. This distribution of lesser contamination is likely to be related to localized disposal actions across the site, and may not be directly related to the source suspected near MW-05S.

REFERENCES

REFERENCES

Federal Emergency Management Agency, September 30, 1993. Flood Insurance Rate Map (FIRM) Town of North Providence, Rhode Island, Panel 440020-0001. National Flood Insurance Program.

Federal Emergency Management Agency, September 30, 1993. Flood Insurance Rate Map (FIRM) Town of North Providence, Rhode Island, Panel 440020-0002. National Flood Insurance Program.

Goldman Environmental Consultants, Inc. April 14, 1999. Boring logs for Brook Village. Subsurface Investigation, Brook Village, 2072 Smith Street, North Providence Rhode Island. GEC Inc., Braintree, MA.

IT Corporation, March 16, 2000. Final Site Investigation Report. Centredale Manor Restoration Project, North Providence Rhode Island. Submitted to USEPA under contract no. 68-R1-98-01. IT Corporation, Hopkinton MA.

Louis Federici and Associates. October 1999. North Providence Tax Plat No. 10. Louis Federici & Assoc. Providence, Rhode Island.

Louis Federici and Associates. October 1999. North Providence Tax Plat No. 11. Louis Federici & Assoc. Providence, Rhode Island

Louis Federici and Associates. October 1999. North Providence Tax Plat No. 12. Louis Federici & Assoc. Providence, Rhode Island.

Louis Federici and Associates. October 1999. North Providence Tax Plat No. 14. Louis Federici & Assoc. Providence, Rhode Island.

USEPA and Lockheed Martin, September 19, 1999. Final Report for Centredale Manor (Woonasquatucket River) North Providence Rhode Island. REAC Emergency Response Team. Submitted to USEPA under contract no. 68-C99-223. USEPA Office of Emergency Response, Boston, MA.

Roy F. Weston, March 9, 1999. Final Summary Report for the Expanded Site Investigation, Centredale Manor Site, North Providence Rhode Island. Prepared for USEPA Region I, Under Contract No. 68-W5-0009. R.F. Weston, Burlington, MA.

Tetra Tech NUS, Inc., September 1999. Sampling and Analysis Plan for Woonasquatucket River Sediment Investigation, Centredale Manor Site, North Providence Rhode Island. Prepared for USEPA under Contract No. 68-W6-045. TtNUS Inc. Wilmington, MA.

Tetra Tech NUS, Inc., October 1999. Draft Final Work Plan for Technical Assistance, Centredale Manor, North Providence Rhode Island. Prepared for USEPA under Contract no. 68-W6-045. TtNUS Inc. Wilmington, MA.

Tetra Tech NUS, Inc., October 4 1999. Meeting Notes, Centredale Manor Site, Sampling and Analysis Plan. Meeting held September 20, 1999. Notes prepared for attendees under RAC 1 WA No. 043-TATA-016P. TtNUS Inc. Wilmington, MA.

Tetra Tech NUS, Inc. June 2000. Final Technical Memorandum Volume I. Prepared for USEPA under Contract no. 68-W6-0045. TtNUS Inc. Wilmington, MA.

Tetra Tech NUS, Inc. November 2000. Quality Assurance Project Plan, Centredale Manor Restoration Project. Prepared for USEPA under Contract no. 68-W6-0045. TtNUS Inc. Wilmington, MA.

Dominico, P. A. and F. W. Schwartz. 1998. *Physical and Chemical Hydrogeology, 2nd ed*, John Wiley and Sons, New York, 506pp.

USEPA (United States Environmental Protection Agency), 1988. Health and Environmental Effects Profile for Caprolactam. USEPA Office of Health and Environmental Assessment, Office of Research and Development, Cincinnati, OH.

USEPA (United States Environmental Protection Agency), July 31, 1998. Woonasquatucket River Sediment/Water Quality Analysis Project Report. USEPA Region I New England, Office of Environmental Management and Evaluation Ecosystem Assessment. USEPA Lexington, MA.

USEPA (United States Environmental Protection Agency) August 23, 1999. Centredale Manor Indoor Air Survey, Final Report. USEPA New England Regional Laboratory, OEME, Lexington, MA.

USGS (United States Geological Survey) January 11, 2000. Distribution of Volatile Organic Compounds at the Interface Between Ground Water and Surface Water Determined with Water to Vapor Diffusion Samplers, Centredale Manor Site, North Providence, Rhode Island. USGS Water Resources Division, 10 Bearfoot Road, Northborough, MA.

Viswanathan and Kleopfer, 1986. "Presence of Hexachlorophene at Missouri Dioxin Sites". Chlorinated Dioxins and Dibenzofurans in Perspective, Lewis Publishers, Inc. Chelsea, Michigan.

USEPA (United States Environmental Protection Agency), November 1980. Dioxins. Industrial Environmental Research Laboratory, Office of Research and Development, Cincinnati, Ohio.

TABLES

TABLE 3-1
SUMMARY OF SOIL SAMPLES COLLECTED
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample ID	Date	Parameters			
		VOCs	SVOCs Pesticides/PCBs	Metals	Dioxins
CM-SO-SB02-0204	1/3/01	X	X	X	X
CM-SO-DUP03 Duplicate of CM-SO-SB02-0204	1/3/01		X	X	
CM-SO-SB02-0406	1/3/01	X	X	X	X
CM-SO-SB02-0608	1/3/01	X	X	X	X
CM-SO-SB03-0204	1/9/01	X	X	X	X
CM-SO-SB03-0406	1/9/01	X	X	X	X
CM-SO-DUP05 Duplicate of CM-SO-SB03-0406	1/9/01	X	X	X	X
CM-SO-SB03-0608	1/9/01	X	X	X	X
CM-SO-SB03-1820	1/9/01	X	X	X	X
CM-SO-MW01S-0102	12/28/00	X	X	X	X
CM-SO-MW01S-0204	12/28/00	X	X	X	X
CM-SO-MW01S-0406	12/28/00	X	X	X	X
CM-SO-MW01S-0608	12/28/00	X	X	X	X
CM-SO-MW02S-0204	1/5/01	X	X	X	X
CM-SO-MW02S-0406	1/5/01	X			X
CM-SO-DUP04 Duplicate of CM-SO-MW02S-0406	1/5/01	X			X
CM-SO-MW02S-0608	1/5/01	X	X	X	X
CM-SO-MW02S-0810	1/5/01	X	X	X	X
CM-SO-MW02S-1820	1/5/01	X	X	X	X
CM-SO-MW02M-6163	6/26/01	X			
CM-SO-MW02D-6466	7/2/01	X			
CM-SO-DUP02 Duplicate of CM-SO-MW02D-6466	7/2/01	X			
CM-SO-MW02D-7272.2	7/3/01	X			
CM-SO-MW03S-0406	12/27/00	X	X	X	X
CM-SO-MW03S-0608	12/27/00	X	X	X	X
CM-SO-MW04D-0204	6/12/01	X			X
CM-SO-MW04D-0406	6/12/01	X	X	X	X
CM-SO-MW04D-0608	6/12/01	X	X	X	X
CM-SO-MW04B-4244	8/2/01	X			
CM-SO-DUP-04 Duplicate of CM-SO-MW04B-4244	8/2/01	X			

TABLE 3-1 (cont'd)
SUMMARY OF SOIL SAMPLES COLLECTED
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample ID	Date	Parameters			
		VOCs	SVOCs Pesticides/PCBs	Metals	Dioxins
CM-SO-MW05S-0102	6/18/01	X	X	X	X
CM-SO-DUP-01 Duplicate of CM-SO-MW05S-0102	6/18/01	X	X	X	X
CM-SO-MW05S-0204	6/18/01	X	X	X	X
CM-SO-MW05S-0406	6/18/01	X	X	X	X
CM-SO-MW05S-0810	6/19/01	X	X	X	X
CM-SO-MW05S-1012	6/19/01	X	X	X	X
CM-SO-MW06S-0204	12/19/00	X	X	X	X
CM-SO-MW06-DUP01 Duplicate of CM-SO-MW06S-0204	12/19/00	X	X	X	X
CM-SO-MW06S-0406	12/19/00	X	X	X	X
CM-SO-MW06S-0608	12/19/00	X	X	X	X
CM-SO-MW07S-0304	12/21/00	X	X	X	X
CM-SO-MW07S-0406	12/21/00	X	X	X	X
CM-SO-MW07S-0608	12/21/00	X	X	X	X
CM-SO-MW08S-0102	12/26/00	X	X	X	X
CM-SO-MW08S-0204	12/26/00	X	X	X	X
CM-SO-DUP02 Duplicate of CM-SO-MW08S-0204	12/26/00	X	X	X	X
CM-SO-MW08S-0406	12/26/00	X	X	X	X
CM-SO-MW08S-0608	12/26/00	X	X	X	X
CM-SO-MW09S-0406	12/18/00	X	X	X	X
CM-SO-MW09S-1011	12/18/00	X	X	X	X
CM-SO-MW14D-0102	7/13/01	X	X	X	X
CM-SO-DUP03 Duplicate of CM-SO-MW14D-0102	7/13/01	X	X	X	X
CM-SO-MW14D-0204	7/13/01	X	X	X	X
CM-SO-MW14D-0607	7/13/01	X			
CM-SO-MW14D-0608	7/13/01		X	X	X
CM-SO-MW14D-0708	7/13/01	X			
CM-SO-MW14D-5252.75	7/18/01	X			
CM-SO-MW15D-0204	8/7/01	X	X	X	X
CM-SO-MW15D-0406	8/7/01	X	X	X	X
CM-SO-DUP05 Duplicate of CM-SO-MW15D-0406	8/7/01	X	X	X	X
CM-SO-MW15D-0608	8/7/01	X	X	X	X
CM-SO-MW15D-4850	8/8/01	X			

TABLE 3-2
SUMMARY OF GROUNDWATER SAMPLES COLLECTED
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample ID	Date	Parameters					
		VOCs	SVOCs Pesticides/PCBs	Total Metals	Filtered Metals	Dioxins	Alkalinity TOC/Sulfides
CM-GW-MW01S-01	2/21/01	X	X	X	X	X	X
CM-GW-DUP01-01 Duplicate of CM-GW-MW01S-01	2/21/01	X	X	X	X	X	X
CMS-GW-MW01S-02	8/16/01	X	X	X	X	X	X
CMS-GW-DUP02-02 Duplicate of CMS-GW-MW01S-02	8/16/01	X	X	X	X	X	X
CM-GW-MW02S-01	2/22/01	X	X	X	X	X	X
CMS-GW-MW02S-02	8/13/01	X	X	X	X	X	X
CMS-GW-MW02M-02	8/13/01	X	X	X	X	X	X
CMS-GW-MW02D-02	8/13/01	X	X	X	X	X	X
CM-GW-MW03S-01	2/21/01	X	X	X	X	X	X
CMS-GW-MW03S-02	8/16/01	X	X	X	X	X	X
CMS-GW-MW04S-02	8/14/01	X	X	X	X	X	X
CMS-GW-DUP1-02 Duplicate of CMS-GW-MW04S-02	8/14/01	X	X	X	X	X	X
CMS-GW-MW04D-02	8/14/01	X	X	X	X	X	X
CMS-GW-MW04B-02	8/14/01	X	X	X	X	X	X
CMS-GW-MW05S-02	8/15/01	X	X	X	X	X	X
CM-GW-MW06S-01	2/22/01	X	X	X	X	X	X
CMS-GW-MW06S-02	8/15/01	X	X	X	X	X	X
CM-GW-MW07S-01	2/22/01	X	X	X	X	X	X
CMS-GW-MW07S-02	8/15/01	X	X	X	X	X	X
CMS-GW-MW07D-02	8/15/01	X	X	X	X	X	X
CM-GW-MW08S-01	2/21/01	X	X	X	X	X	X
CMS-GW-MW08S-02	8/15/01	X	X	X	X	X	X
CM-GW-MW09S-01	2/21/01	X	X	X	X	X	X
CMS-GW-MW09S-02	8/15/01	X	X	X	X	X	X
CMS-GW-MW10D-02	8/23/01	X	X	X	X	X	X
CMS-GW-DUP04-02 Duplicate of CMS-GW-MW10D-02	8/23/01	X	X	X	X	X	X
CMS-GW-MW10B-02	8/23/01	X	X	X	X	X	X
CMS-GW-MW11S-02	8/22/01	X	X	X	X	X	X
CMS-GW-MW11M-02	8/22/01	X	X	X	X	X	X
CMS-GW-MW11B-02	8/22/01	X	X	X	X	X	X
CMS-GW-MW12D-02	8/22/01	X	X	X	X	X	X
CMS-GW-MW12B-02	8/22/01	X	X	X	X	X	X
CMS-GW-DUP03-02 Duplicate of CMS-GW-MW12B-02	8/22/01	X	X	X	X	X	X
CMS-GW-MW13S-02	8/23/01	X	X	X	X	X	X
CMS-GW-MW13D-02	8/23/01	X	X	X	X	X	X
CMS-GW-MW13B-02	8/23/01	X	X	X	X	X	X
CMS-GW-MW14M-02	8/21/01	X	X	X	X	X	X
CMS-GW-MW15D-02	8/21/01	X	X	X	X	X	X
CMS-GW-GEC2-02	8/21/01	X	X	X	X	X	X
CMS-GW-GEC6-02	8/21/01	X	X	X	X	X	X
CMS-GW-TMW3-02	8/23/01	X	X	X	X	X	X

TABLE 4-1
JAR HEADSPACE RESULTS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESOTRATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Well/Boring	Depth (Feet)		Instrument Reading (ppm)		Well Screen Interval
	Top	Bottom	FID	PID	
SB-02	0.0	2.0	538.0	4.8	
	2.0	4.0	150.0	6.8	
	4.0	6.0	280.0	8.0	
	12.0	14.0	10.0	9.1	
	14.0	16.0	24.0	2.0	No Well
EOB@ 20' BGS	16.0	18.0	28.0	2.7	Installed
SB-03	0.0	2.0	32.0	1.8	
	2.0	4.0	0.5	1.5	
	4.0	6.0	1.4	2.0	
	6.0	8.0	0.0	0.0	
	8.0	10.0	20.5	4.9	
	10.0	12.0	1.7	0.3	
	12.0	14.0	0.0	0.8	
	14.0	16.0	0.0	0.6	
	16.0	18.0	0.0	0.7	No Well
EOB@ 20' BGS	18.0	20.0	0.0	0.0	Installed
MW-01	0.0	2.0	170.0	0.0	
	4.0	6.0	482.4	1.6	MW-01S, 3.5-
	6.0	8.0	1048.0	2.5	8.1 feet BGS
	8.0	10.0	50.0	7.9	
	10.0	12.0	106.8	9.9	
	12.0	14.0	21.0	5.5	
	14.0	16.0	40.0	14.8	
EOB@ 22' BGS	16.0	18.0	0.0	7.1	
MW-02	0.0	2.0	0.0	0.0	
	2.0	4.0	52.0	8.0	
	4.0	6.0	NS	NS	MW-02S, 4.0-
	6.0	8.0	28.9	8.6	8.0 feet BGS
	8.0	10.0	94.5	0.0	
	10.0	12.0	18.2	1.5	
	14.0	16.0	8.2	0.0	
	16.0	18.0	27.1	0.0	
	18.0	20.0	4.1	0.0	
MW-02M	20.0	22.0	0.0	0.1	
	22.0	24.0	0.0	0.0	
	24.0	26.0	0.0	0.0	
	26.0	28.0	3.5	2.2	MW-02M, 25.0-
	28.0	30.0	0.0	0.0	30.0 feet BGS
	30.0	32.0	0.8	0.0	
	32.0	34.0	0.0	0.0	
	36.0	38.0	0.0	0.0	
	38.0	40.0	0.0	0.0	
	40.0	42.0	0.0	0.0	
	42.0	44.0	0.0	0.0	
	44.0	46.0	0.0	0.0	

BR - Bedrock, EOB - End of Boring, BGS - Below Ground Surface

TABLE 4-1 (cont'd)
JAR HEADSPACE RESULTS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESOTRATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Well/Boring	Depth (Feet)		Instrument Reading (ppm)		Well Screen Interval
	Top	Bottom	FID	PID	
	46.0	48.0	0.0	0.0	
	48.0	50.0	0.0	0.0	
	52.0	54.0	0.0	0.0	
	54.0	56.0	0.0	0.0	
	56.0	58.0	0.0	0.0	
	58.0	60.0	0.0	0.0	
	60.0	62.0	0.0	0.0	
	62.0	64.0	6.6	NS	
	64.0	66.0	2.1	3.6	
	66.0	68.0	1.2	2.5	MW-02D, 65.3-69.9 feet BGS
	68.0	70.0	1.0	0.5	
EOB@ 79.0' BGS	72.0	74.0	0.5	0.2	
MW-03	4.0	6.0	285.9	0.0	
	6.0	8.0	838.1	1.5	MW-03S, 3.9-8.9 feet BGS
	8.0	10.0	251.5	0.0	
	10.0	12.0	515.2	16.2	
	12.0	14.0	651.5	5.7	
	14.0	16.0	7.6	7.3	
	16.0	18.0	9.4	4.3	
	18.0	20.0	3.8	15.2	
MW-04	4.0	6.0	100.9	9.3	
	6.0	8.0	21.9	10.9	
	8.0	10.0	18.7	1.4	
	10.0	12.0	26.0	11.3	MW-04S, 4.0-14.0 feet BGS
	12.0	14.0	3.9	2.1	
	14.0	16.0	9.7	2.9	
	16.0	18.0	0.0	0.0	
	18.0	20.0	3.9	0.0	
	20.0	22.0	0.0	0.0	
	24.0	26.0	0.3	7.2	
	26.0	28.0	2.0	0.0	
	28.0	30.0	0.0	0.0	
	30.0	32.0	0.0	0.0	
	38.0	40.0	0.0	0.0	
	40.0	42.0	0.0	0.0	
	42.0	44.0	0.0	0.0	MW-04D, 42.5-45.5 feet BGS
	44.0	46.0	11.1	4.2	
BR@ 49.5' BGS	46.0	48.0	0.6	1.0	
MW-05	0.0	2.0	0.0	0.0	
	2.0	4.0	119.4	56.8	
	4.0	6.0	2480.0	>2000	MW-05S, 3.1-8.0 feet BGS
	6.0	8.0	NS	NS	
	8.0	10.0	953.0	NS	
EOB@ 12' BGS	10.0	12.0	1190.0	1250.0	

BR - Bedrock, EOB - End of Boring, BGS - Below Ground Surface

TABLE 4-1 (cont'd)
JAR HEADSPACE RESULTS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESOTRATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Well/Boring	Depth (Feet)		Instrument Reading (ppm)		Well Screen Interval
	Top	Bottom	FID	PID	
MW-06	2.0	4.0	411.0	98.6	
	4.0	6.0	3396.0	159.0	
	6.0	8.0	2159.0	149.0	MW-06S, 5.0-
	8.0	10.0	168.4	1.5	9.0 feet BGS
	10.0	12.0	911.0	22.0	
	12.0	14.0	0.0	0.0	
	14.0	16.0	9.6	28.9	
	16.0	18.0	41.1	38.4	
	18.0	20.0	28.0	28.0	
EOB@ 22' BGS	20.0	22.0	6.1	22.0	
MW-07	2.0	4.0	1824.0	15.1	
	4.0	6.0	602.0	0.0	MW-07S, 3.8-
	6.0	8.0	100.1	0.0	7.8 feet BGS
	8.0	10.0	0.0	0.0	
	10.0	12.0	0.0	0.0	
	12.0	14.0	0.0	0.0	
	14.0	16.0	0.0	5.2	
	16.0	18.0	0.0	1.5	
	18.0	20.0	0.0	0.6	
	20.0	22.0	0.0	0.1	
	22.0	24.0	8.9	6.1	
	24.0	26.0	0.0	0.0	
	26.0	28.0	0.0	0.6	
	28.0	30.0	0.0	2000.0	
	30.0	32.0	0.2	115.0	
	32.0	34.0	0.0	10.6	
	34.0	36.0	0.0	5.5	
	38.0	40.0	4.5	5.6	
	40.0	42.0	0.0	6.0	
	42.0	44.0	1.7	1.7	
	44.0	46.0	0.0	4.1	
	46.0	48.0	0.0	4.5	
	52.0	54.0	0.0	3.7	
	54.0	56.0	0.0	0.0	MW-07D, 53.0-
	56.0	58.0	0.0	2.5	58.0 feet BGS
BR@ 59' BGS	58.0	59.0	0.0	3.5	
MW-08	0.0	2.0	813.0	284.0	
	2.0	4.0	1328.0	127.0	
	4.0	6.0	3200.0	4.7	MW-08S, 3.5-
	6.0	8.0	644.0	1.7	8.5 feet BGS
	10.0	12.0	10.4	6.4	
	12.0	14.0	1.6	3.6	
	14.0	16.0	0.5	4.3	
	16.0	18.0	10.4	15.5	
EOB@ 22' BGS	20.0	22.0	3.8	5.4	

BR - Bedrock, EOB - End of Boring, BGS - Below Ground Surface

TABLE 4-1 (cont'd)
JAR HEADSPACE RESULTS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESOTRATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Well/Boring	Depth (Feet)		Instrument Reading (ppm)		Well Screen Interval
	Top	Bottom	FID	PID	
MW-09	0.0	2.0	0.0	NS	
	2.0	4.0	0.0	NS	
	4.0	6.0	390.0	NS	MW-09S, 5.0-
	8.0	10.0	NS	NS	10.0 feet BGS
	10.0	12.0	1.0	NS	
	12.0	14.0	99.5	NS	
	14.0	16.0	4.9	2.5	
	16.0	18.0	7.2	0.0	
EOB@ 20' BGS	18.0	20.0	0.0	0.0	
MW-10	0.0	2.0	0.5	0.3	
	2.0	4.0	0.7	0.2	
	4.0	6.0	105.2	40.0	
	6.0	8.0	0.5	0.5	
	8.0	10.0	3.0	1.2	
	10.0	12.0	8.2	1.1	
	12.0	14.0	21.0	2.0	
	16.0	18.0	38.4	1.4	
	18.0	20.0	43.0	3.1	
	20.0	22.0	38.0	1.0	
	22.0	24.0	38.4	1.0	
	34.0	36.0	0.3	1.0	
	36.0	38.0	0.0	1.1	
	38.0	40.0	1.9	1.4	
	40.0	42.0	15.1	2.8	
	42.0	44.0	0.0	0.0	MW-10B, 40.0-
	44.0	46.0	2.0	1.0	45.0 feet BGS
	46.0	48.0	8.1	1.6	
	48.0	50.0	7.9	1.4	
	50.0	52.0	5.7	1.1	
BR@ 54' BGS	52.0	54.0	0.5	0.0	
MW-11	0.0	2.0	0.0	0.0	
	2.0	4.0	0.0	0.0	
	6.0	10.0	0.0	0.0	
	10.0	12.0	0.0	0.0	
	12.0	14.0	0.0	0.0	
	14.0	16.0	0.0	0.0	
	16.0	18.0	0.0	0.0	
	18.0	20.0	0.0	0.2	
	20.0	22.0	1.1	0.4	
	22.0	24.0	0.8	0.1	MW-11S, 20.0-
	24.0	26.0	0.0	0.0	25.0 feet BGS
	26.0	28.0	3.9	0.0	
	28.0	30.0	2.4	0.0	
	30.0	32.0	1.7	0.0	
	32.0	34.0	1.3	0.0	
	34.0	36.0	4.3	0.0	

BR - Bedrock, EOB - End of Boring, BGS - Below Ground Surface

TABLE 4-1 (cont'd)
JAR HEADSPACE RESULTS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESOTRATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Well/Boring	Depth (Feet)		Instrument Reading (ppm)		Well Screen Interval
	Top	Bottom	FID	PID	
	36.0	38.0	NS	NS	MW-11M, 36.0-42.0 feet BGS
	40.0	42.0	1.0	0.0	
	42.0	44.0	0.4	0.0	
	44.0	46.0	0.9	0.0	
	46.0	48.0	0.0	0.0	
	48.0	50.0	0.0	0.0	
	50.0	52.0	1.2	0.0	
	52.0	54.0	0.0	0.0	
BR@ 59' BGS	54.0	56.0	1.5	0.0	
MW-12	0.0	2.0	0.0	0.0	
	2.0	4.0	0.0	0.0	
	4.0	6.0	0.0	0.0	
	6.0	8.0	0.0	0.0	
	8.0	10.0	0.0	0.0	
	10.0	12.0	0.0	0.0	
	12.0	14.0	0.0	0.1	
	14.0	16.0	0.0	0.0	
	16.0	18.0	0.0	0.0	
	19.0	20.0	0.0	0.0	
	22.0	24.0	0.0	0.0	
	24.0	26.0	0.0	0.0	
	28.0	30.0	0.0	0.0	
	32.0	34.0	0.0	0.0	
	34.0	36.0	0.0	0.0	
	38.0	40.0	0.0	0.5	
	40.0	42.0	0.0	0.0	
	42.0	43.0	0.0	0.0	MW-12D, 39.0-44.0 feet BGS
	43.0	44.0	0.0	0.0	
	44.0	46.0	0.0	0.0	
	46.0	48.0	0.0	0.0	
BR@ 52.5' BGS	48.0	50.0	0.0	0.0	
MW-13	0.0	2.0	0.0	0.0	
	4.0	6.0	0.0	0.0	
	10.0	11.0	0.0	2.6	MW-13S, 4.0-14.0 feet BGS
	12.0	14.0	2.5	4.5	
	14.0	16.0	0.0	1.9	
	16.0	18.0	0.0	1.9	
	18.0	20.0	0.0	0.5	
	22.0	24.0	0.9	0.7	
	24.0	26.0	9.7	1.0	
	23.0	34.0	0.0	NS	
	34.0	36.0	0.0	NS	
	36.0	36.0	1.0	NS	
	38.0	40.0	0.5	0.5	
	40.0	42.0	3.2	1.3	
	42.0	44.0	2.8	1.5	MW-13D, 39.1-45.5 feet BGS
	44.0	46.0	4.0	4.5	
BR@ 46' BGS	46.0	48.0	2.3	1.5	

BR - Bedrock, EOB - End of Boring, BGS - Below Ground Surface

TABLE 4-1 (cont'd)
JAR HEADSPACE RESULTS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESOTRATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Well/Boring	Depth (Feet)		Instrument Reading (ppm)		Well Screen
	Top	Bottom	FID	PID	Interval
MW-14	0.0	2.0	100.0	1.0	
	2.0	4.0	655.0	0.0	
	4.0	8.0	248.0	0.5	
	8.0	10.0	7.1	0.7	
	10.0	12.0	6.3	0.5	
	14.0	16.0	1.0	1.3	
	16.0	18.0	1.1	0.8	
	18.0	20.0	1.8	0.5	
	22.0	24.0	0.0	0.5	
	24.0	26.0	1.0	8.0	
	26.0	28.0	0.2	0.4	
	28.0	30.0	NS	NS	
	30.0	32.0	7.0	6.8	MW-14M, 29.0-
	32.0	34.0	0.0	0.0	34.0 feet BGS
	36.0	38.0	0.1	0.2	
	38.0	40.0	0.0	0.1	
	40.0	42.0	0.0	0.0	
	42.0	44.0	0.0	0.0	
BR@ 53' BGS	44.0	46.0	4.8	1.2	
MW-15	0.0	2.0	0.9	0.0	
	2.0	4.0	156.2	0.0	
	4.0	6.0	718.6	5.3	
	6.0	8.0	393.9	0.7	
	8.0	10.0	57.9	1.8	
	10.0	12.0	0.0	0.0	
	12.0	14.0	0.0	0.0	
	14.0	16.0	6.2	0.1	
	16.0	18.0	5.0	0.2	
	18.0	20.0	0.9	0.0	
	20.0	22.0	0.5	0.0	
	22.0	24.0	1.8	0.0	
	24.0	26.0	0.2	0.0	
	26.0	28.0	12.0	5.4	
	28.0	30.0	1.6	0.3	
	30.0	32.0	8.5	2.8	
	32.0	34.0	4.7	0.8	
	34.0	36.0	1.2	0.4	
	36.0	38.0	1.5	0.9	
	38.0	40.0	0.9	0.2	
	40.0	42.0	7.0	2.6	
	42.0	44.0	2.8	1.5	
	44.0	46.0	1.3	0.7	
	46.0	48.0	1.2	0.8	
	48.0	50.0	5.1	1.6	
	50.0	52.0	2.1	0.0	MW-15D, 48.1-
	52.0	54.0	1.2	0.0	53.1 feet BGS
BR@ 55.4' BGS	54.0	56.0	6.5	1.1	

BR - Bedrock, EOB - End of Boring, BGS - Below Ground Surface

TABLE 4-2a
SUMMARY OF DETECTED DIOXINS AND FURANS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW01-0102		CM-SO-MW01-0204		CM-SO-MW01-0406		CM-SO-MW01-0608		CM-SO-MW02-0204		CM-SO-MW02-0406		CM-SO-DUP04	
Sample Location	MW01		MW01		MW01		MW01		MW02		MW02		MW02	
Date Sampled	12/28/2000		12/28/2000		12/28/2000		12/28/2000		1/5/2001		1/5/2001		1/5/2001	
Interval	1.0-2.0		2.0-4.0		4.0-6.0		6.0-8.0		2.0-4.0		4.0-6.0		4.0-6.0	
QC Identifier	None		None		None		None		None		Field Dup. CM-SO-MW02-0406		Field Dup. CM-SO-MW02-0406	
Dioxin Analysis (NG/KG)														
1,2,3,4,6,7,8-HpCDD	26.7		45.5		91.6		59.1		7.8		16.5		14.6	
1,2,3,4,6,7,8-HpCDF	10.1		15.2	EMPC	42.4		22.4		5.7		14.6		11.4	
1,2,3,4,7,8,9-HpCDF	1.2	U	1.5	U	2.5	J	1.1	EMPC	0.80	U	0.85	J	0.56	J
1,2,3,4,7,8-HxCDD	0.6	U	0.90	U	0.57	EMPC	0.46	J	0.60	U	0.39	EMPC	0.30	U
1,2,3,4,7,8-HxCDF	5		11.7		6.1		2.7	J	0.95	J	2.5	J	1.8	J
1,2,3,6,7,8-HxCDD	1.3	EMPC	3.9		3.4		2.2	J	0.51	J	1.1	J	0.88	J
1,2,3,6,7,8-HxCDF	2.4	J	4.8		4.2		1.4	J	0.74	J	2.0	J	1.5	J
1,2,3,7,8,9-HxCDD	0.6	U	0.90	U	2.2	J	1.4	J	0.60	U	1.3	J	1.0	J
1,2,3,7,8,9-HxCDF	0.5	U	0.70	U	0.60	U	0.30	U	0.40	U	0.30	U	0.20	U
1,2,3,7,8-PeCDD	0.4	U	1.5	EMPC	0.40	U	0.20	U	0.40	U	0.43	EMPC	0.20	U
1,2,3,7,8-PeCDF	0.3	U	26.9	EMPC	0.30	U	0.10	U	0.30	U	0.20	U	0.20	U
HCX		NA	17.2	J	23.4	J	8.67	J		NA	1.75	J	1.06	J
2,3,4,6,7,8-HxCDF	2.8	J	4.9		4.1		1.8	J	1.2	J	3.1	J	2.4	J
2,3,4,7,8-PeCDF	2.1	EMPC	7.6		1.5	J	0.63	J	0.57	J	1.5	J	0.98	EMPC
2,3,7,8-TCDD	5.8		1060	$	1.4		2.6		11.5		68.1		86.0	
2,3,7,8-TCDF	5.5		36.2		1.4	EMPC	0.62	EMPC	0.66	J	2.6		1.4	
OCDD	201		297	J	630		466	J	47.9		92.6		85.4	
OCDF	17		24.2	J	113		72.2	J	4.4	J	9.3	J	7.7	J
PCDD/Fs		NA		NA		NA		NA		NA		NA		NA
Total HpCDD	53.8	J	88.5	J	176	J	118	J	15.5	J	30.8	J	26.9	J
Total HpCDF	20.3	J	12.4		136	J	73.2	J	10.2	J	25.7	J	20.6	J
Total HxCDD	14.9	J	33.2	J	25.1	J	14.2	J	3.3	J	9.9	J	7.1	J
Total HxCDF	41.4	J	91.3	J	91.9	J	39.0	J	18.1	J	46.0	J	37.8	J
Total PeCDD	1.8	J	7.9	J	2.9	J	1.5	J	0.40	U	1.4	J	1.3	J
Total PeCDF	59.7	J	148	J	69.0	J	24.6	J	25.1	J	57.9	J	45.8	J
Total TCDD	8.6	J	1060	J$	2.9	J	3.1	J	11.8	J	69.6	J	87.6	J
Total TCDF	29.9	J	233	J	24.0	J	9.0	J	13.0	J	44.7	J	22.0	J
Toxicity Equivalency	8.9	J	1100	J	5.79	J	4.85	J	12.33	J	71.0	J	88.0	J

U- Not detected; UJ- Detection limit approximate, J- Quantitation approximate;

*/$ - From dilution analysis, R- Rejected; NA- Not analyzed; EMPC- Estimated Maximum Possible Concentration; TB/EB- Equipment/Trip blank contamination

TABLE 4-2a (cont.)
SUMMARY OF DETECTED DIOXINS AND FURANS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW02-0608		CM-SO-MW02-0810		CM-SO-MW02-1820		CM-SO-MW03-0406		CM-SO-MW03-0608		CM-SO-MW04-0204		CM-SO-MW04-0406	
Sample Location	MW02		MW02		MW02		MW03		MW03		MW04		MW04	
Date Sampled	1/5/2001		1/5/2001		1/5/2001		12/27/2000		12/27/2000		6/12/2001		6/12/2001	
Interval	6.0-8.0		8.0-10.0		18.0-20.0		4.0-6.0		6.0-8.0		2.0-4.0		4.0-6.0	
QC Identifier	None		None		None		None		None		None		None	
Dioxin Analysis (NG/KG)														
1,2,3,4,6,7,8-HpCDD	17.7		0.81	J	0.60	U	46.7		34.4		112		0.50	U
1,2,3,4,6,7,8-HpCDF	12.6		0.23	J	0.30	U	7.7		7.8		132		0.39	EMPC
1,2,3,4,7,8,9-HpCDF	1.6	U	0.10	U	0.40	U	0.90	U	3.2	U	6.7		0.30	U
1,2,3,4,7,8-HxCDD	1.0	U	0.10	U	0.30	U	0.50	U	1.8	U	5.0	J	0.30	U
1,2,3,4,7,8-HxCDF	2.1	J	0.080	U	0.20	U	3.6		3.6		22.0		0.20	U
1,2,3,6,7,8-HxCDD	1.3	J	0.10	U	0.30	U	2.6	J	2.1	J	10.4		0.30	U
1,2,3,6,7,8-HxCDF	1.8	J	0.080	U	0.20	U	2.2	J	2.0	J	14.0		0.20	U
1,2,3,7,8,9-HxCDD	1.0	U	0.10	U	0.30	U	2.3	J	2.2	EMPC	13.8		0.30	U
1,2,3,7,8,9-HxCDF	0.80	U	0.10	U	0.30	U	0.40	U	1.2	U	3.1	J	0.20	U
1,2,3,7,8-PeCDD	0.70	U	0.10	U	0.20	U	1.0	J	3.6		3.8	J	0.20	U
1,2,3,7,8-PeCDF	16.8	EMPC	0.090	U	0.20	U	0.20	U	0.50	U	0.50	U	0.20	U
HCX		NA		NA		NA	15.7	J	456	J	153.31	J		NA
2,3,4,6,7,8-HxCDF	2.6	J	0.090	U	0.20	U	3.1		3.1		14.8		0.20	U
2,3,4,7,8-PeCDF	1.3	J	0.090	U	0.20	U	2.3	J	4.9		8.5		0.10	U
2,3,7,8-TCDD	65.2		1.1		0.20	U	169		907	$	766	$	0.55	U
2,3,7,8-TCDF	1.8		0.20	J	0.10	U	4.5		4.7		15.1		0.20	U
OCDD	110		4.9	J	1.3	U	317	J	246	J	452		2.7	U
OCDF	10.8		0.30	U	1.1	U	18.1	J	14.4	J	103		0.60	U
PCDD/Fs		NA		NA		NA		NA		NA		NA		NA
Total HpCDD	32.8	J	1.6	J	0.60	U	89.7	J	75.4	J	237	J	0.50	UJ
Total HpCDF	21.6	J	0.23	J	0.40	U	19.1	J	16.5	J	228	J	0.39	EMPC
Total HxCDD	9.0	J	1.2	J	0.30	U	26.7	J	28.6	J	119	J	0.84	EMPC
Total HxCDF	44.3	J	0.42	J	0.20	U	122	J	523	J	265	J	0.20	UJ
Total PeCDD	0.70	U	1.0	J	0.20	U	6.3	J	15.5	J	23.8	J	0.20	UJ
Total PeCDF	65.5	J	0.41	J	0.20	U	117	J	192	J	213	J	0.10	UJ
Total TCDD	68.1	J	2.9	J	0.20	U	199	J	907	J$	806	$J	0.81	EMPC
Total TCDF	34.5	J	0.72	J	0.33	EMPC	72.0	J	40.1	J$	114	JEB	0.20	UJ
Toxicity Equivalency	67.99	J	1.13	J	0.00	U	190	J	915.27	J	790	J	0.0039	J

U- Not detected; UJ- Detection limit approximate, J- Quantitation approximate,
*/$ - From dilution analysis, R- Rejected; NA- Not analyzed; EMPC- Estimated Maximum Possible Concentration; TB/EB- Equipment/Trip blank contamination

TABLE 4-2a (cont.)
SUMMARY OF DETECTED DIOXINS AND FURANS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW04-0608		CM-SO-MW05-0102		CM-SO-DUP-01		CM-SO-MW05-0204		CM-SO-MW05-0406		CM-SO-MW05-0610		CM-SO-MW05-1012	
Sample Location	MW04		MW05		MW05		MW05		MW05		MW05		MW05	
Date Sampled	6/12/2001		6/18/2001		6/18/2001		6/18/2001		6/19/2001		6/19/2001		6/19/2001	
Interval	6.0-8.0		1.0-2.0		1.0-2.0		2.0-4.0		4.0-6.0		8.0-10.0		10.0-12.0	
QC Identifier	None		Field Dup. CM-SO-MW05-0102		Field Dup. CM-SO-MW05-0102		None		None		None		None	
Dioxin Analysis (NG/KG)														
1,2,3,4,6,7,8-HpCDD	1.2	U	0.70	U	0.50	U	12.7		61.9	J	0.90	U	1.7	J
1,2,3,4,6,7,8-HpCDF	0.85	J	0.40	U	0.30	U	3.4	J	11.5	J	0.50	U	0.60	U
1,2,3,4,7,8,9-HpCDF	0.30	U	0.50	U	0.30	U	0.60	U	1.1	EMPC	0.70	U	0.80	U
1,2,3,4,7,8-HxCDD	0.30	U	0.50	U	0.40	U	0.60	U	2.1	J	0.70	U	0.80	U
1,2,3,4,7,8-HxCDF	0.20	U	0.46	J	0.20	U	1.0	J	3.6	J	0.40	U	0.50	U
1,2,3,6,7,8-HxCDD	0.30	U	0.50	U	0.50	U	1.1	J	24.8	J	1.9	J	17.3	
1,2,3,6,7,8-HxCDF	0.20	U	0.30	U	0.20	U	0.67	J	1.8	J	0.40	U	0.50	U
1,2,3,7,8,9-HxCDD	0.30	U	0.50	U	0.40	U	0.60	EMPC	5.7	J	1.1	J	6.9	
1,2,3,7,8,9-HxCDF	0.20	U	0.30	U	0.30	U	0.40	U	0.20	UJ	0.50	U	0.70	U
1,2,3,7,8-PeCDD	0.30	U	0.40	U	0.40	U	0.75	J	52.2	J	2.8	EMPC	7.8	
1,2,3,7,8-PeCDF	0.20	U	0.42	EMPC	0.30	U	0.40	U	3.2	EMPC	0.54	EMPC	0.70	U
HCX		NA		NA		NA	10.4	J	2350	J	62.2	J	73.8	J
2,3,4,6,7,8-HxCDF	0.20	U	0.30	U	0.20	U	0.61	EMPC	6.7	J	0.40	U	0.50	U
2,3,4,7,8-PeCDF	0.20	U	0.30	U	0.20	U	1.0	J	19.2	J	0.50	U	0.60	U
2,3,7,8-TCDD	0.91	U	2.7	EB	4.0	EB	695	$EB	20380	EMPC	745	$EB	330	EB
2,3,7,8-TCDF	0.20	U	0.96	J	0.20	U	1.7		73.0	J	0.93	EMPC	0.50	U
OCDD	15.1		4.2	JEB	3.6	EMPC	110	EB	803	JEB	2.9	JEB	1.8	U
OCDF	146		0.80	U	0.70	U	5.3	J	34.8	J	1.2	U	1.5	U
PCDD/Fs		NA		NA		NA		NA		NA		NA		NA
Total HpCDD	2.3	UJ	0.70	UJ	0.50	UJ	23.1	JEB	127	JEB	0.90	UJ	3.1	JEB
Total HpCDF	1.6	UJ	0.40	UJ	0.30	UJ	8.2	J	42.7	J	0.60	UJ	0.70	UJ
Total HxCDD	1.9	EMPC	0.50	UJ	0.40	UJ	12.5	J	629	J	26.0	J	177	J
Total HxCDF	0.20	UJ	0.46	J	0.90	EMPC	39.3	J	2180	J	3.4	J	12.2	J
Total PeCDD	0.30	UJ	0.40	UJ	0.40	UJ	5.5	EMPC	314	J	10.1	EMPC	20.9	EMPC
Total PeCDF	0.20	UJ	2.7	EMPC	1.7	EMPC	24.5	EMPC	936	J	2.5	EMPC	4.1	EMPC
Total TCDD	0.91	UJ	2.7	J	4.0	J	516	J	11550	J	626	J	344	J
Total TCDF	0.20	UJ	1.8	EMPC	0.49	UJ	8.0	J	1280	J	2.5	UJ	3.1	EMPC
Toxicity Equivalency	0.025	J	2.9	J	4.0	J	700	J	20500	J	750	J	340	J

U- Not detected; UJ- Detection limit approximate, J- Quantitation approximate;
*/$ - From dilution analysis; R- Rejected; NA- Not analyzed, EMPC- Estimated Maximum Possible Concentration; TB/EB- Equipment/Trip blank contamination

TABLE 4-2a (cont.)
SUMMARY OF DETECTED DIOXINS AND FURANS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW06-0204		CM-SO-MW06-DUP01		CM-SO-MW06-0406		CM-SO-MW06-0606		CM-SO-MW07-0304		CM-SO-MW07-0406		CM-SO-MW07-0606	
Sample Location	MW06		MW06		MW06		MW06		MW07		MW07		MW07	
Date Sampled	12/19/2000		12/19/2000		12/19/2000		12/19/2000		12/21/2000		12/21/2000		12/21/2000	
Interval	2.0-4.0		2.0-4.0		4.0-6.0		6.0-8.0		3.0-4.0		4.0-6.0		6.0-8.0	
QC Identifier	Field Dup. CM-SO-MW06-0204		Field Dup. CM-SO-MW06-0204		None		None		None		None		None	
Dioxin Analysis (NG/KG)														
1,2,3,4,6,7,8-HpCDD	755	J	455		147		77.1		105		17.0		0.43	EMPC
1,2,3,4,6,7,8-HpCDF	327	J	210		59.3		32.2		32.3		6.7	B	1.5	JB
1,2,3,4,7,8,9-HpCDF	57.0	J	28.7	EMPC	7.3		4.0	J	2.0	J	0.40	U	0.30	U
1,2,3,4,7,8-HxCDD	17.2	J	11.0		5.8		2.7	J	1.5	J	0.23	J	0.20	U
1,2,3,4,7,8-HxCDF	127	J	94.1		40.4		18.7		4.8	J	1.4	JB	0.97	JB
1,2,3,6,7,8-HxCDD	54.8	J	37.3		20.3		9.4		5.3		0.47	J	0.20	U
1,2,3,6,7,8-HxCDF	58.8	J	34.3	J	15.7		7.8		2.8	J	0.65	JB	0.46	JB
1,2,3,7,8,9-HxCDD	56.3	J	35.7		17.4		8.6		4.4	J	0.46	EMPC	0.20	U
1,2,3,7,8,9-HxCDF	4.2	UJ	2.9	U	0.30	U	0.30	U	0.20	U	0.30	U	0.20	U
1,2,3,7,8-PeCDD	16.5	J	11.7		6.1		3.1	J	1.4	J	0.20	U	0.20	U
1,2,3,7,8-PeCDF		R		R		R		R		R	0.20	U	0.68	J
HCX	22.6	J	18.2	J		NA		NA	83.3	J		NA		NA
2,3,4,6,7,8-HxCDF	43.7	J	32.7		14.0		6.9		3.5	J	0.72	J	0.21	EMPC
2,3,4,7,8-PeCDF	40.3	J	28.0		9.5		4.6	J	1.9	J	0.58	EMPC	0.32	J
2,3,7,8-TCDD	193	J	190		1.3		0.84	EMPC	417	$	40.3		3.1	
2,3,7,8-TCDF	63.7	J	52.6		17.0		8.1		2.8		0.61	J	0.49	J
OCDD	6520	J$	5310	J$	1010	J	663	J	689	J	816		7.7	JB
OCDF	953	J	760	J	140	J	91.2	J	51.5		30.6		0.50	U
PCDD/Fs		NA		NA		NA		NA		NA		NA		NA
Total HpCDD	1390	J	909	J	346	J	182	J	211	J	38.0		0.97	EMPC
Total HpCDF	736	J	429	J	152	J	84.7	J	77.8	J	14.9	EMPC	1.5	
Total HxCDD	340	J	383	J	295	J	119	J	55.8	J	7.5	EMPC	2.0	EMPC
Total HxCDF	510	J	460	J	152	J	79.3	J	88.7	J	15.1	EMPC	3.2	EMPC
Total PeCDD	16.5	J	90.5	J	63.1	J	27.9	J	9.9	J	0.20	U	0.87	EMPC
Total PeCDF	333	J$	306	J	375	J	174	J	47.9	J	15.0	EMPC	3.9	EMPC
Total TCDD	297	J	322	J	29.7	J	11.2	J	442	J$	43.1	EMPC	3.4	EMPC
Total TCDF	538	J$	318	J$	491	J	225	J	30.2	J	24.6	EMPC	1.9	EMPC
Toxicity Equivalency	284	J	253	J	27.5	J	13.7	J	423	J		NA		NA

Sample Number	CM-SO-MW06-0204		CM-SO-MW06-DUP01		CM-SO-MW06-0406		CM-SO-MW06-0606		CM-SO-MW07-0304		CM-SO-MW07-0406		CM-SO-MW07-0606	
Sample Location	MW06		MW06		MW06		MW06		MW07		MW07		MW07	
Date Sampled	12/19/2000		12/19/2000		12/19/2000		12/19/2000		12/21/2000		12/21/2000		12/21/2000	
Interval	2.0-4.0		2.0-4.0		4.0-6.0		6.0-8.0		3.0-4.0		4.0-6.0		6.0-8.0	
QC Identifier	Field Dup. CM-SO-MW06-0204		Field Dup. CM-SO-MW06-0204		None		None		None		None		None	
Dioxin Analysis (NG/KG)														
1,2,3,4,6,7,8-HpCDD	755	J	455		147		77.1		105		17.0		0.43	EMPC
1,2,3,4,6,7,8-HpCDF	327	J	210		59.3		32.2		32.3		6.7	B	1.5	JB
1,2,3,4,7,8,9-HpCDF	57.0	J	28.7	EMPC	7.3		4.0	J	2.0	J	0.40	U	0.30	U
1,2,3,4,7,8-HxCDD	17.2	J	11.0		5.8		2.7	J	1.5	J	0.23	J	0.20	U
1,2,3,4,7,8-HxCDF	127	J	94.1		40.4		18.7		4.8	J	1.4	JB	0.97	JB
1,2,3,6,7,8-HxCDD	54.8	J	37.3		20.3		9.4		5.3		0.47	J	0.20	U
1,2,3,6,7,8-HxCDF	58.8	J	34.3	J	15.7		7.8		2.8	J	0.65	JB	0.46	JB
1,2,3,7,8,9-HxCDD	56.3	J	35.7		17.4		8.6		4.4	J	0.46	EMPC	0.20	U
1,2,3,7,8,9-HxCDF	4.2	UJ	2.9	U	0.30	U	0.30	U	0.20	U	0.30	U	0.20	U
1,2,3,7,8-PeCDD	16.5	J	11.7		6.1		3.1	J	1.4	J	0.20	U	0.20	U
1,2,3,7,8-PeCDF		R		R		R		R		R	0.20	U	0.68	J
HCX	22.6	J	18.2	J		NA		NA	83.3	J		NA		NA
2,3,4,6,7,8-HxCDF	43.7	J	32.7		14.0		6.9		3.5	J	0.72	J	0.21	EMPC
2,3,4,7,8-PeCDF	40.3	J	28.0		9.5		4.6	J	1.9	J	0.58	EMPC	0.32	J
2,3,7,8-TCDD	193	J	190		1.3		0.84	EMPC	417	$	40.3		3.1	
2,3,7,8-TCDF	63.7	J	52.6		17.0		8.1		2.8		0.61	J	0.49	J
OCDD	6520	J$	5310	J$	1010	J	663	J	689	J	816		7.7	JB
OCDF	953	J	760	J	140	J	91.2	J	51.5		30.6		0.50	U
PCDD/Fs		NA		NA		NA		NA		NA		NA		NA
Total HpCDD	1390	J	909	J	346	J	182	J	211	J	38.0		0.97	EMPC
Total HpCDF	736	J	429	J	152	J	84.7	J	77.8	J	14.9	EMPC	1.5	
Total HxCDD	340	J	383	J	295	J	119	J	55.8	J	7.5	EMPC	2.0	EMPC
Total HxCDF	510	J	460	J	152	J	79.3	J	88.7	J	15.1	EMPC	3.2	EMPC
Total PeCDD	16.5	J	90.5	J	63.1	J	27.9	J	9.9	J	0.20	U	0.87	EMPC
Total PeCDF	333	J$	306	J	375	J	174	J	47.9	J	15.0	EMPC	3.9	EMPC
Total TCDD	297	J	322	J	29.7	J	11.2	J	442	J$	43.1	EMPC	3.4	EMPC
Total TCDF	538	J$	318	J$	491	J	225	J	30.2	J	24.6	EMPC	1.9	EMPC
Toxicity Equivalency	284	J	253	J	27.5	J	13.7	J	423	J		NA		NA

U- Not detected; UJ- Detection limit approximate, J- Quantitation approximate,
*/$ - From dilution analysis; R- Rejected; NA- Not analyzed; EMPC- Estimated Maximum Possible Concentration; TB/EB- Equipment/Trip blank contamination

TABLE 4-2a (cont.)
SUMMARY OF DETECTED DIOXINS AND FURANS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW08-0102		CM-SO-MW08-0204		CM-SO-DUP02		CM-SO-MW08-0406		CM-SO-MW08-0608		CM-SO-MW09-0406		CM-SO-MW09-1011	
Sample Location	MW08		MW08		MW08		MW08		MW08		MW09		MW09	
Date Sampled	12/26/2000		12/26/2000		12/26/2000		12/26/2000		12/26/2000		12/18/2000		12/18/2000	
Interval	1.0-2.0		2.0-4.0		2.0-4.0		4.0-6.0		6.0-8.0		4.0-6.0		10.0-11.0	
QC Identifier	None		Field Dup. CM-SO-MW08-0204		Field Dup. CM-SO-MW08-0204		None		None		None		None	
Dioxin Analysis (NG/KG)														
1,2,3,4,6,7,8-HpCDD	1150		33.9		36.7		22.3		1.6	J	16.1	J	0.60	J
1,2,3,4,6,7,8-HpCDF	548		83.5		75.0		3.7	JB	1.7	JB	27.4	J	1.5	U
1,2,3,4,7,8,9-HpCDF	50.5		2.7	J	2.9	J	0.45	J	0.40	U	1.7	J	0.20	U
1,2,3,4,7,8-HxCDD	20.3		0.72	J	0.83	EMPC	0.40	U	0.40	U	0.30	UJ	0.20	U
1,2,3,4,7,8-HxCDF	248		7.3	B	10.5		1.8	JB	1.1	JB	6.2	J	0.71	U
1,2,3,6,7,8-HxCDD	72.2		2.4	J	2.8	EMPC	0.40	U	0.40	U	1.1	J	0.20	U
1,2,3,6,7,8-HxCDF	82.6		5.2		5.6		1.0	JB	0.20	U	5.3	J	0.36	U
1,2,3,7,8,9-HxCDD	136		3.7	J	4.2	J	0.73	J	0.40	U	0.30	UJ	0.20	U
1,2,3,7,8,9-HxCDF	3.5	U	0.40	U	0.30	U	0.30	U	0.30	U	0.20	UJ	0.20	U
1,2,3,7,8-PeCDD	17.1		0.40	U	1.1	J	0.30	U	0.30	U	1.6	J	0.20	U
1,2,3,7,8-PeCDF	1.6	U	0.30	U	0.20	U	0.20	U	0.30	U		R		R
HCX		NA		NA		NA		NA		NA	3620	J	3.17	J
2,3,4,6,7,8-HxCDF	103		5.1		5.8		0.57	J	0.30	U	3.0	J	0.19	J
2,3,4,7,8-PeCDF	54.9		2.8	EMPC	3.7	J	0.79	J	0.30	U	1.8	EMPC	0.29	EMPC
2,3,7,8-TCDD	47.9		3.1		3.8		0.76	J	0.30	U	7150	$	25.0	
2,3,7,8-TCDF	41.5		1.7		2.2		0.77	EMPC	0.20	U	10.2	J	0.87	EMPC
OCDD	5560	E	183		186		597		10.2	B	139	J	6.4	UJ
OCDF	341		53.3		46.2		3.1	J	0.80	U	46.9	J	0.52	EMPC
PCDD/Fs		NA		NA		NA		NA		NA		NA		NA
Total HpCDD	2160		61.4		70.3		55.7		3.1		34.8	J	0.60	J
Total HpCDF	944		141		124		6.3		1.7		50.9	J	1.9	UJ
Total HxCDD	858		24.4		32.7	EMPC	4.0	EMPC	0.40	U	11.2	UJ	2.3	UJ
Total HxCDF	1290	EMPC	117	EMPC	115	EMPC	7.0		3.1	EMPC	72.1	J	3.7	UJ
Total PeCDD	215	EMPC	3.3	EMPC	10.7	EMPC	0.53	EMPC	0.30	U	5.5	J	0.39	UJ
Total PeCDF	2950	EMPC	262	EMPC	285	EMPC	12.6	EMPC	4.5	EMPC	53.1	J	4.6	UJ
Total TCDD	214	EMPC	7.2	EMPC	9.7		1.4		0.46		7290	J$	25.1	J
Total TCDF	6560	EMPC	455	EMPC	524	EMPC	26.7	EMPC	6.7	EMPC	64.3	J	0.86	UJ
Toxicity Equivalency		NA		NA		NA		NA		NA	7160	J	25.3	J

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate;
*/$ - From dilution analysis; R- Rejected; NA- Not analyzed; EMPC- Estimated Maximum Possible Concentration, TB/EB- Equipment/Trip blank contamination

TABLE 4-2a (cont.)
SUMMARY OF DETECTED DIOXINS AND FURANS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW14-0102		CM-SO-DUP03-0701		CM-SO-MW14-0204		CM-SO-MW14-0608		CM-SO-MW15D-0204		CM-SO-MW15D-0406		CM-SO-DUP-05	
Sample Location	MW14		MW14		MW14		MW14		MW15D		MW15D		MW15D	
Date Sampled	7/13/2001		7/13/2001		7/13/2001		7/13/2001		8/7/2001		8/7/2001		8/7/2001	
Interval	1.0-2.0		1.0-2.0		2.0-4.0		6.0-8.0		2.0-4.0		4.0-6.0		4.0-6.0	
QC Identifier	Field Dup. CM-SO-MW14-0102		Field Dup. CM-SO-MW14-0102		None		None		None		Field Dup. CM-SO-MW15D-0406		SO-MW15D-0406	
Dioxin Analysis (NG/KG)														
1,2,3,4,6,7,8-HpCDD	83.5	EB	112	EB	3.1	JEB	0.30	U	2.1	J	87.6	J	64.4	J
1,2,3,4,6,7,8-HpCDF	28.5	EB	40.4	EB	2.5	JEB	0.10	U	1.3	J	14.8	EMPC	12.3	J
1,2,3,4,7,8,9-HpCDF	3.6	JEB	6.1	JEB	0.40	U	0.20	U	0.40	U	2.2	UJ	4.9	UJ
1,2,3,4,7,8-HxCDD	1.8	JEB	2.1	U	0.30	U	0.20	U	0.40	U	1.7	UJ	1.8	UJ
1,2,3,4,7,8-HxCDF	14.4	EB	20.9	EB	0.78	JEB	0.090	U	0.55	J	7.2	J	6.6	J
1,2,3,6,7,8-HxCDD	4.2	JEB	6.5	EB	0.40	U	2.2	JEB	0.40	U	1.8	UJ	1.7	EMPC
1,2,3,6,7,8-HxCDF	6.2	EB	8.4	EB	0.20	U	0.090	U	0.30	U	1.1	UJ	2.7	UJ
1,2,3,7,8,9-HxCDD	5.3	EB	8.3	EB	0.40	U	0.20	U	0.40	U	1.7	UJ	1.8	UJ
1,2,3,7,8,9-HxCDF	0.60	U	1.7	U	0.30	U	0.10	U	0.30	U	1.3	UJ	3.3	UJ
1,2,3,7,8-PeCDD	0.60	U	1.8	U	0.30	U	2.2	JEB	0.40	U	0.90	UJ	0.80	UJ
1,2,3,7,8-PeCDF	29.3	EMPC	15.4	EMPC	0.20	U	0.10	U	0.30	U	0.60	UJ	0.90	UJ
HCX		NA		NA		NA	17.0	J	1.8	J	78.8	J	58.7	J
2,3,4,6,7,8-HxCDF	5.1	EB	7.8	EB	0.43	JEB	0.38	JEB	0.30	U	1.0	UJ	2.7	UJ
2,3,4,7,8-PeCDF	5.8	EB	7.8	EB	0.20	U	0.090	U	0.30	U	3.2	J	3.6	J
2,3,7,8-TCDD	3.3	EB	4.6	EB	2.8	EB	4.2	EB	80.1		2640	J$	1470	J$
2,3,7,8-TCDF	15.2	EB	20.5	EB	1.1	EB	1.6	EMPC	0.51	J	5.7	J	4.8	J
OCDD	685	EB	956	EB	22.4	EB	0.50	U	20.3		613	J	602	J
OCDF	81.4	EB	107	EB	4.1	JEB	0.40	U	2.6	J	35.5	J	21.4	J
PCDD/Fs		NA		NA		NA		NA		NA		NA		NA
Total HpCDD	167	JEB	229	JEB	6.7	JEB	0.30	UJ	4.0	J	174	J	125	J
Total HpCDF	67.0	JEB	96.8	JEB	4.6	JEB	0.10	UJ	1.3	J	16.0	J	38.3	J
Total HxCDD	47.2	JEB	66.0	JEB	1.2	JEB	15.3	JEB	0.40	UJ	13.6	JEB	10.1	JEB
Total HxCDF	67.4	JEB	96.7	JEB	3.3	JEB	36.7	JEB	15.9	J	216	J	146	J
Total PeCDD	5.3	JEB	5.9	JEB	0.30	UJ	10.9	JEB	0.40	UJ	9.4	EMPC	1.8	UJ
Total PeCDF	58.4	JEB	106	JEB	5.4	JEB	5.9	JEB	3.0	J	22.9	J	8.9	J
Total TCDD	22.8	J	29.3	J	3.3	J	6.4	J	81.1	J	2670	J$	1460	J$
Total TCDF	81.3	JEB	113	JEB	3.4	JEB	1.1	JEB	1.8	UJ	36.3	J	9.1	J
Toxicity Equivalency	14.1	J	18.2	J	3.09	J	6.82	J	80.3	J	2600	J	1500	J

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate,
*/$ - From dilution analysis; R- Rejected; NA- Not analyzed; EMPC- Estimated Maximum Possible Concentration; TB/EB- Equipment/Trip blank contamination

TABLE 4-2a (cont.)
SUMMARY OF DETECTED DIOXINS AND FURANS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW15D-0608		CM-SO-SB02-0204		CM-SO-SB02-0406		CM-SO-SB02-0608		CM-SO-SB03-0204		CM-SO-SB03-0406		CM-SO-DUP05	
Sample Location	MW15D		SB02		SB02		SB02		SB03		SB03		SB03	
Date Sampled	8/7/2001		1/3/2001		1/3/2001		1/3/2001		1/9/2001		1/9/2001		1/9/2001	
Interval	6.0-8.0		2.0-4.0		4.0-6.0		6.0-8.0		2.0-4.0		4.0-6.0		4.0-6.0	
QC Identifier	None		Field Dup. CM-SO-SB02-0204		None		None		None		Field Dup. CM-SO-SB03-0406		Field Dup. CM-SO-SB03-0406	
Dioxin Analysis (NG/KG)														
1,2,3,4,6,7,8-HpCDD	1.2	EMPC	714		561		333	J	56.7		1.3	J	1.2	J
1,2,3,4,6,7,8-HpCDF	0.60	U	2.7	U	32.0		26.5	J	10.4		0.37	EMPC	0.31	EMPC
1,2,3,4,7,8,9-HpCDF	0.70	U	3.6	U	4.7		3.1	J	0.77	EMPC	0.20	U	0.20	U
1,2,3,4,7,8-HxCDD	0.60	U	6.6	EMPC	4.6		3.3	J	0.70	J	0.20	U	0.20	U
1,2,3,4,7,8-HxCDF	0.40	U	21.9		13.0		11.2	J	1.4	J	0.10	U	0.10	U
1,2,3,6,7,8-HxCDD	0.60	U	21.7		15.6		10.3	J	3.1	J	0.20	U	0.20	U
1,2,3,6,7,8-HxCDF	0.40	U	11.8		5.6		4.9	J	1.3	J	0.10	U	0.090	U
1,2,3,7,8,9-HxCDD	0.60	U	26.3		14.5		11.0	J	1.7	J	0.20	U	0.20	U
1,2,3,7,8,9-HxCDF	0.50	U	1.2	U	1.7	U	1.8	UJ	0.48	J	0.10	U	0.10	U
1,2,3,7,8-PeCDD	0.60	U	4.3		2.6	EMPC	2.1	J	0.55	J	0.20	U	0.10	U
1,2,3,7,8-PeCDF	0.40	U	106	EMPC	40.7	EMPC	34.5	EMPC	0.20	U	0.10	U	0.10	U
HCX		NA	92.5	J	64.6	J	43.1	J	1.25	J		U		U
2,3,4,6,7,8-HxCDF	0.40	UJ	17.2		7.3		6.7	J	1.4	J	0.10	U	0.10	U
2,3,4,7,8-PeCDF	0.40	U	9.4		6.5	EMPC	6.0	J	0.75	J	0.10	U	0.10	U
2,3,7,8-TCDD	23.9		923	$	964	$	970	J$	12.7		0.50	J	0.22	EMPC
2,3,7,8-TCDF	0.30	U	22.9		13.8		10.3	J	1.4		0.10	U	0.090	U
OCDD	22.3		4660	J$EB	3150	J$EB	2330	JEB	367	EB	5.7	JEB	6.4	JEB
OCDF	1.3	U	95.4	J	57.9		41.7	J	22.0		0.71	EMPC	0.60	U
PCDD/Fs		NA		NA		NA		NA		NA		NA		NA
Total HpCDD	2.4	EMPC	1310	J	937	J	564	J	96.2	J	2.1	J	2.1	J
Total HpCDF	0.59	EMPC	183	J	79.1	J	64.6	J	27.9	J	0.47	J	0.31	EMPC
Total HxCDD	0.60	UJ	222	J	128	J	79.5	J	13.0	J	0.20	UJ	0.20	UJ
Total HxCDF	4.0	J	371	J	155	J	131	J	20.9	J	0.33	EMPC	0.29	J
Total PeCDD	0.60	UJ	29.3	J	15.4	J	11.5	J	0.94	J	0.20	UJ	0.10	UJ
Total PeCDF	0.40	UJ	368	J	135	J	131	J	9.4	J	0.10	UJ	0.10	UJ
Total TCDD	23.9	J	923	J$EB	964	J$EB	984	J$EB	13.8	J	0.50	J	0.22	EMPC
Total TCDF	0.30	UJ	245	J	126	J	132	J	8.4	J	0.31	UJ	0.60	UJ
Toxicity Equivalency	24.0	J	957.76	J	985.62	J	986.46	J	16.0	J	0.517	J	0.24	J

U- Not detected; UJ- Detection limit approximate, J- Quantitation approximate;
*/$ - From dilution analysis; R- Rejected; NA- Not analyzed; EMPC- Estimated Maximum Possible Concentration; TB/EB- Equipment/Trip blank contamination

TABLE 4-2a (cont.)
SUMMARY OF DETECTED DIOXINS AND FURANS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-SB03-0608		CM-SO-SB03-1820	
Sample Location	SB03		SB03	
Date Sampled	1/9/2001		1/9/2001	
Interval	6.0-8.0		18.0-20.0	
QC Identifier	None		None	
Dioxin Analysis (NG/KG)				
1,2,3,4,6,7,8-HpCDD	0.39	EMPC	0.30	U
1,2,3,4,6,7,8-HpCDF	0.20	U	0.20	U
1,2,3,4,7,8,9-HpCDF	0.20	U	0.20	U
1,2,3,4,7,8-HxCDD	0.20	U	0.20	U
1,2,3,4,7,8-HxCDF	0.10	U	0.10	U
1,2,3,6,7,8-HxCDD	0.20	U	0.20	U
1,2,3,6,7,8-HxCDF	0.10	U	0.10	U
1,2,3,7,8,9-HxCDD	0.20	U	0.20	U
1,2,3,7,8,9-HxCDF	0.20	U	0.20	U
1,2,3,7,8-PeCDD	0.20	U	0.10	U
1,2,3,7,8-PeCDF	0.10	U	0.10	U
HCX		U		U
2,3,4,6,7,8-HxCDF	0.10	U	0.10	U
2,3,4,7,8-PeCDF	0.10	U	0.10	U
2,3,7,8-TCDD	0.16	EMPC	0.10	U
2,3,7,8-TCDF	0.10	U	0.090	U
OCDD	2.9	JEB	0.79	EB
OCDF	0.62	J	0.50	U
PCDD/Fs		NA		NA
Total HpCDD	0.44	J	0.30	UJ
Total HpCDF	0.20	UJ	0.20	UJ
Total HxCDD	0.20	UJ	0.20	UJ
Total HxCDF	0.10	UJ	0.10	UJ
Total PeCDD	0.20	UJ	0.10	UJ
Total PeCDF	0.10	UJ	0.10	UJ
Total TCDD	0.16	EMPC	0.10	UJ
Total TCDF	0.78	UJ	0.57	UJ
Toxicity Equivalency	0.16	J	0.000079	J

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate,
*/$ - From dilution analysis; R- Rejected; NA- Not analyzed; EMPC- Estimated Maximum Possible Concentration, TB/EB- Equipment/Trip blank contamination

TABLE 4-2b
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW01-0102		CM-SO-MW01-0204		CM-SO-MW01-0406		CM-SO-MW01-0608		CM-SO-MW02-0204		CM-SO-MW02-0406		CM-SO-DUP04	
Sample Location	MW01		MW01		MW01		MW01		MW02		MW02		MW02	
Date Sampled	12/28/2000		12/28/2000		12/28/2000		12/28/2000		1/5/2001		1/5/2001		1/5/2001	
Interval	1.0-2.0		2.0-4.0		4.0-6.0		6.0-8.0		2.0-4.0		4.0-6.0		4.0-6.0	
QC identifier	None		None		None		None		None		Field Dup. CM-SO-MW02-0406		Field Dup. CM-SO-MW02-0406	
Volatile Organic Analysis (UG/KG)														
1,1,2-Trichloroethane	340	U	220	U	240	U	260	U	200	U	420	U	550	U
1,1-Dichloroethane	340	U	220	U	240	U	260	U	200	U	420	U	550	U
1,1-Dichloroethene		NA		NA		NA		NA		NA		NA		NA
1,2,3-Trichlorobenzene		NA		NA		NA		NA		NA		NA		NA
1,2,4-Trichlorobenzene	340	U	220	U	240	U	260	U	200	U	420	U	550	U
1,2,4-Trimethylbenzene		NA		NA		NA		NA		NA		NA		NA
1,2-Dibromo-3-chloropropane	340	U	220	U	240	U	260	U	200	U	420	U	550	U
1,2-Dichlorobenzene	340	U	220	U	240	U	260	U	200	U	420	U	550	U
1,2-Dichloroethane	340	U	220	U	240	U	260	U	200	U	420	U	550	U
1,3,5-Trimethylbenzene		NA		NA		NA		NA		NA		NA		NA
1,3-Dichlorobenzene	340	U	220	U	240	U	260	U	200	U	420	U	550	U
1,4-Dichlorobenzene	340	U	220	U	240	U	260	U	200	U	420	U	550	U
2-Butanone	340	U	220	U	240	U	260	U	200	U	420	U	300	J
2-Chlorotoluene		NA		NA		NA		NA		NA		NA		NA
4-Chlorotoluene		NA		NA		NA		NA		NA		NA		NA
4-Methyl-2-Pentanone	340	U	220	U	240	U	260	U	200	U	420	U	550	U
Acetone	340	UJ	410	UJ	290	UJ	390	UJ	490	U	420	UJ	1300	UJ
Benzene	340	U	220	U	240	U	260	U	200	U	420	U	550	U
Bromomethane	340	U	220	U	240	U	260	U	200	U	420	U	550	U
Chlorobenzene	340	U	220	U	240	U	69	J	200	U	420	U	550	U
Chloroethane	340	U	220	U	240	U	260	U	200	U	420	U	550	U
cis-1,2-Dichloroethene	340	U	220	U	50	J	260	U	200	U	420	U	550	U
Cyclohexane	340	U	220	U	240	U	260	U	200	U	420	U	550	U
Ethylbenzene	340	U	220	U	240	U	260	U	200	U	420	U	550	U
Hexachlorobutadiene		NA		NA		NA		NA		NA		NA		NA
Isopropylbenzene	340	U	220	U	240	U	260	U	200	U	420	U	550	U

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate,
*/$ - From dilution analysis, R- Rejected; EB/TB- Equipment/ Trip Blank contamination,
EMPC- Estimated Maximum Possible Concentration

TABLE 4-2b (cont.)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW01-0102		CM-SO-MW01-0204		CM-SO-MW01-0406		CM-SO-MW01-0606		CM-SO-MW02-0204		CM-SO-MW02-0406		CM-SO-DUP04	
Sample Location	MW01		MW01		MW01		MW01		MW02		MW02		MW02	
Date Sampled	12/28/2000		12/28/2000		12/28/2000		12/28/2000		1/5/2001		1/5/2001		1/5/2001	
Interval	1.0-2.0		2.0-4.0		4.0-6.0		6.0-8.0		2.0-4.0		4.0-6.0		4.0-6.0	
QC Identifier	None		None		None		None		None		Field Dup. CM-SO-MW02-0406		Field Dup. CM-SO-MW02-0406	
m&p-Xylene		NA		NA		NA		NA		NA		NA		NA
Methyl Acetate	300	JTB	430	TB	260	TB	250	JTB	240	U	530	U	550	U
Methylcyclohexane	340	U	220	U	240	U	260	U	200	U	420	U	550	U
Methylene Chloride	90	JTB	220	U	240	U	64	JTB	200	U	420	U	550	U
n-Butylbenzene		NA		NA		NA		NA		NA		NA		NA
n-Propylbenzene		NA		NA		NA		NA		NA		NA		NA
Naphthalene		NA		NA		NA		NA		NA		NA		NA
o-Xylene		NA		NA		NA		NA		NA		NA		NA
p-Isopropyltoluene		NA		NA		NA		NA		NA		NA		NA
sec-Butylbenzene		NA		NA		NA		NA		NA		NA		NA
Styrene	340	U	220	U	240	U	260	U	200	U	420	U	550	U
tert-Butylbenzene		NA		NA		NA		NA		NA		NA		NA
Tetrachloroethene	340	U	220	U	520		140	J	200	U	420	U	550	U
Toluene	340	U	220	U	240	U	260	U	200	U	420	U	550	U
Total Volatile Organics		NA		NA		NA		NA		NA		NA		NA
Total Xylenes	340	U	220	U	240	U	260	U	200	U	420	U	550	U
trans-1,2-Dichloroethene	340	U	220	U	240	U	260	U	200	U	420	U	550	U
Trichloroethene	340	U	220	U	260		260	U	200	U	420	U	550	U
Trichlorofluoromethane	340	U	220	UJ	240	UJ	260	UJ	200	U	420	U	550	U
Vinyl Chloride	340	U	220	U	240	U	260	U	200	U	420	U	550	U

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate;
*/$ - From dilution analysis; R- Rejected; EB/TB- Equipment/ Trip Blank contamination;
EMPC- Estimated Maximum Possible Concentration

TABLE 4-2b (cont.)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW02-0608		CM-SO-MW02-0810		CM-SO-MW02-1820		CM-SO-MW02-6163		CM-SO-MW02-6466		CM-SO-DUP02-0701		CM-SO-MW02-7272.2	
Sample Location	MW02		MW02		MW02		MW02		MW02		MW02		MW02	
Date Sampled	1/5/2001		1/5/2001		1/5/2001		6/26/2001		7/2/2001		7/2/2001		7/3/2001	
Interval	6.0-8.0		8.0-10.0		18.0-20.0		61.0-63.0		64.0-66.0		64.0-66.0		72.0-72.2	
QC Identifier	None		None		None		None		Field Dup CM-SO-MW02-6466		Field Dup CM-SO-MW02-6466		None	
Volatile Organic Analysis (UG/KG)														
1,1,2-Trichloroethane	290	U	220	U	240	U	100	U	140	U	100	U	120	U
1,1-Dichloroethane	290	U	220	U	240	U	100	U	140	U	100	U	120	U
1,1-Dichloroethene		NA		NA		NA		NA		NA		NA		NA
1,2,3-Trichlorobenzene		NA		NA		NA		NA		NA		NA		NA
1,2,4-Trichlorobenzene	290	U	220	U	240	U	100	U	140	U	100	U	120	U
1,2,4-Trimethylbenzene		NA		NA		NA		NA		NA		NA		NA
1,2-Dibromo-3-chloropropane	290	U	220	U	240	U		R		R		R		R
1,2-Dichlorobenzene	290	U	220	U	240	U	100	U	140	U	100	U	120	U
1,2-Dichloroethane	290	U	220	U	240	U	100	U	140	U	100	U	120	U
1,3,5-Trimethylbenzene		NA		NA		NA		NA		NA		NA		NA
1,3-Dichlorobenzene	290	U	220	U	240	U	100	U	140	U	100	U	120	U
1,4-Dichlorobenzene	290	U	220	U	240	U	100	U	140	U	100	U	120	U
2-Butanone	140	J	51	J	240	U	100	U	140	U	100	U	120	U
2-Chlorotoluene		NA		NA		NA		NA		NA		NA		NA
4-Chlorotoluene		NA		NA		NA		NA		NA		NA		NA
4-Methyl-2-Pentanone	290	U	220	U	240	U	100	U	140	U	100	U	120	U
Acetone	750	U	220	U	610	U	350	U	460	U	350	U	350	U
Benzene	290	U	220	U	240	U	100	U	140	U	100	U	120	U
Bromomethane	290	U	220	U	240	U	100	U	140	U	100	U	120	U
Chlorobenzene	290	U	220	U	240	U	100	U	140	U	100	U	120	U
Chloroethane	290	U	220	U	240	U	100	U	140	U	100	U	120	U
cis-1,2-Dichloroethene	290	U	220	U	240	U	100	U	140	U	100	U	120	U
Cyclohexane	290	U	220	U	240	U	100	U	140	U	100	U	120	U
Ethylbenzene	290	U	220	U	240	U	100	U	140	U	100	U	120	U
Hexachlorobutadiene		NA		NA		NA		NA		NA		NA		NA
Isopropylbenzene	290	U	220	U	240	U	100	U	140	U	100	U	120	U

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate;
*/$ - From dilution analysis; R- Rejected; EB/TB- Equipment/ Trip Blank contamination;
EMPC- Estimated Maximum Possible Concentration

TABLE 4-2b (cont.)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW02-0608		CM-SO-MW02-0810		CM-SO-MW02-1820		CM-SO-MW02-6163		CM-SO-MW02-6466		CM-SO-DUP02-0701		CM-SO-MW02-7272.2	
Sample Location	MW02		MW02		MW02		MW02		MW02		MW02		MW02	
Date Sampled	1/5/2001		1/5/2001		1/5/2001		6/26/2001		7/2/2001		7/2/2001		7/3/2001	
Interval	6.0-8.0		8.0-10.0		18.0-20.0		61.0-63.0		64.0-66.0		64.0-66.0		72.0-72.2	
QC Identifier	None		None		None		None		Field Dup CM-SO-MW02-6466		Field Dup CM-SO-MW02-6466		None	
m&p-Xylene		NA		NA		NA		NA		NA		NA		NA
Methyl Acetate	430	U	220	U	320	U	260	U	330	U	250	U	260	U
Methylcyclohexane	290	U	220	U	240	U	100	U	140	U	100	U	120	U
Methylene Chloride	290	U	220	U	240	U	100	U	140	U	100	U	120	U
n-Butylbenzene		NA		NA		NA		NA		NA		NA		NA
n-Propylbenzene		NA		NA		NA		NA		NA		NA		NA
Naphthalene		NA		NA		NA		NA		NA		NA		NA
o-Xylene		NA		NA		NA		NA		NA		NA		NA
p-Isopropyltoluene		NA		NA		NA		NA		NA		NA		NA
sec-Butylbenzene		NA		NA		NA		NA		NA		NA		NA
Styrene	290	U	220	U	240	U	100	U	140	U	100	U	120	U
tert-Butylbenzene		NA		NA		NA		NA		NA		NA		NA
Tetrachloroethene	290	U	220	U	240	U	100	U	140	U	26	J	120	U
Toluene	290	U	220	U	240	U	100	U	140	U	100	U	120	U
Total Volatile Organics		NA		NA		NA		NA		NA		NA		NA
Total Xylenes	290	U	220	U	240	U	100	U	140	U	100	U	120	U
trans-1,2-Dichloroethene	290	U	220	U	240	U	100	U	140	U	100	U	120	U
Trichloroethene	290	U	220	U	240	U	100	U	140	U	100	U	120	U
Trichlorofluoromethane	290	U	220	U	240	U	100	U	140	U	100	U	120	U
Vinyl Chloride	290	U	220	U	240	U	100	U	140	U	100	U	120	U

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate;
*/$ - From dilution analysis; R- Rejected, EB/TB- Equipment/ Trip Blank contamination;
EMPC- Estimated Maximum Possible Concentration

TABLE 4-2b (cont.)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW03-0406		CM-SO-MW03-0608		CM-SO-MW04-0204		CM-SO-MW04-0406		CM-SO-MW04-0608		CM-SO-MW04B-4244		CM-SO-DUP-04	
Sample Location	MW03		MW03		MW04		MW04		MW04		MW04B		MW04B	
Date Sampled	12/27/2000		12/27/2000		6/12/2001		6/12/2001		6/12/2001		8/2/2001		8/2/2001	
Interval	4.0-6.0		6.0-8.0		2.0-4.0		4.0-6.0		6.0-8.0		42.0-44.0		42.0-44.0	
QC Identifier	None		None		None		None		None		Field Dup CM-SO-MW04B-4244		Field Dup CM-SO-MW04B-4244	
Volatile Organic Analysis (UG/KG)														
1,1,2-Trichloroethane	350	U	290	U	500	U	180	U	160	U	65	U	85	U
1,1-Dichloroethane	350	U	290	U	500	U	180	U	160	U	65	U	85	U
1,1-Dichloroethene		NA		NA		NA		NA		NA		NA		NA
1,2,3-Trichlorobenzene		NA		NA		NA		NA		NA		NA		NA
1,2,4-Trichlorobenzene	350	U	290	U	500	U	180	U	160	U	65	U	85	U
1,2,4-Trimethylbenzene		NA		NA		NA		NA		NA		NA		NA
1,2-Dibromo-3-chloropropane	350	U	290	U	500	U	180	U	160	U	65	U	85	U
1,2-Dichlorobenzene	350	U	290	U	500	U	180	U	160	U	65	U	85	U
1,2-Dichloroethane	350	U	290	U	500	U	180	U	160	U	65	U	85	U
1,3,5-Trimethylbenzene		NA		NA		NA		NA		NA		NA		NA
1,3-Dichlorobenzene	350	U	290	U	500	U	180	U	160	U	65	U	85	U
1,4-Dichlorobenzene	350	U	290	U	500	U	180	U	160	U	65	U	85	U
2-Butanone	220	J	190	J	500	U	180	U	160	U	65	U	85	U
2-Chlorotoluene		NA		NA		NA		NA		NA		NA		NA
4-Chlorotoluene		NA		NA		NA		NA		NA		NA		NA
4-Methyl-2-Pentanone	350	U	290	U	500	U	180	U	160	U	65	U	85	U
Acetone	490	UJ	290	UJ	500	U	480	UJ	470	UJ	73	UJ	110	UJ
Benzene	350	U	290	U	500	U	180	U	160	U	65	U	85	U
Bromomethane	350	U	290	U	500	U	180	U	160	U	65	U	85	U
Chlorobenzene	350	U	290	U	500	U	180	U	160	U	65	U	85	U
Chloroethane	350	U	290	U	500	U	180	U	160	U	65	U	85	U
cis-1,2-Dichloroethene	350	U	290	U	500	U	180	U	160	U	65	U	85	U
Cyclohexane	350	U	290	U	500	U	180	U	160	U	65	U	85	U
Ethylbenzene	350	U	290	U	500	U	180	U	160	U	65	U	85	U
Hexachlorobutadiene		NA		NA		NA		NA		NA		NA		NA
Isopropylbenzene	350	U	290	U	500	U	180	U	160	U	65	U	85	U

U- Not detected, UJ- Detection limit approximate; J- Quantitation approximate;
*/$ - From dilution analysis; R- Rejected; EB/TB- Equipment/ Trip Blank contamination;
EMPC- Estimated Maximum Possible Concentration

TABLE 4-2b (cont.)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW03-0406		CM-SO-MW03-0608		CM-SO-MW04-0204		CM-SO-MW04-0406		CM-SO-MW04-0608		CM-SO-MW04B-4244		CM-SO-DUP-04	
Sample Location	MW03		MW03		MW04		MW04		MW04		MW04B		MW04B	
Date Sampled	12/27/2000		12/27/2000		6/12/2001		6/12/2001		6/12/2001		8/2/2001		8/2/2001	
Interval	4.0-6.0		6.0-8.0		2.0-4.0		4.0-6.0		6.0-8.0		42.0-44.0		42.0-44.0	
QC Identifier	None		None		None		None		None		Field Dup. CM-SO-MW04B-4244		Field Dup. CM-SO-MW04B-4244	
m&p-Xylene		NA		NA		NA		NA		NA		NA		NA
Methyl Acetate	390	TB	210	JTB	6200		180	U	250	U	88	U	120	U
Methylcyclohexane	350	U	290	U	500	U	180	U	160	U	65	U	85	U
Methylene Chloride	78	JTB	87	JTB	500	U	180	U	160	U	65	U	85	U
n-Butylbenzene		NA		NA		NA		NA		NA		NA		NA
n-Propylbenzene		NA		NA		NA		NA		NA		NA		NA
Naphthalene		NA		NA		NA		NA		NA		NA		NA
o-Xylene		NA		NA		NA		NA		NA		NA		NA
p-isopropyltoluene		NA		NA		NA		NA		NA		NA		NA
sec-Butylbenzene		NA		NA		NA		NA		NA		NA		NA
Styrene	350	U	290	U	500	U	180	U	160	U	65	U	85	U
tert-Butylbenzene		NA		NA		NA		NA		NA		NA		NA
Tetrachloroethene	490		160	J	500	U	180	U	160	U	65	U	85	U
Toluene	350	U	290	U	430	J	180	U	160	U	65	U	85	U
Total Volatile Organics		NA		NA		NA		NA		NA		NA		NA
Total Xylenes	350	U	290	U	500	U	180	U	160	U	65	U	85	U
trans-1,2-Dichloroethene	350	U	290	U	500	U	180	U	160	U	65	U	85	U
Trichloroethene	130	J	290	U	500	U	180	U	160	U	65	U	85	U
Trichlorofluoromethane	350	UJ	290	UJ	500	U	180	U	160	U	65	U	85	U
Vinyl Chloride	350	U	290	U	500	U	180	U	160	U	65	U	85	U

U- Not detected, UJ- Detection limit approximate; J- Quantitation approximate;
*/$ - From dilution analysis; R- Rejected; EB/TB- Equipment/ Trip Blank contamination,
EMPC- Estimated Maximum Possible Concentration

TABLE 4-2b (cont.)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW05-0102		CM-SO-DUP-01		CM-SO-MW05-0204		CM-SO-MW05-0406		CM-SO-MW05-0810		CM-SO-MW05-1012		CM-SO-MW06-0204	
Sample Location	MW05		MW05		MW05		MW05		MW05		MW05		MW06	
Date Sampled	6/18/2001		6/18/2001		6/18/2001		6/19/2001		6/19/2001		6/19/2001		12/19/2000	
Interval	1.0-2.0		1.0-2.0		2.0-4.0		4.0-6.0		8.0-10.0		10.0-12.0		2.0-4.0	
QC Identifier	Field Dup. CM-SO-MW05-0102		Field Dup. CM-SO-MW05-0102		None		None		None		None		Field Dup. CM-SO-MW06-0204	
Volatile Organic Analysis (UG/KG)														
1,1,2-Trichloroethane	110	U	95	U	100	U	110	UJ	90	U	100	U	300	U
1,1-Dichloroethane	110	U	95	U	100	U	110	UJ	90	U	100	U	300	U
1,1-Dichloroethene		NA		NA		NA		NA		NA		NA		NA
1,2,3-Trichlorobenzene		NA		NA		NA		NA		NA		NA		NA
1,2,4-Trichlorobenzene	110	U	95	U	100	U	160	UJ	90	U	100	U	300	U
1,2,4-Trimethylbenzene		NA		NA		NA		NA		NA		NA		NA
1,2-Dibromo-3-chloropropane	110	UJ	95	UJ	100	UJ	110	UJ	90	UJ	100	UJ	300	U
1,2-Dichlorobenzene	110	U	95	U	100	U	3400	J	26	J	40	J	300	U
1,2-Dichloroethane	110	U	95	U	100	U	110	UJ	90	U	100	U	300	U
1,3,5-Trimethylbenzene		NA		NA		NA		NA		NA		NA		NA
1,3-Dichlorobenzene	110	U	95	U	100	U	1000	J	90	U	100	U	300	U
1,4-Dichlorobenzene	110	U	95	U	100	U	800	J	90	U	100	U	300	U
2-Butanone	110	UJ	95	UJ	100	UJ	110	UJ	90	UJ	100	UJ	300	U
2-Chlorotoluene		NA		NA		NA		NA		NA		NA		NA
4-Chlorotoluene		NA		NA		NA		NA		NA		NA		NA
4-Methyl-2-Pentanone	110	U	95	U	100	U	110	UJ	90	U	100	U	300	U
Acetone	320	UJ	340	UJ	340	UJ	780	J	90	UJ	410	UJ	1200	UJ
Benzene	110	U	95	U	100	U	110	UJ	90	U	100	U	300	U
Bromomethane	110	U	95	U	100	U	110	UJ	90	U	100	U	300	U
Chlorobenzene	110	U	95	U	100	U	130	J	90	U	100	U	300	U
Chloroethane	110	U	95	U	100	U	110	UJ	90	U	100	U	300	U
cis-1,2-Dichloroethene	110	U	95	U	690		3100	J	220		170		300	U
Cyclohexane	110	U	95	U	100	U	110	UJ	90	U	100	U	300	U
Ethylbenzene	110	U	95	U	100	U	150	J	90	U	100	U	300	U
Hexachlorobutadiene		NA		NA		NA		NA		NA		NA		NA
Isopropylbenzene	110	U	95	U	100	U	120	J	90	U	100	U	300	U

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate;
*/$ - From dilution analysis; R- Rejected, EB/TB- Equipment/ Trip Blank contamination;
EMPC- Estimated Maximum Possible Concentration

TABLE 4-2b (cont.)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW05-0102		CM-SO-DUP-01		CM-SO-MW05-0204		CM-SO-MW05-0406		CM-SO-MW05-0810		CM-SO-MW05-1012		CM-SO-MW06-0204	
Sample Location	MW05		MW05		MW05		MW05		MW05		MW05		MW06	
Date Sampled	6/18/2001		6/18/2001		6/18/2001		6/19/2001		6/19/2001		6/19/2001		12/19/2000	
Interval	1.0-2.0		1.0-2.0		2.0-4.0		4.0-6.0		8.0-10.0		10.0-12.0		2.0-4.0	
QC Identifier	Field Dup. CM-SO-MW05-0102		Field Dup. CM-SO-MW05-0102		None		None		None		None		Field Dup. CM-SO-MW06-0204	
m&p-Xylene		NA		NA		NA		NA		NA		NA		NA
Methyl Acetate	210	U	150	U	260	U	340	UJ	150	U	180	U	560	
Methylcyclohexane	110	U	95	U	100	U	110	UJ	90	U	100	U	300	U
Methylene Chloride	110	U	95	U	100	U	110	UJ	58	J	85	J	300	U
n-Butylbenzene		NA		NA		NA		NA		NA		NA		NA
n-Propylbenzene		NA		NA		NA		NA		NA		NA		NA
Naphthalene		NA		NA		NA		NA		NA		NA		NA
o-Xylene		NA		NA		NA		NA		NA		NA		NA
p-Isopropyltoluene		NA		NA		NA		NA		NA		NA		NA
sec-Butylbenzene		NA		NA		NA		NA		NA		NA		NA
Styrene	110	U	95	U	100	U	110	UJ	90	U	100	U	300	U
tert-Butylbenzene		NA		NA		NA		NA		NA		NA		NA
Tetrachloroethene	110	U	95	U	230		300000	*J	9000	*	12000	*	300	U
Toluene	44	J	95	U	100	U	130	J	90	U	100	U	590	
Total Volatile Organics		NA		NA		NA		NA		NA		NA		NA
Total Xylenes	110	U	95	U	100	U	2500	J	43	J	88	J	300	U
trans-1,2-Dichloroethene	110	U	95	U	84	J	62	J	90	U	100	U	300	U
Trichloroethene	110	U	95	U	970		26000	*J	290		300		300	U
Trichlorofluoromethane	110	U	95	U	100	U	110	UJ	90	U	100	U	300	U
Vinyl Chloride	110	U	95	U	290		550	J	90	U	100	U	300	UJ

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate;
*/$ - From dilution analysis; R- Rejected; EB/TB- Equipment/ Trip Blank contamination;
EMPC- Estimated Maximum Possible Concentration

TABLE 4-2b (cont.)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW06-DUP01		CM-SO-MW06-0406		CM-SO-MW06-0608		CM-SO-MW07-0304		CM-SO-MW07-0406		CM-SO MW07-0608		CM-SO-MW08-0102	
Sample Location	MW06		MW06		MW06		MW07		MW07		MW07		MW08	
Date Sampled	12/19/2000		12/19/2000		12/19/2000		12/21/2000		12/21/2000		12/21/2000		12/26/2000	
Interval	2.0-4.0		4.0-6.0		6.0-8.0		3.0-4.0		4.0-6.0		6.0-8.0		1.0-2.0	
QC Identifier	Field Dup. CM-SO-MW06-0204		None		None		None		None		None		None	
Volatile Organic Analysis (UG/KG)														
1,1,2-Trichloroethane	300	U	120	J	190	U	500	U	260	U	280	U	260	U
1,1-Dichloroethane	300	U	430	U	190	U	500	U	260	U	280	U	260	U
1,1-Dichloroethene		NA		NA		NA		NA		NA		NA		NA
1,2,3-Trichlorobenzene		NA		NA		NA		NA		NA		NA		NA
1,2,4-Trichlorobenzene	300	U	430	U	190	U	500	U	260	U	280	U	260	U
1,2,4-Trimethylbenzene		NA		NA		NA		NA		NA		NA		NA
1,2-Dibromo-3-chloropropane	300	U	430	U	190	U	500	U	260	U	280	U	61	J
1,2-Dichlorobenzene	300	U	6500		91	J	500	U	260	U	280	U	1000	
1,2-Dichloroethane	300	U	160	J	190	U	500	U	260	U	280	U	260	U
1,3,5-Trimethylbenzene		NA		NA		NA		NA		NA		NA		NA
1,3-Dichlorobenzene	300	U	430	U	190	U	500	U	260	U	280	U	260	U
1,4-Dichlorobenzene	300	U	580		61	J	500	U	260	U	280	U	100	J
2-Butanone	300	U	4000		190	U	150	J	260	UJ	280	UJ	260	U
2-Chlorotoluene		NA		NA		NA		NA		NA		NA		NA
4-Chlorotoluene		NA		NA		NA		NA		NA		NA		NA
4-Methyl-2-Pentanone	300	U	430	U	190	U	500	U	260	U	280	U	260	U
Acetone	1300	UJ	3500	UJ	720	UJ	640	UJ	260	UJ	1000	UJ	990	U
Benzene	300	U	430	U	190	U	500	U	260	U	280	U	220	J
Bromomethane	300	U	430	U	190	U	500	U	260	U	280	U	260	U
Chlorobenzene	300	U	3300		350		500	U	260	U	280	U	130	J
Chloroethane	300	U	430	U	190	U	500	U	260	U	280	U	260	U
cis-1,2-Dichloroethene	300	U	7200		42	J	500	U	260	U	280	U	260	U
Cyclohexane	300	U	530	J	190	U	500	U	260	U	280	U	260	U
Ethylbenzene	300	U	2300		190	U	250	J	260	U	280	U	1300	
Hexachlorobutadiene		NA		NA		NA		NA		NA		NA		NA
Isopropylbenzene	300	U	430	U	190	U	500	U	260	U	280	U	360	

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate,
*/$ - From dilution analysis; R- Rejected, EB/TB- Equipment/ Trip Blank contamination;
EMPC- Estimated Maximum Possible Concentration

TABLE 4-2b (cont.)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW06 DUP01		CM-SO-MW06-0406		CM-SO-MW06-0608		CM-SO-MW07-0304		CM-SO-MW07-0406		CM-SO-MW07-0608		CM-SO-MW08-0102	
Sample Location	MW06		MW06		MW06		MW07		MW07		MW07		MW08	
Date Sampled	12/19/2000		12/19/2000		12/19/2000		12/21/2000		12/21/2000		12/21/2000		12/26/2000	
Interval	2.0-4.0		4.0-6.0		6.0-8.0		3.0-4.0		4.0-6.0		6.0-8.0		1.0-2.0	
QC Identifier	Field Dup. CM-SO-MW06-0204		None		None		None		None		None		None	
m&p-Xylene		NA		NA		NA		NA		NA		NA		NA
Methyl Acetate	500		1700		190	U	1200	U	260	U	280	U	330	U
Methylcyclohexane	300	U	1400		270		500	U	260	U	280	U	210	J
Methylene Chloride	300	U	430	U	190	U	500	U	260	U	280	U	260	U
n-Butylbenzene		NA		NA		NA		NA		NA		NA		NA
n-Propylbenzene		NA		NA		NA		NA		NA		NA		NA
Naphthalene		NA		NA		NA		NA		NA		NA		NA
o-Xylene		NA		NA		NA		NA		NA		NA		NA
p-Isopropyltoluene		NA		NA		NA		NA		NA		NA		NA
sec-Butylbenzene		NA		NA		NA		NA		NA		NA		NA
Styrene	300	U	430	U	190	U	500	U	260	U	280	U	260	U
tert-Butylbenzene		NA		NA		NA		NA		NA		NA		NA
Tetrachloroethene	300	U	160	J	190	U	500	U	260	U	280	U	260	U
Toluene	590		2500		190	U	6200		260	U	280	U	580	
Total Volatile Organics		NA		NA		NA		NA		NA		NA		NA
Total Xylenes	300	U	9800		220		500	U	260	U	280	U	7800	
trans-1,2-Dichloroethene	300	U	1200		190	U	500	U	260	U	280	U	260	U
Trichloroethene	300	U	3600		190	U	500	U	260	U	280	U	260	U
Trichlorofluoromethane	300	U	430	U	190	U	500	U	260	U	280	U	260	U
Vinyl Chloride	300	UJ	370	J	190	UJ	500	U	260	U	280	U	260	U

U- Not detected, UJ- Detection limit approximate; J- Quantitation approximate;
*/$ - From dilution analysis, R- Rejected, EB/TB- Equipment/ Trip Blank contamination,
EMPC- Estimated Maximum Possible Concentration

TABLE 4-2b (cont.)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW08-0204		CM-SO-DUP02		CM-SO-MW08-0406		CM-SO-MW08-0608		CM-SO-MW09-0406		CM-SO-MW09-1011		CM-SO-MW14-0102	
Sample Location	MW08		MW08		MW08		MW08		MW09		MW09		MW14	
Date Sampled	12/26/2000		12/26/2000		12/26/2000		12/26/2000		12/18/2000		12/18/2000		7/13/2001	
Interval	2.0-4.0		2.0-4.0		4.0-6.0		6.0-8.0		4.0-6.0		10.0-11.0		1.0-2.0	
QC Identifier	Field Dup. CM-SO-MW08-0204		Field Dup. CM-SO-MW08-0204		None		None		None		None		Field Dup. CM-SO-MW14-0102	
Volatile Organic Analysis (UG/KG)														
1,1,2-Trichloroethane	320	U	210	U	300	U	270	U	260	U	180	U	110	U
1,1-Dichloroethane	320	U	210	U	300	U	270	U	260	U	180	U	110	U
1,1-Dichloroethene		NA		NA		NA		NA		NA		NA		NA
1,2,3-Trichlorobenzene		NA		NA		NA		NA		NA		NA		NA
1,2,4-Trichlorobenzene	320	U	210	U	300	U	270	U	260	U	180	U	110	U
1,2,4-Trimethylbenzene		NA		NA		NA		NA		NA		NA		NA
1,2-Dibromo-3-chloropropane	320	U	210	U	300	U	270	U	240	J	180	U		R
1,2-Dichlorobenzene	96	J	65	J	300	U	270	U	260	U	180	U	1400	J
1,2-Dichloroethane	320	U	210	U	300	U	270	U	260	U	180	U	110	U
1,3,5-Trimethylbenzene		NA		NA		NA		NA		NA		NA		NA
1,3-Dichlorobenzene	320	U	210	U	300	U	270	U	260	U	180	U	390	J
1,4-Dichlorobenzene	320	U	210	U	300	U	270	U	260	U	180	U	390	J
2-Butanone	320	UJ	230	J	300	U	270	U	260	U	180	U	110	U
2-Chlorotoluene		NA		NA		NA		NA		NA		NA		NA
4-Chlorotoluene		NA		NA		NA		NA		NA		NA		NA
4-Methyl-2-Pentanone	320	U	210	U	300	U	270	U	260	U	180	U	250	
Acetone	320	UJ	900	UJ	1200	U	270	UJ	1100	UJ	720	UJ	540	U
Benzene	320	U	210	U	110	J	270	U	260	U	180	U	41	J
Bromomethane	320	U	210	U	300	U	270	U	260	U	180	U	110	U
Chlorobenzene	320	U	210	U	200	J	270	U	260	U	180	U	94	J
Chloroethane	320	U	210	U	300	U	270	U	260	U	180	U	110	U
cis-1,2-Dichloroethene	320	U	210	U	300	U	270	U	260	U	180	U	1400	
Cyclohexane	320	U	210	U	300	U	270	U	260	U	180	U	110	U
Ethylbenzene	320	U	210	U	300	U	270	U	260	U	180	U	120	
Hexachlorobutadiene		NA		NA		NA		NA		NA		NA		NA
Isopropylbenzene	320	U	210	U	300	U	270	U	260	U	180	U	110	U

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate;
*/$ - From dilution analysis; R- Rejected; EB/TB- Equipment/ Trip Blank contamination;
EMPC- Estimated Maximum Possible Concentration

TABLE 4-2b (cont.)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW08-0204		CM-SO-DUP02		CM-SO-MW08-0406		CM-SO-MW08-0608		CM-SO-MW09 0406		CM-SO-MW09-1011		CM-SO MW14-0102	
Sample Location	MW08		MW08		MW08		MW08		MW09		MW09		MW14	
Date Sampled	12/26/2000		12/26/2000		12/26/2000		12/26/2000		12/18/2000		12/18/2000		7/13/2001	
Interval	2.0-4.0		2.0-4.0		4.0-6.0		6.0-8.0		4.0-6.0		10.0-11.0		1.0-2.0	
QC Identifier	Field Dup. CM-SO-MW08-0204		Field Dup. CM-SO-MW08-0204		None		None		None		None		Field Dup. CM-SO-MW14-0102	
m&p-Xylene		NA		NA		NA		NA		NA		NA		NA
Methyl Acetate	400	U	310	U	510	U	270	U	250	J	180	U	380	U
Methylcyclohexane	320	U	210	U	300	U	270	U	260	U	180	U	110	U
Methylene Chloride	320	U	210	U	300	U	270	U	260	U	180	U	150	UJ
n-Butylbenzene		NA		NA		NA		NA		NA		NA		NA
n-Propylbenzene		NA		NA		NA		NA		NA		NA		NA
Naphthalene		NA		NA		NA		NA		NA		NA		NA
o-Xylene		NA		NA		NA		NA		NA		NA		NA
p-isopropyltoluene		NA		NA		NA		NA		NA		NA		NA
sec-Butylbenzene		NA		NA		NA		NA		NA		NA		NA
Styrene	320	U	210	U	300	U	270	U	260	U	180	U	110	U
tert-Butylbenzene		NA		NA		NA		NA		NA		NA		NA
Tetrachloroethene	320	U	210	U	300	U	270	U	260	U	180	U	170	
Toluene	320	U	210	U	300	U	270	U	260	U	180	U	97	
Total Volatile Organics		NA		NA		NA		NA		NA		NA		NA
Total Xylenes	320	J	230		500		270	U	260	U	180	U	660	J
trans-1,2-Dichloroethene	320	U	210	U	300	U	270	U	260	U	180	U	180	
Trichloroethene	320	U	210	U	300	U	270	U	260	U	180	U	2000	J
Trichlorofluoromethane	320	U	210	U	300	U	270	UJ	260	U	180	U	110	U
Vinyl Chloride	320	U	210	U	300	U	270	U	260	UJ	180	UJ	110	U

U- Not detected; UJ- Detection limit approximate, J- Quantitation approximate;
*/$ - From dilution analysis; R- Rejected; EB/TB- Equipment/ Trip Blank contamination;
EMPC- Estimated Maximum Possible Concentration

TABLE 4-2b (cont.)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-DUP03-0701		CM-SO-MW14-0204		CM-SO-MW14-0607		CM-SO-MW14-0708		CM-SO-MW14-5252.75		CM-SO-MW15D-0204		CM-SO-MW15D-0406	
Sample Location	MW14		MW14		MW14		MW14		MW14		MW15D		MW15D	
Date Sampled	7/13/2001		7/13/2001		7/13/2001		7/13/2001		7/18/2001		8/7/2001		8/7/2001	
Interval	1.0-2.0		2.0-4.0		6.0-7.0		7.0-8.0		52.0-52.8		2.0-4.0		4.0-6.0	
QC Identifier	Field Dup. CM-SO-MW14-0102		None		None		None		None		None		Field Dup. CM-SO-MW15D-0406	
Volatile Organic Analysis (UG/KG)														
1,1,2-Trichloroethane	150	UJ	140	U	90	U	75	U	90	U	140	U	120	U
1,1-Dichloroethane	150	UJ	140	U	90	U	75	U	90	U	140	U	120	U
1,1-Dichloroethene		NA		NA		NA		NA		NA		NA		NA
1,2,3-Trichlorobenzene		NA		NA		NA		NA		NA		NA		NA
1,2,4-Trichlorobenzene	150	UJ	140	U	90	U	75	U	90	U	140	U	120	U
1,2,4-Trimethylbenzene		NA		NA		NA		NA		NA		NA		NA
1,2-Dibromo-3-chloropropane		R		R		R		R		R		R		R
1,2-Dichlorobenzene	4200	J	69	J	90	U	75	U	90	U	140	U	120	U
1,2-Dichloroethane	150	UJ	140	U	90	U	75	U	90	U	140	U	120	U
1,3,5-Trimethylbenzene		NA		NA		NA		NA		NA		NA		NA
1,3-Dichlorobenzene	150	UJ	140	U	90	U	75	U	90	U	140	U	120	U
1,4-Dichlorobenzene	1100	J	140	U	90	U	75	U	90	U	140	U	120	U
2-Butanone	150	UJ	140	U	90	U	75	U	90	U	140	U	120	U
2-Chlorotoluene		NA		NA		NA		NA		NA		NA		NA
4-Chlorotoluene		NA		NA		NA		NA		NA		NA		NA
4-Methyl-2-Pentanone	330	J	140	U	90	U	75	U	90	U	140	U	120	U
Acetone	840	UJ	720	U	410	U	310	U	360	U	500	U	490	U
Benzene	40	J	140	U	90	U	75	U	90	U	140	U	120	U
Bromomethane	150	UJ	140	U	90	U	26	J	90	U	140	U	120	U
Chlorobenzene	130	J	140	U	90	U	75	U	90	U	140	U	120	U
Chloroethane	150	UJ	140	U	90	U	75	U	22	J	110	JTB	120	U
cis-1,2-Dichloroethene	970	J	140	U	90	U	75	U	90	U	140	U	120	U
Cyclohexane	150	UJ	140	U	90	U	75	U	90	U	140	U	120	U
Ethylbenzene	180	J	140	U	90	U	75	U	90	U	140	U	120	U
Hexachlorobutadiene		NA		NA		NA		NA		NA		NA		NA
Isopropylbenzene	150	UJ	140	U	90	U	75	U	90	U	140	U	120	U

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate;
*/$ - From dilution analysis; R- Rejected; EB/TB- Equipment/ Trip Blank contamination;
EMPC- Estimated Maximum Possible Concentration

TABLE 4-2b (cont.)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-DUP03-0701		CM-SO-MW14-0204		CM-SO-MW14-0607		CM-SO-MW14-0708		CM-SO-MW14-5252.75		CM-SO-MW15D-0204		CM-SO-MW15D-0406	
Sample Location	MW14		MW14		MW14		MW14		MW14		MW15D		MW15D	
Date Sampled	7/13/2001		7/13/2001		7/13/2001		7/13/2001		7/18/2001		8/7/2001		8/7/2001	
Interval	1.0-2.0		2.0-4.0		6.0-7.0		7.0-8.0		52.0-52.8		2.0-4.0		4.0-6.0	
QC Identifier	Field Dup. CM-SO-MW14-0102		None		None		None		None		None		Field Dup. CM-SO-MW15D-0406	
m&p-Xylene		NA		NA		NA		NA		NA		NA		NA
Methyl Acetate	580	UJ	600	U	240	U	180	U	210	U	410	U	490	U
Methylcyclohexane	150	UJ	140	U	90	U	75	U	90	U	140	U	120	U
Methylene Chloride	150	UJ	140	U	90	U	95	U	90	U	140	U	120	U
n-Butylbenzene		NA		NA		NA		NA		NA		NA		NA
n-Propylbenzene		NA		NA		NA		NA		NA		NA		NA
Naphthalene		NA		NA		NA		NA		NA		NA		NA
o-Xylene		NA		NA		NA		NA		NA		NA		NA
p-Isopropyltoluene		NA		NA		NA		NA		NA		NA		NA
sec-Butylbenzene		NA		NA		NA		NA		NA		NA		NA
Styrene	150	UJ	140	U	90	U	75	U	90	U	140	U	120	U
tert-Butylbenzene		NA		NA		NA		NA		NA		NA		NA
Tetrachloroethene	140	J	140	U	90	U	130		90	U	140	U	120	U
Toluene	93	J	140	U	90	U	75	U	90	U	140	U	35	J
Total Volatile Organics		NA		NA		NA		NA		NA		NA		NA
Total Xylenes	950	J	140	U	90	U	75	U	90	U	140	U	120	U
trans-1,2-Dichloroethene	150	J	140	U	90	U	75	U	90	U	140	U	120	U
Trichloroethene	970	J	140	U	90	U	75	U	90	U	140	U	120	U
Trichlorofluoromethane	150	UJ	140	U	90	U	75	U	90	U	140	U	120	U
Vinyl Chloride	150	UJ	140	U	90	U	75	U	90	U	140	U	120	U

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate;
*/$ - From dilution analysis, R- Rejected; EB/TB- Equipment/ Trip Blank contamination;
EMPC- Estimated Maximum Possible Concentration

TABLE 4-2b (cont.)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-DUP-05		CM-SO-MW15D-0608		CM-SO-MW15D-4850		CM-SO-SB02-0204		CM-SO-SB02-0406		CM-SO-SB02-0608		CM-SO-SB03-0204	
Sample Location	MW15D		MW15D		MW15D		SB02		SB02		SB02		SB03	
Date Sampled	8/7/2001		8/7/2001		8/8/2001		1/3/2001		1/3/2001		1/3/2001		1/9/2001	
Interval	4.0-6.0		6.0-8.0		48.0-50.0		2.0-4.0		4.0-6.0		6.0-8.0		2.0-4.0	
QC Identifier	Field Dup. CM-SO-MW15D-0406		None		None		Field Dup. CM-SO-SB02-0204		None		None		None	
Volatile Organic Analysis (UG/KG)														
1,1,2-Trichloroethane	100	U	110	U	100	U	380	U	260	U	220	U	300	U
1,1-Dichloroethane	100	U	110	U	100	U	380	U	260	U	220	U	300	U
1,1-Dichloroethene		NA		NA		NA		NA		NA		NA		NA
1,2,3-Trichlorobenzene		NA		NA		NA		NA		NA		NA		NA
1,2,4-Trichlorobenzene	100	U	110	U	100	U	380	UJ	260	UJ	220	UJ	300	U
1,2,4-Trimethylbenzene		NA		NA		NA		NA		NA		NA		NA
1,2-Dibromo-3-chloropropane		R		R		R	380	UJ	260	UJ	220	UJ	300	UJ
1,2-Dichlorobenzene	100	U	110	U	100	U	380	U	260	U	220	U	300	U
1,2-Dichloroethane	100	U	110	U	100	U	380	U	260	U	220	U	300	U
1,3,5-Trimethylbenzene		NA		NA		NA		NA		NA		NA		NA
1,3-Dichlorobenzene	100	U	110	U	100	U	380	U	260	U	220	U	300	U
1,4-Dichlorobenzene	100	U	110	U	100	U	380	U	260	U	220	U	300	U
2-Butanone	100	U	110	U	100	U	380	U	260	U	44	J	300	U
2-Chlorotoluene		NA		NA		NA		NA		NA		NA		NA
4-Chlorotoluene		NA		NA		NA		NA		NA		NA		NA
4-Methyl-2-Pentanone	100	U	110	U	100	U	380	U	260	U	65	J	300	U
Acetone	410	U	400	U	340	U	490	U	680	U	220	U	500	U
Benzene	100	U	110	U	100	U	380	U	260	U	220	U	300	U
Bromomethane	100	U	110	U	100	U	380	U	260	U	220	U	300	U
Chlorobenzene	100	U	110	U	100	U	630		1000		570		300	U
Chloroethane	100	U	110	U	100	U	380	U	260	U	220	U	300	U
cis-1,2-Dichloroethene	100	U	110	U	100	U	380	U	260	U	220	U	320	
Cyclohexane	100	U	110	U	100	U	380	U	260	U	220	U	300	U
Ethylbenzene	100	U	110	U	100	U	380	U	260	U	220	U	300	U
Hexachlorobutadiene		NA		NA		NA		NA		NA		NA		NA
Isopropylbenzene	100	U	110	U	100	U	380	U	260	U	220	U	300	U

U- Not detected, UJ- Detection limit approximate, J- Quantitation approximate,
"/$ - From dilution analysis; R- Rejected; EB/TB- Equipment/ Trip Blank contamination;
EMPC- Estimated Maximum Possible Concentration

TABLE 4-2b (cont.)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-DUP-05		CM-SO-MW15D-0608		CM-SO-MW15D-4850		CM-SO-SB02-0204		CM-SO-SB02-0406		CM-SO-SB02-0608		CM-SO-SB03-0204	
Sample Location	MW15D		MW15D		MW15D		SB02		SB02		SB02		SB03	
Date Sampled	8/7/2001		8/7/2001		8/8/2001		1/3/2001		1/3/2001		1/3/2001		1/9/2001	
Interval	4.0-6.0		6.0-8.0		48.0-50.0		2.0-4.0		4.0-6.0		6.0-8.0		2.0-4.0	
QC Identifier	Field Dup. CM-SO-MW15D-0406		None		None		Field Dup. CM-SO-SB02-0204		None		None		None	
m&p-Xylene		NA		NA		NA		NA		NA		NA		NA
Methyl Acetate	460	U	350	U	200	U	610	U	340	U	220	U	320	U
Methylcyclohexane	100	U	110	U	100	U	380	U	260	U	220	U	300	U
Methylene Chloride	100	U	110	U	100	U	380	U	260	U	220	U	300	U
n-Butylbenzene		NA		NA		NA		NA		NA		NA		NA
n-Propylbenzene		NA		NA		NA		NA		NA		NA		NA
Naphthalene		NA		NA		NA		NA		NA		NA		NA
o-Xylene		NA		NA		NA		NA		NA		NA		NA
p-Isopropyltoluene		NA		NA		NA		NA		NA		NA		NA
sec-Butylbenzene		NA		NA		NA		NA		NA		NA		NA
Styrene	100	U	110	U	100	U	380	U	260	U	220	U	300	U
tert-Butylbenzene		NA		NA		NA		NA		NA		NA		NA
Tetrachloroethene	100	U	110	U	100	U	380	U	260	U	220	U	430	
Toluene	42	J	110	U	100	U	380	U	260	U	220	U	300	U
Total Volatile Organics		NA		NA		NA		NA		NA		NA		NA
Total Xylenes	100	U	110	U	100	U	380	U	260	U	220	U	300	U
trans-1,2-Dichloroethene	100	U	110	U	100	U	380	U	260	U	220	U	300	U
Trichloroethene	100	U	110	U	100	U	380	U	260	U	220	U	160	J
Trichlorofluoromethane	100	U	110	U	100	U	380	U	260	U	220	U	300	U
Vinyl Chloride	100	U	110	U	100	U	380	U	260	U	220	U	76	J

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate;
*/$ - From dilution analysis; R- Rejected; EB/TB- Equipment/ Trip Blank contamination;
EMPC- Estimated Maximum Possible Concentration

TABLE 4-2b (cont.)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-SB03-0406		CM-SO-DUP05		CM-SO-SB03-0608		CM-SO-SB03-1820	
Sample Location	SB03		SB03		SB03		SB03	
Date Sampled	1/9/2001		1/9/2001		1/9/2001		1/9/2001	
Interval	4.0-6.0		4.0-6.0		6.0-8.0		18.0-20.0	
QC Identifier	Field Dup. CM-SO-SB03-0406		Field Dup. CM-SO-SB03-0406		None		None	
Volatile Organic Analysis (UG/KG)								
1,1,2-Trichloroethane	180	U	200	U	190	U	170	U
1,1-Dichloroethane	180	U	200	U	190	U	170	U
1,1-Dichloroethene		NA		NA		NA		NA
1,2,3-Trichlorobenzene		NA		NA		NA		NA
1,2,4-Trichlorobenzene	180	U	200	U	190	U	170	U
1,2,4-Trimethylbenzene		NA		NA		NA		NA
1,2-Dibromo-3-chloropropane	180	UJ	200	UJ	190	UJ	170	UJ
1,2-Dichlorobenzene	180	U	200	U	190	U	170	U
1,2-Dichloroethane	180	U	200	U	190	U	170	U
1,3,5-Trimethylbenzene		NA		NA		NA		NA
1,3-Dichlorobenzene	180	U	200	U	190	U	170	U
1,4-Dichlorobenzene	180	U	200	U	190	U	170	U
2-Butanone	180	U	200	U	190	U	170	U
2-Chlorotoluene		NA		NA		NA		NA
4-Chlorotoluene		NA		NA		NA		NA
4-Methyl-2-Pentanone	180	U	200	U	190	U	170	U
Acetone	440	U	390	U	190	U	240	U
Benzene	180	U	200	U	190	U	170	U
Bromomethane	180	U	200	U	190	U	170	U
Chlorobenzene	180	U	200	U	190	U	170	U
Chloroethane	180	U	200	U	190	U	170	U
cis-1,2-Dichloroethene	180	U	200	U	190	U	170	U
Cyclohexane	180	U	200	U	190	U	170	U
Ethylbenzene	180	U	200	U	190	U	170	U
Hexachlorobutadiene		NA		NA		NA		NA
Isopropylbenzene	180	U	200	U	190	U	170	U

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate;
*/$ - From dilution analysis; R- Rejected; EB/TB- Equipment/ Trip Blank contamination;
EMPC- Estimated Maximum Possible Concentration

TABLE 4-2b (cont.)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-SB03-0406		CM-SO-DUP05		CM-SO-SB03-0608		CM-SO-SB03-1820	
Sample Location	SB03		SB03		SB03		SB03	
Date Sampled	1/9/2001		1/9/2001		1/9/2001		1/9/2001	
Interval	4.0-6.0		4.0-6.0		6.0-8.0		18.0-20.0	
QC Identifier	Field Dup. CM-SO-SB03-0406		Field Dup. CM-SO-SB03-0406		None		None	
m&p-Xylene		NA		NA		NA		NA
Methyl Acetate	180	U	220	U	190	U	170	U
Methylcyclohexane	180	U	200	U	190	U	170	U
Methylene Chloride	180	U	200	U	190	U	170	U
n-Butylbenzene		NA		NA		NA		NA
n-Propylbenzene		NA		NA		NA		NA
Naphthalene		NA		NA		NA		NA
o-Xylene		NA		NA		NA		NA
p-Isopropyltoluene		NA		NA		NA		NA
sec-Butylbenzene		NA		NA		NA		NA
Styrene	180	U	200	U	190	U	170	U
tert-Butylbenzene		NA		NA		NA		NA
Tetrachloroethene	180	U	200	U	190	U	170	U
Toluene	180	U	200	U	190	U	170	U
Total Volatile Organics		NA		NA		NA		NA
Total Xylenes	180	U	200	U	190	U	170	U
trans-1,2-Dichloroethene	180	U	200	U	190	U	170	U
Trichloroethene	180	U	200	U	190	U	170	U
Trichlorofluoromethane	180	U	200	U	190	U	170	U
Vinyl Chloride	180	U	200	U	190	U	170	U

U- Not detected; UJ- Detection limit approximate, J- Quantitation approximate,
*/$ - From dilution analysis; R- Rejected; EB/TB- Equipment/ Trip Blank contamination;
EMPC- Estimated Maximum Possible Concentration

TABLE 4-2c
SUMMARY OF DETECTED SEMI-VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW01-0102		CM-SO-MW01-0204		CM-SO-MW01-0406		CM-SO-MW01-0608		CM-SO-MW02-0204		CM-SO-MW02-0608		CM-SO-MW02-0810		CM-SO-MW02-1820	
Sample Location	MW01		MW01		MW01		MW01		MW02		MW02		MW02		MW02	
Date Sampled	12/28/2000		12/28/2000		12/28/2000		12/28/2000		1/5/2001		1/5/2001		1/5/2001		1/5/2001	
Interval	1.0-2.0		2.0-4.0		4.0-6.0		6.0-8.0		2.0-4.0		6.0-8.0		8.0-10.0		18.0-20.0	
QC identifier	None		None		None		None		None		None		None		None	
Semivolatile Organic Analysis (UG/KG)																
1,1'-Biphenyl	380	U	1600	U	400	U	380	U	380	U	370	U	400	U	380	U
1,2,4-Trichlorobenzene		NA		NA		NA		NA		NA		NA		NA		NA
1,2-Dichlorobenzene		NA		NA		NA		NA		NA		NA		NA		NA
1,4-Dichlorobenzene		NA		NA		NA		NA		NA		NA		NA		NA
2,4,5-Trichlorophenol	950	U	4000	U	73	J	950	U	970	U	930	U	1000	U	940	U
2,4-Dichlorophenol	380	U	1600	U	400	U	380	U	380	U	370	U	400	U	380	U
2,4-Dimethylphenol	380	U	1600	U	400	U	380	U	380	U	370	U	400	U	380	U
2-Methylnaphthalene	380	U	1600	U	400	U	380	U	380	U	370	U	400	U	380	U
2-Methylphenol	380	U	1600	U	400	U	380	U	380	U	370	U	400	U	380	U
3+4-Methylphenols		NA		NA		NA		NA		NA		NA		NA		NA
4,6-Dinitro-2-methylphenol	950	U	4000	U	1000	U	950	J	970	U	930	U	1000	U	940	U
4-Chloroaniline	380	U	1600	U	400	U	380	U	380	U	370	U	400	U	380	U
4-Methylphenol		R		R		R		R	380	U	370	U	400	U	380	U
Acenaphthene	76	J	1600	U	110	J	380	U	380	U	370	U	400	U	380	U
Acenaphthylene	110	J	1600	U	140	J	380	U	380	U	78	J	400	U	380	U
Acetophenone	380	U	1600	U	400	U	380	U	380	U	370	U	400	U	380	U
Anthracene	330	J	280	J	250	J	39	J	380	U	130	J	400	U	380	U
BAPEQ		NA		NA		NA		NA		NA		NA		NA		NA
Benzaldehyde	380	U	1600	U	400	U	380	U	380	U	370	U	400	U	380	U
Benzo(a)anthracene	850		770	J	810		66	J	46	J	590	J	400	U	380	U
Benzo(a)pyrene	900		750	JEB	770		91	J	39	J	630	J	400	U	380	U
Benzo(b)fluoranthene	1800	JEB	750	J	750	EB	93	JEB	53	J	680	J	400	U	380	U
Benzo(g,h,i)perylene	190	J	300	J	310	J	44	J	380	U	220	J	400	U	380	U
Benzo(k)fluoranthene	1600	J	540	J	650		83	J	41	J	640	J	400	U	380	U
bis(2-Ethylhexyl)phthalate	86	J	470	J	480		230	J	380	U	670	U	400	U	380	U
Butylbenzylphthalate	380	U	1600	U	400	U	380	U	380	U	370	U	400	U	380	U

U- Not detected; UJ- Detection limit approximate, J- Quantitation approximate,
*- From dilution analysis, R- Rejected; NA- Not analyzed; NR- Not rejected,
TB/EB- Equipment/Trip blank contamination

TABLE 4-2c (cont.)
SUMMARY OF DETECTED SEMI-VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW01-0102		CM-SO-MW01-0204		CM-SO-MW01-0406		CM-SO-MW01-0608		CM-SO-MW02-0204		CM-SO-MW02-0608		CM-SO-MW02-0810		CM-SO-MW02-1820	
Sample Location	MW01		MW01		MW01		MW01		MW02		MW02		MW02		MW02	
Date Sampled	12/28/2000		12/28/2000		12/28/2000		12/28/2000		1/5/2001		1/5/2001		1/5/2001		1/5/2001	
Interval	1.0-2.0		2.0-4.0		4.0-6.0		6.0-8.0		2.0-4.0		6.0-8.0		8.0-10.0		18.0-20.0	
QC Identifier	None		None		None		None		None		None		None		None	
Caprolactam	380	U	1600	U	400	U	380	U	380	U	370	U	400	U	380	U
Carbazole	70	J	1600	UJ	140	J	380	UJ	380	U	370	U	400	U	380	U
Chrysene	900	EB	930	JEB	970	EB	120	JEB	66	J	760	J	400	U	380	U
Di-n-Butylphthalate	380	U	1600	U	400	U	380	U	380	U	370	U	400	U	380	U
Di-n-octylphthalate	380	U	1600	U	400	U	380	U	380	U	370	UJ	400	U	380	U
Dibenzo(a,h)anthracene	380	U	1600	U	140	J	380	U	380	U	370	UJ	400	U	380	U
Dibenzofuran	53	J	1600	U	62	J	380	U	380	U	370	U	400	U	380	U
Diethylphthalate	380	U	1600	U	400	U	380	U	380	U	370	U	400	U	380	U
Fluoranthene	2000	EB	1600	EB	1900	EB	170	JEB	99	J	1000	J	71	J	380	U
Fluorene	110	J	1600	U	130	J	380	U	380	U	67	J	400	U	380	U
High Molecular Weight PAHs		NA		NA		NA		NA		NA		NA		NA		NA
Indeno(1,2,3-cd)pyrene	260	J	340	J	480		67	J	380	U	200	J	400	U	380	U
Low Molecular Weight PAHs		NA		NA		NA		NA		NA		NA		NA		NA
N-Nitroso-diphenylamine	380	U	1600	U	400	U	380	U	380	U	370	U	400	U	380	U
Naphthalene	380	U	1600	U	400	U	380	U	380	U	41	J	400	U	380	U
Nitrobenzene	380	U	1600	U	400	U	380	U	380	U	370	U	400	U	380	U
Pentachlorophenol	950	U	4000	U	1000	U	950	U	970	U		R	1000	U	940	U
Phenanthrene	1200	EB	1200	JEB	1300	EB	77	JEB	380	U	460	J	49	J	380	U
Phenol	380	U	1600	U	400	U	380	U	380	U	370	U	400	U	380	U
Pyrene	1500	EB	1400	JEB	1700	EB	170	JEB	120	J	1800	J	88	J	380	U
Total PAH		NA		NA		NA		NA		NA		NA		NA		NA
Total Semi-Volatile Organics		NA		NA		NA		NA		NA		NA		NA		NA

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate;
*- From dilution analysis; R- Rejected; NA- Not analyzed; NR- Not rejected;
TB/EB- Equipment/Trip blank contamination

TABLE 4-2c (cont.)
SUMMARY OF DETECTED SEMI-VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW03-0406		CM-SO-MW03-0608		CM-SO-MW04-0406		CM-SO-MW04-0608		CM-SO-MW05-0102		CM-SO-DUP-01		CM-SO-MW05-0204		CM-SO-MW05-0406	
Sample Location	MW03		MW03		MW04		MW04		MW05		MW05		MW05		MW05	
Date Sampled	12/27/2000		12/27/2000		6/12/2001		6/12/2001		6/18/2001		6/18/2001		6/18/2001		6/19/2001	
Interval	4.0-6.0		6.0-8.0		4.0-6.0		6.0-8.0		1.0-2.0		1.0-2.0		2.0-4.0		4.0-6.0	
QC Identifier	None		None		None		None		Field Dup. CM-SO-MW05-0102		Field Dup. CM-SO-MW05-0102		None		None	
Semivolatile Organic Analysis (UG/KG)																
1,1'-Biphenyl	400	U	1100	U	420	U	360	U	360	U	360	U	82	J	820	U
1,2,4-Trichlorobenzene		NA		NA		NA		NA		NA		NA		NA		NA
1,2-Dichlorobenzene		NA		NA		NA		NA		NA		NA		NA		NA
1,4-Dichlorobenzene		NA		NA		NA		NA		NA		NA		NA		NA
2,4,5-Trichlorophenol	1000	U	2900	U	1100	U	900	U	890	U	900	U	86	J	16000	*
2,4-Dichlorophenol	400	U	1100	U	420	U	360	U	360	U	360	U	370	UJ	820	U
2,4-Dimethylphenol	400	U	1100	U	420	UJ	360	UJ	360	UJ	360	UJ	370	UJ	820	U
2-Methylnaphthalene	400	U	1100	U	420	U	360	U	360	U	360	U	240	UJ	2400	
2-Methylphenol	400	U	1100	U	420	U	360	U	360	U	360	U	370	UJ	820	U
3+4-Methylphenols		NA		NA		NA		NA		NA		NA		NA		NA
4,6-Dinitro-2-methylphenol	1000	U	2900	U	1100	U	900	U	890	U	900	U	940	UJ	2100	U
4-Chloroaniline	400	U	1100	U	420	U	360	U	360	U	360	U	370	UJ	820	U
4-Methylphenol		R		R	420	U	360	U	360	U	360	U	370	UJ	820	U
Acenaphthene	130	J	150	J	420	U	360	U	360	U	360	U	950	J	820	U
Acenaphthylene	140	J	120	J	420	U	360	U	360	U	360	U	110	J	820	U
Acetophenone	400	U	1100	U	420	U	360	U	360	U	360	U	40	J	820	U
Anthracene	300	J	320	J	420	U	360	U	360	U	360	U	2200	J	820	U
BAPEQ		NA		NA		NA		NA		NA		NA		NA		NA
Benzaldehyde	400	U	1100	U	420	U	360	U	360	U	360	U	370	UJ	820	U
Benzo(a)anthracene	840		840	J	420	U	360	U	360	U	360	U	3900	J*	820	U
Benzo(a)pyrene	870		790	J		R		R		R		R	2300	J*	820	U
Benzo(b)fluoranthene	1300	EB	680	JEB	420	U	360	U	360	U	360	U	4200	J*	470	J
Benzo(g,h,i)perylene	240	J	330	J	420	U	360	U	360	U	360	U	1100	J	820	U
Benzo(k)fluoranthene	1000		820	J	420	U	360	U	360	U	360	U	1600	J	820	U
bis(2-Ethylhexyl)phthalate	900		5000	J	420	U	360	U	360	U	360	U	540	UJ	1300	
Butylbenzylphthalate	75	J	1100	U	420	U	360	U	360	U	360	U	370	UJ	820	U

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate;
*- From dilution analysis; R- Rejected; NA- Not analyzed; NR- Not rejected;
TB/EB- Equipment/Trip blank contamination

TABLE 4-2c (cont.)
SUMMARY OF DETECTED SEMI-VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW03-0406		CM-SO-MW03-0608		CM-SO-MW04-0406		CM-SO-MW04-0608		CM-SO-MW05-0102		CM-SO-DUP-01		CM-SO-MW05-0204		CM-SO-MW05-0406	
Sample Location	MW03		MW03		MW04		MW04		MW05		MW05		MW05		MW05	
Date Sampled	12/27/2000		12/27/2000		6/12/2001		6/12/2001		6/18/2001		6/18/2001		6/18/2001		6/19/2001	
Interval	4.0-6.0		6.0-8.0		4.0-6.0		6.0-8.0		1.0-2.0		1.0-2.0		2.0-4.0		4.0-6.0	
QC Identifier	None		None		None		None		Field Dup. CM-SO-MW05-0102		Field Dup. CM-SO-MW05-0102		None		None	
Caprolactam	400	U	1100	U	420	U	360	U	360	U	360	U	370	UJ	820	U
Carbazole	88	J	150	J	420	U	360	U	360	U	360	U	1300	J	820	U
Chrysene	1100	EB	1000	JEB	420	U	360	U	360	U	360	U	3600	J*	820	U
Di-n-Butylphthalate	400	U	1100	U	420	U	360	U	360	U	360	U	370	UJ	820	U
Di-n-octylphthalate	400	U	1100	U	420	U	64	J	360	U	360	U	370	UJ	820	U
Dibenzo(a,h)anthracene	52	J	1100	U	420	U	360	U	360	U	360	U	360	J	820	U
Dibenzofuran	62	J	1100	U	420	U	360	U	360	U	360	U	700	J	820	U
Diethylphthalate	400	U	1100	U	420	U	360	U	360	U	360	U	370	UJ	820	U
Fluoranthene	2000	EB	2000	EB	420	U	360	U	360	U	360	U	7600	J*	960	
Fluorene	180	J	210	J	420	U	360	U	360	U	360	U	1200	J	820	U
High Molecular Weight PAHs		NA		NA		NA		NA		NA		NA		NA		NA
Indeno(1,2,3-cd)pyrene	280	J	530	J	420	U	360	U	360	U	360	U	1500	J	820	U
Low Molecular Weight PAHs		NA		NA		NA		NA		NA		NA		NA		NA
N-Nitroso-diphenylamine	400	U	1100	U	420	U	360	U	360	U	360	U	370	UJ	820	U
Naphthalene	400	U	1100	U	420	U	360	U	360	U	360	U	430		910	J
Nitrobenzene	400	U	1100	U	420	U	360	U	360	U	360	U	66	J	820	U
Pentachlorophenol	1000	U	2900	U	1100	U	900	U	890	U	900	U	940	UJ	2100	U
Phenanthrene	1200	EB	1400	JEB	420	U	360	U	360	U	360	U	7100	J*	1100	
Phenol	400	U	1100	U	420	U	360	U	360	U	360	U	370	UJ	820	U
Pyrene	1600	EB	1600	EB	420	U	360	U	360	U	360	U	6600	J*	830	
Total PAH		NA		NA		NA		NA		NA		NA		NA		NA
Total Semi-Volatile Organics		NA		NA		NA		NA		NA		NA		NA		NA

U- Not detected; UJ- Detection limit approximate, J- Quantitation approximate;
*- From dilution analysis; R- Rejected; NA- Not analyzed, NR- Not rejected,
TB/EB- Equipment/Trip blank contamination

TABLE 4-2c (cont.)
SUMMARY OF DETECTED SEMI-VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW05-0810		CM-SO-MW05-1012		CM-SO-MW06-0204		CM-SO-MW06-DUP01		CM-SO-MW06-0406		CM-SO-MW06-0608		CM-SO-MW07-0304	
Sample Location	MW05		MW05		MW06		MW06		MW06		MW06		MW07	
Date Sampled	6/19/2001		6/19/2001		12/19/2000		12/19/2000		12/19/2000		12/19/2000		12/21/2000	
Interval	8.0-10.0		10.0-12.0		2.0-4.0		2.0-4.0		4.0-6.0		6.0-8.0		3.0-4.0	
QC Identifier	None		None		Field Dup. CM-SO-MW06-0204		Field Dup. CM-SO-MW06-0204		None		None		None	
Semivolatile Organic Analysis (UG/KG)														
1,1'-Biphenyl	370	U	380	U	490		460		670		230	J	380	U
1,2,4-Trichlorobenzene		NA		NA		NA		NA		NA		NA		NA
1,2-Dichlorobenzene		NA		NA		NA		NA		NA		NA		NA
1,4-Dichlorobenzene		NA		NA		NA		NA		NA		NA		NA
2,4,5-Trichlorophenol	7000	*	1400		910	U	920	U	1200	U	1000	U	970	U
2,4-Dichlorophenol	76	J	380	U	360	U	370	U	460	U	410	U	380	U
2,4-Dimethylphenol	370	UJ	380	UJ	360	U	370	U	460	U	410	U	380	U
2-Methylnaphthalene	73	J	46	J	210	J	180	J	180	J	54	J	380	U
2-Methylphenol	370	U	380	U	360	U	370	U	460	U	410	U	380	U
3+4-Methylphenols		NA		NA		NA		NA		NA		NA		NA
4,6-Dinitro-2-methylphenol	930	U	960	U	910	U	920	U	1200	U	1000	U	970	U
4-Chloroaniline	370	U	380	U	360	U	370	U	460	U	410	U	380	U
4-Methylphenol	370	U	380	U	78	J		R	170	J		R	99	J
Acenaphthene	370	U	380	U	230	J	170	J	87	J	43	J	80	J
Acenaphthylene	370	U	380	U	360	U	370	U	460	U	410	U	92	J
Acetophenone	370	U	380	U	360	U	370	U	460	U	410	U	380	U
Anthracene	370	U	380	U	110	J	97	J	460	U	410	U	240	J
BAPEQ		NA		NA		NA		NA		NA		NA		NA
Benzaldehyde	370	U	380	U	360	U	370	U	460	U	410	U	380	U
Benzo(a)anthracene	370	U	380	U	180	J	170	J	84	J	49	J	710	
Benzo(a)pyrene		R		R	190	J	160	J	72	J	48	J	680	
Benzo(b)fluoranthene	370	U	380	U	250	J	340	J	92	J	62	J	810	
Benzo(g,h,i)perylene	370	U	380	U	130	J	120	J	53	J	43	J	450	
Benzo(k)fluoranthene	370	U	380	U	170	J	310	J	85	J	47	J	590	
bis(2-Ethylhexyl)phthalate	390	U	380	U	34000	*	41000	*	36000	*	11000	*	20000	*
Butylbenzylphthalate	61	J	40	J	180	J	120	J	460	U	410	U	75	J

U- Not detected, UJ- Detection limit approximate; J- Quantitation approximate;
*- From dilution analysis; R- Rejected, NA- Not analyzed, NR- Not rejected;
TB/EB- Equipment/Trip blank contamination

TABLE 4-2c (cont.)
SUMMARY OF DETECTED SEMI-VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW05-0810		CM-SO-MW05-1012		CM-SO-MW06-0204		CM-SO-MW06-DUP01		CM-SO-MW06-0406		CM-SO-MW06-0608		CM-SO-MW07-0304	
Sample Location	MW05		MW05		MW06		MW06		MW06		MW06		MW07	
Date Sampled	6/19/2001		6/19/2001		12/19/2000		12/19/2000		12/19/2000		12/19/2000		12/21/2000	
Interval	8.0-10.0		10.0-12.0		2.0-4.0		2.0-4.0		4.0-6.0		6.0-8.0		3.0-4.0	
QC Identifier	None		None		Field Dup. CM-SO-MW06-0204		Field Dup. CM-SO-MW06-0204		None		None		None	
Caprolactam	370	U	380	U	360	U	370	U	460	U	410	U	380	U
Carbazole	370	U	380	U	360	U	370	U	460	U	410	U	180	J
Chrysene	370	U	380	U	310	J	280	J	160	J	74	J	820	
Di-n-Butylphthalate	370	U	380	U	560		480		240	J	110	J	380	U
Di-n-octylphthalate	370	U	380	U	5100	*	6100	*	200	J	170	J	380	U
Dibenzo(a,h)anthracene	370	U	380	U	360	U	370	U	460	U	410	U	170	J
Dibenzofuran	370	U	380	U	140	J	100	J	460	U	410	U	61	J
Diethylphthalate	370	U	380	U	360	U	370	U	460	U	410	U	380	U
Fluoranthene	370	U	380	U	590		490		210	J	130	J	1700	
Fluorene	370	U	380	U	220	J	170	J	72	J	410	U	120	J
High Molecular Weight PAHs		NA		NA		NA		NA		NA		NA		NA
Indeno(1,2,3-cd)pyrene	370	U	380	U	170	J	140	J	68	J	57	J	610	
Low Molecular Weight PAHs		NA		NA		NA		NA		NA		NA		NA
N-Nitroso-diphenylamine	370	U	380	U	360	U	370	U	460	U	410	U	380	U
Naphthalene	370	U	380	U	110	J	96	J	160	J	53	J	380	U
Nitrobenzene	370	U	380	U	190	J	140	J	50	J	410	U	380	U
Pentachlorophenol	930	U	960	U	910	U	920	U	1200	U	1000	U	970	U
Phenanthrene	370	U	380	U	460		400		280	J	150	J	1200	
Phenol	370	U	380	U	52	J	46	J	120	J	51	J		R
Pyrene	370	U	380	U	590		490		210	J	120	J	1400	
Total PAH		NA		NA		NA		NA		NA		NA		NA
Total Semi-Volatile Organics		NA		NA		NA		NA		NA		NA		NA

U- Not detected; UJ- Detection limit approximate, J- Quantitation approximate;
*- From dilution analysis; R- Rejected; NA- Not analyzed; NR- Not rejected,
TB/EB- Equipment/Trip blank contamination

TABLE 4-2c (cont.)
SUMMARY OF DETECTED SEMI-VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW07-0406		CM-SO-MW07-0608		CM-SO-MW08-0102		CM-SO-MW08-0204		CM-SO-DUP02		CM-SO-MW08-0406		CM-SO-MW08-0608	
Sample Location	MW07		MW07		MW08		MW08		MW08		MW08		MW08	
Date Sampled	12/21/2000		12/21/2000		12/26/2000		12/26/2000		12/26/2000		12/26/2000		12/26/2000	
Interval	4.0-6.0		6.0-8.0		1.0-2.0		2.0-4.0		2.0-4.0		4.0-6.0		6.0-8.0	
QC Identifier	None		None		None		Field Dup. CM-SO-MW08-0204		Field Dup. CM-SO-MW08-0204		None		None	
Semivolatile Organic Analysis (UG/KG)														
1,1'-Biphenyl	400	U	390	U	420	U	410	U	450	U	450	U	380	U
1,2,4-Trichlorobenzene		NA		NA		NA		NA		NA		NA		NA
1,2-Dichlorobenzene		NA		NA		NA		NA		NA		NA		NA
1,4-Dichlorobenzene		NA		NA		NA		NA		NA		NA		NA
2,4,5-Trichlorophenol	1000	U	990	U	1100	U	1000	U	1100	U	1100	U	970	U
2,4-Dichlorophenol	400	U	390	U	420	U	410	U	450	U	450	U	380	U
2,4-Dimethylphenol	400	U	390	U	420	U	410	U	450	U	450	U	380	U
2-Methylnaphthalene	400	U	390	U	50	J	410	U	450	U	450	U	380	U
2-Methylphenol	400	U	390	U	420	U	410	U	450	U	450	U	380	U
3+4-Methylphenols		NA		NA		NA		NA		NA		NA		NA
4,6-Dinitro-2-methylphenol	1000	U	990	U	1100	U	1000	U	1100	U	1100	U	970	U
4-Chloroaniline	400	U	390	U	420	U	410	U	450	U	450	U	380	U
4-Methylphenol		R		R	910	J	200	J	310	J		R		R
Acenaphthene	68	J	390	U	420	U	410	U	450	U	450	U	380	U
Acenaphthylene	400	U	390	U	420	U	45	J	66	J	450	U	380	U
Acetophenone	400	U	390	U	420	U	410	U	60	J	450	U	380	U
Anthracene	93	J	390	U	64	J	63	J	80	J	450	U	380	U
BAPEQ		NA		NA		NA		NA		NA		NA		NA
Benzaldehyde	400	U	390	U	420	U	410	U	450	U	450	U	380	U
Benzo(a)anthracene	160	J	390	U	170	J	250	J	390	J	450	U	380	U
Benzo(a)pyrene	130	J	390	U	170	J	240	J	340	J	450	U	380	U
Benzo(b)fluoranthene	140	J	390	U	190	EB	230	JEB	300	JEB	450	U	380	U
Benzo(g,h,i)perylene	79	J	390	U	66	J	110	J	130	J	450	U	380	U
Benzo(k)fluoranthene	110	J	390	U	190	J	240	J	350	J	450	U	380	U
bis(2-Ethylhexyl)phthalate	400	U	42	J	5400	*J	170	J	260	J	130	J	190	J
Butylbenzylphthalate	400	U	390	U	420	U	67	J	120	J	450	U	380	U

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate,
*- From dilution analysis; R- Rejected; NA- Not analyzed; NR- Not rejected,
TB/EB- Equipment/Trip blank contamination

TABLE 4-2c (cont.)
SUMMARY OF DETECTED SEMI-VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW07-0406		CM-SO-MW07-0608		CM-SO-MW08-0102		CM-SO-MW08-0204		CM-SO-DUP02		CM-SO-MW08-0406		CM-SO-MW08-0608	
Sample Location	MW07		MW07		MW08		MW08		MW08		MW08		MW08	
Date Sampled	12/21/2000		12/21/2000		12/26/2000		12/26/2000		12/26/2000		12/26/2000		12/26/2000	
Interval	4.0-6.0		6.0-8.0		1.0-2.0		2.0-4.0		2.0-4.0		4.0-6.0		6.0-8.0	
QC Identifier	None		None		None		Field Dup. CM-SO-MW08-0204		Field Dup. CM-SO-MW08-0204		None		None	
Caprolactam	400	U	390	U	420	U	410	U	450	U	450	U	380	U
Carbazole	82	J	390	U	420	UJ	410	UJ	450	UJ	450	UJ	380	UJ
Chrysene	160	J	390	U	220	EB	280	JEB	400	JEB	450	U	380	U
Di-n-Butylphthalate	400	U	390	U	1100		410	U	84	J	450	U	380	U
Di-n-octylphthalate	400	U	390	U	1900		410	U	450	U	450	U	380	U
Dibenzo(a,h)anthracene	400	U	390	U	420	U	410	U	450	U	450	U	380	U
Dibenzofuran	55	J	390	U	420	U	410	U	450	U	450	U	380	U
Diethylphthalate	400	U	390	U	420	U	410	U	450	U	450	U	380	U
Fluoranthene	380	J	390	U	400	EB	470	EB	630	EB	76	JEB	380	U
Fluorene	79	J	390	U	420	U	410	U	450	U	450	U	380	U
High Molecular Weight PAHs		NA		NA		NA		NA		NA		NA		NA
Indeno(1,2,3-cd)pyrene	110	J	390	U	91	J	190	J	250	J	450	U	380	U
Low Molecular Weight PAHs		NA		NA		NA		NA		NA		NA		NA
N-Nitroso-diphenylamine	400	U	390	U	420	U	410	U	450	U	450	U	380	U
Naphthalene	52	J	390	U	130	J	410	U	46	J	450	U	380	U
Nitrobenzene	400	U	390	U	420	U	410	U	450	U	450	U	380	U
Pentachlorophenol	1000	U	990	U	1100	U	1000	U	1100	U	1100	U	970	U
Phenanthrene	490		390	U	320	EB	260	JEB	260	JEB	450	U	380	U
Phenol		R		R	220	J	410	U	450	U	450	U	380	U
Pyrene	320	J	390	U	330	EB	440	EB	590	EB	69	JEB	380	U
Total PAH		NA		NA		NA		NA		NA		NA		NA
Total Semi-Volatile Organics		NA		NA		NA		NA		NA		NA		NA

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate;
*- From dilution analysis; R- Rejected; NA- Not analyzed, NR- Not rejected;
TB/EB- Equipment/Trip blank contamination

TABLE 4-2c (cont.)
SUMMARY OF DETECTED SEMI-VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW09-0406		CM-SO-MW09-1011		CM-SO-MW14-0102		CM-SO-DUP03-0701		CM-SO-MW14-0204		CM-SO-MW14-0608		CM-SO-MW15D-0204	
Sample Location	MW09		MW09		MW14		MW14		MW14		MW14		MW15D	
Date Sampled	12/18/2000		12/18/2000		7/13/2001		7/13/2001		7/13/2001		7/13/2001		8/7/2001	
Interval	4.0-6.0		10.0-11.0		1.0-2.0		1.0-2.0		2.0-4.0		6.0-8.0		2.0-4.0	
QC Identifier	None		None		Field Dup. CM-SO-MW14-0102		Field Dup. CM-SO-MW14-0102		None		None		None	
Semivolatile Organic Analysis (UG/KG)														
1,1'-Biphenyl	850	U	360	U	330	U	340	U	380	U	340	U	370	U
1,2,4-Trichlorobenzene		NA		NA		NA		NA		NA		NA		NA
1,2-Dichlorobenzene		NA		NA		NA		NA		NA		NA		NA
1,4-Dichlorobenzene		NA		NA		NA		NA		NA		NA		NA
2,4,5-Trichlorophenol	2100	U	910	U	840	U	860	U	940	U	69	J	930	U
2,4-Dichlorophenol	850	U	360	U	330	U	340	U	380	U	340	U	370	U
2,4-Dimethylphenol	850	U	360	U	330	U	340	U	380	U	340	U	370	U
2-Methylnaphthalene	850	U	360	U	180	J	240	J	380	U	340	U	370	U
2-Methylphenol	850	U	360	U	330	U	340	U	380	U	340	U	370	U
3+4-Methylphenols		NA		NA		NA		NA		NA		NA		NA
4,6-Dinitro-2-methylphenol	2100	U	910	U	840	U	860	U	940	U	860	U	930	U
4-Chloroaniline	850	U	360	U	330	U	340	U	380	U	340	U	370	U
4-Methylphenol		R		R	330	U	340	U	380	U	340	U	370	U
Acenaphthene	850	U	360	U	330	U	41	J	380	U	340	U	370	U
Acenaphthylene	130	J	360	U	330	U	340	U	380	U	340	U	370	U
Acetophenone	850	U	360	U	330	U	340	U	380	U	340	U	370	U
Anthracene	110	J	360	U	63	J	94	J	47	J	340	U	51	J
BAPEQ		NA		NA		NA		NA		NA		NA		NA
Benzaldehyde	850	U	360	U	330	U	340	U	380	U	340	U	370	UJ
Benzo(a)anthracene	360	J	360	U	240	J	350		200	J	340	U	140	J
Benzo(a)pyrene	390	J	360	U	260	J	350		160	J	340	U	130	J
Benzo(b)fluoranthene	410	J	360	U	430		590		190	J	340	U	190	J
Benzo(g,h,i)perylene	400	J	360	U	69	J	56	J	380	U	340	U	77	J
Benzo(k)fluoranthene	350	J	360	U	200	J	300	J	140	J	340	U	79	J
bis(2-Ethylhexyl)phthalate	110	J	360	U	1000		1700		64	J	53	J	490	JEB
Butylbenzylphthalate	850	U	360	U	330	U	340	U	380	U	340	U	370	U

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate,
*- From dilution analysis; R- Rejected; NA- Not analyzed; NR- Not rejected;
TB/EB- Equipment/Trip blank contamination

TABLE 4-2c (cont.)
SUMMARY OF DETECTED SEMI-VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW09-0406		CM-SO-MW09-1011		CM-SO-MW14-0102		CM-SO-DUP03-0701		CM-SO-MW14-0204		CM-SO-MW14-0608		CM-SO-MW15D-0204	
Sample Location	MW09		MW09		MW14		MW14		MW14		MW14		MW15D	
Date Sampled	12/18/2000		12/18/2000		7/13/2001		7/13/2001		7/13/2001		7/13/2001		8/7/2001	
Interval	4.0-6.0		10.0-11.0		1.0-2.0		1.0-2.0		2.0-4.0		6.0-8.0		2.0-4.0	
QC Identifier	None		None		Field Dup. CM-SO-MW14-0102		Field Dup. CM-SO-MW14-0102		None		None		None	
Caprolactam	850	U	360	U	330	U	340	U	380	U	340	U	370	U
Carbazole	850	U	360	U	330	U	49	J	380	U	340	U	99	J
Chrysene	500	J	360	U	360		490		200	J	340	U	160	J
Di-n-Butylphthalate	850	U	360	U	290	J	390		380	U	340	U	370	U
Di-n-octylphthalate	850	U	360	U	330	U	340	U	380	U	340	U	370	U
Dibenzo(a,h)anthracene	110	J	360	U	330	U	340	U	380	U	340	U	370	U
Dibenzofuran	850	U	360	U	45	J	62	J	380	U	340	U	370	U
Diethylphthalate	850	U	360	U	330	U	340	U	380	U	340	U	370	U
Fluoranthene	780	J	360	U	580		850		320	J	340	U	330	J
Fluorene	850	U	360	U	36	J	50	J	380	U	340	U	370	U
High Molecular Weight PAHs		NA		NA		NA		NA		NA		NA		NA
Indeno(1,2,3-cd)pyrene	380	J	360	U	53	J	53	J	380	U	340	U	94	J
Low Molecular Weight PAHs		NA		NA		NA		NA		NA		NA		NA
N-Nitroso-diphenylamine	850	U	360	U	330	U	340	U	380	U	340	U	370	U
Napthalene	850	U	360	U	65	J	93	J	380	U	340	U	370	U
Nitrobenzene	850	U	360	U	330	U	340	U	380	U	340	U	370	U
Pentachlorophenol	2100	U	910	U	840	U	860	U	940	U	860	U	930	U
Phenanthrene	390	J	360	U	410		660		260	J	340	U	180	J
Phenol		R		R	330	U	340	U	380	U	340	U	370	U
Pyrene	650	J	360	U	350		540		280	J	340	U	230	J
Total PAH		NA		NA		NA		NA		NA		NA		NA
Total Semi-Volatile Organics		NA		NA		NA		NA		NA		NA		NA

U- Not detected; UJ- Detection limit approximate, J- Quantitation approximate,
*- From dilution analysis; R- Rejected, NA- Not analyzed; NR- Not rejected,
TB/EB- Equipment/Trip blank contamination

TABLE 4-2c (cont.)
SUMMARY OF DETECTED SEMI-VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW15D-0406		CM-SO-DUP05-0801		CM-SO-MW15D-0608		CM-SO-SB02-0204		CM-SO-DUP03		CM-SO-SB02-0406		CM-SO-SB02-0608		CM-SO-SB03-0204	
Sample Location	MW15D		MW15D		MW15D		SB02		SB02		SB02		SB02		SB03	
Date Sampled	8/7/2001		8/7/2001		8/7/2001		1/3/2001		1/3/2001		1/3/2001		1/3/2001		1/9/2001	
Interval	4.0-6.0		4.0-6.0		6.0-8.0		2.0-4.0		2.0-4.0		4.0-6.0		6.0-8.0		2.0-4.0	
QC Identifier	Field Dup. CM-SO-MW15D-0406		Field Dup. CM-SO-MW15D-0406		None		Field Dup. CM-SO-SB02-0204		Field Dup. CM-SO-SB02-0204		None		None		None	
Semivolatile Organic Analysis (UG/KG)																
1,1'-Biphenyl	350	J	300	J	380	U	2200	U	2300	U	230	J	120	J	990	U
1,2,4-Trichlorobenzene		NA		NA		NA		NA		NA		NA		NA		NA
1,2-Dichlorobenzene		NA		NA		NA		NA		NA		NA		NA		NA
1,4-Dichlorobenzene		NA		NA		NA		NA		NA		NA		NA		NA
2,4,5-Trichlorophenol	890	U	1000	U	950	U	5500	U	5800	U	2100	U	1000	U	2500	U
2,4-Dichlorophenol	350	U	400	U	380	U	2200	U	2300	U	830	U	400	U	990	U
2,4-Dimethylphenol	48	J	44	J	380	U	2200	U	2300	U	85	J	400	U	990	U
2-Methylnaphthalene	210	J	250	J	380	U	2200	U	2300	U	120	J	53	J	990	U
2-Methylphenol	350	U	400	U	380	U	2200	U	2300	U	830	U	400	U	990	U
3+4-Methylphenols		NA		NA		NA		NA		NA		NA		NA		NA
4,6-Dinitro-2-methylphenol	890	UJ	1000	UJ	950	U	5500	U	5800	U	2100	U	1000	U	2500	UJ
4-Chloroaniline	59	J	76	J	380	U	2200	U	2300	U	830	U	400	U	990	U
4-Methylphenol	58	J	43	J	380	U	2200	U	2300	U	200	J	81	J	990	U
Acenaphthene	49	J	68	J	380	U	2200	U	2300	U	830	U	400	U	390	J
Acenaphthylene	310	J	260	J	380	U	2200	U	2300	U	830	U	58	J	170	J
Acetophenone	350	U	400	U	380	U	2200	U	2300	U	830	U	400	U	990	U
Anthracene	320	J	400	J	380	U	2200	U	2300	U	97	J	54	J	860	J
BAPEO		NA		NA		NA		NA		NA		NA		NA		NA
Benzaldehyde	48	JEB	42	JEB	380	UJ	2200	U	2300	U	830	U	400	U	990	U
Benzo(a)anthracene	650	J	1100	J	54	J	700	J	600	J	390	J	330	J	3400	
Benzo(a)pyrene	730		960		51	J	550	J	440	J	240	J	190	J	2900	
Benzo(b)fluoranthene	1100		1300		67	J	680	J	550	J	310	J	270	J	3100	
Benzo(g,h,i)peryiene	440		470		59	J	270	J	2300	U	99	J	82	J	1400	
Benzo(k)fluoranthene	490		790		40	J	450	J	410	J	190	J	170	J	2200	
bis(2-Ethylhexyl)phthalate	2100	JEB	1200	JEB	110	JEB	6000		4800		3500		3100		990	U
Butylbenzylphthalate	350	U	400	U	380	U	2200	U	2300	U	830	U	400	U	990	U

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate;
*- From dilution analysis; R- Rejected; NA- Not analyzed; NR- Not rejected;
TB/EB- Equipment/Trip blank contamination

TABLE 4-2c (cont.)
SUMMARY OF DETECTED SEMI-VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW15D-0406		CM-SO-DUP05-0801		CM-SO-MW15D-0608		CM-SO-SB02-0204		CM-SO-DUP03		CM-SO-SB02-0406		CM-SO-SB02-0608		CM-SO-SB03-0204	
Sample Location	MW15D		MW15D		MW15D		SB02		SB02		SB02		SB02		SB03	
Date Sampled	8/7/2001		8/7/2001		8/7/2001		1/3/2001		1/3/2001		1/3/2001		1/3/2001		1/9/2001	
Interval	4.0-6.0		4.0-6.0		6.0-8.0		2.0-4.0		2.0-4.0		4.0-6.0		6.0-8.0		2.0-4.0	
QC Identifier	Field Dup. CM-SO-MW15D-0406		Field Dup. CM-SO-MW15D-0406		None		Field Dup. CM-SO-SB02-0204		Field Dup. CM-SO-SB02-0204		None		None		None	
Caprolactam	350	U	400	U	380	U	2200	U	2300	U	110	J	400	U	990	U
Carbazole	240	J	330	J	46	J	2200	U	2300	U	91	J	400	U	350	J
Chrysene	820		1300		62	J	1000	J	880	J	530	J	400		3500	
Di-n-Butylphthalate	39	J	400	U	380	U	2200	U	2300	U	830	U	400	U	990	U
Di-n-octylphthalate	350	U	400	U	380	U	2200	U	2300	U	150	J	400	U	990	U
Dibenzo(a,h)anthracene	45	J	220	J	380	U	2200	U	2300	U	830	U	400	U	640	J
Dibenzofuran	58	J	70	J	380	U	2200	U	2300	U	830	U	400	U	210	J
Diethylphthalate	350	U	400	U	380	U	2200	U	2300	U	830	U	400	U	990	U
Fluoranthene	1400	J	2500	J	130	J	1500	J	1400	J	780	J	600		5200	
Fluorene	100	J	130	J	380	U	2200	U	2300	U	88	J	400	U	480	J
High Molecular Weight PAHs		NA		NA		NA		NA		NA		NA		NA		NA
Indeno(1,2,3-cd)pyrene	620		700		41	J	260	J	2300	U	89	J	75	J	1400	
Low Molecular Weight PAHs		NA		NA		NA		NA		NA		NA		NA		NA
N-Nitroso-diphenylamine	350	U	400	U	380	U	2200	U	2300	U	85	J	400	U	990	U
Naphthalene	190	J	230	J	380	U	2200	U	2300	U	830	U	400	U	140	J
Nitrobenzene	350	U	400	U	380	U	2200	U	2300	U	150	J	67	J	990	U
Pentachlorophenol	890	U	1000	U	950	U	5500	U	650	J	2100	U	1000	U	2500	U
Phenanthrene	760		1000		82	J	520	J	490	J	340	J	270	J	3600	
Phenol	350	U	400	U	380	U	2200	U	2300	U	830	U	400	U	990	U
Pyrene	1100		1800		95	J	1900	J	1600	J	1100		910		6300	
Total PAH		NA		NA		NA		NA		NA		NA		NA		NA
Total Semi-Volatile Organics		NA		NA		NA		NA		NA		NA		NA		NA

U- Not detected, UJ- Detection limit approximate; J- Quantitation approximate;
*- From dilution analysis; R- Rejected, NA- Not analyzed; NR- Not rejected;
TB/EB- Equipment/Trip blank contamination

TABLE 4-2c (cont.)
SUMMARY OF DETECTED SEMI-VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-SB03-0406		CM-SO-DUP05		CM-SO-SB03-0608		CM-SO-SB03-1820	
Sample Location	SB03		SB03		SB03		SB03	
Date Sampled	1/9/2001		1/9/2001		1/9/2001		1/9/2001	
Interval	4.0-6.0		4.0-6.0		6.0-8.0		18.0-20.0	
QC Identifier	Field Dup. CM-SO-SB03-0406		Field Dup. CM-SO-SB03-0406		None		None	
Semivolatile Organic Analysis (UG/KG)								
1,1'-Biphenyl	380	U	370	U	380	U	400	U
1,2,4-Trichlorobenzene		NA		NA		NA		NA
1,2-Dichlorobenzene		NA		NA		NA		NA
1,4-Dichlorobenzene		NA		NA		NA		NA
2,4,5-Trichlorophenol	940	U	930	U	940	U	1000	U
2,4-Dichlorophenol	380	U	370	U	380	U	400	U
2,4-Dimethylphenol	380	U	370	U	380	U	400	U
2-Methylnaphthalene	380	U	370	U	380	U	400	U
2-Methylphenol	380	U	370	U	380	U	400	U
3+4-Methylphenols		NA		NA		NA		NA
4,6-Dinitro-2-methylphenol	940	U	930	U	940	U	1000	U
4-Chloroaniline	380	U	370	U	380	U	400	U
4-Methylphenol	380	U	370	U	380	U	400	U
Acenaphthene	380	U	370	U	380	U	400	U
Acenaphthylene	380	U	370	U	380	U	400	U
Acetophenone	380	U	370	U	380	U	400	U
Anthracene	380	U	370	U	380	U	400	U
BAPEQ		NA		NA		NA		NA
Benzaldehyde	380	U	370	U	380	U	400	U
Benzo(a)anthracene	380	U	370	U	380	U	400	U
Benzo(a)pyrene	380	U	370	U	380	U	400	U
Benzo(b)fluoranthene	380	U	370	U	380	U	400	U
Benzo(g,h,i)perylene	380	U	370	U	380	U	400	U
Benzo(k)fluoranthene	380	U	370	U	380	U	400	U
bis(2-Ethylhexyl)phthalate	380	U	370	U	380	U	400	U
Butylbenzylphthalate	380	U	370	U	380	U	400	U

U- Not detected, UJ- Detection limit approximate; J- Quantitation approximate;
*- From dilution analysis; R- Rejected; NA- Not analyzed, NR- Not rejected;
TB/EB- Equipment/Trip blank contamination

TABLE 4-2c (cont.)
SUMMARY OF DETECTED SEMI-VOLATILE ORGANIC COMPOUNDS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-SB03-0406		CM-SO-DUP05		CM-SO-SB03-0606		CM-SO-SB03-1820	
Sample Location	SB03		SB03		SB03		SB03	
Date Sampled	1/9/2001		1/9/2001		1/9/2001		1/9/2001	
Interval	4.0-6.0		4.0-6.0		6.0-8.0		18.0-20.0	
QC Identifier	Field Dup. CM-SO-SB03-0406		Field Dup. CM-SO-SB03-0406		None		None	
Caprolactam	380	U	370	U	380	U	400	U
Carbazole	380	U	370	U	380	U	400	U
Chrysene	380	U	370	U	380	U	400	U
Di-n-Butylphthalate	380	U	370	U	380	U	400	U
Di-n-octylphthalate	380	U	370	U	380	U	400	U
Dibenzo(a,h)anthracene	380	U	370	U	380	U	400	U
Dibenzofuran	380	U	370	U	380	U	400	U
Diethylphthalate	380	U	370	U	380	U	400	U
Fluoranthene	380	U	370	U	380	U	400	U
Fluorene	380	U	370	U	380	U	400	U
High Molecular Weight PAHs		NA		NA		NA		NA
Indeno(1,2,3-cd)pyrene	380	U	370	U	380	U	400	U
Low Molecular Weight PAHs		NA		NA		NA		NA
N-Nitroso-diphenylamine	380	U	370	U	380	U	400	U
Naphthalene	380	U	370	U	380	U	400	U
Nitrobenzene	380	U	370	U	380	U	400	U
Pentachlorophenol	940	U	930	U	940	U	1000	U
Phenanthrene	380	U	370	U	380	U	400	U
Phenol	380	U	370	U	380	U	400	U
Pyrene	380	U	370	U	380	U	400	U
Total PAH		NA		NA		NA		NA
Total Semi-Volatile Organics		NA		NA		NA		NA

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate;
*- From dilution analysis; R- Rejected; NA- Not analyzed; NR- Not rejected;
TB/EB- Equipment/Trip blank contamination

TABLE 4-2d
SUMMARY OF DETECTED PESTICIDES AND POLYCHLORINATED BIPHENYLS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW01-0102		CM-SO-MW01-0204		CM-SO-MW01-0406		CM-SO-MW01-0608		CM-SO-MW02-0204		CM-SO-MW02-0608		CM-SO-MW02-0810		CM-SO-MW02-1820	
Sample Location	MW01		MW01		MW01		MW01		MW02		MW02		MW02		MW02	
Date Sampled	12/28/2000		12/28/2000		12/28/2000		12/28/2000		1/5/2001		1/5/2001		1/5/2001		1/5/2001	
Interval	1.0-2.0		2.0-4.0		4.0-6.0		6.0-8.0		2.0-4.0		6.0-8.0		8.0-10.0		18.0-20.0	
QC Identifier	None		None		None		None		None		None		None		None	
Pesticide/PCB Analysis (UG/KG)																
4,4'-DDD	3.4	J	3.9	U	4.0	U	2.3	J	0.25	J	0.59	J	0.33	J	3.8	U
4,4'-DDE	1.6	J	4.4		4.0	U	1.6	J	0.77	J	1.7	J	1.1	J	0.15	J
4,4'-DDT	3.8	J	3.9	U	4.0	U	3.8	U	3.8	U	3.7	U	4.0	U	3.8	U
Aldrin	2	U	2.0	U	2.0	U	2.0	U	2.0	U	0.12	J	2.0	U	1.9	U
alpha-BHC	2	U	2.0	U	2.0	U	2.0	U	2.0	U	0.62	J	0.34	J	0.30	J
alpha-Chlordane	2	U	2.0	U	2.0	U	2.0	U	0.98	J	0.42	J	0.33	J	0.17	J
Aroclor, Total		NA		NA		NA		NA		NA		NA		NA		NA
Aroclor-1016	38	U	39	U	40	U	38	U	38	U	37	U	40	U	38	U
Aroclor-1232	38	U	39	U	40	U	38	U	38	U	37	U	40	U	38	U
Aroclor-1242	38	U	39	U	40	U	38	U	38	U	37	U	40	U	38	U
Aroclor-1248	38	U	39	U	40	U	38	U	96		96		40	U	38	U
Aroclor-1254	110		390		470		180		89		150		40	U	38	U
Aroclor-1260	38	U	39	U	40	U	38	U	38	U	37	U	40	U	38	U
beta-BHC	10		17		10		2.3		2.1	EB	1.9	U	2.0	U	1.9	U
delta-BHC	2	U	2.0	U	2.0	U	2.0	U	2.0	U	1.9	U	2.0	U	1.9	U
Dieldrin	4.8		16		4.6		1.6	J	2.0	JEB	5.0	EB	0.71	JEB	3.8	U
Endosulfan I	2	U	2.0	U	1.8	J	0.52	J	2.0	U	1.9	U	0.60	J	0.40	J
Endosulfan II	3.8	U	3.9	U	4.0	U	3.8	U	3.8	U	0.79	J	0.21	J	3.8	U
Endosulfan Sulfate	3.8	U	3.9	U	3.9	J	3.8	U	0.92	J	3.7	U	4.0	U	3.8	U
Endrin	3.8	U	3.9	U	4.0	U	3.8	U	3.8	U	3.7	U	4.0	U	3.8	U
Endrin Aldehyde	2.1	J	3.9	U	2.0	J	1.8	J	3.8	U	1.8	J	0.37	J	3.8	U
Endrin Ketone	8.8		9.6		11		3.8	U	0.67	J	3.2	J	1.8	J	3.8	U
gamma-BHC	2	U	2.0	U	2.0	U	2.0	U	0.96	J	1.9	U	0.82	J	1.9	U
gamma-Chlordane	2	U	2.0	U	2.0	U	2.0	U	1.2	J	1.8	J	2.0	U	1.9	U
Heptachlor	2	U	2.0	U	2.0	U	2	U	2.0	U	1.9	U	2.0	U	1.9	U
Heptachlor Epoxide	2	U	2.0	U	2.0	U	2.0	U	0.054	J	1.9	U	0.22	J	1.9	U
Methoxychlor	20	U	20	U	34		20	U	20	U	19	U	20	U	19	U
Toxaphene	200	U	200	U	200	U	200	U	200	U	190	U	200	U	190	U

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate;
* - From dilution analysis; R- Rejected; NA- Not analyzed; *EB/TB- Equipment/Trip* blank contamination

TABLE 4-2d (cont)
SUMMARY OF DETECTED PESTICIDES AND POLYCHLORINATED BIPHENYLS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW03-0406		CM-SO-MW03-0608		CM-SO-MW04-0406		CM-SO-MW04-0608		CM-SO-MW05-0102		CM-SO-DUP-01		CM-SO-MW05-0204		CM-SO-MW05-0406	
Sample Location	MW03		MW03		MW04		MW04		MW05		MW05		MW05		MW05	
Date Sampled	12/27/2000		12/27/2000		6/12/2001		6/12/2001		6/18/2001		6/18/2001		6/18/2001		6/19/2001	
Interval	4.0-6.0		6.0-8.0		4.0-6.0		6.0-8.0		1.0-2.0		1.0-2.0		2.0-4.0		4.0-6.0	
QC Identifier	None		None		None		None		Field Dup. CM-SO-MW05-0102		Field Dup. CM-SO-MW05-0102		None		None	
Pesticide/PCB Analysis (UG/KG)																
4,4'-DDD	7.1		13		4.3	UJ	3.6	U	3.6	U	3.6	U	4.3		410	U
4,4'-DDE	2.3	J	3.4	J	4.3	UJ	3.6	U	3.6	U	3.6	U	3.8	U	410	U
4,4'-DDT	15		3.8	U	4.3	UJ	3.6	U	3.6	U	3.6	U	6.1		410	U
Aldrin	2.1	U	2.0	U	2.2	UJ	1.8	U	1.9	U	1.9	U	1.9	U	210	U
alpha-BHC	2.1	U	2.0	U	2.2	UJ	1.8	U	1.9	U	1.9	U	1.9	U	210	U
alpha-Chlordane	3.6		2.3		2.2	UJ	1.8	U	1.9	U	1.9	U	1.9	U	210	U
Aroclor, Total		NA		NA		NA		NA		NA		NA		NA		NA
Aroclor-1016	40	U	38	U	43	U	36	U	36	U	36	U	38	U	17	U
Aroclor-1232	40	U	38	U	43	U	36	U	36	U	36	U	38	U	17	U
Aroclor-1242	40	U	38	U	43	U	36	U	36	U	36	U	38	U	17	U
Aroclor-1248	40	U	38	U	43	U	36	U	36	U	36	U	38	U	17	U
Aroclor-1254	40	U	170		43	U	36	U	36	U	36	U	38	U	17	U
Aroclor-1260	40	U	38	U	43	U	36	U	36	U	36	U	38	U	17	U
beta-BHC	2.1	U	27	J	2.2	UJ	1.8	U	1.9	U	1.9	U	1.9	U	210	U
delta-BHC	2.1	U	2.0	U	2.2	UJ	1.8	U	1.9	U	1.9	U	1.9	U		R
Dieldrin	2.5	J	5.7		4.3	UJ	3.6	U	3.6	U	3.6	U	3.8	U	410	U
Endosulfan I	2.1	U	2.0	U	2.2	UJ	1.8	U	1.9	U	1.9	U	1.9	U		R
Endosulfan II	4.0	U	3.8	U	4.3	UJ	3.6	U	3.6	U	3.6	U	3.8	U	410	U
Endosulfan Sulfate	4.0	U	3.1	J	4.3	UJ	3.6	U	3.6	U	3.6	U	3.8	U	410	U
Endrin	4.0	U	3.8	U	4.3	UJ	3.6	U	3.6	U	3.6	U	3.8	U	410	U
Endrin Aldehyde	2.9	J	1.6	J	4.3	UJ	3.6	U	3.6	U	3.6	U	3.8	U		R
Endrin Ketone	3.8	J	3.8	U	4.3	UJ	3.6	U	3.6	U	3.6	U	8.1		410	U
gamma-BHC	2.1	U	2.0	U	2.2	UJ	1.8	U	1.9	U	1.9	U	1.9	U	210	U
gamma-Chlordane	2.1	U	2.0	U	2.2	UJ	1.8	U	1.9	U	1.9	U	1.9	U	210	U
Heptachlor	2.1	U	2.0	U	2.2	UJ	1.8	U	1.9	U	1.9	U	1.9	U	210	U
Heptachlor Epoxide	2.1	U	2.0	U	2.2	UJ	1.8	U	1.9	U	1.9	U	1.9	U	210	U
Methoxychlor	20		17	J	22	UJ	18	U	19	U	19	U	19	U	2100	U
Toxaphene	210	U	200	U	220	UJ	180	U	190	U	190	U	190	U	4100	U

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate,
* - From dilution analysis; R- Rejected; NA- Not analyzed; EB/TB- Equipment/Trip blank contamination

TABLE 4-2d (cont)
SUMMARY OF DETECTED PESTICIDES AND POLYCHLORINATED BIPHENYLS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW05-0810		CM-SO-MW05-1012		CM-SO-MW06-0204		CM-SO-MW06-DUP01		CM-SO-MW06-0406		CM-SO-MW06-0608		CM-SO-MW07-0304		CM-SO-MW07-0406	
Sample Location	MW05		MW05		MW06		MW06		MW06		MW06		MW07		MW07	
Date Sampled	6/19/2001		6/19/2001		12/19/2000		12/19/2000		12/19/2000		12/19/2000		12/21/2000		12/21/2000	
Interval	8.0-10.0		10.0-12.0		2.0-4.0		2.0-4.0		4.0-6.0		6.0-8.0		3.0-4.0		4.0-6.0	
QC Identifier	None		None		Field Dup. CM-SO-MW06-0204		Field Dup. CM-SO-MW06-0204		None		None		None		None	
Pesticide/PCB Analysis (UG/KG)																
4,4'-DDD	3.7	U	3.8	U	7.3	U	7.3	U	4.6	U	4.1	U	3.8	U	4.0	U
4,4'-DDE	3.7	U	3.8	U	220	*J	400	*J	41		17		5.1		15	
4,4'-DDT	3.7	U	3.8	U	7.3	U	7.3	U	4.6	U	4.1	U	3.8	U	4.0	U
Aldrin	1.9	U	2.0	U	3.7	U	3.8	U	2.4	U	2.1	U	1.4	J	2.1	U
alpha-BHC	1.9	U	2.0	U	6.7		12		4.7		2.4		2.0	U	2.1	U
alpha-Chlordane	1.9	U	2.0	U	11		21		3.0		1.0	J	8.6		2.1	U
Aroclor, Total		NA		NA		NA		NA		NA		NA		NA		NA
Aroclor-1016	37	U	38	U	840		1400		320		150		38	U	40	U
Aroclor-1232	37	U	38	U	73	U	73	U	46	U	41	U	38	U	40	U
Aroclor-1242	37	U	38	U	73	U	73	U	46	U	41	U	38	U	40	U
Aroclor-1248	37	U	38	U	73	U	73	U	46	U	41	U	38	U	40	U
Aroclor-1254	37	U	38	U	4800	*J	8800	*J	4100	*	1300		120		32	J
Aroclor-1260	37	U	38	U	1100		1700		46	U	300		38	U	40	U
beta-BHC	1.9	U	2.0	U	3.7	U	3.8	U	2.4	U	2.1	U	4.6		2.1	U
delta-BHC	1.9	U	2.0	U	3.7	U	3.8	U	2.4	U	2.1	U	2.0	U	2.1	U
Dieldrin	3.7	U	3.8	U	260	*J	520	*J	65	J	26		2.9	J	4.0	U
Endosulfan I	1.9	U	2.0	U	3.7	U	5.7		2.3	J	1.1	J	2.0	U	2.1	U
Endosulfan II	3.7	U	3.8	U	7.3	U	7.3	U	10		6.1		2.1	J	4.0	U
Endosulfan Sulfate	3.7	U	3.8	U	7.3	U	7.3	U	74		4.1	U	4.5		4.0	U
Endrin	3.7	U	3.8	U	7.3	U	7.3	U	4.6	U	4.1	U	9.2		4.0	U
Endrin Aldehyde	3.7	U	3.8	U	7.3	U	7.3	U	4.6	U	4.1	U	3.8	U	4.0	U
Endrin Ketone	3.7	U	3.8	U	7.3	U	7.3	U	4.6	U	4.1	U	3.8	U	4.0	U
gamma-BHC	1.9	U	2.0	U	3.7	U	3.8	U	2.4	U	2.1	U	2.0	U	2.1	U
gamma-Chlordane	1.9	U	2.0	U	3.7	U	3.8	U	2.4	U	2.1	U	2.0	U	2.1	U
Heptachlor	1.9	U	2.0	U	3.7	U	3.8	U	2.4	U	2.1	U	2.0	U	2.1	U
Heptachlor Epoxide	1.9	U	2.0	U	3.7	U	2.2	J	2.4	U	2.1	U	2.0	U	2.1	U
Methoxychlor	19	U	20	U	37	U	38	U	24	U	21	U	20	U	21	U
Toxaphene	190	U	200	U	370	U	380	U	240	U	210	U	200	U	210	U

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate;
* - From dilution analysis; R- Rejected; NA- Not analyzed; EB/TB- Equipment/Trip blank contamination

TABLE 4-2d (cont)
SUMMARY OF DETECTED PESTICIDES AND POLYCHLORINATED BIPHENYLS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW07-0608		CM-SO-MW08-0102		CM-SO-MW08-0204		CM-SO-DUP02		CM-SO-MW08-0406		CM-SO-MW08-0608		CM-SO-MW09-0406		CM-SO-MW09-1011	
Sample Location	MW07		MW08		MW08		MW08		MW08		MW08		MW09		MW09	
Date Sampled	12/21/2000		12/26/2000		12/26/2000		12/26/2000		12/26/2000		12/26/2000		12/18/2000		12/18/2000	
Interval	6.0-8.0		1.0-2.0		2.0-4.0		2.0-4.0		4.0-6.0		6.0-8.0		4.0-6.0		10.0-11.0	
QC Identifier	None		None		Field Dup. CM-SO-MW08-0204		Field Dup. CM-SO-MW08-0204		None		None		None		None	
Pesticide/PCB Analysis (UG/KG)																
4,4'-DDD	3.9	U	4.2	U	4.1	U	4.5	U	4.4	U	3.8	U	4.2	U	3.6	U
4,4'-DDE	1.3	J	20		4.1	U	3.3	J	4.4	U	3.8	U	2.4	J	3.6	U
4,4'-DDT	3.9	U	4.2	U	4.1	U	4.5	U	4.4	U	3.8	U	4.2	U	3.6	U
Aldrin	2.0	U	2.2	U	2.1	U	2.3	U	2.3	U	2.0	U	2.2	U	1.9	U
alpha-BHC	1.1	J	1.8	J	2.3		2.3	U	2.3	U	2.0	U	2.2	U	1.9	U
alpha-Chlordane	2.0	U	2.2	U	2.1	U	2.3	U	2.3	U	2.0	U	3.1		1.9	U
Aroclor, Total		NA		NA		NA		NA		NA		NA		NA		NA
Aroclor-1016	39	U	42	U	41	U	45	U	44	U	38	U	42	U	36	U
Aroclor-1232	39	U	42	U	41	U	45	U	44	U	38	U	42	U	36	U
Aroclor-1242	39	U	42	U	41	U	45	U	44	U	38	U	42	U	36	U
Aroclor-1248	39	U	42	U	41	U	45	U	44	U	38	U	42	U	36	U
Aroclor-1254	39	U	1300		130		130		44	U	38	U	150		36	U
Aroclor-1260	39	U	500		41	U	45	U	44	U	38	U	42	U	36	U
beta-BHC	2.0	U	7.8		2.1	U	2.3	U	2.3	U	2.0	U	2.2	U	1.9	U
delta-BHC	2.0	U	2.2	U	2.1	U	2.3	U	2.3	U	2.0	U	2.2	U	1.9	U
Dieldrin	3.9	U	20		1.9	J	2.4	J	4.4	U	3.8	U	8.8		3.6	U
Endosulfan I	2.0	U	2.2	U	0.44	J	2.3	U	2.3	U	2.0	U	2.2	U	1.9	U
Endosulfan II	3.9	U	4.2	U	4.1	U	4.5	U	4.4	U	3.8	U	4.2	U	3.6	U
Endosulfan Sulfate	3.9	U	4.2	U	2.4	J	3.6	J	4.4	U	3.8	U	5.8		3.6	U
Endrin	3.9	U	4.2	U	4.1	U	4.5	U	4.4	U	3.8	U	4.2	U	3.6	U
Endrin Aldehyde	3.9	U	4.2	U	1.4	J	0.92	J	4.4	U	3.8	U	1.8	J	3.6	U
Endrin Ketone	3.9	U	4.2	U	5.5		2.6	J	4.4	U	3.8	U	1.4	J	3.6	U
gamma-BHC	0.96	J	2.2	U	2.1	U	2.3	U	2.3	U	2.0	U	2.2	U	1.9	U
gamma-Chlordane	2.0	U	2.2	U	2.1	U	2.3	U	2.3	U	2.0	U	2.2	U	1.9	U
Heptachlor	2.0	U	4.1		2.1	U	2.3	U	2.3	U	2.0	U	2.2	U	1.9	U
Heptachlor Epoxide	2.0	U	2.2	U	1.4	J	2.3	U	2.3	U	2.0	U	2.2	U	1.9	U
Methoxychlor	20	U	22	U	21	U	23	U	23	U	20	U	22	U	19	U
Toxaphene	200	U	220	U	210	U	230	U	230	U	200	U	220	U	190	U

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate;
* - From dilution analysis; R- Rejected; NA- Not analyzed; EB/TB- Equipment/Trip blank contamination

TABLE 4-2d (cont)
SUMMARY OF DETECTED PESTICIDES AND POLYCHLORINATED BIPHENYLS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW14-0102		CM-SO-DUP03-0701		CM-SO-MW14-0204		CM-SO-MW14-0608		CM-SO-MW15D-0204		CM-SO-MW15D-0406		CM-SO-DUP05-0801		CM-SO-MW15D-0608	
Sample Location	MW14		MW14		MW14		MW14		MW15D		MW15D		MW15D		MW15D	
Date Sampled	7/13/2001		7/13/2001		7/13/2001		7/13/2001		8/7/2001		8/7/2001		8/7/2001		8/7/2001	
Interval	1.0-2.0		1.0-2.0		2.0-4.0		6.0-8.0		2.0-4.0		4.0-6.0		4.0-6.0		6.0-8.0	
QC Identifier	Field Dup. CM-SO-MW14-0102		Field Dup. CM-SO-MW14-0102		None		None		None		Field Dup. CM-SO-MW15D-0406		Field Dup. CM-SO-MW15D-0406		None	
Pesticide/PCB Analysis (UG/KG)																
4,4'-DDD	16		15		1.0	J	3.4	U	3.7	U	3.5	U	4.0	U	3.8	U
4,4'-DDE	41		37		0.55	J	1.9	J	3.7	U	3.5	U	4.0	U	3.8	U
4,4'-DDT	330	UJ	330	UJ	3.8	U	3.4	U	3.7	U	3.5	U	4.0	U	3.8	U
Aldrin	0.54	J	0.56	J	1.9	U	1.8	U	1.9	U	1.8	U	2.1	U	2.0	U
alpha-BHC	2.0	J	2.1	J	1.9	UJ	1.8	U	1.9	U	1.8	U	2.1	U	2.0	U
alpha-Chlordane	7.2		6.0		1.9	U	1.2	J	1.9	U	1.8	U	2.1	U	2.0	U
Aroclor, Total		NA		NA		NA		NA		NA		NA		NA		NA
Aroclor-1016	33	U	34	U	38	U	34	U	37	U	35	U	40	U	38	U
Aroclor-1232	33	U	34	U	38	U	34	U	37	U	35	U	40	U	38	U
Aroclor-1242	33	U	34	U	38	U	34	U	37	U	35	U	40	U	38	U
Aroclor-1248	33	U	34	U	38	U	34	U	37	U	35	U	40	U	38	U
Aroclor-1254	3700		3300		38	U	34	U	37	U	35	U	40	U	38	U
Aroclor-1260	33	U	34	U	38	U	34	U	42		35	U	40	U	38	U
beta-BHC	1.3	U	1.8	U	0.82	U	3.4		1.9	U	1.8	U	2.1	U	2.0	U
delta-BHC	1.7	U	0.24	J	1.9	U	1.8	U	1.9	U	1.8	U	2.1	U	2.0	U
Dieldrin	90	*J	78	*	0.95	J	8.0		3.7	U	3.5	U	4.0	U	3.8	U
Endosulfan I		R		R	1.9	U	1.4	J	1.9	U	1.8	U	2.1	U	2.0	U
Endosulfan II	3.3	U	3.4	U	0.45	J	3.4	U	3.7	U	3.5	U	4.0	U	3.8	U
Endosulfan Sulfate	60	*	57	*	0.59	J	2.7	J	3.7	U	3.5	U	4.0	U	3.8	U
Endrin	2.5	J	3.4	U	3.8	U	3.4	U	3.7	U	3.5	U	4.0	U	3.8	U
Endrin Aldehyde		R		R	3.8	U	4.6	J	3.7	U	3.5	U	4.0	U	3.8	U
Endrin Ketone	5.2		1.9	J	1.6	J	3.4	U	3.7	U	3.5	U	4.0	U	3.8	U
gamma-BHC	1.4	JEB	1.2	JEB	1.9	U	1.8	U	1.9	U	1.8	U	2.1	U	2.0	U
gamma-Chlordane	33	*	28	*	1.0	J	1.8	U	0.49	J	1.8	U	2.1	U	2.0	U
Heptachlor	2.5		1.7		1.9	U	1.8	U	1.9	U	1.8	U	2.1	U	2.0	U
Heptachlor Epoxide	0.49	J	1.8	U	0.19	J	2.1		1.9	U	1.8	U	2.1	U	2.0	U
Methoxychlor	6.0	J	20		19	U	2.8	U	19	U	18	U	21	U	20	U
Toxaphene	170	U	180	U	190	U	180	U	190	U	180	U	210	U	200	U

U- Not detected; UJ- Detection limit approximate, J- Quantitation approximate;
* - From dilution analysis; R- Rejected; NA- Not analyzed, EB/TB- Equipment/Trip blank contamination

TABLE 4-2d (cont)
SUMMARY OF DETECTED PESTICIDES AND POLYCHLORINATED BIPHENYLS IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-SB02-0204		CM-SO-DUP03		CM-SO-SB02-0406		CM-SO-SB02-0608		CM-SO-SB03-0204		CM-SO-SB03-0406		CM-SO-DUP05		CM-SO-SB03-0608		CM-SO-SB03-1820	
Sample Location	SB02		SB02		SB02		SB02		SB03		SB03		SB03		SB03		SB03	
Date Sampled	1/3/2001		1/3/2001		1/3/2001		1/3/2001		1/9/2001		1/9/2001		1/9/2001		1/9/2001		1/9/2001	
Interval	2.0-4.0		2.0-4.0		4.0-6.0		6.0-8.0		2.0-4.0		4.0-6.0		4.0-6.0		6.0-8.0		18.0-20.0	
QC Identifier	Field Dup. CM-SO-SB02-0204		Field Dup. CM-SO-SB02-0204		None		None		None		Field Dup. CM-SO-SB03-0406		Field Dup. CM-SO-SB03-0406		None		None	
Pesticide/PCB Analysis (UG/KG)																		
4,4'-DDD	4.4	U	4.6	U	4.1	U	4.0	U	1.1	J	3.8	U	0.51	J	3.8	U	4.0	U
4,4'-DDE	46	J	110	*J	48		42		1.2	J	3.8	U	3.7	U	3.8	U	4.0	U
4,4'-DDT	4.4	U	4.6	U	4.1	U	4.0	U	4.9	U	3.8	U	3.7	U	3.8	U	4.0	U
Aldrin	2.0	J	5.8	J	1.2	J	1.7	J	2.5	U	1.9	U	0.21	J	1.9	U	2.0	U
alpha-BHC	0.55	J	0.85	J	0.71	J	0.58	J	2.5	U	1.9	U	0.27	J	1.9	U	0.17	J
alpha-Chlordane	9.7	J	19	J	11		7.1		0.75	J	1.9	U	1.9	U	1.9	U	2.0	U
Aroclor, Total		NA		NA		NA		NA		NA		NA		NA		NA		NA
Aroclor-1016	44	U	46	U	41	U	40	U	49	U	38	U	37	U	38	U	40	U
Aroclor-1232	44	U	46	U	41	U	40	U	49	U	38	U	37	U	38	U	40	U
Aroclor-1242	44	U	46	U	41	U	40	U	49	U	38	U	37	U	38	U	40	U
Aroclor-1248	1500	J	2900	J	1400		1500		49	U	38	U	37	U	38	U	40	U
Aroclor-1254	2800	J	5300	J	2800		2900		49	U	38	U	37	U	38	U	40	U
Aroclor-1260	44	U	46	U	41	U	40	U	49	U	38	U	37	U	38	U	40	U
beta-BHC	3.6	EB	8.9	EB	4.4	EB	4.7	EB	0.50	JEB	1.9	U	1.9	U	1.9	U	2.0	U
delta-BHC	0.19	J	0.38	J	0.28	J	2.0	U	2.5	U	1.9	U	0.29	J	1.9	U	0.28	J
Dieldrin	89	EB	200	*EB	96	*EB	99	*EB	1.6	JEB	0.29	JEB	0.21	JEB	3.8	U	4.0	U
Endosulfan I	2.3	U	2.4	U	2.1	U	2.0	U	0.33	J	1.9	U	1.9	U	1.9	U	2.0	U
Endosulfan II	4.4	U	4.6	U	4.1	U	4.0	U	0.85	J	3.8	U	3.7	U	3.8	U	4.0	U
Endosulfan Sulfate	26	J	52	J	20		23		4.9	U	3.8	U	0.24	J	0.18	J	4.0	U
Endrin	1.3	J	2.8	J	1.5	J	1.7	J	4.9	U	0.26	J	0.91	J	0.28	J	4.0	U
Endrin Aldehyde	19	J	42	J	20		21		2.8	J	0.36	J	3.7	U	3.8	U	4.0	U
Endrin Ketone	1.8	J	3.6	J	1.9	J	2.0	J	2.8	JB	3.8	U	3.7	U	3.8	U	4.0	U
gamma-BHC	2.3	U	2.4	U	0.94	J	0.82	J	2.5	U	1.9	U	1.9	U	1.9	U	2.0	U
gamma-Chlordane	29	J	70	*J	15		26		1.0	J	0.21	J	1.9	U	1.9	U	2.0	U
Heptachlor	2.3	U	2.4	U	2.1	U	2	U	2.5	U	1.9	U	1.9	U	1.9	U	2.0	U
Heptachlor Epoxide	0.60	J	1.2	J	0.75	J	0.48	J	0.39	J	1.9	U	0.48	J	1.9	U	0.082	J
Methoxychlor	23	U	37		21	U	20	U	25	U	19	U	19	U	19	U	20	U
Toxaphene	230	U	240	U	210	U	200	U	250	U	190	U	190	U	190	U	200	U

U- Not detected, UJ- Detection limit approximate; J- Quantitation approximate;
* - From dilution analysis; R- Rejected; NA- Not analyzed; EB/TB- Equipment/Trip blank contamination

TABLE 4-2e
SUMMARY OF METALS DETECTED IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW01-0102		CM-SO-MW01-0406		CM-SO-MW01-0608		CM-SO-MW02-0204		CM-SO-MW02-0608		CM-SO-MW02-0810		CM-SO-MW02-1820		CM-SO-MW03-0406	
Sample Location	MW01		MW01		MW01		MW02		MW02		MW02		MW02		MW03	
Date Sampled	12/28/2000		12/28/2000		12/28/2000		1/5/2001		1/5/2001		1/5/2001		1/5/2001		12/27/2000	
Interval	1.0-2.0		4.0-6.0		6.0-8.0		2.0-4.0		6.0-8.0		8.0-10.0		18.0-20.0		4.0-6.0	
QC Identifier	None		None		None		None		None		None		None		None	
TAL Metal Analysis (MG/KG)																
Aluminum	6320		2360		4600		2660		1710		3830		1670		1770	
Antimony	4.9	U	5.3	U	5.2	U	0.88	J	0.56	U	0.51	U	0.55	U	5.1	U
Arsenic	2.7		1.4	U	1.6	U	5.1		2.9		1.2	J	0.81	U	2.2	
Barium	78.2		13.9		23.4		25.5		17.7		25.4		11.6		16.4	
Beryllium	0.05	U	0.050	UJ	0.050	U	0.30	U	0.18	U	0.24	U	0.15	U	0.050	U
Cadmium	0.64		0.35	U	0.14	UJ	0.066	U	0.073	U	0.067	U	0.072	U	0.43	
Calcium	7660	J	603	J	614	J	491		438		1150		461		679	J
Chromium	35.3	J	8.3	J	7.1	J	5.2		7.7		7.3		1.9		7.5	J
Cobalt	5.3	J	1.9	J	3.0	J	3.4		2.0		2.7		1.2		1.8	J
Copper	42.3	J	7.1	J	5.5	J	19.8	J	19.6	J	6.3	J	2.9	J	34.8	J
Iron	10700	J	5640	J	5620	J	8600		6850		6270		3610		9160	J
Lead	118		38.2		18.3		13.8		35.1		10.2		3.9		204	
Magnesium	3700	J	604	J	1240	J	764		451		1440		569		964	J
Manganese	197	J	76.9	J	83.2	J	101		45.0		82.0		64.7		57.1	J
Mercury	0.15		0.060	U	0.060	U	0.050	U	0.061	U	0.044	U	0.048	U	0.060	U
Molybdenum		NA		NA		NA		NA		NA		NA		NA		NA
Nickel	19.6		2.1		3.8		6.2		4.9		5.0		1.6		8.4	
Potassium	2980		430		760		603		254		793		380		405	
Selenium	0.54	J	0.50	U	0.48	U	1.0	UJ	1.0	U	0.96	U	1.0	U	0.67	J
Silver	0.32	U	0.35	U	0.34	U	0.088	U	0.097	U	0.089	U	0.096	U	0.33	U
Sodium	279	J	238	U	344	J	167	U	185	U	218	U	181	U	262	J
Thallium	0.84	U	0.92	U	0.89	U	8.4		7.1	J	6.2	J	2.8	J	0.89	U
Vanadium	29.1		5.3		6.9		5.6		5.0		11.7		4.0		36.1	
Zinc	112		21.5		22.8		26.8	J	36.0	J	25.1	J	9.0	J	55.8	

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate;
* - From dilution analysis; R- Rejected; NA-Not analyzed;
EB/TB- Equipment/Trip blank contamination

TABLE 4-2e (cont.)
SUMMARY OF METALS DETECTED IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW03-0608		CM-SO-MW04-0406		CM-SO-MW04-0608		CM-SO-MW05-0102		CM-SO-DUP-01		CM-SO-MW05-0204		CM-SO-MW05-0406		CM-SO-MW05-0810	
Sample Location	MW03		MW04		MW04		MW05		MW05		MW05		MW05		MW05	
Date Sampled	12/27/2000		6/12/2001		6/12/2001		6/18/2001		6/18/2001		6/18/2001		6/19/2001		6/19/2001	
Interval	6.0-8.0		4.0-6.0		6.0-8.0		1.0-2.0		1.0-2.0		2.0-4.0		4.0-6.0		8.0-10.0	
QC Identifier	None		None		None		Field Dup. CM-SO-MW05-0102		Field Dup. CM-SO-MW05-0102		None		None		None	
TAL Metal Analysis (MG/KG)																
Aluminum	2240		3770		2060		4860		3830		5090		4650		4910	
Antimony	5.0	U	0.40	UJ	0.31	UJ	0.32	UJ	0.16	UJ	0.40	UJ	1.0	J	0.36	UJ
Arsenic	2.4		7.1		0.88	J	1.8	J	1.8	J	4.7	J	5.1	J	1.9	J
Barium	23.6		9.7		10.6		28.6		26.0		53.9		123		27.4	
Beryllium	0.050	U	1.0		0.36		0.39		0.27		0.60		0.75	J	0.51	
Cadmium	0.30	U	0.44	J	0.44	J	0.56	J	0.67	J	1.0	J	0.80	J	0.31	J
Calcium	3230	J	270		339		742		674		1420		3940		621	
Chromium	8.7	J	4.9	J	6.6	J	2.4	J	2.5	J	18.2	J	89.8		5.0	J
Cobalt	2.1	J	3.6		1.4		3.4		2.5		4.4		5.6	J	4.7	
Copper	20.9	J	2.5	UJ	2.3	UJ	5.6	UJ	4.0	UJ	90.5	J	25.3		6.9	UJ
Iron	8020	J	16000		4900		10000		7140		10700		10300		11700	
Lead	122		4.6	J	5.7	J	3.9	J	3.5	J	99.0	J	115		8.9	J
Magnesium	936	J	375		525		1410		1080		1120		892		1300	
Manganese	96.3	J	226	J	66.7	J	161	J	122	J	225	J	259		192	J
Mercury	0.060	U	0.060	U	0.049	U	0.051	U	0.050	U	0.10	J	0.82		0.047	U
Molybdenum		NA		NA		NA		NA		NA		NA		NA		NA
Nickel	6.3		1.6		2.6		3.0		2.2		9.7		24.2		5.4	
Potassium	542		167		331		1570		947		511		366		1120	
Selenium	0.47	U	4.1	U	1.2	UJ	1.8	UJ	1.9	UJ	3.0	UJ	0.58	U	2.3	UJ
Silver	0.33	U	0.80	UJ	0.62	UJ	0.65	UJ	0.16	UJ	0.80	UJ	0.20	U	0.71	UJ
Sodium	223	U	59.6	U	76.6	U	91.6	U	48.0	U	165		101	J	189	
Thallium	0.86	U	0.40	U	0.31	U	0.32	U	0.48	UJ	0.40	U	0.90	U	0.36	U
Vanadium	36.1		6.7		2.7		6.2		5.2		16.0		14.6		4.6	
Zinc	42.0		53.7		37.7		56.3		42.1		97.1		80.1		63.1	

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate;
* - From dilution analysis; R- Rejected; NA-Not analyzed;
EB/TB- Equipment/Trip blank contamination

TABLE 4-2e (cont.)
SUMMARY OF METALS DETECTED IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW05-1012		CM-SO-MW06-0204		CM-SO-MW06-DUP01		CM-SO-MW06-0406		CM-SO-MW06-0608		CM-SO-MW07-0304		CM-SO-MW07-0406		CM-SO-MW07-0608	
Sample Location	MW05		MW06		MW06		MW06		MW06		MW07		MW07		MW07	
Date Sampled	6/19/2001		12/19/2000		12/19/2000		12/19/2000		12/19/2000		12/21/2000		12/21/2000		12/21/2000	
Interval	10.0-12.0		2.0-4.0		2.0-4.0		4.0-6.0		6.0-8.0		3.0-4.0		4.0-6.0		6.0-8.0	
QC Identifier	None		Field Dup. CM-SO-MW06-0204		Field Dup. CM-SO-MW06-0204		None		None		None		None		None	
TAL Metal Analysis (MG/KG)																
Aluminum	4530		5030		5680		4820		4330		3260		7390		2890	
Antimony	0.48	UJ	5.0	J	4.4	UJ	5.5	UJ	4.6	UJ	4.5	UJ	4.8	UJ	4.6	UJ
Arsenic	3.3	J	5.9	J	6.9		5.4	J	2.5	J	1.7	J	3.3	J	2.5	J
Barium	35.2	J	142		85.5		259		52.0		42.0		24.9		15.3	
Beryllium	0.49		0.24		0.26		0.44		0.25		0.29		0.29		0.20	U
Cadmium		R	11.1	J	3.7	J	7.6	J	0.37	J	0.36	J	0.17	J	0.14	J
Calcium	482		789		862		1580		1150		732		1170		549	J
Chromium	8.0	J	50.6		31.1		33.0		7.1		46.3		10.2		3.3	
Cobalt	4.7	J	3.4		4.5		5.5		1.7		8.0		3.6		1.5	
Copper	7.8	UJ	86.1	J	47.4	J	58.7	J	8.9	J	20.9	J	10.2	J	2.6	J
Iron	14000		12400		12300		11100		6670		8720		9150		7830	
Lead	47.0	J	204	J	103	J	177	J	14.0	J	44.1	J	35.6	J	2.7	J
Magnesium	1240		984		1580		679		619		980		654		779	
Manganese	380	J	121	J	176	J	162	J	91.4	J	571	J	140	J	93.7	J
Mercury	0.052	U	0.20		0.16		0.14		0.060	U	0.050	U	0.060	U	0.050	U
Molybdenum		NA		NA		NA		NA		NA		NA		NA		NA
Nickel	6.1	J	8.6		11.5		21.4		4.8		8.3		5.1		2.1	
Potassium	1110		814		893		455		482		975		460		656	
Selenium	3.4	UJ	1.2		0.58	J	1.0	J	0.53	U	0.52	U	1.1	J	0.52	J
Silver	0.63	UJ	3.7		1.1		0.61	J	0.30	U	0.54	J	0.38	J	0.30	U
Sodium	151	J	117	U	120	U	236	U	178	U	147	U	171	U	130	U
Thallium	0.31	U	0.89	U	0.90	U	1.1	U	0.95	U	0.92	U	0.99	U	0.93	U
Vanadium	6.0	J	12.0		10.9		26.6		9.0		17.0		10.0		6.4	
Zinc	58.0	J	454	J	377	J	438	J	51.6	J	54.1	J	52.0	J	16.2	J

U- Not detected, UJ- Detection limit approximate; J- Quantitation approximate;
* - From dilution analysis; R- Rejected, NA-Not analyzed,
EB/TB- Equipment/Trip blank contamination

TABLE 4-2e (cont.)
SUMMARY OF METALS DETECTED IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-MW08-0102		CM-SO-MW08-0204		CM-SO-DUP02		CM-SO-MW08-0406		CM-SO-MW08-0608		CM-SO-MW09-0406		CM-SO-MW09-1011		CM-SO-MW14-0102	
Sample Location	MW08		MW08		MW08		MW08		MW08		MW09		MW09		MW14	
Date Sampled	12/26/2000		12/26/2000		12/26/2000		12/26/2000		12/26/2000		12/18/2000		12/18/2000		7/13/2001	
Interval	1.0-2.0		2.0-4.0		2.0-4.0		4.0-6.0		6.0-8.0		4.0-6.0		10.0-11.0		1.0-2.0	
QC Identifier	None		Field Dup. CM-SO-MW08-0204		Field Dup. CM-SO-MW08-0204		None		None		None		None		Field Dup. CM-SO-MW14-0102	
TAL Metal Analysis (MG/KG)																
Aluminum	6270		3380		4310		4910		2850		5910		3890		3220	
Antimony	6.6	J	5.9	U	6.4	U	5.1	U	5.5	U	6.0	UJ	4.4	UJ	1.9	U
Arsenic	8.0		5.8		9.5		2.8		1.3	U	5.2	J	2.1	J	6.7	
Barium	218		87.2		60.0		26.4		14.4		50.1		38.8		87.2	
Beryllium	0.050	UJ	0.060	UJ	0.060	UJ	0.050	U	0.050	U	0.51		0.26		0.83	
Cadmium	3.5	J	1.7	J	2.4	J	0.24	U	0.10	UJ	0.54	J	0.13	J	1.1	
Calcium	2690	J	2190	J	2110	J	967	J	624	J	1160		620		1100	
Chromium	62.8	J	33.6	J	67.4	J	10.4	J	18.2	J	40.2		5.6		12.3	
Cobalt	20.9	J	93.3	J	28.1	J	3.3	J	1.8	J	3.1		2.2		4.1	
Copper	166	J	58.4	J	56.3	J	4.3	J	4.5	J	27.1	J	3.9	J	53.7	
Iron	55200	J	32200	J	50000	J	10300	J	6820	J	12400		10300		8900	
Lead	380		298		387		13.7		9.5		110	J	5.4	J	100	
Magnesium	2440	J	1150	J	1300	J	1070	J	585	J	1190		1120		739	
Manganese	334	J	327	J	485	J	168	J	113	J	232	J	161	J	175	
Mercury	0.23		0.50		0.95		0.060	U	0.060	U	0.15		0.060	U	0.10	UJ
Molybdenum		NA		NA		NA		NA		NA		NA		NA		NA
Nickel	28.8	J	11.8	J	13.1	J	4.3		3.5		6.4		2.8		11.8	
Potassium	1060		552		460		392		483		1180		1420		508	J
Selenium	2.2		1.3		2.3		0.48	U	0.51	U	0.69	U	0.51	U	0.35	UJ
Silver	0.68		0.82		4.9		0.33	U	0.36	U	0.48	J	0.49	J	0.43	J
Sodium	703		511	J	542	J	229	U	246	U	159	U	162	U	78.3	U
Thallium	3.5		1.5	J	2.9		0.88	U	0.95	U	1.2	U	0.91	U	0.94	UJ
Vanadium	18.8	J	11.0	J	14.4	J	13.8		4.7		12.5		5.8		12.7	
Zinc	556		308		254		22.0		18.8		151	J	23.5	J	131	

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate;
* - From dilution analysis; R- Rejected; NA Not analyzed;
EB/TB- Equipment/Trip blank contamination

TABLE 4-2e (cont.)
SUMMARY OF METALS DETECTED IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-DUP03-0701		CM-SO-MW14-0204		CM-SO-MW14-0608		CM-SO-MW15D-0204		CM-SO-MW15D-0406		CM-SO-DUP05-0801		CM-SO-MW15D-0608		CM-SO-SB02-0204	
Sample Location	MW14		MW14		MW14		MW15D		MW15D		MW15D		MW15D		SB02	
Date Sampled	7/13/2001		7/13/2001		7/13/2001		8/7/2001		8/7/2001		8/7/2001		8/7/2001		1/3/2001	
Interval	1.0-2.0		2.0-4.0		6.0-8.0		2.0-4.0		4.0-6.0		4.0-6.0		6.0-8.0		2.0-4.0	
QC Identifier	Field Dup. CM-SO-MW14-0102		None		None		None		Field Dup. CM-SO-MW15D-0406		Field Dup. CM-SO-MW15D-0406		None		Field Dup. CM-SO-SB02-0204	
TAL Metal Analysis (MG/KG)																
Aluminum	3250		6710		13400		2840		5070		4900		5200		3700	
Antimony	1.9	U	2.2	U	2.0	U	0.38	U	0.48	UJ	0.49	UJ	0.56	UJ	18.5	
Arsenic	6.0		6.8		6.3		1.4	J	2.6	J	2.6	J	1.8	J	6.3	
Barium	65.5		93.8		102		16.2		38.8		32.3		19.2		33.0	
Beryllium	0.63		0.64		1.0		0.41	U	0.50	U	0.37	U	0.55	U	0.58	
Cadmium	1.1		0.36			R	0.089	U	0.12	UJ	0.12	UJ	0.085	U	0.67	
Calcium	979		8070		1670		508		1620		1490		560		838	
Chromium	9.3		8.8		7.9		3.6	J	5.8	J	5.6	J	5.3	J	49.3	
Cobalt	3.7		4.5		14.8	J	1.2		18.0		2.1		2.6		18.7	
Copper	44.5		15.5		13.5		6.0		12.7		9.6		4.3		28.5	J
Iron	8520		14200		30300		5440		11100		9410		9260		12500	
Lead	97.5		138		9.0		15.2	J	66.0	J	43.7	J	13.1	J	150	
Magnesium	763		1580		3620		702		903		847		1080		888	
Manganese	147		279		1100		75.9		160		142		156		168	
Mercury	0.10	UJ	0.17	J	0.11	UJ	0.056	U	0.049	U	0.094	J	0.047	U	0.49	
Molybdenum		NA		NA		NA		NA		NA		NA		NA		NA
Nickel	7.2		5.7		9.2	J	9.4		6.7		4.1		4.2		6.4	
Potassium	533	J	497	J	4130	J	431		496		466		435		570	
Selenium	0.34	UJ	0.47	UJ	0.35	UJ	0.62	UJ	0.92	J	0.60	UJ	0.78	J	1.3	UJ
Silver	0.36	U	0.42	U	0.38	U	0.11	UJ	0.10	UJ	0.11	UJ	0.11	UJ	0.10	U
Sodium	75.8	U	87.9	U	79.1	U	387	U	439	U	431	U	410	U	665	U
Thallium	0.91	UJ	1.1	UJ	0.95	UJ	0.91	UJ	0.85	UJ	0.88	UJ	0.88	UJ	11.7	
Vanadium	11.3		14.2		18.9		210	J	11.8	J	13.1	J	17.0	J	15.0	
Zinc	115		77.0		90.3		20.1		119		125		30.3		223	J

U- Not detected; UJ- Detection limit approximate; J- Quantitation approximate;
* - From dilution analysis; R- Rejected; NA-Not analyzed;
EB/TB- Equipment/Trip blank contamination

TABLE 4-2e (cont.)
SUMMARY OF METALS DETECTED IN SUBSURFACE SOILS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-SO-DUP03		CM-SO-SB02-0406		CM-SO-SB02-0608		CM-SO-SB03-0204		CM-SO-SB03-0406		CM-SO-DUP05		CM-SO-SB03-0608		CM-SO-SB03-1820	
Sample Location	SB02		SB02		SB02		SB03		SB03		SB03		SB03		SB03	
Date Sampled	1/3/2001		1/3/2001		1/3/2001		1/9/2001		1/9/2001		1/9/2001		1/9/2001		1/9/2001	
Interval	2.0-4.0		4.0-6.0		6.0-8.0		2.0-4.0		4.0-6.0		4.0-6.0		6.0-8.0		18.0-20.0	
QC Identifier	Field Dup. CM-SO-SB02-0204		None		None		None		Field Dup. CM-SO-SB03-0406		Field Dup. CM-SO-SB03-0406		None		None	
TAL Metal Analysis (MG/KG)																
Aluminum	4060		4080		1860		2360		2500		2860		2070		1520	
Antimony	3.2		1.0	J	1.5		0.53	U	0.52	U	0.53	U	0.53	U	0.50	U
Arsenic	6.2		5.4		4.2		1.9		1.0	J	1.1	J	0.78	J	0.74	U
Barium	47.4		27.5		13.5		23.8		21.5		24.7		18.6		14.3	
Beryllium	0.58		0.82		0.37		0.29	U	0.28	U	0.28	U	0.27	U	0.22	U
Cadmium	1.1		0.34		0.25		0.069	U	0.068	U	0.070	U	0.069	U	0.065	U
Calcium	792		702		384		607		834		840		684		541	
Chromium	49.8		37.0		20.2		16.2		12.1		3.7		2.4		4.1	
Cobalt	5.5		4.0		2.5		1.9		1.7		1.8		2.5		0.97	
Copper	37.0	J	15.1	J	9.1	J	15.9	J	558	J	5.5	J	4.6	J	3.3	J
Iron	11500		13400		7520		5290		6940		5780		5040		3570	
Lead	211		88.0		53.4		55.6		10.0		7.4		9.0		5.7	
Magnesium	924		984		427		608		1020		1310		676		549	
Manganese	128		129		92.5		65.2		102		92.3		82.7		60.2	
Mercury	0.66		0.21		0.35		0.52		0.055	U	0.049	U	0.050	U	0.051	U
Molybdenum		NA		NA		NA		NA		NA		NA		NA		NA
Nickel	6.2		5.8		2.6		3.0		4.8		2.9		1.6		1.5	
Potassium	525		528		228		379		716		920		543		377	
Selenium	1.3	U	1.2	U	0.92	U	0.99	U	0.97	U	1.0	U	0.98	U	0.93	U
Silver	0.19	J	0.11	U	0.085	U	0.092	U	0.090	U	0.093	U	0.092	U	0.087	U
Sodium	406	U	271	U	220	U	195	U	170	U	213	U	201	U	154	U
Thallium	11.3		13.4		6.7		5.1	J	5.9	J	5.3	J	5.3	J	3.9	J
Vanadium	16.3		16.5		8.3		7.3		4.6		6.1		4.0		3.1	
Zinc	329	J	72.4	J	51.8	J	41.1	J	53.2	J	17.3	J	15.6	J	11.5	J

U- Not detected, UJ- Detection limit approximate; J- Quantitation approximate,
* - From dilution analysis, R- Rejected; NA-Not analyzed,
EB/TB- Equipment/Trip blank contamination

TABLE 4-3
HYDRAULIC CONDUCTIVITY IN SHALLOW OVERBURDEN
SINGLE WELL PUMP TEST RESULTS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Location	Interval Tested (ft bgs)	Soil Description	Hydraulic Conductivity (ft/d)
MW-01S	4.3 - 8.5	fill (fine to coarse sand, trace silt) over fine to coarse sand and gravel	55
MW-02S	3.8 - 10	fill (fine to coarse sand, some gravel, trace silt, wood, brick, glass) over silty fine sand	9
MW-03S	5.2 - 10.1	fill (fine to coarse sand, trace silt, wood, brick, asphalt?) over fine to coarse sand and gravel	20
MW-04S	6.7 - 14.5	fine to coarse sand, little to some gravel, trace to little silt	48
MW-06S	5.4 - 10.0	fill (brick fragments, sand, gravel, silt) over fine to coarse sand and gravel	11
MW-07S	3.8 - 9.0	fine to coarse sand over fine to coarse gravel with some fine to coarse sand	21
MW-08S	3.1 - 11.4	Fill (silty f-m sand, trace glass, wood) over gravelly fine to coarse sand with cobbles and two inch thick layer of organic silt/peat	4
MW-09S	7.8 - 11.5	sand and gravel, extent of fines unknown	12

TABLE 4-4
HYDRAULIC CONDUCTIVITY IN MODERATE TO DEEP OVERBURDEN
SINGLE WELL PUMP TEST RESULTS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Location	Interval Tested (ft bgs)	Soil Description	Hydraulic Conductivity (ft/d)
MW-02M	23 - 31	gravelly fine to coarse sands and sandy gravels with little to no silt	190
MW-02D	62.8 - 70	fine to coarse sand and gravel, little silt	33
MW-04D	40.5 - 46	fine to coarse sandy gravel and gravelly fine to coarse sand, trace to little silt	33
MW-07D	51 - 58.5	fine to coarse sandy gravel and gravelly fine to coarse sand, trace to little silt	49
MW-10D	38 - 46	gravelly fine to coarse sand and sandy gravel, trace silt (little to some silt at 42-46 ft ?)*	10
MW-11M	34 - 43	gravelly fine to coarse sand and fine to coarse sandy gravel	49
MW-13D	37 - 46.3	gravelly fine to coarse sand and fine to coarse sand, trace silt	65
MW-14M	24.7 - 35	gravelly fine to coarse sand	77
MW-15M	46 - 54	fine to coarse sand and gravel, trace to few silt	12

* Poor sample recovery between 42 and 46 ft bgs. Immediately below this interval (from 46 to 52 ft bgs) soil contained little to some silt.

TABLE 4-5
HYDRAULIC CONDUCTIVITY IN BEDROCK
SLUG TEST AND SINGLE WELL PUMP TEST RESULTS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Location	Interval Tested (ft bgs)	Bedrock Description	Hydraulic Conductivity (ft/d)				
			Slug Test				Single Well Pump Test
			Hvorslev Method		Bower and Rice Method		
			Falling Head	Rising Head	Falling Head	Rising Head	
MW-04B	46 - 77	greenish-gray schist	11.9	10.6	6.0	5.6	8.3
MW-10B	60 - 84.5	gray granite	18.8	17.0	16.4	16.0	NT
MW-11B	59.5 - 89.5	gray to greenish-gray gneiss	NT	NT	NT	NT	8.3
MW-12B	52.5 - 101	greenish-gray schist	1.1	0.3	0.9	0.2	NT
MW-13B	50 - 80	green schist over gray schist	2.2	1.0	1.2	0.8	NT

NT = not tested

TABLE 4-6
HYDRAULIC CONDUCTIVITY IN BEDROCK PACKER TEST RESULTS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Location	Interval Tested (ft bgs)	Hydraulic Conductivity (ft/d)	Location	Interval Tested (ft bgs)	Hydraulic Conductivity (ft/d)
MW-04B	50 – 55.5	1.1	MW-12B	55.5 – 61	0.01
	52.5 – 58	0.9		57.5 – 63	0.01
	57.5 – 63	0.3		63 – 68.5	0.00
	62.5 – 68	0.1		68.5 – 74	0.01
	67.5 – 73	3.0		74 – 79.5	0.00
MW-10B	66.5 – 72	3.2		79 – 84.5	0.02
	71.5 – 77	0.0		84 – 89.5	0.00
	76.5 – 82	0.0		89 – 94.5	0.00
MW-11B	66.5 – 72	0.1		94 – 99.5	0.00
	69.5 – 75	0.1	MW-13B	60.5 – 66	0.00
	74.5 – 80	0.0		71 – 76.5	0.00
	79.5 – 85	0.0			

TABLE 4-7
VERTICAL HYDRAULIC GRADIENTS
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATIONS
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Location	Elevation Top of Screen	Screen Length	Screen Midpoint	Groundwater Elevation		Vertical Gradient	
				4-Oct	1-Nov	4-Oct	1-Nov
MW-02S	91.1	8	87.1	92.53	92.46		
MW-02M	71.9	5	69.4	92.54	92.48	0.001	0.001
MW-02D	32.0	4.5	29.7	92.45	92.38	-0.002	-0.003
P-15	91.4	5	88.9	91.20	91.20		
MW-04D	53.8	3	52.3	91.35	91.31	0.004	0.003
MW-04B	50.0	31	34.5	91.28	91.26	-0.004	-0.003
MW-07S	94.8	7.8	90.9	93.68	93.64		
MW-07D	45.3	5	42.8	93.78	93.70	0.002	0.001
TMW-3*	95.9	5	93.4	94.78	94.66		
MW-10D	65.1	5	62.6	94.78	94.68	0.000	0.001
MW-10B	44.8	24.5	32.6	94.74	94.63	-0.001	-0.002
MW-11S	99.7	5	97.2	94.72	94.55		
MW-11M	83.3	6	80.3	94.72	94.58	0.000	0.002
MW-11B	60.0	30	45.0	94.76	94.64	0.001	0.002
MW-12D	64.2	5	61.7	90.63	90.60		
MW-12B	50.9	48.5	26.7	90.66	90.63	0.001	0.001
MW-13S	95.1	10	90.1	91.90	91.83		
MW-13D	59.7	6.33	56.5	91.89	91.82	0.000	0.000
MW-13B	48.7	30	33.7	91.89	91.85	0.000	0.001
P-21	96.1	5	93.6	94.36	94.30		
MW-14M	70.6	5	68.1	94.59	94.51	0.009	0.008

* Actual screen length is not known. Screen elevations for TMW-3 are based on the elevation of the bottom of the well (90.9 ft) and the assumption that a 5 ft screen extends to the bottom of the well.

TABLE 4-8a
SUMMARY OF DETECTED DIOXINS AND FURANS IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-GW-MW01-01		CM-GW-DUP01-01		CM-GW-MW02-01		CM-GW-MW03-01		CM-GW-MW06-01		CM-GW-MW07-01	
Sample Location	MW01		MW01		MW02		MW03		MW06		MW07	
Date Sampled	2/21/2001		2/21/2001		2/22/2001		2/21/2001		2/22/2001		2/22/2001	
QC Identifier	Field Dup. CM-GW-MW01-01		Field Dup. CM-GW-MW01-01		None		None		None		None	
Filtered	Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered	
Dioxin Analysis (pg/L)	D02088		D02089		D02094		D02091		D02093		D02092	
1,2,3,4,6,7,8-HpCDD	10.2	EMPC	5.6	U	5.3	EMPC	6.0	U	6.7	U	6.5	U
1,2,3,4,6,7,8-HpCDF	4.7	U	3.8	U	1.8	U	3.9	U	4.4	U	3.6	U
1,2,3,4,7,8,9-HpCDF	5.5	U	4.6	U	2.1	U	4.6	U	5.2	U	4.3	U
1,2,3,4,7,8-HxCDD	4.5	U	4.1	U	1.8	U	3.9	U	5.1	U	4.0	U
1,2,3,4,7,8-HxCDF	2.9	U	2.6	U	1.2	U	2.7	U	3.1	U	2.6	U
1,2,3,6,7,8-HxCDD	4.5	U	4.1	U	1.8	U	4.0	U	5.1	U	4.0	U
1,2,3,6,7,8-HxCDF	2.8	U	2.6	U	1.2	U	2.6	U	3.0	U	2.5	U
1,2,3,7,8,9-HxCDD	4.3	U	3.9	U	1.7	U	3.8	U	4.9	U	3.9	U
1,2,3,7,8,9-HxCDF	3.2	U	3.0	U	1.4	U	3.0	U	3.5	U	2.9	U
1,2,3,7,8-PeCDD	3.3	U	3.4	U	1.6	U	3.5	U	4.5	U	3.5	U
1,2,3,7,8-PeCDF	2.3	U	2.2	U	1.1	U	2.4	U	2.9	U	2.4	U
HCX		NR		NR		NR		NR		NR		NR
2,3,4,6,7,8-HxCDF	3.0	U	2.8	U	1.3	U	2.8	U	3.3	U	2.7	U
2,3,4,7,8-PeCDF	2.2	U	2.2	U	1.1	U	2.4	U	2.9	U	2.4	U
2,3,7,8-TCDD	6.4	J	2.4	U	4.7	J	3.6	EMPC	3.0	U	2.4	U
2,3,7,8-TCDF	1.7	U	1.9	U	0.80	U	1.9	U	2.3	U	2.1	U
OCDD	72.4	J	19.0	J	52.0	J	15.5	J	12.6	J	13.1	EMPC
OCDF	14.7	J	7.2	U	3.7	U	7.2	U	8.6	U	7.2	U
Total HpCDD	10.2	EMPC	5.6	U	10.8	EMPC	6.0	U	6.7	U	6.5	U
Total HpCDF	7.1	EMPC	4.2	U	4.0		4.2	U	4.8	U	3.9	U
Total HxCDD	4.4	U	4.1	U	1.8	U	3.9	U	5.0	U	4.0	U
Total HxCDF	3.0	U	2.7	U	1.3	U	2.8	U	3.2	U	2.7	U
Total PeCDD	3.3	U	3.4	U	1.6	U	3.5	U	4.5	U	3.5	U
Total PeCDF	2.2	U	2.2	U	1.1	U	2.4	U	2.9	U	2.4	U
Total TCDD	6.4		23.8	EMPC	4.7		3.6	EMPC	16.4	EMPC	8.1	EMPC
Total TCDF	4.7	EMPC	6.7	EMPC	0.80	U	4.1		2.3	U	24.3	EMPC
Toxicity Equivalency		NA		NA		NA		NA		NA		NA

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate;
* - From dilution analysis, R - Rejected, NA - Not analyzed; NR - Not reported, EMPC - Estimated Maximum Possible Concentration

TABLE 4-8a (cont.)
SUMMARY OF DETECTED DIOXINS AND FURANS IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-GW-MW08-01		CM-GW-MW09-01		CMS-GW-GEC2-02		CMS-GW-GEC6-02		CMS-GW-MW01S-02		CMS-GW-DUP02-02	
Sample Location	MW08		MW09		GEC2		GEC6		MW01S		MW01S	
Date Sampled	2/21/2001		2/21/2001		8/21/2001		8/21/2001		8/16/2001		8/16/2001	
QC Identifier	None		None		None		None		Field Dup. CMS-GW-MW01S-02		Field Dup. CMS-GW-MW01S-02	
filtered	Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered	
Dioxin Analysis (pg/L)	D02087		D02090		D03903		D03904		D03897		D03898	
1,2,3,4,6,7,8-HpCDD	4.4	U	6.0	U	3.9	U	6.3	U	6.3	U	5.0	U
1,2,3,4,6,7,8-HpCDF	2.5	U	3.7	U	5.9	U	3.1	U	3.3	U	2.6	U
1,2,3,4,7,8,9-HpCDF	3.0	U	4.4	U	2.4	UJ	3.7	UJ	3.9	U	3.1	U
1,2,3,4,7,8-HxCDD	2.9	U	3.8	U	1.8	EMPC	3.7	U	4.0	U	3.0	U
1,2,3,4,7,8-HxCDF	1.9	U	2.5	U	3.9	U	2.2	U	2.6	U	1.7	U
1,2,3,6,7,8-HxCDD	2.9	U	3.8	U	1.8	EMPC	3.8	U	4.1	U	3.0	U
1,2,3,6,7,8-HxCDF	1.8	U	2.4	U	3.0	U	2.3	U	2.7	U	1.8	U
1,2,3,7,8,9-HxCDD	2.8	U	3.6	U	2.3	U	3.7	U	4.0	U	3.0	U
1,2,3,7,8,9-HxCDF	2.1	U	2.8	U	1.9	U	2.8	U	3.3	U	2.2	U
1,2,3,7,8-PeCDD	2.5	U	3.2	U	2.2	U	3.5	U	3.7	U	2.7	U
1,2,3,7,8-PeCDF	1.9	U	2.2	U	4.7	U	2.5	U	2.9	U	2.0	U
HCX		NR		NR		NR		NR		NR		NR
2,3,4,6,7,8-HxCDF	2.0	U	2.6	U	1.5	U	2.2	U	2.6	U	1.7	U
2,3,4,7,8-PeCDF	1.8	U	2.2	U	2.5	EMPC	2.4	U	2.7	U	1.9	U
2,3,7,8-TCDD	1.9	U	18.2		3.2	U	10.8	EMPC	5.3	EMPC	4.7	EMPC
2,3,7,8-TCDF	1.5	U	1.8	U	2.4	EMPC	11.1	EMPC	2.4	U	1.6	U
OCDD	19.4	J	11.1	J	20.4	U	7.3	EMPC	19.2	U	14.8	U
OCDF	5.1	U	6.7	U	17.6	U	9.5	U	7.9	U	8.7	U
Total HpCDD	4.4	U	6.0	U	6.9	EMPC	6.3	UJ	6.3	UJ	5.0	UJ
Total HpCDF	2.7	U	4.1	U	5.9	UJ	3.3	UJ	3.6	UJ	2.8	UJ
Total HxCDD	2.9	U	3.7	U	16.0	EMPC	3.7	UJ	4.0	UJ	3.0	UJ
Total HxCDF	2.0	U	2.6	U	8.4	EMPC	81.1	EMPC	2.8	UJ	1.8	UJ
Total PeCDD	2.5	U	3.2	U	2.2	UJ	6.6	UJ	3.7	UJ	2.7	UJ
Total PeCDF	1.9	U	2.2	U	7.2	EMPC	18.5	UJ	2.8	UJ	1.9	UJ
Total TCDD	1.9	U	18.2		9.4	EMPC	32.7	EMPC	5.3	EMPC	4.7	EMPC
Total TCDF	1.5	U	3.6	EMPC	4.8	EMPC	11.1	EMPC	2.4	UJ	1.6	UJ
Toxicity Equivalency		NA		NA	0.00	UJ	0.00	UJ	5.3	J	4.7	J

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate;
* - From dilution analysis; R - Rejected; NA - Not analyzed; NR - Not reported, EMPC - Estimated Maximum Possible Concentration

TABLE 4-8a (cont.)
SUMMARY OF DETECTED DIOXINS AND FURANS IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CMS-GW-MW02D-02		CMS-GW-MW02M-02		CMS-GW-MW02S-02		CMS-GW-MW03S-02		CMS-GW-MW04B-02		CMS-GW-MW04D-02	
Sample Location	MW02D		MW02M		MW02S		MW03S		MW04B		MW04D	
Date Sampled	8/13/2001		8/13/2001		8/13/2001		8/16/2001		8/14/2001		8/14/2001	
QC Identifier	None		None		None		None		None		None	
Filtered	Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered	
Dioxin Analysis (pg/L)	D03884		D03883		D03885		D03900		D03889		D03888	
1,2,3,4,6,7,8-HpCDD	2.3	U	3.2	U	4.2	U	8.4	U	4.0	U	2.0	U
1,2,3,4,6,7,8-HpCDF	1.1	U	1.4	U	2.2	U	3.9	U	2.3	U	1.0	U
1,2,3,4,7,8,9-HpCDF	1.2	U	1.6	U	2.8	U	4.9	U	2.8	U	2.0	EMPC
1,2,3,4,7,8-HxCDD	1.3	U	1.6	U	2.5	U	5.3	U	2.5	U	1.2	U
1,2,3,4,7,8-HxCDF	0.57	U	0.67	EMPC	1.8	U	3.3	U	1.7	U	2.5	EMPC
1,2,3,6,7,8-HxCDD	1.3	U	1.7	U	2.6	U	5.4	U	2.6	U	1.2	U
1,2,3,6,7,8-HxCDF	0.80	U	1.1	U	1.8	U	3.4	U	1.7	U	2.4	U
1,2,3,7,8,9-HxCDD	1.2	U	1.6	U	2.5	U	5.3	U	2.5	U	3.8	EMPC
1,2,3,7,8,9-HxCDF	0.90	U	1.3	U	2.2	U	4.2	U	2.1	U	4.0	J
1,2,3,7,8-PeCDD	0.60	U	1.2	U	1.9	U	4.9	U	1.6	U	3.2	J
1,2,3,7,8-PeCDF	0.70	U	1.0	U	1.6	U	3.9	U	1.4	U	3.6	EMPC
HCX		NR		NR		NR		NR		NR		NR
2,3,4,6,7,8-HxCDF	0.70	U	1.1	U	1.8	U	3.3	U	1.7	U	3.0	EMPC
2,3,4,7,8-PeCDF	0.60	U	0.60	J	1.5	U	3.7	U	1.4	U	3.5	J
2,3,7,8-TCDD	1.2	J	1.2	U	1.8	U	11.3		1.6	U	3.9	J
2,3,7,8-TCDF	0.60	U	0.90	U	1.6	U	3.4	U	1.5	U	0.80	U
OCDD	3.2	EMPC	3.2	U	13.5	U	16.7	EMPC	10.4	U	21.0	U
OCDF	2.7	U	3.8	U	3.8	U	10.7	U	3.7	U	5.1	EMPC
Total HpCDD	2.3	UJ	3.2	UJ	4.2	UJ	8.4	UJ	4.0	UJ	7.7	EMPC
Total HpCDF	1.2	UJ	1.5	UJ	2.5	UJ	3.9	UJ	2.5	UJ	4.1	EMPC
Total HxCDD	18.5	EMPC	17.4	EMPC	2.5	UJ	5.3	UJ	2.5	UJ	8.6	EMPC
Total HxCDF	0.57	UJ	0.67	EMPC	1.9	UJ	5.3	UJ	1.8	UJ	11.8	EMPC
Total PeCDD	5.9	EMPC	3.8	EMPC	1.9	UJ	4.9	UJ	4.6	EMPC	8.9	UJ
Total PeCDF	0.70	UJ	0.60	J	1.5	UJ	3.8	UJ	1.4	UJ	3.5	J
Total TCDD	4.4	EMPC	2.3	EMPC	1.8	UJ	11.3	UJ	1.6	UJ	3.9	UJ
Total TCDF	3.1	EMPC	4.1	EMPC	1.6	UJ	10.7	UJ	1.5	UJ	0.80	UJ
Toxicity Equivalency	1.2	J	0.30	J	0.00	U	11.0		0.00	U	10.0	J

U - Not detected; UJ - Detection limit approximate, J - Quantitation approximate;
* - From dilution analysis; R - Rejected; NA - Not analyzed; NR - Not reported, EMPC - Estimated Maximum Possible Concentration

TABLE 4-8a (cont.)
SUMMARY OF DETECTED DIOXINS AND FURANS IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CMS-GW-MW04S-02		CMS-GW-DUP1-02		CMS-GW-MW05S-02		CMS-GW-MW06S-02		CMS-GW-MW07D-02		CMS-GW-MW07S-02	
Sample Location	MW04S		MW04S		MW05S		MW06S		MW07D		MW07S	
Date Sampled	8/14/2001		8/14/2001		8/15/2001		8/15/2001		8/15/2001		8/15/2001	
QC Identifier	Field Dup. CMS-GW-MW04S-02		Field Dup. CMS-GW-MW04S-02		None		None		None		None	
Filtered	Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered	
Dioxin Analysis (pg/L)	D03886		D03887		D03894		D03893		D03891		D03892	
1,2,3,4,6,7,8-HpCDD	6.0	U	5.6	U	6.2	U	4.4	U	3.7	EMPC	3.9	U
1,2,3,4,6,7,8-HpCDF	1.6	EMPC	3.4	EMPC	3.4	U	2.2	U	4.0	U	2.1	U
1,2,3,4,7,8,9-HpCDF	3.5	U	1.7	U	4.1	U	2.6	U	3.6	EMPC	2.5	U
1,2,3,4,7,8-HxCDD	3.1	U	5.6	EMPC	3.7	U	2.6	U	4.2	J	2.4	U
1,2,3,4,7,8-HxCDF	2.2	U	3.7	U	2.9	U	1.5	U	4.5	U	2.1	U
1,2,3,6,7,8-HxCDD	3.2	U	6.6	EMPC	3.8	U	2.6	U	4.0	J	2.4	U
1,2,3,6,7,8-HxCDF	2.2	U	2.5	EMPC	1.6	EMPC	1.6	U	4.4	J	1.5	U
1,2,3,7,8,9-HxCDD	3.1	U	5.1	J	3.7	U	2.6	U	4.2	EMPC	2.4	U
1,2,3,7,8,9-HxCDF	2.7	U	2.5	J	3.0	EMPC	2.0	U	5.1	EMPC	1.9	U
1,2,3,7,8-PeCDD	2.3	U	3.2	J	202		2.2	U	3.3	EMPC	2.0	U
1,2,3,7,8-PeCDF	1.8	U	3.9	J	2.3	U	2.3	J	3.8	J	2.7	J
HCX		NR		NR	270	J		NR		NR		NR
2,3,4,6,7,8-HxCDF	2.2	U	3.4	J	3.1	J	1.6	U	3.7	J	1.4	EMPC
2,3,4,7,8-PeCDF	1.8	U	2.8	EMPC	2.2	U	1.5	U	2.9	EMPC	1.5	U
2,3,7,8-TCDD	2.0	U	1.4	U	4180	J	6.6	J	3.4	J	1.8	U
2,3,7,8-TCDF	1.8	U	0.90	U	9.3	J	1.2	U	1.1	U	1.4	U
OCDD	9.9	U	9.7	U	10.2	EMPC	7.1	U	13.1	U	5.8	EMPC
OCDF	5.7	U	7.0	EMPC	9.3	U	5.9	U	7.3	U	5.9	U
Total HpCDD	6.0	UJ	5.8	UJ	6.2	UJ	4.4	UJ	3.7	EMPC	3.9	UJ
Total HpCDF	1.6	EMPC	3.4	EMPC	4.2	EMPC	2.4	UJ	7.6	EMPC	2.3	UJ
Total HxCDD	3.1	UJ	45.6	EMPC	8.2	EMPC	2.6	UJ	19.6	EMPC	2.4	UJ
Total HxCDF	2.3	UJ	12.0	EMPC	99.2	J	1.6	UJ	17.6	EMPC	3.4	EMPC
Total PeCDD	2.3	UJ	5.7	EMPC	3940	J	2.2	UJ	3.3	EMPC	2.7	EMPC
Total PeCDF	1.8	UJ	6.9	J	1140	J	2.3	J	3.8	J	2.7	J
Total TCDD	2.0	UJ	1.4	UJ	4460	J	6.6	UJ	3.4	UJ	1.8	UJ
Total TCDF	1.8	UJ	0.90	UJ	2710	J	1.2	UJ	1.1	EMPC	1.4	UJ
Toxicity Equivalency	0.00	U	7.14	J	4400	J	6.7	J	11.0	J	0.26	J

U - Not detected, UJ - Detection limit approximate; J - Quantitation approximate;
* - From dilution analysis; R - Rejected; NA - Not analyzed; NR - Not reported, EMPC - Estimated Maximum Possible Concentration

TABLE 4-8a (cont.)
SUMMARY OF DETECTED DIOXINS AND FURANS IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CMS-GW-MW08S-02		CMS-GW-MW09S-02		CMS-GW-MW10B-02		CMS-GW-MW10D-02		CMS-GW-DUP04-02		CMS-GW-MW11B-02	
Sample Location	MW08S		MW09S		MW10B		MW10D		MW10D		MW11B	
Date Sampled	8/15/2001		8/15/2001		8/23/2001		8/23/2001		8/23/2001		8/22/2001	
QC Identifier	None		None		None		Field Dup. CMS-GW-MW10D-02		Field Dup. CMS-GW-MW10D-02		None	
Filtered	Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered	
Dioxin Analysis (pg/L)	D03895		D03896		D03919		D03916		D03917		D03912	
1,2,3,4,6,7,8-HpCDD	4.6	U	4.3	U	2.2	U	2.9	EMPC	6.5	U	3.6	U
1,2,3,4,6,7,8-HpCDF	2.3	U	2.1	U	2.2	U	3.0	EMPC	3.9	U	1.8	U
1,2,3,4,7,8,9-HpCDF	2.7	U	2.6	U	2.5	UJ	4.2	UJ	4.8	UJ	2.2	UJ
1,2,3,4,7,8-HxCDD	2.4	U	2.8	U	2.6	U	1.7	EMPC	4.3	U	2.3	U
1,2,3,4,7,8-HxCDF	1.6	U	1.6	U	1.3	EMPC	2.8	EMPC	3.0	U	2.9	EMPC
1,2,3,6,7,8-HxCDD	2.4	U	2.9	U	2.7	U	3.3	U	4.5	U	2.4	U
1,2,3,6,7,8-HxCDF	1.7	U	1.6	U	1.7	U	2.5	EMPC	3.1	U	2.8	U
1,2,3,7,8,9-HxCDD	2.4	U	2.8	U	2.6	U	4.1	EMPC	4.4	U	2.4	U
1,2,3,7,8,9-HxCDF	2.1	U	2.0	U	1.9	U	7.5	U	4.0	EMPC	1.8	U
1,2,3,7,8-PeCDD	2.1	U	2.4	U	2.5	U	2.8	U	3.5	U	2.5	U
1,2,3,7,8-PeCDF	1.5	U	1.7	U	2.1	U	5.1	U	2.8	U	1.9	U
HCX		NR		NR		NR		NR		NR		NR
2,3,4,6,7,8-HxCDF	1.6	U	1.6	U	1.6	U	2.2	U	3.0	U	1.4	U
2,3,4,7,8-PeCDF	1.4	U	1.6	U	2.0	U	2.2	U	2.7	U	1.8	U
2,3,7,8-TCDD	5.1	J	10.2		2.5	U	2.8	U	3.5	U	2.3	U
2,3,7,8-TCDF	1.1	U	1.4	U	1.8	U	2.0	U	2.8	U	1.7	U
OCDD	7.4	U	10.1	U	4.4	U	11.9	U	10.2	EMPC	11.1	EMPC
OCDF	7.5	U	6.1	U	4.7	U	8.7	U	6.7	U	11.6	U
Total HpCDD	4.6	UJ	4.3	UJ	2.2	UJ	2.9	EMPC	6.5	UJ	3.6	UJ
Total HpCDF	2.5	UJ	2.3	UJ	2.3	UJ	7.3	EMPC	4.3	UJ	2.0	UJ
Total HxCDD	2.4	UJ	2.8	UJ	23.4	EMPC	38.9	EMPC	4.4	UJ	6.9	EMPC
Total HxCDF	1.7	UJ	1.7	UJ	1.3	EMPC	15.2	EMPC	4.0	EMPC	5.7	EMPC
Total PeCDD	2.1	UJ	2.4	UJ	8.9	EMPC	11.2	EMPC	3.5	UJ	2.5	UJ
Total PeCDF	1.4	UJ	1.6	UJ	2.0	UJ	5.1	UJ	2.8	UJ	1.8	UJ
Total TCDD	5.1	UJ	10.2	UJ	5.6	EMPC	8.5	EMPC	3.5	UJ	14.1	EMPC
Total TCDF	1.1	UJ	1.4	UJ	1.8	UJ	9.9	EMPC	7.5	EMPC	3.9	EMPC
Toxicity Equivalency	5.1	J	10.0	J	0.00	UJ	0.00	UJ	0.00	UJ	0.00	UJ

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate;
* - From dilution analysis; R - Rejected; NA - Not analyzed, NR - Not reported, EMPC - Estimated Maximum Possible Concentration

TABLE 4-8a (cont.)
SUMMARY OF DETECTED DIOXINS AND FURANS IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CMS-GW-MW11M-02		CMS-GW-MW11S-02		CMS-GW-MW12B-02		CMS-GW-DUP03-02		CMS-GW-MW12D-02		CMS-GW-MW13B-02	
Sample Location	MW11M		MW11S		MW12B		MW12B		MW12D		MW13B	
Date Sampled	8/22/2001		8/22/2001		8/22/2001		8/22/2001		8/22/2001		8/23/2001	
QC Identifier	None		None		Field Dup. CMS-GW-MW12B-02		Field Dup. CMS-GW-MW12B-02		None		None	
filtered	Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered	
Dioxin Analysis (pg/L)	D03909		D03914		D03910		D03911		D03915		D03918	
1,2,3,4,6,7,8-HpCDD	3.8	U	3.7	U	2.8	EMPC	4.2	U	3.9	U	3.6	U
1,2,3,4,6,7,8-HpCDF	1.7	U	2.1	U	1.6	U	5.6	U	2.4	U	2.4	U
1,2,3,4,7,8,9-HpCDF	2.4	UJ	2.4	UJ	1.9	UJ	2.5	UJ	2.7	UJ	2.9	UJ
1,2,3,4,7,8-HxCDD	2.3	U	2.5	U	2.1	U	2.6	U	2.7	U	2.4	U
1,2,3,4,7,8-HxCDF	1.5	U	1.5	U	2.8	EMPC	3.1	U	1.3	U	1.8	U
1,2,3,6,7,8-HxCDD	2.4	U	2.6	U	1.4	EMPC	2.7	U	2.8	U	2.5	U
1,2,3,6,7,8-HxCDF	1.5	U	1.5	U	3.0	U	1.6	U	1.8	U	1.8	U
1,2,3,7,8,9-HxCDD	2.3	U	2.4	U	2.1	U	2.6	U	2.7	U	2.4	U
1,2,3,7,8,9-HxCDF	1.9	U	1.8	U	1.5	U	2.0	U	2.1	U	2.1	U
1,2,3,7,8-PeCDD	2.3	U	1.5	EMPC	1.9	U	2.8	U	2.7	U	1.9	U
1,2,3,7,8-PeCDF	1.7	U	1.9	U	3.7	U	3.9	U	2.3	U	1.6	U
HCX		NR		NR		NR		NR		NR		NR
2,3,4,6,7,8-HxCDF	1.5	U	1.5	U	1.2	U	1.6	U	1.7	U	1.7	U
2,3,4,7,8-PeCDF	1.6	U	1.8	U	1.7	EMPC	1.9	U	2.1	U	1.5	U
2,3,7,8-TCDD	1.9	U	2.2	U	2.2	EMPC	4.7	U	2.7	U	1.9	U
2,3,7,8-TCDF	1.8	U	1.5	U	1.1	U	1.7	U	1.8	U	1.6	U
OCDD	4.8	U	7.4	U	13.2	U	19.5	U	6.2	U	5.2	U
OCDF	5.1	EMPC	5.2	U	11.0	EMPC	17.2	U	5.4	U	4.2	U
Total HpCDD	3.8	UJ	3.7	UJ	2.8	EMPC	9.1	EMPC	3.9	UJ	3.6	UJ
Total HpCDF	1.7	UJ	2.3	UJ	1.8	UJ	5.6	UJ	2.5	UJ	2.6	UJ
Total HxCDD	8.2	EMPC	29.5	EMPC	8.5	EMPC	6.0	EMPC	31.1	EMPC	11.2	EMPC
Total HxCDF	1.6	UJ	1.6	UJ	5.9	EMPC	3.1	UJ	1.3	UJ	1.8	UJ
Total PeCDD	2.3	UJ	6.1	EMPC	1.9	UJ	2.8	UJ	13.9	EMPC	1.9	UJ
Total PeCDF	1.6	UJ	1.8	UJ	5.3	EMPC	3.9	UJ	2.2	UJ	1.6	UJ
Total TCDD	44.6	EMPC	11.1	EMPC	2.2	EMPC	11.2	EMPC	15.6	EMPC	1.9	UJ
Total TCDF	10.8	EMPC	10.1	EMPC	3.6	EMPC	1.7	UJ	7.6	EMPC	4.5	EMPC
Toxicity Equivalency	0.00	UJ	0.00	UJ	0.00	UJ	0.00	UJ	0.00	UJ	0.00	UJ

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate,
* - From dilution analysis; R - Rejected; NA - Not analyzed; NR - Not reported, EMPC - Estimated Maximum Possible Concentration

TABLE 4-8a (cont.)
SUMMARY OF DETECTED DIOXINS AND FURANS IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CMS-GW-MW13D-02		CMS-GW-MW13S-02		CMS-GW-MW14M-02		CMS-GW-MW15D-02		CMS-GW-TMW3-02	
Sample Location	MW13D		MW13S		MW14M		MW15D		TMW3	
Date Sampled	8/23/2001		8/23/2001		8/21/2001		8/21/2001		8/23/2001	
QC Identifier	None		None		None		None		None	
filtered	Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered	
Dioxin Analysis (pg/L)	D04062		D04063		D03906		D03905		D04061	
1,2,3,4,6,7,8-HpCDD	3.8	U	5.5	U	2.6	U	10.0	U	4.8	U
1,2,3,4,6,7,8-HpCDF	8.2	U	3.0	U	1.3	U	4.8	U	3.0	U
1,2,3,4,7,8,9-HpCDF	2.3	UJ	3.4	UJ	1.6	UJ	5.7	UJ	3.7	UJ
1,2,3,4,7,8-HxCDD	2.5	U	3.6	U	1.6	U	6.0	U	3.0	U
1,2,3,4,7,8-HxCDF	3.4	EMPC	3.3	U	1.0	U	3.6	U	2.2	U
1,2,3,6,7,8-HxCDD	2.6	U	3.8	U	1.6	U	6.1	U	3.1	U
1,2,3,6,7,8-HxCDF	1.6	U	2.3	U	1.0	U	3.7	U	2.2	U
1,2,3,7,8,9-HxCDD	2.4	U	3.6	U	1.6	U	6.0	U	3.0	U
1,2,3,7,8,9-HxCDF	1.8	U	2.7	U	1.2	U	4.6	U	2.6	U
1,2,3,7,8-PeCDD	2.4	U	3.0	U	2.0	U	6.1	U	2.6	U
1,2,3,7,8-PeCDF	2.0	U	2.6	U	1.3	U	4.8	U	1.9	U
HCX		NR		NR		NR		NR		NR
2,3,4,6,7,8-HxCDF	1.5	U	2.2	U	1.0	U	3.6	U	2.1	U
2,3,4,7,8-PeCDF	1.8	U	2.6	U	1.2	U	4.5	U	1.9	U
2,3,7,8-TCDD	2.3	U	3.1	U	1.5	U	5.7	U	2.1	U
2,3,7,8-TCDF	1.6	U	2.2	U	1.0	U	3.8	U	1.9	U
OCDD	6.7	EMPC	16.1	U	5.9	U	17.0	EMPC	9.5	EMPC
OCDF	32.3	EMPC	8.5	U	3.9	EMPC	15.4	EMPC	9.2	EMPC
Total HpCDD	3.8	UJ	5.5	UJ	2.6	UJ	10.0	UJ	4.8	UJ
Total HpCDF	8.2	UJ	3.2	UJ	1.5	UJ	5.2	UJ	3.3	UJ
Total HxCDD	29.7	EMPC	30.0	EMPC	8.5	EMPC	6.0	UJ	8.4	EMPC
Total HxCDF	3.4	EMPC	3.3	UJ	1.0	UJ	3.8	UJ	2.3	UJ
Total PeCDD	12.5	EMPC	13.5	EMPC	5.2	EMPC	6.1	UJ	2.6	UJ
Total PeCDF	4.6	UJ	2.7	UJ	1.3	UJ	4.6	UJ	1.9	UJ
Total TCDD	7.8	EMPC	6.7	EMPC	26.5	EMPC	34.3	EMPC	2.1	UJ
Total TCDF	1.5	EMPC	6.3	EMPC	5.2	EMPC	3.8	UJ	3.9	EMPC
Toxicity Equivalency	0.00	UJ	0.00	UJ	0.00	UJ	0.00	UJ	0.00	UJ

U - Not detected, UJ - Detection limit approximate, J - Quantitation approximate;
* - From dilution analysis, R - Rejected, NA - Not analyzed; NR - Not reported, EMPC - Estimated Maximum Possible Concentration

TABLE 4-8b
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-GW-MW01-01		CM-GW-DUP01-01		CM-GW-MW02-01		CM-GW-MW03-01		CM-GW-MW06-01		CM-GW-MW07-01		CM-GW-MW08-01	
Sample Location	MW01		MW01		MW02		MW03		MW06		MW07		MW08	
Date Sampled	2/21/2001		2/21/2001		2/22/2001		2/21/2001		2/22/2001		2/22/2001		2/21/2001	
QC Identifier	Field Dup. CM-GW-MW01-01		Field Dup. CM-GW-MW01-01		None		None		None		None		None	
Filtered or unfiltered	Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered	
Volatile Organic Analysis (UG/L)	A0454		A0455		A0461		A0457		A0460		A0459		A0453	
1,1,2,2-Tetrachloroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,2-Dibromo-3-chloropropane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,2-Dibromoethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,2-Dichlorobenzene	10	U	10	U	10	U	10	U	21		10	U	1	J
1,4-Dichlorobenzene	10	U	10	U	10	U	10	U	5	J	10	U	10	U
2-Hexanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Benzene	10	U	10	U	10	U	10	U	5	J	10	U	6	J
Bromoform	10	U	10	U	10	U	10	U	10	UJ	10	U	10	U
Chlorobenzene	10	U	10	U	10	U	10	U	100		10	U	10	
cis-1,2-Dichloroethene	10	U	10	U	10	U	10	U	4	J	10	U	10	U
Cyclohexane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Ethylbenzene	10	U	10	U	10	U	10	U	7	J	10	U	1	J
Isopropylbenzene	10	U	10	U	10	U	10	U	1	J	10	U	10	U
Methyl Acetate	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Methyl tert-Butyl Ether	10	U	10	U	10	U	11		10	U	10	U	10	U
Methylcyclohexane	10	U	10	U	10	U	10	U	13		10	U	10	U
Tetrachloroethene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Toluene	10	U	10	U	10	U	10	U	5	J	5	J	1	J
Total Xylenes	10	U	10	U	10	U	10	U	69		10	U	27	
Trichloroethene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Vinyl Chloride	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ	10	UJ

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate;
* - From dilution analysis, R - Rejected; NA - Not analyzed

TABLE 4-8b (cont.)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-GW-MW09-01		CMS-GW-GEC2-02		CMS-GW-GEC6-02		CMS-GW-MW01S-02		CMS-GW-DUP02-02		CMS-GW-MW02D-02	
Sample Location	MW09		GEC2		GEC6		MW01S		MW01S		MW02D	
Date Sampled	2/21/2001		8/21/2001		8/21/2001		8/16/2001		8/16/2001		8/13/2001	
QC Identifier	None		None		None		Field Dup. CMS-GW-MW01S-02		Field Dup. CMS-GW-MW01S-02		None	
filtered or unfiltered	Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered	
Volatile Organic Analysis (UG/L)	A0456		A0910		A0911		A0906		A0907		A08Y9	
1,1,2,2-Tetrachloroethane	10	U	10	U	10	U	10	U	10	U	10	U
1,2-Dibromo-3-chloropropane	10	U	10	UJ	10	UJ	10	U	10	U		R
1,2-Dibromoethane	10	U	10	U	10	U	10	U	10	U	10	U
1,2-Dichlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U
1,4-Dichlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U
2-Hexanone	10	U	10	UJ	10	UJ	10	UJ	10	U	10	U
Benzene	1	J	10	U	10	U	10	U	10	U	10	U
Bromoform	10	U	10	U	10	U	10	U	10	U	10	U
Chlorobenzene	1	J	10	U	10	U	10	U	10	U	10	U
cis-1,2-Dichloroethene	2	J	10	U	18		10	U	10	UJ	2	J
Cyclohexane	10	U	10	U	10	U	10	U	10	U	10	U
Ethylbenzene	10	U	10	U	10	U	10	U	10	U	10	U
Isopropylbenzene	10	U	10	U	10	U	10	U	10	U	10	U
Methyl Acetate	10	U	10	U	10	U	10	U	5	UJ	10	U
Methyl tert-Butyl Ether	10	U	10	U	10	U	10	U	10	UJ	4	J
Methylcyclohexane	10	U	10	U	10	U	10	U	10	U	10	U
Tetrachloroethene	2	J	10	U	200	*	10	U	10	U	700	*
Toluene	10	U	10	U	10	U	10	U	10	U	10	U
Total Xylenes	10	U	10	U	10	U	10	U	10	U	10	U
Trichloroethene	10	U	10	U	10	U	10	U	10	U	27	
Vinyl Chloride	10	UJ	10	U	10	U	10	U	10	U	10	U

U - Not detected, UJ - Detection limit approximate, J - Quantitation approximate;
* - From dilution analysis; R - Rejected, NA - Not analyzed

TABLE 4-8b (cont.)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CMS-GW-MW02M-02		CMS-GW-MW02S-02		CMS-MW03S-02		CMS-GW-MW04B-02		CMS-GW-MW04D-02		CMS-GW-MW04S-02	
Sample Location	MW02M		MW02S		MW03S		MW04B		MW04D		MW04S	
Date Sampled	8/13/2001		8/13/2001		8/16/2001		8/14/2001		8/14/2001		8/14/2001	
QC Identifier	None		None		None		None		None		Field Dup. CMS-GW-MW04S-02	
Filtered or unfiltered	Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered	
Volatile Organic Analysis (UG/L)	A08Y8		A08Z0		A0909		A08Z4		A08Z3		A08Z1	
1,1,2,2-Tetrachloroethane	10	U	10	U	10	U	10	U	10	U	10	U
1,2-Dibromo-3-chloropropane		R		R	10	U		R		R		R
1,2-Dibromoethane	10	U	10	U	10	U	10	U	10	U	10	U
1,2-Dichlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U
1,4-Dichlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U
2-Hexanone	10	U	10	U	10	U	10	U	10	U	10	U
Benzene	10	U	1	J	10	U	10	U	10	U	2	J
Bromoform	10	U	10	U	10	U	10	U	10	U	10	U
Chlorobenzene	10	U	1	J	10	U	10	U	10	U	5	J
cis-1,2-Dichloroethene	10	U	10	U	10	UJ	10	U	10	U	7	J
Cyclohexane	10	U	10	U	10	U	10	U	10	U	10	U
Ethylbenzene	10	U	10	U	10	U	10	U	10	U	10	U
Isopropylbenzene	10	U	10	U	10	U	10	U	10	U	10	U
Methyl Acetate	10	U	10	U	10	UJ	10	U	10	U	10	U
Methyl tert-Butyl Ether	3	J	10	U	10	UJ	4	J	4	J	2	J
Methylcyclohexane	10	U	10	U	10	U	10	U	10	U	10	U
Tetrachloroethene	110		10	U	10	U	63		64		17	U
Toluene	10	U	10	U	10	U	10	U	10	U	10	U
Total Xylenes	10	U	10	U	10	U	10	U	10	U	10	U
Trichloroethene	2	J	10	U	10	U	0.9	J	1	J	0.6	J
Vinyl Chloride	10	U	10	U	10	U	10	U	10	U	3	J

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate;
* - From dilution analysis, R - Rejected, NA - Not analyzed

TABLE 4-8b (cont.)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CMS-GW-DUP1-02		CMS-GW-MW05S-02		CMS-GW-MW06S-02		CMS-GW-MW07D-02		CMS-GW-MW07S-02		CMS-GW-MW08S-02	
Sample Location	MW04S		MW05S		MW06S		MW07D		MW07S		MW08S	
Date Sampled	8/14/2001		8/15/2001		8/15/2001		8/15/2001		8/15/2001		8/15/2001	
QC Identifier	Field Dup. CMS-GW-MW04S-02		None		None		None		None		None	
filtered or unfiltered	Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered	
Volatile Organic Analysis (UG/L)	A08Z2		A0903		A0902		A0900		A0901		A0904	
1,1,2,2-Tetrachloroethane	10	U	1700	U	10	U	10	U	4	J	10	U
1,2-Dibromo-3-chloropropane		R	1700	U	10	U		R	7	J	10	U
1,2-Dibromoethane	10	U	1700	U	10	U	10	U	1	J	10	U
1,2-Dichlorobenzene	10	U	1700	U	4	J	10	U	10	U	10	U
1,4-Dichlorobenzene	10	U	1700	U	3	J	10	U	10	U	10	U
2-Hexanone	10	U	1700	UJ	10	UJ	10	U	6	J	10	UJ
Benzene	2	J	1700	U	6	J	10	U	10	U	4	J
Bromoform	10	U	1700	U	10	U	10	U	2	J	10	U
Chlorobenzene	5	J	1700	U	58		10	U	10	U	40	
cis-1,2-Dichloroethene	7	J	1200	J	4	J	10	U	10	U	10	U
Cyclohexane	10	U	1700	U	4	J	10	U	10	U	10	U
Ethylbenzene	10	U	1700	U	10	U	10	U	10	U	10	U
Isopropylbenzene	10	U	1700	U	10	U	10	U	10	U	10	U
Methyl Acetate	10	U	430	J	10	U	10	U	6	J	10	U
Methyl tert-Butyl Ether	2	J	1700	U	10	U	10	U	1	J	10	U
Methylcyclohexane	10	U	1700	U	5	J	10	U	10	U	10	U
Tetrachloroethene	17	U	61000	*	10	U	10	U	10	U	16	U
Toluene	10	U	1700	U	10	U	10	U	10	U	10	U
Total Xylenes	10	U	1700	U	3	J	10	U	10	U	8	J
Trichloroethene	0.8	J	2500		0.9	J	10	U	10	U	10	U
Vinyl Chloride	3	J	1700	U	10	U	10	U	10	U	10	U

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate;
* - From dilution analysis; R - Rejected; NA - Not analyzed

TABLE 4-8b (cont.)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CMS-GW-MW09S-02		CMS-GW-MW10B-02		CMS-GW-MW10D-02		CMS-GW-DUP04-02		CMS-GW-MW11B-02		CMS-GW-MW11M-02		CMS-GW-MW11S-02	
Sample Location	MW09S		MW10B		MW10D		MW10D		MW11B		MW11M		MW11S	
Date Sampled	8/15/2001		8/23/2001		8/23/2001		8/23/2001		8/22/2001		8/22/2001		8/22/2001	
QC Identifier	None		None		Field Dup. CMS-GW-MW10D-02		Field Dup. CMS-GW-MW10D-02		None		None		None	
filtered or unfiltered	Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered	
Volatile Organic Analysis (UG/L)	A0905		A0863		A0925		A0861		A0920		A0917		A0923	
1,1,2,2-Tetrachloroethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,2-Dibromo-3-chloropropane	10	U	10	U	10	U	10	U	10	UJ	10	UJ	10	U
1,2-Dibromoethane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,2-Dichlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
1,4-Dichlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
2-Hexanone	10	UJ	10	U	10	U	10	U	10	UJ	10	UJ	10	U
Benzene	21		10	U	10	U	10	U	10	U	10	U	10	U
Bromoform	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Chlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
cis-1,2-Dichloroethene	12		10	U	10	U	10	U	10	U	10	U	10	U
Cyclohexane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Ethylbenzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Isopropylbenzene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Methyl Acetate	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Methyl tert-Butyl Ether	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Methylcyclohexane	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Tetrachloroethene	21	U	10	U	10	U	10	U	10	U	10	U	10	U
Toluene	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Total Xylenes	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Trichloroethene	1	J	10	U	10	U	10	U	10	U	10	U	10	U
Vinyl Chloride	10	J	10	U	10	U	10	U	10	U	10	U	10	U

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate;
* - From dilution analysis; R - Rejected; NA - Not analyzed

TABLE 4-8b (cont.)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CMS-GW-MW12B-02		CMS-GW-DUP03-02		CMS-GW-MW12D-02		CMS-GW-MW13B-02		CMS-GW-MW13D-02		CMS-GW-MW13S-02	
Sample Location	MW12B		MW12B		MW12D		MW13B		MW13D		MW13S	
Date Sampled	8/22/2001		8/22/2001		8/22/2001		8/23/2001		8/23/2001		8/23/2001	
QC Identifier	Field Dup. CMS-GW-MW12B-02		Field Dup. CMS-GW-MW12B-02		None		None		None		None	
filtered or unfiltered	Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered	
Volatile Organic Analysis (UG/L)	A0918		A0919		A0924		A0B62		A0B65		A0B66	
1,1,2,2-Tetrachloroethane	10	U	10	U	10	U	10	U	10	U	10	U
1,2-Dibromo-3-chloropropane	10	UJ	10	UJ	10	U	10	U		R		R
1,2-Dibromoethane	10	U	10	U	10	U	10	U	10	U	10	U
1,2-Dichlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U
1,4-Dichlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U
2-Hexanone	10	UJ	10	UJ	10	U	10	U	10	U	10	U
Benzene	10	U	10	U	10	U	10	U	10	U	10	U
Bromoform	10	U	10	U	10	U	10	U	10	U	10	U
Chlorobenzene	10	U	10	U	10	U	10	U	10	U	10	U
cis-1,2-Dichloroethene	10	U	10	U	10	U	10	U	10	U	10	U
Cyclohexane	10	U	10	U	10	U	10	U	10	U	10	U
Ethylbenzene	10	U	10	U	10	U	10	U	10	U	10	U
Isopropylbenzene	10	U	10	U	10	U	10	U	10	U	10	U
Methyl Acetate	10	U	10	U	10	U	10	U	10	U	10	U
Methyl tert-Butyl Ether	10	U	10	U	10	U	10	U	10	U	10	U
Methylcyclohexane	10	U	10	U	10	U	10	U	10	U	10	U
Tetrachloroethene	10	U	10	U	18		220	*	340	*	10	U
Toluene	10	U	10	U	10	U	10	U	10	U	10	U
Total Xylenes	10	U	10	U	10	U	10	U	10	U	10	U
Trichloroethene	10	U	10	U	10	U	7	J	6	J	10	U
Vinyl Chloride	10	U	10	U	10	U	10	U	10	U	10	U

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate;
* - From dilution analysis; R - Rejected; NA - Not analyzed

TABLE 4-8b (cont.)
SUMMARY OF DETECTED VOLATILE ORGANIC COMPOUNDS IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CMS-GW-MW14M-02		CMS-GW-MW15D-02		CMS-GW-TMW3-02	
Sample Location	MW14M		MW15D		TMW3	
Date Sampled	8/21/2001		8/21/2001		8/23/2001	
QC Identifier	None		None		None	
filtered or unfiltered	Unfiltered		Unfiltered		Unfiltered	
Volatile Organic Analysis (UG/L)	A0913		A0912		A0B64	
1,1,2,2-Tetrachloroethane	10	U	10	U	10	U
1,2-Dibromo-3-chloropropane	10	UJ	10	UJ	10	U
1,2-Dibromoethane	10	U	10	U	10	U
1,2-Dichlorobenzene	10	U	10	U	10	U
1,4-Dichlorobenzene	10	U	10	U	10	U
2-Hexanone	10	UJ	10	UJ	10	U
Benzene	10	U	10	U	10	U
Bromoform	10	U	10	U	10	U
Chlorobenzene	10	U	10	U	10	U
cis-1,2-Dichloroethene	10	U	10	U	10	U
Cyclohexane	10	U	10	U	10	U
Ethylbenzene	10	U	10	U	10	U
Isopropylbenzene	10	U	10	U	10	U
Methyl Acetate	10	U	10	U	10	U
Methyl tert-Butyl Ether	10	U	10	U	10	U
Methylcyclohexane	10	U	10	U	10	U
Tetrachloroethene	10	U	10	U	10	U
Toluene	10	U	10	U	10	U
Total Xylenes	10	U	10	U	10	U
Trichloroethene	10	U	10	U	10	U
Vinyl Chloride	10	U	10	U	10	U

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate;
* - From dilution analysis; R - Rejected; NA - Not analyzed

TABLE 4-8c
SUMMARY OF DETECTED SVOCs, PCBs, AND PESTICIDES IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-GW-MW01-01		CM-GW-DUP01-01		CM-GW-MW02-01		CM-GW-MW03-01		CM-GW-MW06-01		CM-GW-MW07-01		CM-GW-MW08-01	
Sample Location	MW01		MW01		MW02		MW03		MW06		MW07		MW08	
Date Sampled	2/21/2001		2/21/2001		2/22/2001		2/21/2001		2/22/2001		2/22/2001		2/21/2001	
QC Identifier	Field Dup. CM-GW-MW01-01		Field Dup. CM-GW-MW01-01		None		None		None		None		None	
filtered	Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered	
Semivolatile Organic Analysis (UG/L)	A0454		A0455		A0461		A0457		A0460		A0459		A0453	
2,4,6-Trichlorophenol	10	U	10	U	10	U	10	U	10	U	10	U	10	U
2,4-Dichlorophenol	10	U	10	U	10	U	10	U	10	U	10	U	10	U
4-Methylphenol	10	U	10	U	10	U	10	U	10	U	1	J	3	J
bis(2-Ethylhexyl)phthalate	10	U	4	J	10	U	1	J	10	U	10	U	1	J
Caprolactam	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Naphthalene	10	U	10	U	10	U	10	U	1	J	10	U	10	U
Phenanthrene	10	U	10	U	10	U	10	U	10	U	10	U	1	J
Pesticide/PCB Analysis (UG/L)	A0454		A0455		A0461		A0457		A0460		A0459		A0453	
alpha-Chlordane	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U
Dieldrin	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
gamma-Chlordane	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate;
* - From dilution analysis; R - Rejected; NA - Not analyzed

TABLE 4-8c (cont.)
SUMMARY OF DETECTED SVOCs, PCBs, AND PESTICIDES IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-GW-MW09-01		CMS-GW-GEC2-02		CMS-GW-GEC6-02		CMS-GW-MW01S-02		CMS-GW-DUP02-02		CMS-GW-MW02D-02	
Sample Location	MW09		GEC2		GEC6		MW01S		MW01S		MW02D	
Date Sampled	2/21/2001		8/21/2001		8/21/2001		8/16/2001		8/16/2001		8/13/2001	
QC Identifier	None		None		None		Field Dup. CMS-GW-MW01S-02		Field Dup. CMS-GW-MW01S-02		None	
Filtered	Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered	
Semivolatile Organic Analysis (UG/L)	A0456		A0910		A0911		A0906		A0907		A08Y9	
2,4,6-Trichlorophenol	10	U	10	U	10	U	10	U	10	U	10	U
2,4-Dichlorophenol	10	U	10	U	10	U	10	U	10	U	10	U
4-Methylphenol	10	U	10	U	10	U	10	U	10	U	10	U
bis(2-Ethylhexyl)phthalate	10	U	10	UJ	10	U	4	J	16		10	U
Caprolactam	10	U	10	U	10	U	10	U	10	U	10	U
Naphthalene	10	U	10	U	10	U	10	U	10	U	10	U
Phenanthrene	10	U	10	U	10	U	10	U	10	U	10	U
Pesticide/PCB Analysis (UG/L)	A0456		A0910		A0911		A0906		A0907		A08Y9	
alpha-Chlordane	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	UJ
Dieldrin	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	UJ
gamma-Chlordane	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	UJ

U - Not detected, UJ - Detection limit approximate, J - Quantitation approximate;
* - From dilution analysis; R - Rejected; NA - Not analyzed

TABLE 4-8c (cont.)
SUMMARY OF DETECTED SVOCs, PCBs, AND PESTICIDES IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CMS-GW-MW02M-02		CMS-GW-MW02S-02		CMS-MW03S-02		CMS-GW-MW04B-02		CMS-GW-MW04D-02		CMS-GW-MW04S-02	
Sample Location	MW02M		MW02S		MW03S		MW04B		MW04D		MW04S	
Date Sampled	8/13/2001		8/13/2001		8/16/2001		8/14/2001		8/14/2001		8/14/2001	
QC Identifier	None		None		None		None		None		Field Dup. CMS-GW-MW04S-02	
filtered	Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered	
Semivolatile Organic Analysis (UG/L)	A08Y8		A08Z0		A0909		A08Z4		A08Z3		A08Z1	
2,4,6-Trichlorophenol	10	U	10	U	10	U	10	U	10	U	10	U
2,4-Dichlorophenol	10	U	10	U	10	U	10	U	10	U	10	U
4-Methylphenol	10	U	10	U	10	U	10	U	10	U	10	U
bis(2-Ethylhexyl)phthalate	10	U	10	U	10	U	10	U	10	U	10	U
Caprolactam	10	U	10	U	10	U	10	U	10	U	10	U
Naphthalene	10	U	10	U	10	U	10	U	10	U	10	U
Phenanthrene	10	U	10	U	10	U	10	U	10	U	10	U
Pesticide/PCB Analysis (UG/L)	A08Y8		A08Z0		A0909		A08Z4		A08Z3		A08Z1	
alpha-Chlordane	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U
Dieldrin	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
gamma-Chlordane	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate;
* - From dilution analysis; R - Rejected; NA - Not analyzed

TABLE 4-8c (cont.)
SUMMARY OF DETECTED SVOCs, PCBs, AND PESTICIDES IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CMS-GW-DUP1-02		CMS-GW-MW05S-02		CMS-GW-MW06S-02		CMS-GW-MW07D-02		CMS-GW-MW07S-02		CMS-GW-MW08S-02	
Sample Location	MW04S		MW05S		MW06S		MW07D		MW07S		MW08S	
Date Sampled	8/14/2001		8/15/2001		8/15/2001		8/15/2001		8/15/2001		8/15/2001	
QC Identifier	Field Dup. CMS-GW-MW04S-02		None		None		None		None		None	
filtered	Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered	
Semivolatile Organic Analysis (UG/L)	A08Z2		A0903		A0902		A0900		A0901		A0904	
2,4,6-Trichlorophenol	10	U	2900	*	10	U	10	U	10	U	2	J
2,4-Dichlorophenol	10	U	60		10	U	10	U	10	U	10	U
4-Methylphenol	10	U	1	J	10	U	10	U	10	U	10	U
bis(2-Ethylhexyl)phthalate	10	U	10	U	10	U	10	U	10	U	2	J
Caprolactam	10	U	10	U	10	U	10	U	10	U	10	U
Naphthalene	10	U	11		10	U	10	U	10	U	10	U
Phenanthrene	10	U	10	U	10	U	10	U	10	U	10	U
Pesticide/PCB Analysis (UG/L)	A08Z2		A0903		A0902		A0900		A0901		A0904	
alpha-Chlordane	0.050	U	0.050	U	0.032	J	0.050	U	0.050	U	0.050	U
Dieldrin	0.10	U	0.10	U	0.11		0.10	U	0.10	U	0.10	U
gamma-Chlordane	0.050	U	0.050	U	0.049	J	0.050	U	0.018	J	0.050	U

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate;
* - From dilution analysis; R - Rejected; NA - Not analyzed

TABLE 4-8c (cont.)
SUMMARY OF DETECTED SVOCs, PCBs, AND PESTICIDES IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CMS-GW-MW09S-02		CMS-GW-MW10B-02		CMS-GW-MW10D-02		CMS-GW-DUP04-02		CMS-GW-MW11B-02		CMS-GW-MW11M-02	
Sample Location	MW09S		MW10B		MW10D		MW10D		MW11B		MW11M	
Date Sampled	8/15/2001		8/23/2001		8/23/2001		8/23/2001		8/22/2001		8/22/2001	
QC Identifier	None		None		Field Dup. CMS-GW-MW10D-02		Field Dup. CMS-GW-MW10D-02		None		None	
Filtered	Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered	
Semivolatile Organic Analysis (UG/L)	A0905		A0B63		A0925		A0B61		A0920		A0917	
2,4,6-Trichlorophenol	10	U	10	U	10	U	10	U	10	U	10	U
2,4-Dichlorophenol	10	U	10	U	10	U	10	U	10	U	10	U
4-Methylphenol	10	U	10	U	10	U	10	U	10	U	10	U
bis(2-Ethylhexyl)phthalate	10	U	10	U	10	U	10	U	10	U	10	U
Caprolactam	10	U	490	*	10	UJ	10	UJ	10	U	10	U
Naphthalene	10	U	10	U	10	U	10	U	10	U	10	U
Phenanthrene	10	U	10	U	10	U	10	U	10	U	10	U
Pesticide/PCB Analysis (UG/L)	A0905		A0B63		A0925		A0B61		A0920		A0917	
alpha-Chlordane	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U
Dieldrin	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
gamma-Chlordane	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate;
* - From dilution analysis; R - Rejected; NA - Not analyzed

TABLE 4-8c (cont.)
SUMMARY OF DETECTED SVOCs, PCBs, AND PESTICIDES IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CMS-GW-MW11S-02		CMS-GW-MW12B-02		CMS-GW-DUP03-02		CMS-GW-MW12D-02		CMS-GW-MW13B-02		CMS-GW-MW13D-02	
Sample Location	MW11S		MW12B		MW12B		MW12D		MW13B		MW13D	
Date Sampled	8/22/2001		8/22/2001		8/22/2001		8/22/2001		8/23/2001		8/23/2001	
QC Identifier	None		Field Dup. CMS-GW-MW12B-02		Field Dup. CMS-GW-MW12B-02		None		None		None	
filtered	Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered		Unfiltered	
Semivolatile Organic Analysis (UG/L)	A0923		A0918		A0919		A0924		A0B62		A0B65	
2,4,6-Trichlorophenol	10	U	10	U	10	U	10	U	10	U	10	U
2,4-Dichlorophenol	10	U	10	U	10	U	10	U	10	U	10	U
4-Methylphenol	10	U	10	U	10	U	10	U	10	U	10	U
bis(2-Ethylhexyl)phthalate	10	U	10	U	10	U	10	U	10	U	31	
Caprolactam	10	UJ	10	U	10	U	10	UJ	10	UJ	10	UJ
Naphthalene	10	U	10	U	10	U	10	U	10	U	10	U
Phenanthrene	10	U	10	U	10	U	10	U	10	U	10	U
Pesticide/PCB Analysis (UG/L)	A0923		A0918		A0919		A0924		A0B62		A0B65	
alpha-Chlordane	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U
Dieldrin	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
gamma-Chlordane	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U	0.050	U

U - Not detected; UJ - Detection limit approximate, J - Quantitation approximate;
* - From dilution analysis; R - Rejected; NA - Not analyzed

TABLE 4-8c (cont.)
SUMMARY OF DETECTED SVOCs, PCBs, AND PESTICIDES IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CMS-GW-MW13S-02		CMS-GW-MW14M-02		CMS-GW-MW15D-02		CMS-GW-TMW3-02	
Sample Location	MW13S		MW14M		MW15D		TMW3	
Date Sampled	8/23/2001		8/21/2001		8/21/2001		8/23/2001	
QC Identifier	None		None		None		None	
Filtered	Unfiltered		Unfiltered		Unfiltered		Unfiltered	
Semivolatile Organic Analysis (UG/L)	A0B66		A0913		A0912		A0B64	
2,4,6-Trichlorophenol	10	U	10	U	14	U	10	U
2,4-Dichlorophenol	10	U	10	U	14	U	10	U
4-Methylphenol	10	U	10	U	14	U	10	U
bis(2-Ethylhexyl)phthalate	10	UJ	10	U	14	UJ	10	U
Caprolactam	10	UJ	10	U	14	UJ	10	UJ
Naphthalene	10	U	10	U	14	U	10	U
Phenanthrene	10	U	10	U	14	U	10	U
Pesticide/PCB Analysis (UG/L)	A0B66		A0913		A0912		A0B64	
alpha-Chlordane	0.050	U	0.050	U	0.050	U	0.050	U
Dieldrin	0.10	U	0.10	U	0.10	U	0.10	U
gamma-Chlordane	0.050	U	0.050	U	0.050	U	0.050	U

U - Not detected; UJ - Detection limit approximate; J - Quantitation approximate;
* - From dilution analysis; R - Rejected; NA - Not analyzed

TABLE 4-8d
SUMMARY OF METALS AND WET CHEMISTRY PARAMETERS DETECTED IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-GW-MW01-01		CM-GW-MW01-01F		CM-GW-DUP01 01		CM-GW-DUP01-01F		CM-GW-MW02-01		CM-GW-MW02-01F	
Sample Location	MW01		MW01		MW01		MW01		MW02		MW02	
Date Sampled	2/21/2001		2/21/2001		2/21/2001		2/21/2001		2/22/2001		2/22/2001	
QC Identifier	Field Dup. CM-GW-MW01-01		Field Dup. CM-GW-MW01-01F		Field Dup. CM-GW-MW01-01		Field Dup. CM-GW-MW01-01F		None		None	
Filtered	Unfiltered		Filtered		Unfiltered		Filtered		Unfiltered		Filtered	
TAL Metal Analysis (UG/L)	MA04P8		MA04Q1		MA04P9		MA04Q2		MA04Q9		MA04R4	
Aluminum	55.4	U	26.5	U	35.1	U	36.3	U	68.6	U	41.4	U
Arsenic	4.4	J	5.4	J	4.5	J	4.2	U	4.2	U	4.2	U
Barium	112		112		112		112		79.3		80.4	
Beryllium	0.31	U	0.16	UJ	0.19	UJ	0.17	UJ	0.23		0.27	U
Cadmium	0.60	U	0.60	U	0.60	U	0.60	U	0.60	U	0.60	U
Calcium	55800		56800		56300		56100		24700		24200	
Chromium	0.94	UJ	0.50	UJ	0.85	UJ	0.50	U	1.9	U	0.50	U
Cobalt	3.6		3.5		3.4		3.6		0.70	U	0.70	U
Copper	0.70	U	0.70	U	0.70	U	0.70	U	0.70	U	0.70	U
Iron	63300		64200		63400		63400		5310		4950	
Lead	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U	1.7	U
Magnesium	4880		4930		4900		4930		2010		1950	
Manganese	2430		2480		2460		2450		704		654	
Nickel	1.3	U	1.3	U	1.3	U	1.3	U	2.5	J	1.6	J
Potassium	5580	J	5550	J	5600	J	5550	J	2810	J	2740	J
Silver	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
Sodium	135000		136000		136000		136000		65400		67300	
Thallium	6.5	J	6.2	U	6.5	J	6.2	U	6.2	U	6.2	U
Vanadium	2.2		2.4		2.4		2.1		0.70	U	0.70	U
Zinc	7.2	UJ	6.3	UJ	6.2	UJ	8.8	UJ	1.1	UJ	1.1	UJ
Wet Chemistry Parameters (MG/L)	D02088				D02089				D02094			
Alkalinity	75.0			NA	70.0			NA	30.0			NA
Sulfide	4.0	U		NA	6.0	U		NA	2.0			NA
Total Organic Carbon	7.0			NA	5.0			NA	7.0			NA

U - Not detected, UJ - Detection limit approximate; J - Quantitation limit approximate,
* - From dilution analysis, R - Rejected, NA - Not analyzed

TABLE 4-8d (cont.)
SUMMARY OF METALS AND WET CHEMISTRY PARAMETERS DETECTED IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-GW-MW03-01		CM-GW-MW03-01F		CM-GW-MW06-01		CM-GW-MW06-01F		CM-GW-MW07-01		CM-GW-MW07-01F	
Sample Location	MW03		MW03		MW06		MW06		MW07		MW07	
Date Sampled	2/21/2001		2/21/2001		2/22/2001		2/22/2001		2/22/2001		2/22/2001	
QC Identifier	None		None		None		None		None		None	
filtered	Unfiltered		Filtered		Unfiltered		Filtered		Unfiltered		Filtered	
TAL Metal Analysis (UG/L)	MA04Q4		MA04Q6		MA04Q8		MA04R3		MA04Q7		MA04R2	
Aluminum	146	U	68.8	U	143	U	39.9	U	97.7	U	77.2	U
Arsenic	4.2	U	4.2	U	4.2	U	4.2	U	4.2	U	4.2	U
Barium	82.7		100		63.2		62.6		33.7		34.4	
Beryllium	0.16	UJ	0.17	UJ	0.20	U	0.17	UJ	0.27	U	0.32	U
Cadmium	0.99	J	1.0	J	0.60	U	0.60	U	0.60	U	0.60	U
Calcium	12900		15900		25900		26400		31200		32700	
Chromium	6.6		1.0	U	1.5	U	1.0	U	0.63	UJ	1.1	U
Cobalt	0.85	J	0.70	J	0.70	U	0.70	U	11.2		11.8	
Copper	20.2		15.2		0.70	U	0.70	U	0.70	U	0.70	U
Iron	2580		2180		28500		28600		31600		33500	
Lead	12.2		1.7	U	1.7	U	1.7	U	1.7	U	1.7	U
Magnesium	764		898		2910		2970		2560		2630	
Manganese	60.5		83.1		1840		1860		2680		2800	
Nickel	11.8		10.5		2.3	J	2.0	J	4.5		4.4	
Potassium	8940	J	9090	J	4090	J	4110	J	4540	J	4750	J
Silver	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U	0.50	U
Sodium	371000		378000		29000		29500		27100		28000	
Thallium	6.2	U	6.2	U	6.2	U	6.2	U	6.2	U	6.2	U
Vanadium	6.4		2.4		2.1		1.8		1.6		1.7	
Zinc	169	J	174	J	3.0	UJ	2.7	UJ	4.2	UJ	6.2	UJ
Wet Chemistry Parameters (MG/L)	D02091				D02093				D02092			
Alkalinity	40.0			NA	120			NA	87.0			NA
Sulfide	1.0	U		NA	25.0	U		NA	4.0	U		NA
Total Organic Carbon	9.0			NA	23.0			NA	15.0			NA

U - Not detected; UJ - Detection limit approximate, J - Quantitation limit approximate;
* - From dilution analysis; R - Rejected; NA - Not analyzed

TABLE 4-8d (cont.)
SUMMARY OF METALS AND WET CHEMISTRY PARAMETERS DETECTED IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CM-GW-MW08-01		CM-GW-MW08-01F		CM-GW-MW09-01		CM-GW-MW09-01F		CMS-GW-GEC2-02		CMS-GW-GEC2F-02		CMS-GW-GEC6-02	
Sample Location	MW08		MW08		MW09		MW09		GEC2		GEC2		GEC6	
Date Sampled	2/21/2001		2/21/2001		2/21/2001		2/21/2001		8/21/2001		8/21/2001		8/21/2001	
QC Identifier	None		None		None		None		None		None		None	
Filtered	Unfiltered		Filtered		Unfiltered		Filtered		Unfiltered		Filtered		Unfiltered	
TAL Metal Analysis (UG/L)	MA04P7		MA04Q0		MA04Q3		MA04Q5		MA0A40		MA0A41		MA0A42	
Aluminum	756		509		85.3	U	74.7	U	69.3		14.4	U	35.6	U
Arsenic	5.8	J	5.8	J	4.2	U	4.2	U	2.0	U	3.4	UJ	2.0	U
Barium	31.8		21.2		9.7		9.1		145		134		42.1	
Beryllium	0.59	U	0.48	U	0.33	U	0.29	U	0.28	UJ	0.29	UJ	0.23	UJ
Cadmium	0.60	U	0.60	U	0.60	U	0.60	U	0.40	U	0.40	U	0.40	U
Calcium	15900		15800		26600		27500		168000		155000		20100	
Chromium	52.7		43.5		6.6		6.5		4.1	U	3.4	U	1.7	U
Cobalt	8.3		8.1		14.0		13.5		6.2	U	7.2	U	1.2	UJ
Copper	2.1		0.71	J	1.7		0.70	U	6.3	U	4.7	U	5.4	U
Iron	8490		7690		68900		66200		4410		4040	J	136	U
Lead	17.0		2.3	J	1.7	U	1.7	U	1.3	UJ	1.3	UJ	1.3	UJ
Magnesium	3660		3660		6860		6550		5820		5360		2730	
Manganese	1100		1070		4480		4280		2200		2030		630	
Nickel	11.2		10.9		30.9		30.4		2.4	U	2.5	U	0.90	U
Potassium	9670	J	9650	J	3670	J	3480	J	16700	J	15300	J	2980	J
Silver	0.50	U	0.50	U	0.50	U	0.50	U	0.77	UJ	0.70	U	0.76	UJ
Sodium	132000		132000		40500		39000		120000		84700		34500	
Thallium	6.2	U	6.2	U	8.6	J	6.3	J	5.6	UJ	5.6	UJ	5.6	UJ
Vanadium	10.9		9.1		3.5		3.2		0.90	U	0.90	U	0.90	U
Zinc	7.7	UJ	5.3	UJ	55.1	J	76.0	J	41.9	U	25.9	U	28.7	U
Wet Chemistry Parameters (MG/L)	D02087				D02090				D03903				D03904	
Alkalinity	570			NA	86.0			NA	160			NA	26.0	
Sulfide	1.0	U		NA	4.0	U		NA	4.0	U		NA	4.0	
Total Organic Carbon	4.0			NA	35.0			NA	15.0			NA	5.0	

U - Not detected; UJ - Detection limit approximate; J - Quantitation limit approximate;
* - From dilution analysis; R - Rejected; NA - Not analyzed

TABLE 4-8d (cont.)
SUMMARY OF METALS AND WET CHEMISTRY PARAMETERS DETECTED IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CMS-GW-GEC6F-02		CMS-GW-MW01S-02		CMS-GW-MW01SF-02		CMS-GW-DUP02-02		CMS-GW-DUP02F-02		CMS-GW-MW02D-02		CMS-GW-MW02DF-02	
Sample Location	GEC6		MW01S		MW01S		MW01S		MW01S		MW02D		MW02D	
Date Sampled	8/21/2001		8/16/2001		8/16/2001		8/16/2001		8/16/2001		8/13/2001		8/13/2001	
QC Identifier	None		Field Dup CMS-GW-MW01S-02		Field Dup CMS-GW-MW01SF-02		Field Dup CMS-GW-MW01S-02		Field Dup CMS-GW-MW01SF-02		None		None	
Filtered	Filtered		Unfiltered		Filtered		Unfiltered		Filtered		Unfiltered		Filtered	
TAL Metal Analysis (UG/L)	MA0A43		MA0A32		MA0A33		MA0A34		MA0A35		MA0A05		MA0A14	
Aluminum	49.5	U	62.6	J	68.5	J	59.9	J	49.6	J	93.7		100	
Arsenic	2.0	U	7.1	U	5.7	U	6.3	U	6.4	U	2.8	UJ	2.6	U
Barium	43.0		32.6		33.5		32.7		30.9		32.1	U	31.9	
Beryllium	0.26	UJ	0.10	U	0.10	U	0.10	U	0.10	U	0.10	UJ	0.10	U
Cadmium	0.40	U	0.70	U	0.70	U	0.70	U	0.70	U	0.70	U	0.70	U
Calcium	20600		12200		12600		12300		11700		36900		36300	
Chromium	2.3	U	2.2	J	3.8		1.7	J	4.5		1.3	U	1.3	U
Cobalt	0.71	UJ	1.8	U	1.8	U	1.8	U	1.8	U	3.7	U	3.2	J
Copper	8.6	U	2.2	U	2.2	U	2.2	U	2.2	U	2.2	U	2.2	U
Iron	138	UJ	8120		8410		8220		7840		191		144	
Lead	1.3	UJ	2.0	J	1.5	U	1.5	U	1.5	U	1.5	UJ	1.5	U
Magnesium	2870		893		939		897		861		4360		4290	
Manganese	638		348		361		351		335		672		666	
Nickel	1.7	UJ	3.0	U	3.0	U	3.0	U	3.0	U	9.5		9.4	
Potassium	3120	J	3140	J	3200	J	3170	J	2980	J	6220	J	5990	J
Silver	0.72	UJ	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
Sodium	36200		126000	J	129000	J	127000	J	121000	J	96800		91000	J
Thallium	5.6	UJ	5.7	U	5.7	U	5.7	U	5.7	U	5.7	U	5.7	U
Vanadium	0.90	U	3.2	U	3.2	U	3.2	U	3.2	U	3.2	U	3.2	U
Zinc	16.6	U	15.4	J	19.2	U	21.2		12.2	UJ	11.0	UJ	19.0	U
Wet Chemistry Parameters (MG/L)			D03897				D03898				D03884			
Alkalinity		NA	120			NA	120			NA	52.0			NA
Sulfide		NA	4.0			NA	6.0			NA	5.4			NA
Total Organic Carbon		NA	15.0			NA	16.0			NA	2.0			NA

U - Not detected, UJ - Detection limit approximate; J - Quantitation limit approximate;
* - From dilution analysis; R - Rejected; NA - Not analyzed

TABLE 4-8d (cont.)
SUMMARY OF METALS AND WET CHEMISTRY PARAMETERS DETECTED IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CMS-GW-MW02M-02		CMS-GW-MW02MF-02		CMS-GW-MW02S-02		CMS-GW-MW02SF-02		CMS-GW-MW03S-02		CMS GW-MW03SF-02		CMS-GW-MW04B-02	
Sample Location	MW02M		MW02M		MW02S		MW02S		MW03S		MW03S		MW04B	
Date Sampled	8/13/2001		8/13/2001		8/13/2001		8/13/2001		8/16/2001		8/16/2001		8/14/2001	
QC Identifier	None		None		None		None		None		None		None	
filtered	Unfiltered		Filtered		Unfiltered		Filtered		Unfiltered		Filtered		Unfiltered	
TAL Metal Analysis (UG/L)	MA0A04		MA0A13		MA0A06		MA0A15		MA0A38		MA0A39		MA0A10	
Aluminum	45.7	U	45.7	U	45.7	U	45.7	U	118		98.9		45.7	U
Arsenic	2.6	U	2.6	U	2.6	U	2.6	U	3.9	UJ	5.3	U	2.6	U
Barium	55.0	U	51.9	U	168		171		44.8		44.4		35.7	U
Beryllium	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
Cadmium	0.70	U	0.70	U	0.70	U	0.70	U	0.70	U	0.70	U	0.70	U
Calcium	36700		34200		47700		47800		15200		15500		42200	
Chromium	5.4	U	1.3	U	1.5	UJ	1.3	U	2.6		2.6		1.3	U
Cobalt	34.0		14.4		1.8	U	1.8	U	1.8	U	1.8	U	2.7	UJ
Copper	2.2	U	2.2	U	2.2	U	5.3		50.0		40.1		2.2	U
Iron	60.4	U	13.1	U	9960		10000		6830		6850		86.5	U
Lead	1.5	UJ	2.2	UJ	1.5	UJ	1.8	UJ	37.0		27.7		1.5	UJ
Magnesium	5330		4960		4130		4170		1110		1140		5130	
Manganese	1500		1410		1450		1460		118		121		194	
Nickel	15.0		10.2		3.0	U	3.0	U	5.0	J	5.3	J	5.2	J
Potassium	7440	J	6960	J	4410	J	4470	J	2850	J	2890	J	5270	J
Silver	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
Sodium	111000		104000		61300		61800		55000	J	54800	J	83000	
Thallium	5.7	U	5.7	U	5.7	U	5.7	U	5.7	U	5.7	U	5.7	U
Vanadium	3.2	U	3.2	U	3.2	U	3.2	U	38.7		36.2		3.2	U
Zinc	11.3	UJ	10.1	UJ	16.0	UJ	35.2	UJ	54.0		52.9	U	19.5	UJ
Wet Chemistry Parameters (MG/L)	D03883				D03885				D03900				D03889	
Alkalinity	38.0				56.0				100				54.0	
Sulfide	4.0	U			4.0	U			4.0	U			4.0	U
Total Organic Carbon	5.0				10.0				30.0				2.0	

U - Not detected; UJ - Detection limit approximate; J - Quantitation limit approximate.
* - From dilution analysis, R - Rejected, NA - Not analyzed

TABLE 4-8d (cont.)
SUMMARY OF METALS AND WET CHEMISTRY PARAMETERS DETECTED IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTOREATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CMS-GW-MW04BF-02		CMS-GW-MW04D-02		CMS-GW-MW04DF-02		CMS-GW-MW04S-02		CMS-GW-MW04SF-02		CMS-GW-DUP1-02		CMS-GW-DUP01F-02	
Sample Location	MW04B		MW04D		MW04D		MW04S		MW04S		MW04S		MW04S	
Date Sampled	8/14/2001		8/14/2001		8/14/2001		8/14/2001		8/14/2001		8/14/2001		8/14/2001	
QC Identifier	None		None		None		Field Dup. CMS-GW-MW04S-02		Field Dup. CMS-GW-MW04SF-02		Field Dup. CMS-GW-MW04S-02		Field Dup. CMS-GW-MW04SF-02	
filtered	Filtered		Unfiltered		Filtered		Unfiltered		Filtered		Unfiltered		Filtered	
TAL Metal Analysis (UG/L)	MA0A19		MA0A09		MA0A18		MA0A07		MA0A16		MA0A08		MA0A17	
Aluminum	45.7	U	80.1	J	45.7	U	45.7	U	45.7	U	45.7	U	45.7	U
Arsenic	2.6	U	2.6	U	2.6	U	2.6	U	2.6	U	3.7	UJ	2.6	U
Barium	33.9	U	56.0	U	52.2	U	51.8	U	53.0	U	55.1	U	52.1	U
Beryllium	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
Cadmium	0.70	U	0.70	U	0.70	U	0.70	U	0.70	U	0.70	U	0.70	U
Calcium	42200		35100		34600		29900		29900		31100		30400	
Chromium	1.3	U	1.3	U	1.3	U	1.3	U	1.6	UJ	1.3	U	1.6	UJ
Cobalt	1.8	U	1.8	U	1.8	U	12.8	U	13.3	U	16.0		9.9	U
Copper	10.5		9.9		5.5		18.4		9.1		5.2		2.2	U
Iron	32.7	U	182		52.9	U	3580		4070		3540		4150	
Lead	1.5	UJ	1.5	UJ	1.5	UJ	1.5	UJ	1.5	UJ	1.5	UJ	1.5	UJ
Magnesium	5100		5080		4960		4220		4200		4370		4250	
Manganese	194		337		322		2230		2280		2290		2350	
Nickel	4.3	J	8.2		7.3		3.0	U	3.0	U	3.0	U	3.0	U
Potassium	5020	J	5590	J	5330	J	4970	J	5030	J	5230	J	4910	J
Silver	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
Sodium	80600		92100		88500		48300		48300		51200		47900	
Thallium	5.7	U	5.7	U	5.7	U	5.7	U	5.7	U	5.7	U	5.7	U
Vanadium	3.2	U	3.2	U	3.2	U	3.2	U	3.2	U	3.2	U	3.2	U
Zinc	17.7	UJ	24.4	UJ	17.6	UJ	23.8	UJ	52.8	UJ	22.7	UJ	17.0	UJ
Wet Chemistry Parameters (MG/L)			D03888				D03886				D03887			
Alkalinity		NA	36.0			NA	85.0			NA	85.0			NA
Sulfide		NA	4.0	U		NA	4.0	U		NA	4.0	U		NA
Total Organic Carbon		NA	2.0			NA	7.6			NA	7.1			NA

U - Not detected; UJ - Detection limit approximate; J - Quantitation limit approximate;
* - From dilution analysis; R - Rejected; NA - Not analyzed

TABLE 4-8d (cont.)
SUMMARY OF METALS AND WET CHEMISTRY PARAMETERS DETECTED IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CMS-GW-MW05S-02		CMS-GW-MW05SF-02		CMS-GW-MW06S-02		CMS-GW-MW06SF-02		CMS-GW-MW07D-02		CMS-GW-MW07DF-02		CMS-GW-MW07S-02	
Sample Location	MW05S		MW05S		MW06S		MW06S		MW07D		MW07D		MW07S	
Date Sampled	8/15/2001		8/15/2001		8/15/2001		8/15/2001		8/15/2001		8/15/2001		8/15/2001	
QC Identifier	None		None		None		None		None		None		None	
filtered	Unfiltered		Filtered		Unfiltered		Filtered		Unfiltered		Filtered		Unfiltered	
TAL Metal Analysis (UG/L)	MA0A26		MA0A27		MA0A24		MA0A25		MA0A20		MA0A21		MA0A22	
Aluminum	508		352		54.5	J	45.7	U	91.3	J	45.7	U	45.7	U
Arsenic	4.4	UJ	3.6	UJ	5.2	U	5.3	U	2.6	U	2.6	U	4.2	U
Barium	88.6		81.0		54.4	U	56.3	U	32.0		30.7		32.6	U
Beryllium	0.12	UJ	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U
Cadmium	0.70	U	0.70	U	0.70	U	0.70	U	0.70	U	0.70	U	0.70	U
Calcium	27000		25800		34900		36800		14500		14200		25900	
Chromium	12.9		5.5		2.2	UJ	2.9	U	3.0		1.3	U	1.6	UJ
Cobalt	35.6		3.1	J	3.9	U	4.8	U	7.1		6.5		6.0	U
Copper	4.8		3.4	J	11.3		11.2		2.2	U	2.2	U	11.2	
Iron	329		238		26900		28200		80.6		13.1	U	23300	
Lead	1.5	U	1.5	U	2.4	UJ	1.5	UJ	1.5	U	1.5	U	1.5	UJ
Magnesium	1810		1720		3750		3930		1680		1620		2290	
Manganese	593		564		1800		1870		73.9		72.8		2020	
Nickel	12.8		5.4	J	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U
Potassium	4200	J	3960	J	5740	J	6100	J	2700	J	2530	J	4960	J
Silver	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U
Sodium	33200	J	31700	J	37000		38800		23300	J	22800	J	35500	
Thallium	5.7	U	5.7	U	5.7	U	5.7	U	5.7	U	5.7	U	5.7	U
Vanadium	3.2	U	3.2	U	3.2	U	3.2	U	3.2	U	3.2	U	3.2	U
Zinc	23.0		14.8	UJ	23.7	UJ	17.0	UJ	35.1		30.8	U	15.2	UJ
Wet Chemistry Parameters (MG/L)	D03894				D03893				D03891				D03892	
Alkalinity	83.0			NA	140			NA	20.0			NA	71.0	
Sulfide	6.0			NA	16.0	U		NA	4.0			NA	16.0	U
Total Organic Carbon	19.0			NA	24.0			NA	2.0			NA	8.3	

U - Not detected; UJ - Detection limit approximate; J - Quantitation limit approximate;
* - From dilution analysis; R - Rejected, NA - Not analyzed

TABLE 4-8d (cont.)
SUMMARY OF METALS AND WET CHEMISTRY PARAMETERS DETECTED IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CMS-GW-MW07SF-02		CMS-GW-MW08S-02		CMS-GW-MW08SF-02		CMS-GW-MW09S-02		CMS-GW-MW09SF-02		CMS-GW-MW10B-02		CMS-GW-MW10BF-02	
Sample Location	MW07S		MW08S		MW08S		MW09S		MW09S		MW10B		MW10B	
Date Sampled	8/15/2001		8/15/2001		8/15/2001		8/15/2001		8/15/2001		8/23/2001		8/23/2001	
QC Identifier	None		None		None		None		None		None		None	
Filtered	Filtered		Unfiltered		Filtered		Unfiltered		Filtered		Unfiltered		Filtered	
TAL Metal Analysis (UG/L)	MA0A23		MA0A28		MA0A29		MA0A30		MA0A31		MA09W3		MA09W0	
Aluminum	45.7	U	112		84.2	J	88.6	J	69.3	J	57.4	U	19.0	U
Arsenic	3.5	UJ	8.0	U	8.0	U	6.8	U	6.8	U	2.0	U	2.0	U
Barium	31.9	U	17.3		17.3		12.7	J	11.8	J	35.3		32.8	
Beryllium	0.10	U	0.10	U	0.10	U	0.10	U	0.10	U	0.87	UJ	0.87	UJ
Cadmium	0.70	U	0.70	U	0.70	U	0.70	U	0.70	U	0.40	U	0.40	U
Calcium	25300		36100		37800		23000		23300		32800		31000	
Chromium	2.1	UJ	6.0		6.7		3.1		3.9		20.7	U	4.7	U
Cobalt	7.6	U	3.7		5.2		2.2	J	2.7	J	2.6		1.2	UJ
Copper	7.6		2.2	J	2.4	J	4.0	J	2.2	U	7.3	U	7.0	U
Iron	23200		35300		36800		49100		48400		391	U	212	U
Lead	1.5	UJ	2.7	J	3.8		3.8		1.5	U	2.0	UJ	14.8	U
Magnesium	2240		6810		7090		5350		5390		4030		3800	
Manganese	1990		3600		3760		5530		5590		407		383	
Nickel	3.0	U	3.0	U	3.0	U	3.0	U	3.0	U	44.5		32.2	U
Potassium	4760	J	13600	J	14100	J	4520	J	4510	J	5040	J	4650	J
Silver	4.0	U	4.0	U	4.0	U	4.0	U	4.0	U	0.92		1.1	
Sodium	35000		151000	J	156000	J	31600	J	32200	J	46300		44300	
Thallium	5.7	U	5.7	U	6.2	J	5.7	U	6.9	J	5.6	U	5.6	U
Vanadium	3.2	U	3.2	U	3.2	U	3.2	U	3.2	U	0.90	U	0.90	U
Zinc	14.2	UJ	19.1		19.4	U	23.8		20.2	U	81.7	U	108	U
Wet Chemistry Parameters (MG/L)			D03895				D03896				D03919			
Alkalinity		NA	190			NA	120			NA	34.0			NA
Sulfide		NA	64.0	U		NA	100	U		NA	2.0	U		NA
Total Organic Carbon		NA	27.0			NA	24.0			NA	3.0			NA

U - Not detected; UJ - Detection limit approximate; J - Quantitation limit approximate;
* - From dilution analysis; R - Rejected; NA - Not analyzed

TABLE 4-8d (cont.)
SUMMARY OF METALS AND WET CHEMISTRY PARAMETERS DETECTED IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CMS-GW-MW10D-02		CMS-GW-MW10DF-02		CMS-GW-DUP04-02		CMS-GW-DUP04F-02		CMS-GW-MW11B-02		CMS-GW-MW11BF-02		CMS-GW-MW11M-02	
Sample Location	MW10D		MW10D		MW10D		MW10D		MW11B		MW11B		MW11M	
Date Sampled	8/23/2001		8/23/2001		8/23/2001		8/23/2001		8/22/2001		8/22/2001		8/22/2001	
QC Identifier	Field Dup. CMS-GW-MW10D-02		Field Dup. CMS-GW-MW10DF-02		Field Dup. CMS-GW-MW10D-02		Field Dup. CMS-GW-MW10DF-02		None		None		None	
Filtered	Unfiltered		Filtered		Unfiltered		Filtered		Unfiltered		Filtered		Unfiltered	
TAL Metal Analysis (UG/L)	MA09W6		MA09W7		MA09W8		MA09W9		MA0A55		MA0A56		MA0A49	
Aluminum	65.0	U	48.4	U	46.1	U	33.5	U	67.4	U	43.6	U	85.4	U
Arsenic	3.4	UJ	2.0	U	2.0	U	3.4	UJ	2.0	U	2.0	U	2.0	U
Barium	55.6		50.9		53.5		53.3		40.6		41.1		128	
Beryllium	0.90	UJ	0.89	UJ	0.90	UJ	0.92	UJ	0.36	UJ	0.40	UJ	0.84	UJ
Cadmium	0.48		0.40	U	0.54		0.65		0.40	U	0.56	J	0.40	U
Calcium	25000		23100		24300		24400		13800		14500		18500	
Chromium	2.9	U	2.0	U	2.8	U	2.3	U	3.0	U	1.1	U	3.1	U
Cobalt	1.2		0.70	U	1.2		0.70	U	0.70	U	0.70	U	0.70	U
Copper	7.3	U	6.9	U	10.3	U	8.0	U	8.1	U	8.4	U	7.1	U
Iron	88.4	U	46.6	U	92.9	U	52.1	U	80.6	U	25.5	UJ	32.3	UJ
Lead	1.3	UJ	1.3	UJ	1.3	UJ	1.3	UJ	1.3	UJ	1.3	UJ	1.3	UJ
Magnesium	3640		3360		3520		3500		1730		1760		2090	
Manganese	927		850		899		909		110		119		602	
Nickel	158		145		153		152		6.1	U	6.9	U	4.9	U
Potassium	5120	J	4630	J	4900	J	4890	J	2630	J	2780	J	3200	J
Silver	0.70	U	0.73		0.73		1.1		0.70	U	0.70	U	0.70	U
Sodium	63300		58900		61300		61400		16600		17300		30500	
Thallium	5.6	U	5.6	U	5.6	U	5.6	U	5.6	UJ	5.6	UJ	5.6	UJ
Vanadium	0.90	U	0.90	U	0.90	U	0.90	U	0.90	U	0.90	U	0.90	U
Zinc	27.2	U	20.7	U	23.8	U	26.0	U	54.9	U	65.2	U	25.9	U
Wet Chemistry Parameters (MG/L)	D03916				D03917				D03912				D03909	
Alkalinity	20.0			NA	20.0			NA	20.0			NA	20.0	
Sulfide	2.0	U		NA	3.0			NA	2.0			NA	2.0	
Total Organic Carbon	2.0			NA	2.0			NA	16.0			NA	3.0	

U - Not detected; UJ - Detection limit approximate; J - Quantitation limit approximate.
* - From dilution analysis; R - Rejected; NA - Not analyzed

TABLE 4-8d (cont.)
SUMMARY OF METALS AND WET CHEMISTRY PARAMETERS DETECTED IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CMS-GW-MW11MF-02		CMS-GW-MW11S-02		CMS-GW-MW11SF-02		CMS-GW-MW12B-02		CMS-GW-MW12BF-02		CMS-GW-DUP03-02		CMS-GW-DUP03F-02	
Sample Location	MW11M		MW11S		MW11S		MW12B		MW12B		MW12B		MW12B	
Date Sampled	8/22/2001		8/22/2001		8/22/2001		8/22/2001		8/22/2001		8/22/2001		8/22/2001	
QC Identifier	None		None		None		Field Dup. CMS-GW-MW12B-02		Field Dup. CMS-GW-MW12BF-02		Field Dup. CMS-GW-MW12B-02		Field Dup. CMS-GW-MW12BF-02	
Filtered	Filtered		Unfiltered		Filtered		Unfiltered		Filtered		Unfiltered		Filtered	
TAL Metal Analysis (UG/L)	MA0A50		MA0A59		MA0A60		MA0A51		MA0A52		MA0A53		MA0A54	
Aluminum	108	U	383		70.2	U	4360		465		4980		178	
Arsenic	2.0	U	3.5	UJ	2.7	UJ	2.0	U	2.0	U	2.2	UJ	2.0	U
Barium	124		66.7		58.5		88.3		57.3		88.5		51.7	
Beryllium	0.65	UJ	0.92	UJ	0.88	UJ	1.5	UJ	0.72	UJ	1.5	UJ	0.66	UJ
Cadmium	0.40	U	0.40	U	0.40		0.40	U	0.40	U	0.40	U	0.40	U
Calcium	18200		15100		14400		44400		39900		44600		38300	
Chromium	0.60	UJ	20.4	U	2.8	U	13.3	U	5.5	U	15.4	U	4.4	U
Cobalt	0.70	U	5.3		2.2	U	5.3	U	1.7	UJ	6.2	U	0.70	U
Copper	7.8	U	8.8	U	7.1	U	14.0	U	8.8	U	13.7	U	6.2	U
Iron	35.0	UJ	618	U	174	U	4040		800	J	3970		500	J
Lead	1.3	UJ	18.0	U	1.3	UJ	5.3	J	1.3	UJ	4.6	J	1.3	UJ
Magnesium	2060		2060		1930		4350		3100		4500		2870	
Manganese	595		239		209		211		151		210		134	
Nickel	4.8	U	38.7		52.2		12.4	U	6.6	U	14.1	U	7.1	U
Potassium	3100	J	3230	J	3080	J	3730	J	3970	J	3690	J	3680	J
Silver	0.70	U	0.70	U	0.82		0.70	U	0.70	U	0.78	UJ	0.70	U
Sodium	30000		32000		31200		43700		49700		42700		45800	
Thallium	5.6	UJ	5.6	U	5.6	U	5.6	UJ	5.6	UJ	5.6	UJ	5.6	UJ
Vanadium	0.90	U	0.90	U	0.90	U	5.7		2.3		6.3		1.9	
Zinc	51.3	U	56.7	U	49.4	U	48.3	U	19.2	U	56.3	U	33.9	U
Wet Chemistry Parameters (MG/L)			D03914				D03910				D03911			
Alkalinity		NA	10.0			NA	130			NA	130			NA
Sulfide		NA	2.0	U		NA	8.0	U		NA	13.0	U		NA
Total Organic Carbon		NA	2.0			NA	5.0			NA	4.0			NA

U - Not detected; UJ - Detection limit approximate; J - Quantitation limit approximate,
* - From dilution analysis; R - Rejected, NA - Not analyzed

TABLE 4-8d (cont.)
SUMMARY OF METALS AND WET CHEMISTRY PARAMETERS DETECTED IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CMS-GW-MW12D-02		CMS-GW-MW12DF-02		CMS-GW-MW13SF-02		CMS-GW-MW13B-02		CMS-GW-MW13BF-02		CMS-GW-MW13D-02		CMS-GW-MW13DF-02	
Sample Location	MW12D		MW12D		MW13		MW13B		MW13B		MW13D		MW13D	
Date Sampled	8/22/2001		8/22/2001		8/23/2001		8/23/2001		8/23/2001		8/23/2001		8/23/2001	
QC Identifier	None		None		None		None		None		None		None	
Filtered	Unfiltered		Filtered		Filtered		Unfiltered		Filtered		Unfiltered		Filtered	
TAL Metal Analysis (UG/L)	MA09W4		MA09W5		MA0BT0		MA09W1		MA09W2		MA05D6		MA05D7	
Aluminum	37.5	U	19.0	U	12.6	U	130		105		112		10.0	U
Arsenic	2.8	UJ	2.0	U	2.0	U	2.8	UJ	3.3	UJ	2.0	U	2.0	U
Barium	32.6		32.3		103		58.6		57.3		64.6		56.0	
Beryllium	0.79	UJ	0.78	UJ	1.1	UJ	1.1	UJ	1.0	UJ	0.86	UJ	0.86	UJ
Cadmium	0.40	U	0.40	U	0.40	U	0.40	U	0.40	U	0.40	U	0.40	U
Calcium	13500		13600		41200		58700		58500		43600		38000	
Chromium	0.90	UJ	8.9	U	8.5	U	0.70	UJ	114		35.9	U	22.4	U
Cobalt	0.70	U	1.2	UJ	0.70	U	1.7		1.9	U	0.70	U	0.95	UJ
Copper	8.1	U	7.2	U	7.2	U	9.6	U	7.6	U	8.5	U	9.4	U
Iron	89.4	U	105	U	47.2	U	126	U	554	U	370	U	109	U
Lead	3.8	UJ	3.5	UJ	1.3	UJ	1.3	UJ	1.3	UJ	1.3	UJ	1.3	UJ
Magnesium	1930		1920		3720		3780		3800		3910		3440	
Manganese	134		134		47.0		215		220		53.6		35.5	
Nickel	2.9	U	6.9	U	8.6	U	2.9	U	82.6		28.5	U	19.4	U
Potassium	2490	J	2450	J	5010	J	4930	J	4940	J	4320	J	3690	J
Silver	0.70	U	1.4		0.72		0.78		0.70	U	0.88		1.1	
Sodium	26200		26000		64000		53000		53600		63400		57500	
Thallium	5.6	U	5.6	U	5.6	U	5.6	U	5.6	U	5.6	U	5.6	U
Vanadium	0.90	U	0.90	U	0.90	U	1.4		0.90	U	0.90	U	0.90	U
Zinc	30.3	U	18.3	U	18.6	U	23.5	U	34.1	U	15.2	U	15.5	U
Wet Chemistry Parameters (MG/L)	D03915						D03918				D04062			
Alkalinity	20.0			NA		NA	98.0			NA	60.0			NA
Sulfide	4.0			NA		NA	2.0	U		NA	2.0	U		NA
Total Organic Carbon	1.0			NA		NA	1.0			NA	2.0			NA

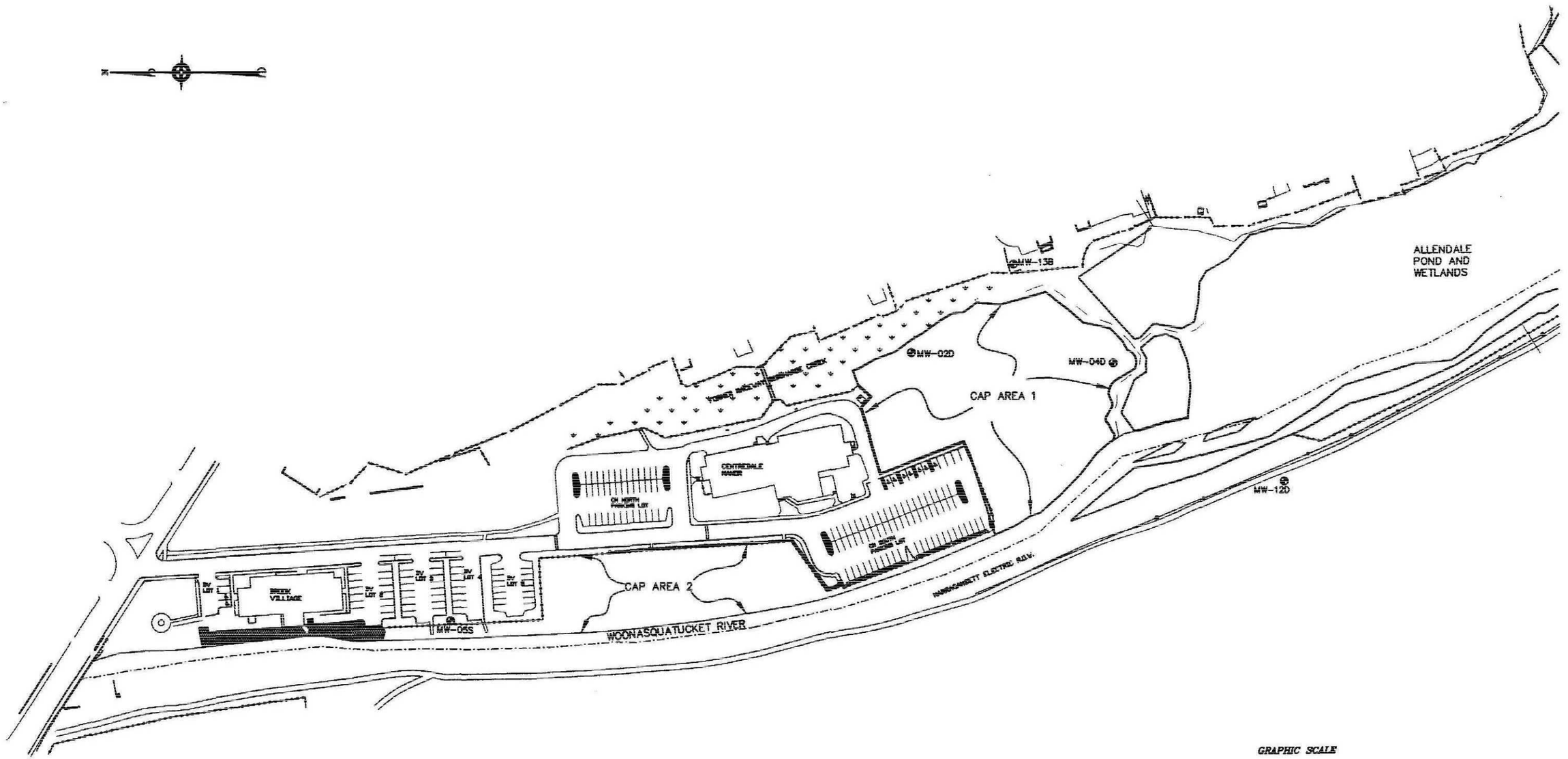
U - Not detected; UJ - Detection limit approximate; J - Quantitation limit approximate;
* - From dilution analysis; R - Rejected; NA - Not analyzed

TABLE 4-8d (cont.)
SUMMARY OF METALS AND WET CHEMISTRY PARAMETERS DETECTED IN GROUNDWATER
DRAFT TECHNICAL MEMORANDUM - SOURCE AREA INVESTIGATION
CENTREDALE MANOR RESTORATION PROJECT SITE
NORTH PROVIDENCE, RHODE ISLAND

Sample Number	CMS-GW-MW13S-02		CMS-GW-MW14M-02		CMS-GW-MW14MF-02		CMS-GW-MW15D-02		CMS-GW-MW15DF-02		CMS-GW-TMW3-02		CMS-GW-TMW3F-02	
Sample Location	MW13S		MW14M		MW14M		MW15D		MW15D		TMW3		TMW3	
Date Sampled	8/23/2001		8/21/2001		8/21/2001		8/21/2001		8/21/2001		8/23/2001		8/23/2001	
QC Identifier	None		None		None		None		None		None		None	
Filtered	Unfiltered		Unfiltered		Filtered		Unfiltered		Filtered		Unfiltered		Filtered	
TAL Metal Analysis (UG/L)	MA05D8		MA0A46		MA0A47		MA0A44		MA0A45		MA0B86		MA0B87	
Aluminum	87.1	U	736		95.6	U	151		26.4	U	316		16.9	U
Arsenic	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	3.4	UJ	4.8	U
Barium	96.4		34.6		32.6		33.9		32.5		53.0		46.9	
Beryllium	0.98	UJ	0.36	UJ	0.40	UJ	0.28	UJ	0.24	UJ	0.86	UJ	0.86	UJ
Cadmium	0.40	U	0.40	U	0.40	U	0.40	U	0.40	U	0.40	U	0.40	U
Calcium	38400		9380		8700		30400		30700		21000		20000	
Chromium	19.9	U	0.96	UJ	0.97	UJ	2.4	U	0.50	U	8.1	U	4.5	U
Cobalt	0.70	U	0.70	U	0.70	U	0.70	U	0.70	U	2.2		2.6	U
Copper	12.2	U	7.9	U	8.4	U	8.7	U	4.8	U	10.2	U	7.5	U
Iron	228	U	70.2	U	39.3	UJ	416	U	75.0	UJ	3560		2870	
Lead	1.3	UJ	1.3	UJ	1.3	UJ	1.3	UJ	1.3	UJ	7.4	UJ	2.2	UJ
Magnesium	3450		1340		1240		2890		2880		2610		2440	
Manganese	52.2		88.7		82.5		488		483		983		929	
Nickel	13.5	U	2.6	U	1.1	UJ	1.8	U	1.2	UJ	11.5	U	8.4	U
Potassium	4510	J	1520	J	1440	J	4160	J	4110	J	4940	J	4550	J
Silver	0.70	U	0.80	UJ	0.70	U	0.70	U	0.70	U	0.70	U	0.77	
Sodium	59800		13700		12800		30800		31100		131000		124000	
Thallium	5.6	U	5.6	UJ	5.6	UJ	5.6	UJ	5.6	UJ	5.6	U	5.6	U
Vanadium	0.90	U	0.90	U	0.90	U	0.90	U	0.90	U	0.90	U	0.90	U
Zinc	18.9	U	49.8	U	43.4	U	25.2	U	20.3	U	29.3	U	28.8	U
Wet Chemistry Parameters (MG/L)	D04063		D03906				D03905				D04061			
Alkalinity	52.0		9.0			NA	54.0			NA	120			NA
Sulfide	2.0	U	2.0	U		NA	2.0	U		NA	1.0	U		NA
Total Organic Carbon	1.0		2.0			NA	3.0			NA	6.0			NA

U - Not detected; UJ - Detection limit approximate; J - Quantitation limit approximate;
* - From dilution analysis; R - Rejected; NA - Not analyzed

FIGURES



NOTES AND REFERENCE:

1. FENCES, PARKING AREAS, BUILDINGS, ROADWAYS, RIVER, AND RESIDENTIAL LOTS TAKEN FROM PLAN ENTITLED "CENTREDALE MANOR RESTORATION SITE WOONASQUTUCKET RIVER NORTH PROVIDENCE AND JOHNSTON, R.I. INUNDATION 100 YEAR FLOOD SITE PLAN 'A'', 'B', AND 'C', WHICH PLAN WAS PROVIDED BY CLIENT.

2. HORIZONTAL DATUM TAKEN FROM THE ABOVE MENTION PLAN. VERTICAL DATUM = NGVD 1929. ALSO TAKEN FROM ABOVE REFERENCED PLAN.

3. ELEVATION FOR BENCHMARK TOP OF DRILL HOLE IN CONCRETE CURB WAS OBSERVED TO BE DIFFERENT FROM PLAN REFERENCED IN NOTE #1.

4. BASEMAP: LOUIS FEDERICI & ASSOCIATES

GRAPHIC SCALE

0' 150' 300'

1 INCH = 150 FEET

SITE FEATURES			FIGURE E-1
CENTREDALE MANOR RESTORATION PROJECT			
NORTH PROVIDENCE, RHODE ISLAND			
DRAWN BY:	D.W. MACDOUGALL	REV.:	0
CHECKED BY:	G. STURGEON	DATE:	JANUARY 11, 2001
SCALE:	1" = 150'	FILE NO.:	DWG\4104\0611\FIG_E-1.DWG

TETRA TECH NUS, INC.
55 Jonspin Road Wilmington, MA 01887
(978)658-7899

Originals in color.

N
W E
S

1500 0 1500 Feet

1 inch = 1500 feet

NORTH PROVIDENCE

BROOK VILLAGE

CENTREDALE MANOR

ALLENDALE POND

ALLENDALE DAM

ASSAPUMPSETT POND

ASSAPUMPSETT BROOK

CRANBERRY BROOK

LYMANSVILLE POND

LYMANSVILLE DAM

MANTON POND

MANTON DAM

JOHNSTON

DYERVILLE POND

DYERVILLE DAM

LEGEND

- Town Boundaries
- Buildings
- Parking lots

FEMA Flood Zones

- 100-year, No BFEs
- 100-year, BFEs
- 100-year, BFEs, 1-3 ft.
- Alluvial Fan, 100-year, 1-3 ft.
- 500-year
- outside 100 and 500 year

NOTES:
1) Plan not to be used for design
2) All locations to be considered approximate
3) Original map created by the EPA GIS lab 21-July-99
Sources: RIGIS, EPA, REAC, Lockheed Martin

Originals in color.

LOCATION MAP

FIGURE 1-1

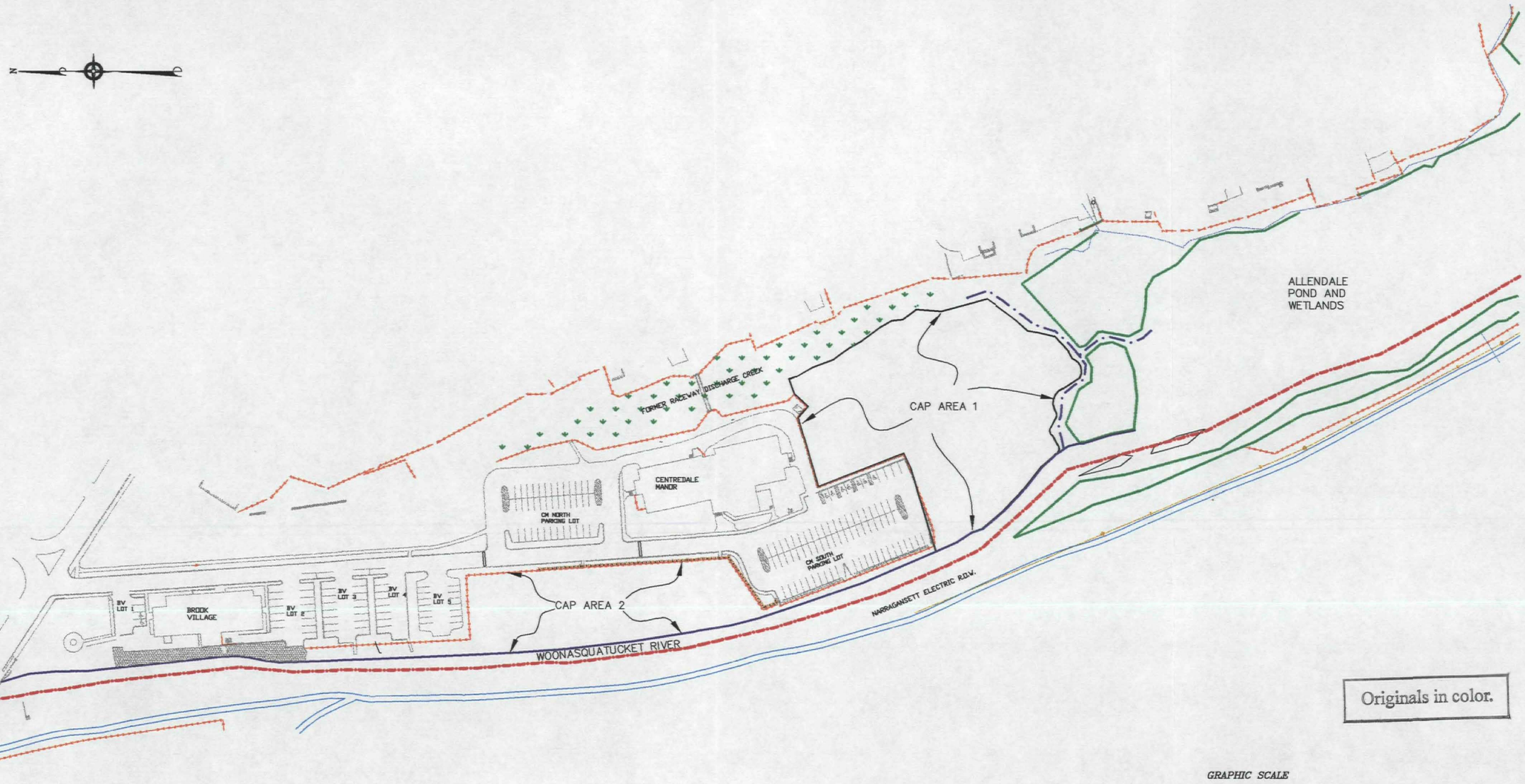
SOURCE AREA INVESTIGATION

CENTREDALE MANOR
RESTORATION PROJECT SITE

DRAWN BY: J. PICCUITO	DATE: NOVEMBER 29, 2001
CHECKED BY: S. PARKER	FILE: ...\CENTREDALE.APR 4104/0611

TETRA TECH NUS, INC.

55 JONSPIN ROAD WILMINGTON, MA 01887
(978)658-7899



Originals in color.

GRAPHIC SCALE

0′ 150′ 300′

1 INCH = 150 FEET

NOTES AND REFERENCE:

1. FENCES, PARKING AREAS, BUILDINGS, ROADWAYS, RIVER, AND RESIDENTIAL LOTS TAKEN FROM PLAN ENTITLED 'CENTREDALE MANOR RESTORATION SITE WOONASQUTUCKET RIVER NORTH PROVIDENCE AND JOHNSTON, R. I. INUNDATION 100 YEAR FLOOD SITE PLAN 'A'', 'B', AND 'C', WHICH PLAN WAS PROVIDED BY CLIENT.

2. HORIZONTAL DATUM TAKEN FROM THE ABOVE MENTION PLAN. VERTICAL DATUM = NGVD 1929. ALSO TAKEN FROM ABOVE REFERENCED PLAN.

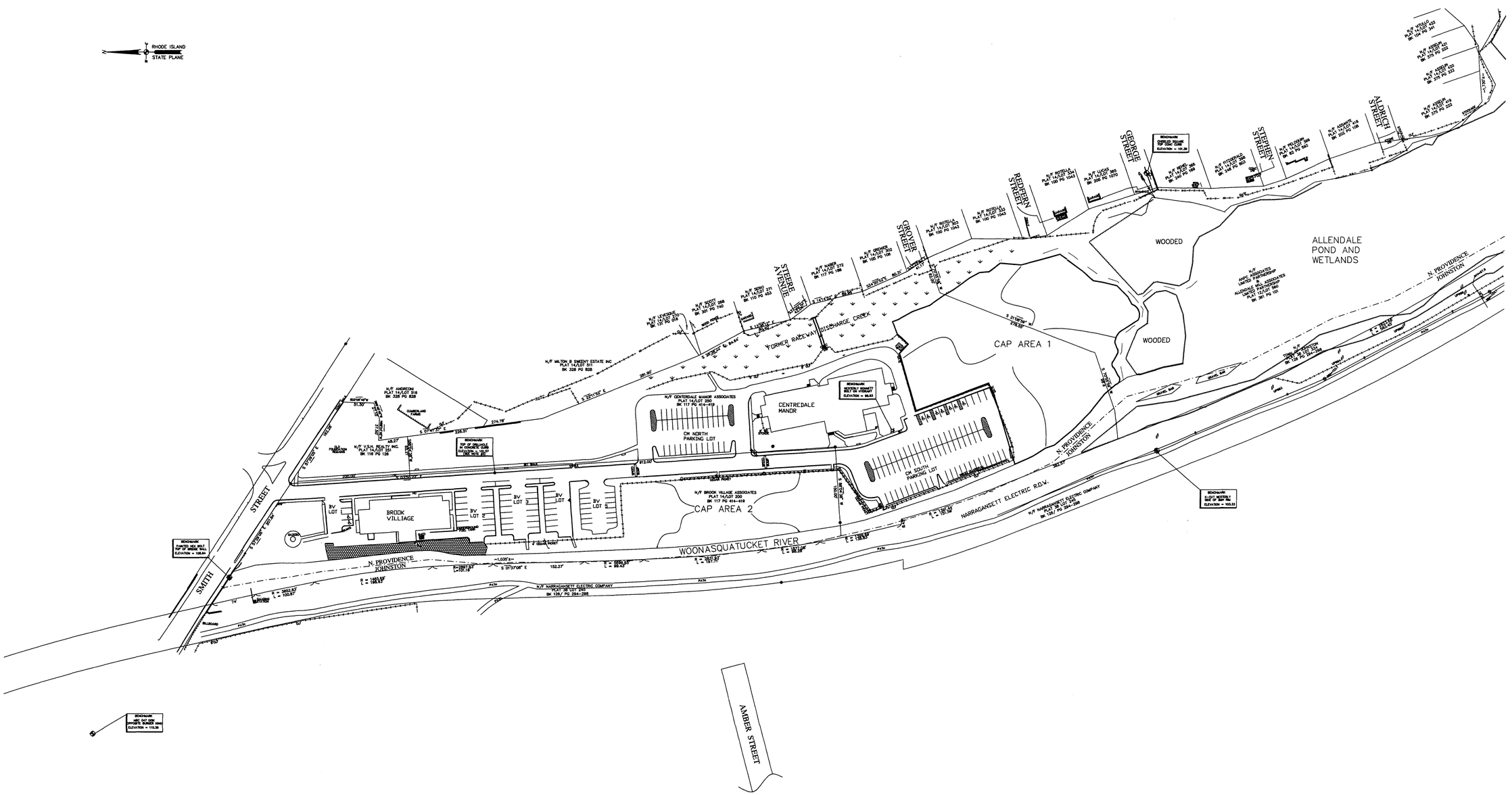
3. ELEVATION FOR BENCHMARK TOP OF DRILL HOLE IN CONCRETE CURB WAS OBSERVED TO BE DIFFERENT FROM PLAN REFERENCED IN NOTE #1.

4. BASEMAP: LOUIS FEDERICI & ASSOCIATES

SITE FEATURES			
CENTREDALE MANOR RESTORATION PROJECT			
NORTH PROVIDENCE, RHODE ISLAND			
DRAWN BY:	D.W. MACDOUGALL	REV.:	0
CHECKED BY:	G. STURGEON	DATE:	DECEMBER 3, 2001
SCALE:	1" = 150'	FILE NO.:	DWG\4104\0611\FIG_1-2.DWG

FIGURE 1-2

TETRA TECH NUS, INC.
55 Jonspin Road Wilmington, MA 01887
(978)658-7899



NOTES AND REFERENCE:

1. FENCES, PARKING AREAS, BUILDINGS, ROADWAYS, RIVER, AND RESIDENTIAL LOTS TAKEN FORM PLAN ENTITLED "CENTREDALE MANOR RESTORATION SITE WOONASQUTUCKET RIVER NORTH PROVIDENCE AND JOHNSTON, R.I. INUNDATION 100 YEAR FLOOD SITE PLAN 'A', 'B', AND 'C', WHICH PLAN WAS PROVIDED BY CLIENT.
2. HORIZONTAL DATUM TAKEN FROM THE ABOVE MENTION PLAN. VERTICAL DATUM = NGVD 1929. ALSO TAKEN FROM ABOVE REFERENCED PLAN.
3. ELEVATION FOR BENCHMARK TOP OF DRILL HOLE IN CONCRETE CURB WAS OBSERVED TO BE DIFFERENT FROM PLAN REFERENCED IN NOTE #1.

LEGEND:

- FENCE
- UTILITY POLE
- BENCHMARK
- HYDRANT

GRAPHIC SCALE

80′ 0′ 80′ 160′

1 INCH = 80 FEET

DRAWN BY: D.W. MACDOUGALL	TITLE: BASE MAP CENTREDALE MANOR RESTORATION PROJECT NORTH PROVIDENCE, RHODE ISLAND		
PREPARED BY: S. PARKER			
CHECKED BY: S. PARKER			
	SOURCE: BASE PLAN BY LOUIS FEDERICI & ASSOCIATES		
	SCALE: 1" = 80′	DATE: NOVEMBER 2001	PROJ. NO: 4104
PROJECT MANAGER: S. PARKER	DRAWING NO: FIGURE 2-1	ACFILE NAME: DWG\4104\0611\FIG_2-1.DWG	REV: 0
PROGRAM MANAGER: G. GARDNER			

TETRA TECH NUS, INC.
55 JONSPIN ROAD
WILMINGTON, MASSACHUSETTS 01887
(978)658-7899



LEGEND

VT	VERTICAL TANK
DR	DRUMS
OF	OUTFALL
ST	STAIN
SL	STANDING LIQUID
SW	SOLID WASTE
WDA	WASTE DISPOSAL AREA
HT	HORIZONTAL TANK
LTM	LIGHT-TONED MATERIAL
BA	BARE AREA

SITE BOUNDARY

DRAINAGE

MOUNDED MATERIAL

VEHICLE ACCESS

SOURCE:

USEPA, 2000. AERIAL PHOTOGRAPHIC ANALYSIS, CENTREDALE MANOR SITE SUBAREA, NORTH PROVIDENCE, RHODE ISLAND, JULY 2000.

CENTREDALE MANOR SOURCE AREA, AERIAL PHOTO FEBRUARY 7, 1962

CENTREDALE MANOR RESTORATION PROJECT

NORTH PROVIDENCE, RHODE ISLAND

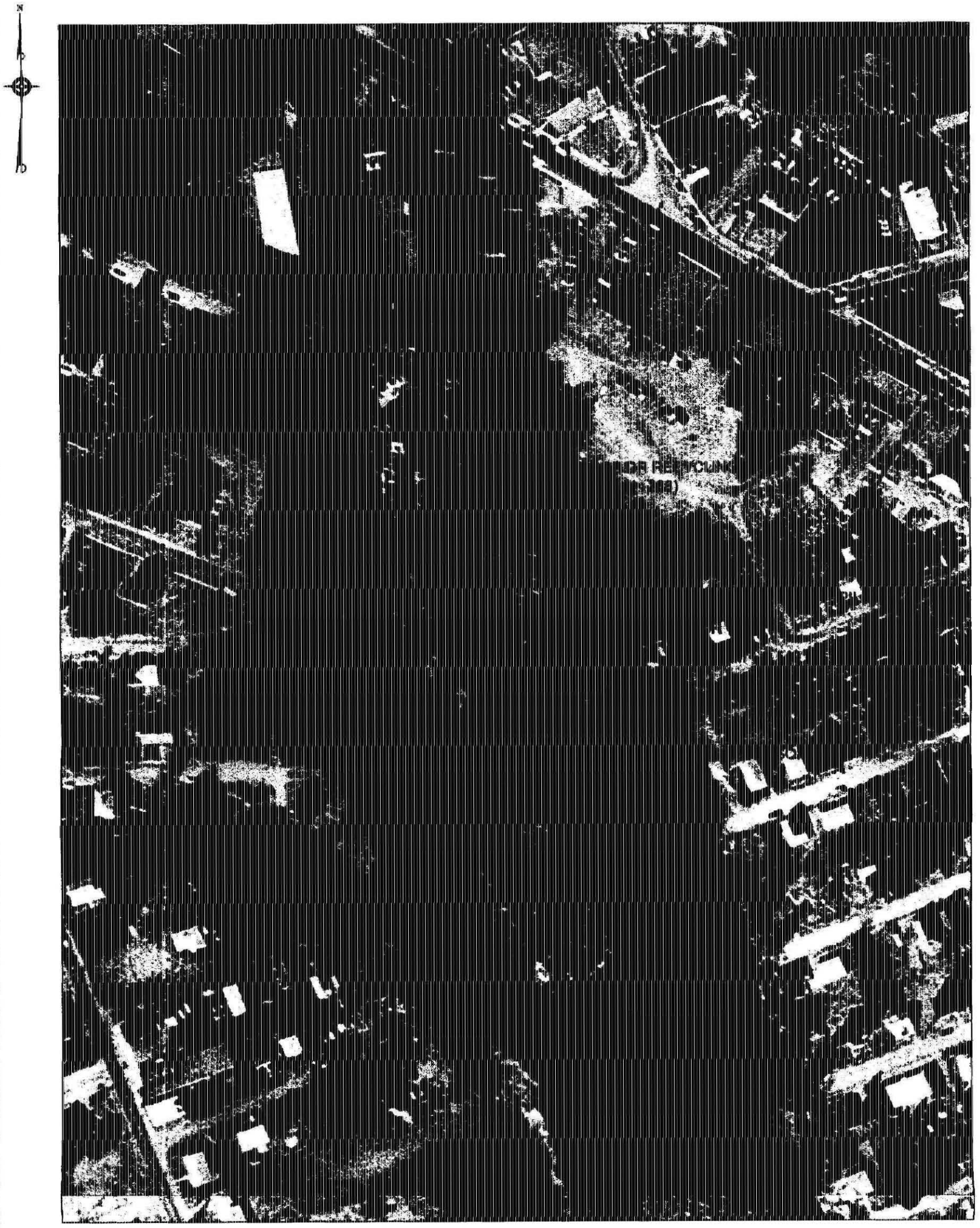
DRAWN BY:	D.W. MACDOUGALL	REV.:	0
CHECKED BY:	K. LANG	DATE:	NOVEMBER 29, 2001
SCALE:	NOT TO SCALE	FILE NO.:	DWG\4104\0611\FIG_2-2.DWG

FIGURE 2-2

TETRA TECH NUS, INC.

55 Jonspin Road Wilmington, MA 01887

(978)658-7899



LEGEND

IM	IMPOUNDMENT
LTMM	LIGHT-TONED MOUNDED MATERIAL
VT	VERTICAL TANK
DR	DRUMS
OF	OUTFALL
ST	STAIN
SL	STANDING LIQUID
SW	SOLID WASTE
WDA	WASTE DISPOSAL AREA
HT	HORIZONTAL TANK
LTM	LIGHT-TONED MATERIAL

BA	BARE AREA
	SITE BOUNDARY
	DRAINAGE
	MOUNDED MATERIAL
	VEHICLE ACCESS

SOURCE:

USEPA. 2000. AERIAL PHOTOGRAPHIC ANALYSIS, CENTREDALE MANOR SITE SUBAREA, NORTH PROVIDENCE, RHODE ISLAND, JULY 2000.

CENTREDALE MANOR SOURCE AREA, AERIAL PHOTO MARCH 9, 1970

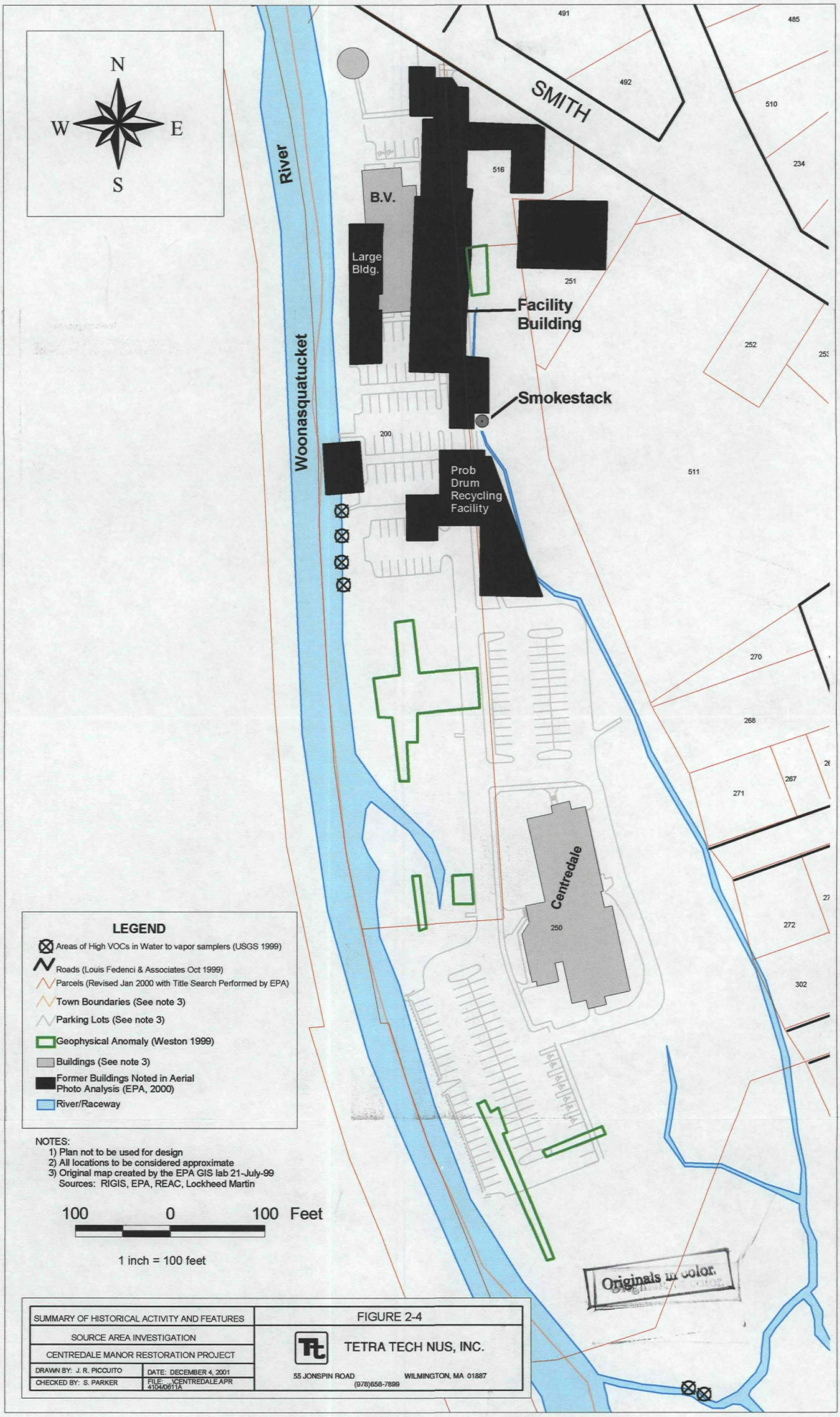
CENTREDALE MANOR RESTORATION PROJECT

NORTH PROVIDENCE, RHODE ISLAND

DRAWN BY:	D.W. MACDOUGALL	REV.:	0
CHECKED BY:	K. LANG	DATE:	NOVEMBER 29, 2001
SCALE:	NOT TO SCALE	FILE NO.:	DWG\4104\0611\FIG_2-3.DWG

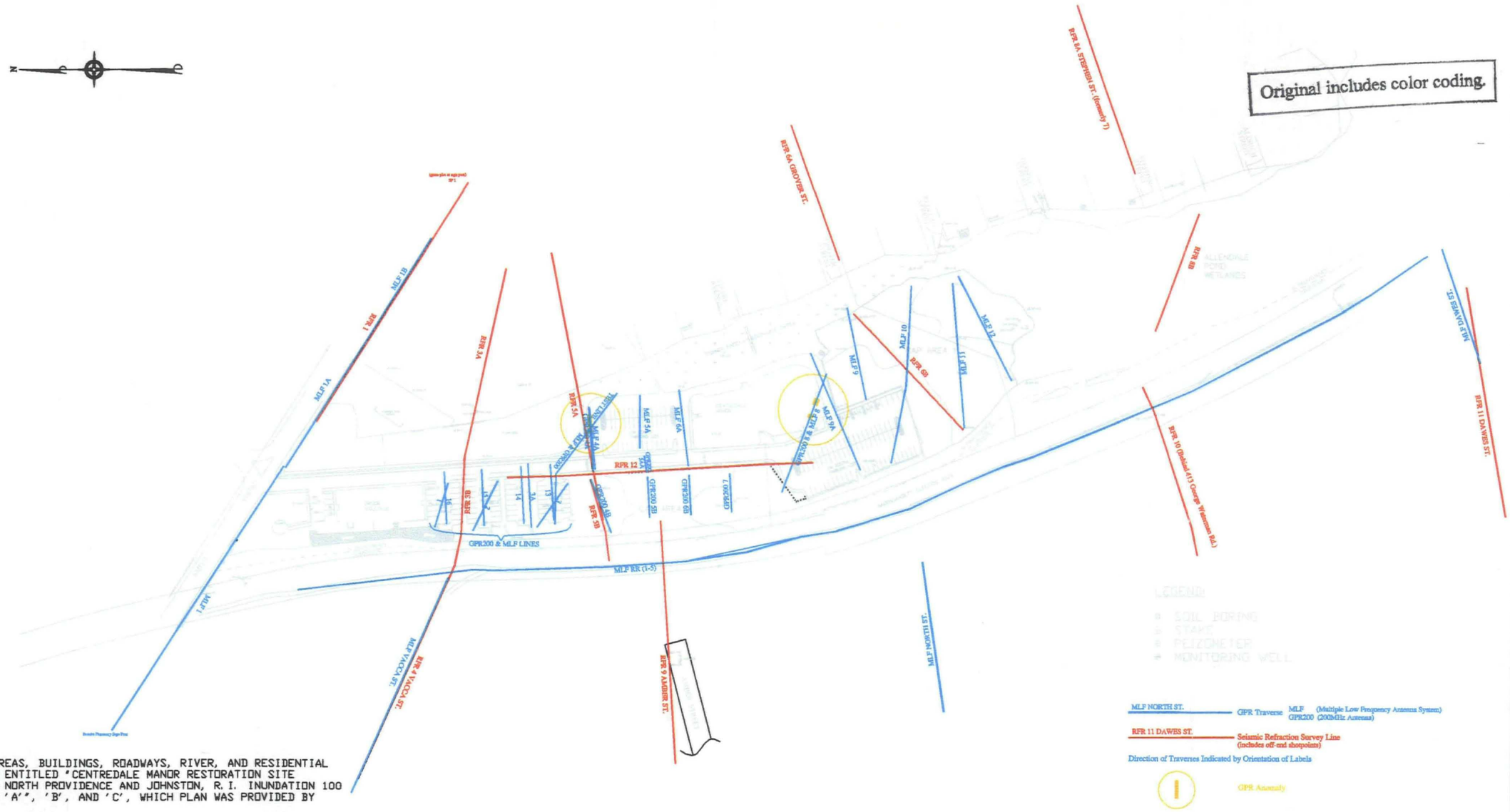
FIGURE 2-3

TETRA TECH NUS, INC.
55 Jonspin Road Wilmington, MA 01887
(978)658-7899



SUMMARY OF HISTORICAL ACTIVITY AND FEATURES	FIGURE 2-4
SOURCE AREA INVESTIGATION	TETRA TECH NUS, INC.
CENTREDALE MANOR RESTORATION PROJECT	55 JONSPIN ROAD WILMINGTON, MA 01887 (978)658-7899
DRAWN BY: J. R. PICCUITO / DATE: DECEMBER 4, 2001	
CHECKED BY: S. PARKER / FILE: ...\CENTREDALE.APR 4104/0611A	

Original includes color coding.



LEGEND

- SOIL BORING
- STAKE
- PIEZOMETER
- MONITORING WELL

MLF NORTH ST. — GPR Traverse — MLF (Multiple Low Frequency Antenna System) GPR200 (200MHz Antenna)

RFR 11 DAWES ST. — Seismic Refraction Survey Line (includes off-end shotpoints)

Direction of Traverses Indicated by Orientation of Labels

1 — GPR Anomaly

NOTES AND REFERENCE:

1. FENCES, PARKING AREAS, BUILDINGS, ROADWAYS, RIVER, AND RESIDENTIAL LOTS TAKEN FROM PLAN ENTITLED 'CENTREDALE MANOR RESTORATION SITE WOONASQUTUCKET RIVER NORTH PROVIDENCE AND JOHNSTON, R.I. INUNDATION 100 YEAR FLOOD SITE PLAN 'A'', 'B', AND 'C', WHICH PLAN WAS PROVIDED BY CLIENT.

2. HORIZONTAL DATUM TAKEN FROM THE ABOVE MENTION PLAN. VERTICAL DATUM = NGVD 1929. ALSO TAKEN FROM ABOVE REFERENCED PLAN.

3. ELEVATION FOR BENCHMARK TOP OF DRILL HOLE IN CONCRETE CURB WAS OBSERVED TO BE DIFFERENT FROM PLAN REFERENCED IN NOTE #1.

4. BASEMAP: LOUIS FEDERICI & ASSOCIATES

5. GEOPHYSICAL INVESTIGATION LINES PREPARED BY HAGER GEOSCIENCE, INC., OCTOBER, 2001.

GRAPHIC SCALE

0' 200' 400'

1 INCH = 200 FEET

GEOPHYSICAL INVESTIGATION LINES

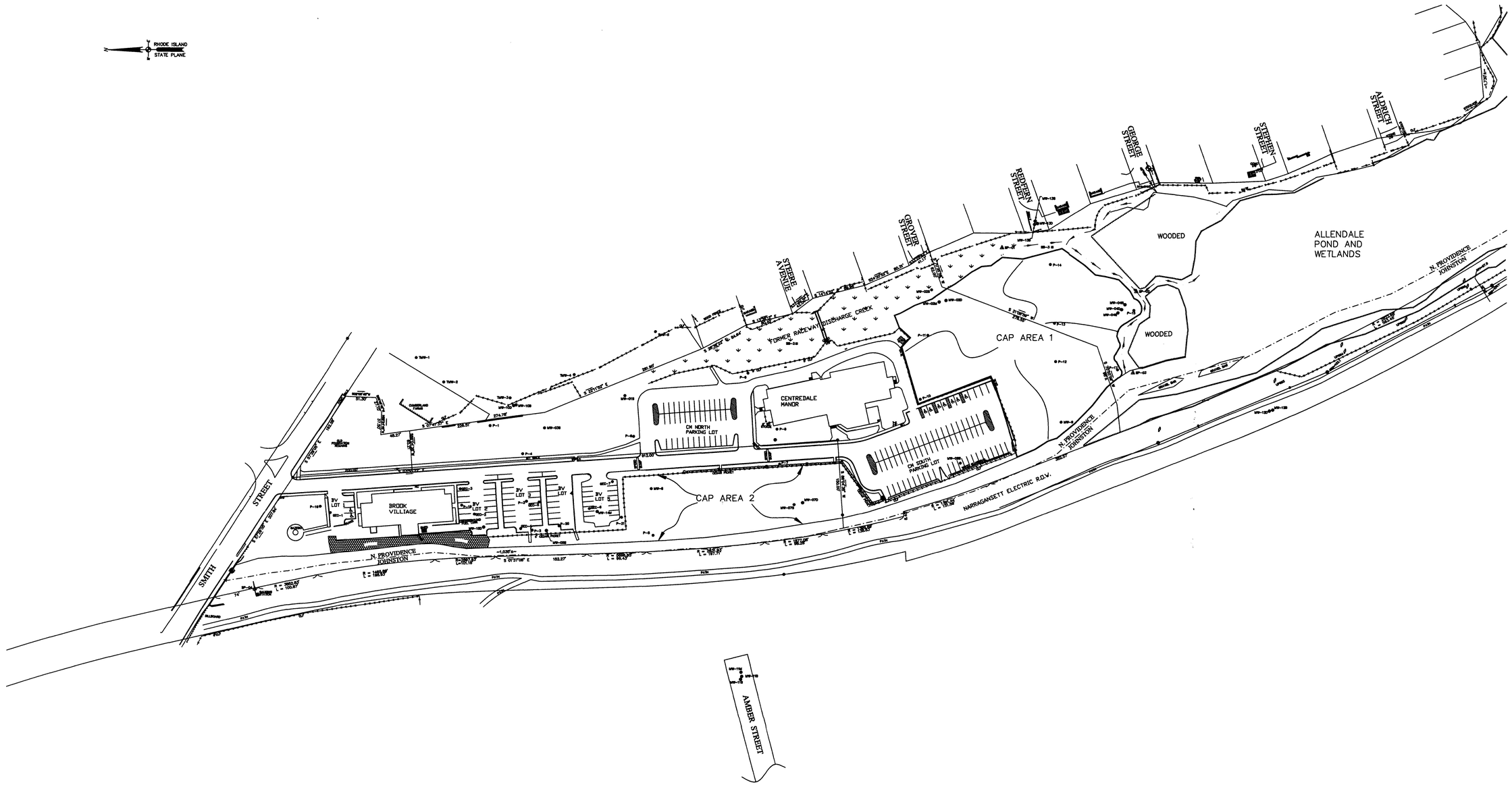
CENTREDALE MANOR RESTORATION PROJECT

NORTH PROVIDENCE, RHODE ISLAND

DRAWN BY:	D.W. MACDOUGALL	REV.:	0
CHECKED BY:	G. STURGEON	DATE:	NOVEMBER 29, 2001
SCALE:	1" = 200'	FILE NO.:	DWG\4104\0611\FIG_3-1.DWG

FIGURE 3-1

TETRA TECH NUS, INC.
55 Jonspin Road Wilmington, MA 01887
(978)658-7899



NOTES AND REFERENCE:

1. FENCES, PARKING AREAS, BUILDINGS, ROADWAYS, RIVER, AND RESIDENTIAL LOTS TAKEN FORM PLAN ENTITLED "CENTREDALE MANOR RESTORATION SITE WOONASQUATUCKET RIVER NORTH PROVIDENCE AND JOHNSTON, R.I. INUNDATION 100 YEAR FLOOD SITE PLAN 'A'', 'B', AND 'C', WHICH PLAN WAS PROVIDED BY CLIENT.
2. HORIZONTAL DATUM TAKEN FROM THE ABOVE MENTION PLAN. VERTICAL DATUM = NGVD 1929. ALSO TAKEN FROM ABOVE REFERENCED PLAN.
3. ELEVATION FOR BENCHMARK TOP OF DRILL HOLE IN CONCRETE CURB WAS OBSERVED TO BE DIFFERENT FROM PLAN REFERENCED IN NOTE #1.

LEGEND:

- ■ SOIL BORING
- ▲ SURFACE WATER MONITORING STATION
- ⊕ PIEZOMETER
- ● MONITORING WELL
- xxx-x TETRA TECH I.D.
- ∅ UTILITY POLE
- ○ MANHOLE COVER
- —D DISSHARGE CREEK AND FLOW DIRECTION

GRAPHIC SCALE:

80' 0' 80' 160'

1 INCH = 80 FEET

DRAWN BY:: D.W. MACDOUGALL	TITLE: LOCATIONS OF BORINGS, WELLS, AND PIEZOMETERS CENTREDALE MANOR RESTORATION PROJECT NORTH PROVIDENCE, RHODE ISLAND
PREPARED BY: S. PARKER	
CHECKED BY:: S. PARKER	SOURCE: BASE PLAN BY LOUIS FEDERICI & ASSOCIATES
	SCALE: 1" = 80' DATE: DECEMBER 2001 PROJ. NO: 4104
PROJECT MANAGER: S. PARKER	DRAWING NO: FIGURE 3-2 ACFILE NAME: DWG\4104\DB51\FIG_3-2.DWG REV: 0
PROGRAM MANAGER: G. GARDNER	

TETRA TECH NUS, INC.
55 JONSPIN ROAD
WILMINGTON, MASSACHUSETTS 01887
(978)658-7899

RHODE ISLAND STATE PLANE

MW-03S		
Depth	Parameter	Conc.
2-4	2,4,5 TCP	NA
	TCE	NA
	PCE	NA
4-6	2,4,5 TCP	1000U
	TCE	130J
	PCE	490
6-8	2,4,5 TCP	2900U
	TCE	290U
	PCE	160J

MW-01S		
Depth	Parameter	Conc.
1-2	2,4,5 TCP	950U
	TCE	340U
	PCE	340U
2-4	2,4,5 TCP	4000U
	TCE	220U
	PCE	220U
4-6	2,4,5 TCP	73J
	TCE	28U
	PCE	52U
6-8	2,4,5 TCP	950U
	TCE	260U
	PCE	140

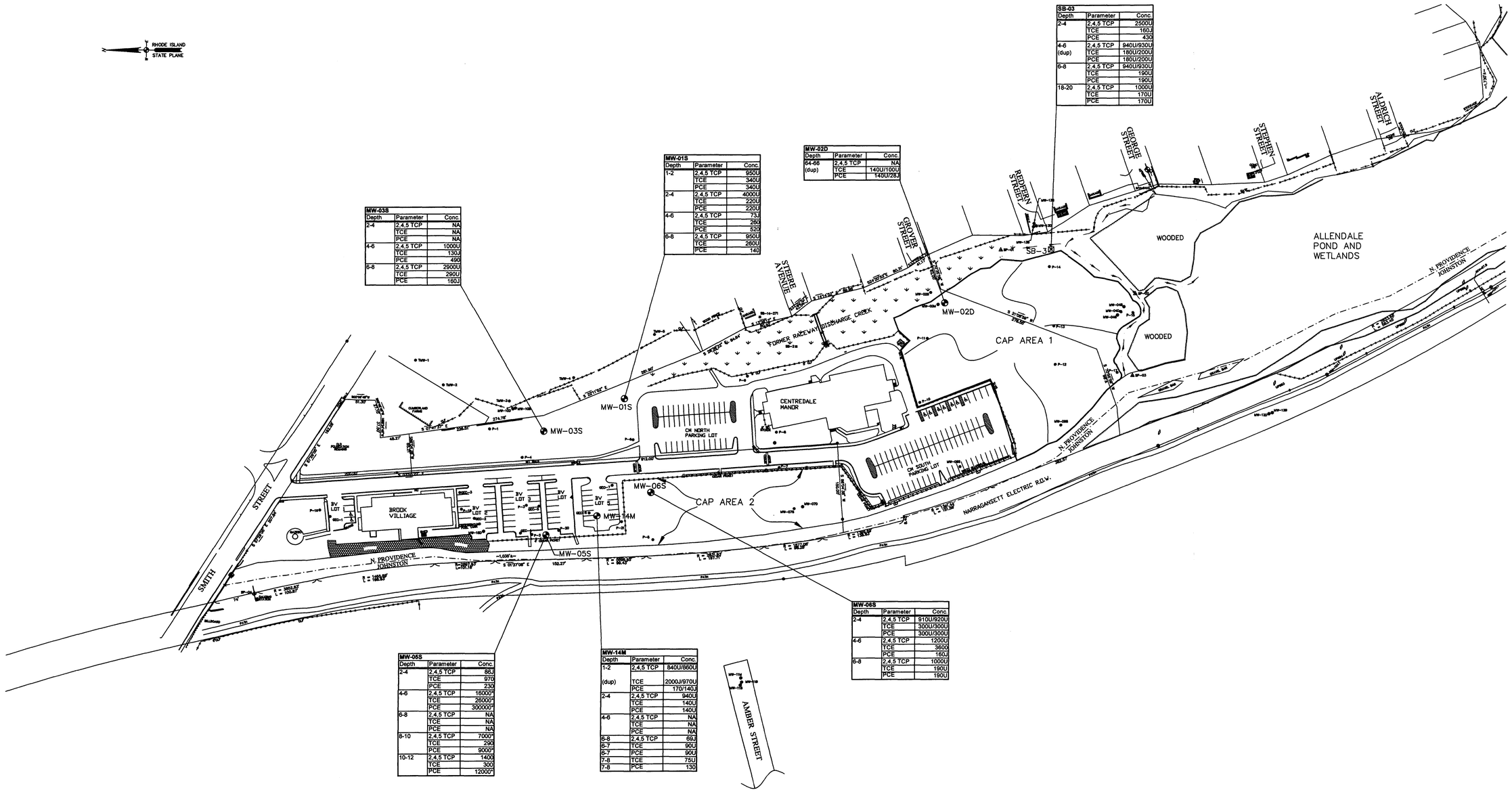
MW-02D		
Depth	Parameter	Conc.
64-66	2,4,5 TCP	NA
(dup)	TCE	140U/100U
	PCE	140U/26J

SB-03		
Depth	Parameter	Conc.
2-4	2,4,5 TCP	2500U
	TCE	160J
	PCE	430
4-6 (dup)	2,4,5 TCP	940U/930U
	TCE	180U/200U
	PCE	180U/200U
6-8	2,4,5 TCP	940U/930U
	TCE	190U
	PCE	190U
18-20	2,4,5 TCP	1000U
	TCE	170U
	PCE	170U

MW-05S		
Depth	Parameter	Conc.
2-4	2,4,5 TCP	86J
	TCE	97U
	PCE	23U
4-6	2,4,5 TCP	16000"
	TCE	2600U"
	PCE	30000U"
6-8	2,4,5 TCP	NA
	TCE	NA
	PCE	NA
8-10	2,4,5 TCP	7000"
	TCE	29U
	PCE	9000"
10-12	2,4,5 TCP	1400
	TCE	30U
	PCE	12000"

MW-14M		
Depth	Parameter	Conc.
1-2	2,4,5 TCP	840U/860U
(dup)	TCE	2000J/970U
	PCE	170/140J
2-4	2,4,5 TCP	940U
	TCE	140U
	PCE	140U
4-6	2,4,5 TCP	NA
	TCE	NA
	PCE	NA
6-8	2,4,5 TCP	69J
6-7	TCE	90U
6-7	PCE	90U
7-8	TCE	75U
7-8	PCE	130

MW-06S		
Depth	Parameter	Conc.
2-4	2,4,5 TCP	910U/920U
	TCE	300U/300U
	PCE	300U/300U
4-6	2,4,5 TCP	1200U
	TCE	360J
	PCE	160J
6-8	2,4,5 TCP	1000U
	TCE	190U
	PCE	190U



NOTES AND REFERENCE:
1. FENCES, PARKING AREAS, BUILDINGS, ROADWAYS, RIVER, AND RESIDENTIAL LOTS TAKEN FORM PLAN ENTITLED "CENTREDALE MANOR RESTORATION SITE WOONASQUTUCKET RIVER NORTH PROVIDENCE AND JOHNSTON, R.I. INUNDATION 100 YEAR FLOOD SITE PLAN 'A', 'B', AND 'C', WHICH PLAN WAS PROVIDED BY CLIENT.

2. HORIZONTAL DATUM TAKEN FROM THE ABOVE MENTION PLAN. VERTICAL DATUM = NGVD 1929. ALSO TAKEN FROM ABOVE REFERENCED PLAN.

3. ELEVATION FOR BENCHMARK TOP OF DRILL HOLE IN CONCRETE CURB WAS OBSERVED TO BE DIFFERENT FROM PLAN REFERENCED IN NOTE #1.

LEGEND:
- ■ SOIL BORING
- ▲ SURFACE WATER MONITORING STATION
- ⊕ PEIZOMETER
- ● MONITORING WELL
- xxx-x TETRA TECH I.D.
- ∅ UTILITY POLE
- ⊙ MANHOLE COVER
- —→— DISCHARGE CREEK AND FLOW DIRECTION

2,4,5 TCP = 2,4,5 TRICHLOROPHENOL
TCE = TRICHLORDETHENE
PCE = TETRACHLORDETHENE
ALL CONCENTRATIONS ARE EXPRESSED IN µg/kg.

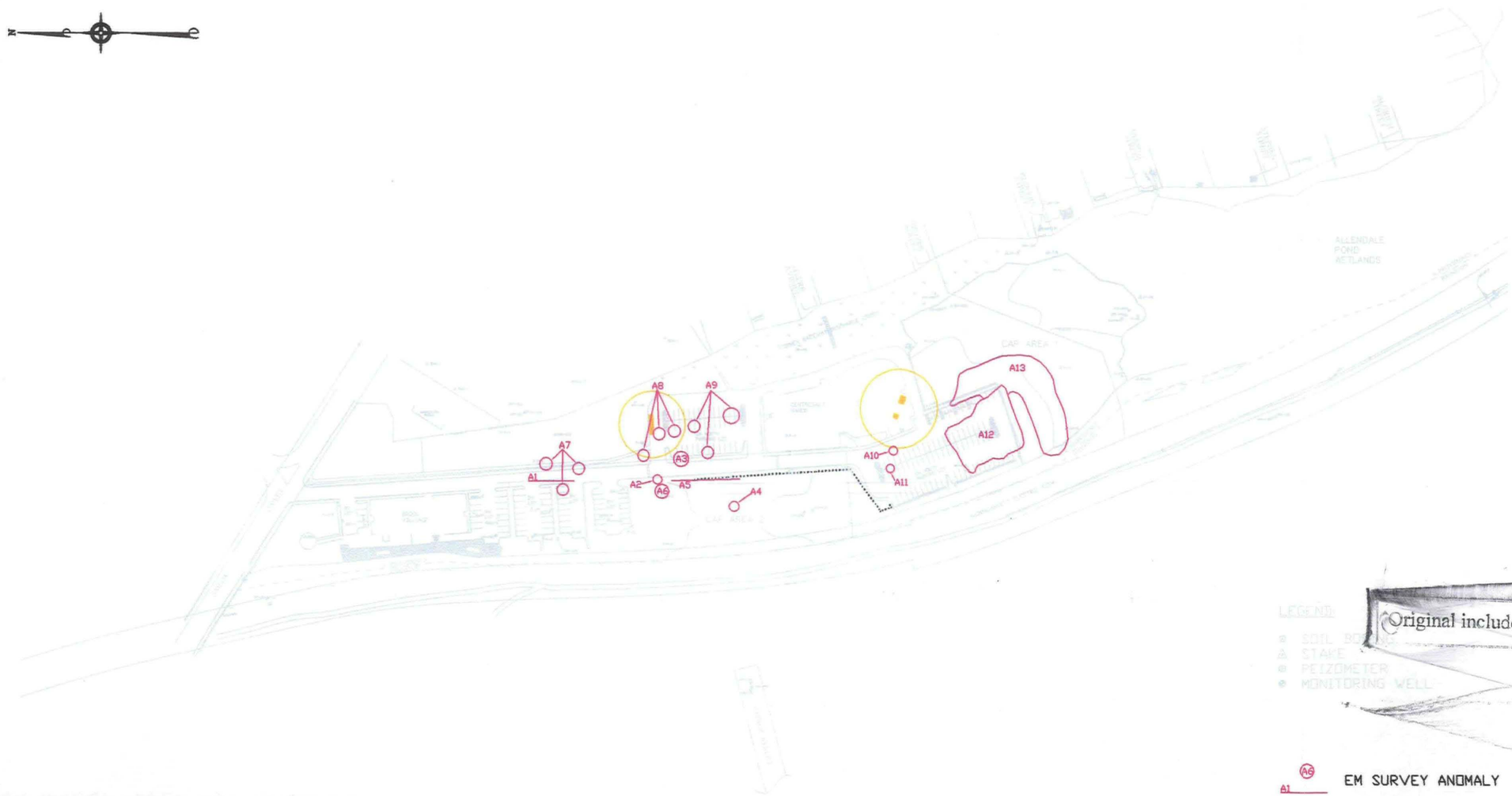
GRAPHIC SCALE

80′ 0′ 80′ 160′

1 INCH = 80 FEET

DRAWN BY: D.W. MACDOUGALL	TITLE: SELECTED CONTAMINANTS IN SUBSURFACE SOIL CENTREDALE MANOR RESTORATION PROJECT NORTH PROVIDENCE, RHODE ISLAND		
PREPARED BY: S. PARKER			
CHECKED BY: S. PARKER	SOURCE: BASE PLAN BY LOUIS FEDERICI & ASSOCIATES		
	SCALE: 1" = 80′	DATE: JANUARY 2002	PROJ. NO: 4104
PROJECT MANAGER: S. PARKER	DRAWING NO: FIGURE 4-1	ACFILE NAME: DWG\4104\0811\FIG_4-1.DWG	REV: 0
PROGRAM MANAGER: G. GARDNER			

TETRA TECH NUS, INC.
55 JONSPIN ROAD
WILMINGTON, MASSACHUSETTS 01887
(978)658-7899



Original includes color coding.

LEGEND

A1 (A6) EM SURVEY ANOMALY

GPR ANOMALY

NOTES AND REFERENCE:

1. FENCES, PARKING AREAS, BUILDINGS, ROADWAYS, RIVER, AND RESIDENTIAL LOTS TAKEN FROM PLAN ENTITLED "CENTREDALE MANOR RESTORATION SITE WOONASQUTUCKET RIVER NORTH PROVIDENCE AND JOHNSTON, R. I. INUNDATION 100 YEAR FLOOD SITE PLAN 'A'', 'B', AND 'C', WHICH PLAN WAS PROVIDED BY CLIENT.

2. HORIZONTAL DATUM TAKEN FROM THE ABOVE MENTION PLAN. VERTICAL DATUM = NGVD 1929. ALSO TAKEN FROM ABOVE REFERENCED PLAN.

3. ELEVATION FOR BENCHMARK TOP OF DRILL HOLE IN CONCRETE CURB WAS OBSERVED TO BE DIFFERENT FROM PLAN REFERENCED IN NOTE #1.

4. BASEMAP: LOUIS FEDERICI & ASSOCIATES

5. GEOPHYSICAL INVESTIGATION LINES PREPARED BY HAGER GEOSCIENCE, INC., OCTOBER, 2001.

GRAPHIC SCALE

0' 200' 400'

1 INCH = 200 FEET

GEOPHYSICAL INVESTIGATION LINES

CENTREDALE MANOR RESTORATION PROJECT

NORTH PROVIDENCE, RHODE ISLAND

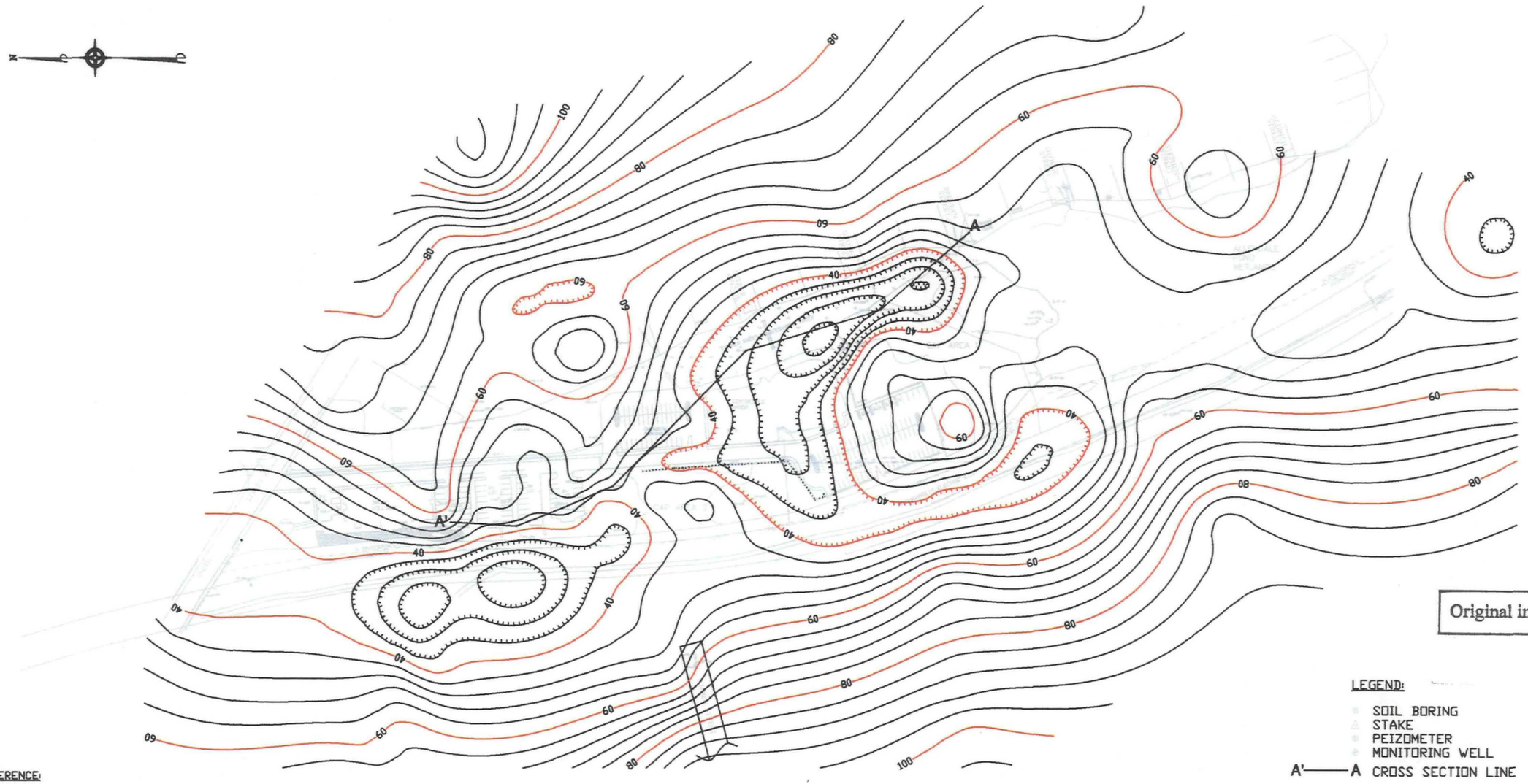
DRAWN BY:	D.W. MACDOUGALL	REV.:	0
CHECKED BY:	G. STURGEON	DATE:	JANUARY 11, 2000
SCALE:	1" = 200'	FILE NO.:	DWG\4104\0611\FIG_4-2.DWG

FIGURE 4-2

TETRA TECH NUS, INC.

55 Jonspin Road Wilmington, MA 01887

(978)658-7899



Original includes color coding.

LEGEND:

- SOIL BORING
- STAKE
- PEIZOMETER
- MONITORING WELL

A'——A CROSS SECTION LINE

NOTES AND REFERENCE:

1. FENCES, PARKING AREAS, BUILDINGS, ROADWAYS, RIVER, AND RESIDENTIAL LOTS TAKEN FROM PLAN ENTITLED "CENTREDALE MANOR RESTORATION SITE WOONASQUTUCKET RIVER NORTH PROVIDENCE AND JOHNSTON, R.I. INUNDATION 100 YEAR FLOOD SITE PLAN 'A'', 'B', AND 'C', WHICH PLAN WAS PROVIDED BY CLIENT.

2. HORIZONTAL DATUM TAKEN FROM THE ABOVE MENTION PLAN. VERTICAL DATUM = NGVD 1929. ALSO TAKEN FROM ABOVE REFERENCED PLAN.

3. ELEVATION FOR BENCHMARK TOP OF DRILL HOLE IN CONCRETE CURB WAS OBSERVED TO BE DIFFERENT FROM PLAN REFERENCED IN NOTE #1.

4. BASEMAP: LOUIS FEDERICI & ASSOCIATES

5. TOPOGRAPHY OF BEDROCK PROVIDED BY HAGER GEOSCIENCE, INC., OCTOBER, 2001.

GRAPHIC SCALE

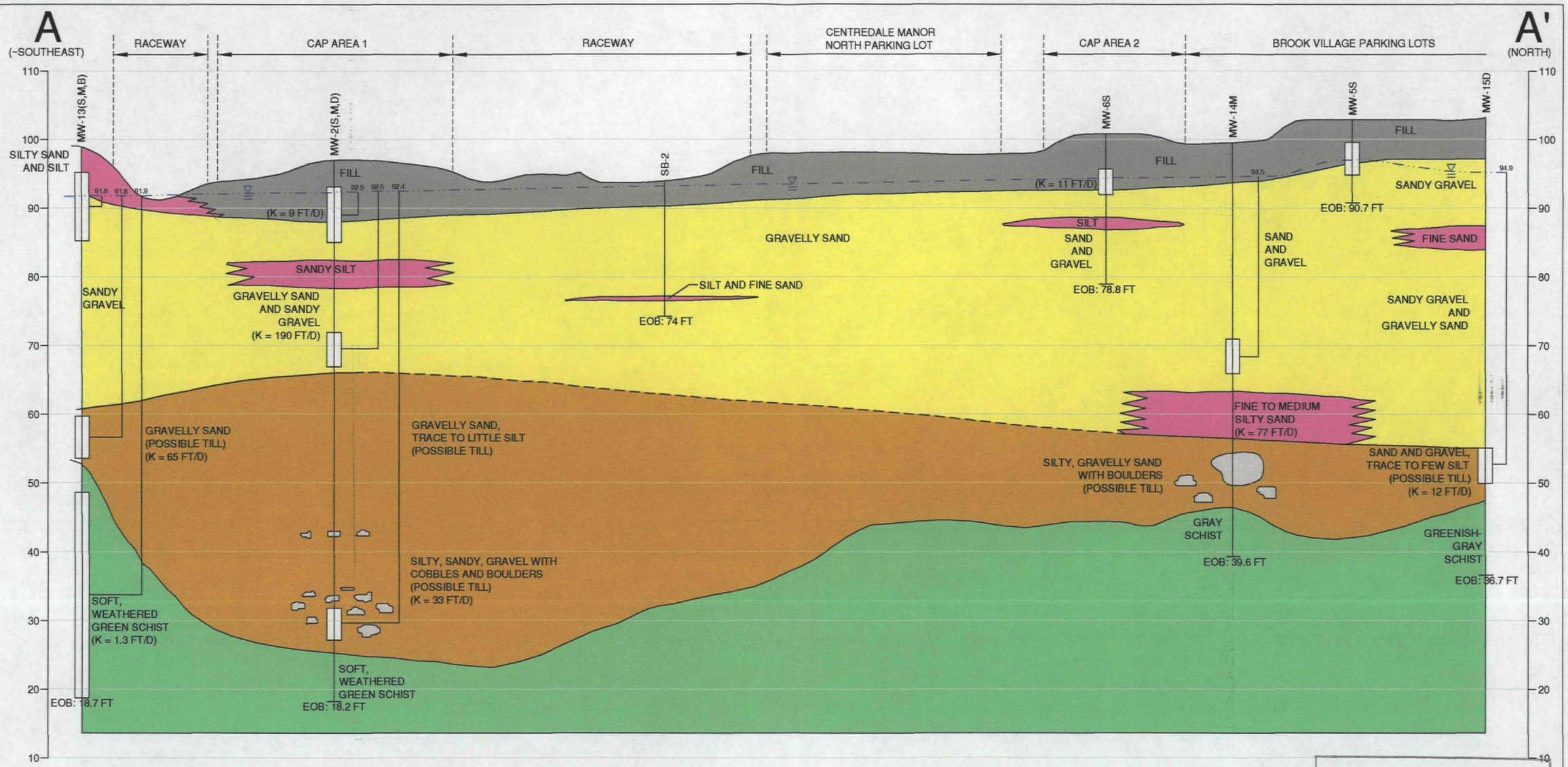
0' 200' 400'

1 INCH = 200 FEET

TOPOGRAPHY OF BEDROCK			
CENTREDALE MANOR RESTORATION PROJECT			
NORTH PROVIDENCE, RHODE ISLAND			
DRAWN BY:	D.W. MACDOUGALL	REV.:	0
CHECKED BY:	G. STURGEON	DATE:	JANUARY 15, 2002
SCALE:	1" = 200'	FILE NO.:	DWG\4104\0611\FIG_4-3.DWG

FIGURE 4-3

TETRA TECH NUS, INC.
55 Jonspin Road Wilmington, MA 01887
(978)658-7899



Original includes color coding.

LEGEND

92.4 — WELL SCREEN AND CORRESPONDING GROUNDWATER ELEVATION (NOVEMBER 1, 2001)

EOB: 18.2 FT — END OF BORING WITH CORRESPONDING ELEVATION

WATER TABLE

INFERRED GEOLOGIC BOUNDARY

HORIZONTAL GRAPHIC SCALE

0′ 80′ 160′

1 INCH = 80 FEET

VERTICAL GRAPHIC SCALE

0′ 15′ 30′

1 INCH = 15 FEET

NOTE:
1. FILL IS TYPICALLY GRAVELLY OR SILTY SANDS WITH TRACES OF MAN-MADE DEBRIS, INCLUDING: WOOD, BRICK, GLASS, PLASTIC, CHARCOAL, SLAG, VITRIFIED CLAY PIPE FRAGMENTS, AND METAL DEBRIS. ORGANIC SILT AT SB-02.
2. REFER TO FIGURE 4-3 FOR LOCATION OF CROSS-SECTION

GEOLOGIC CROSS-SECTION A-A'

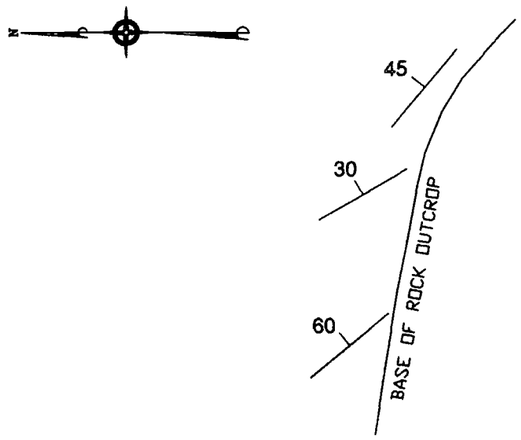
CENTREDALE MANOR RESTORATION PROJECT

NORTH PROVIDENCE, RHODE ISLAND

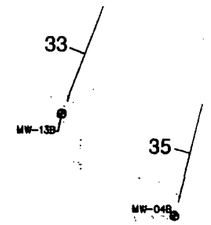
DRAWN BY:	D.W. MACDOUGALL	REV.:	0
CHECKED BY:	G. STURGEON	DATE:	JANUARY 15, 2002
SCALE:	AS NOTED	FILE NO.:	DWG\4104\0611\FIG_4-3A.DWG

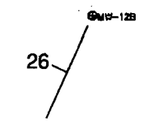
FIGURE 4-3A

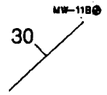
TETRA TECH NUS, INC.
55 Jonspin Road Wilmington, MA 01887
(978)658-7899











Original includes color coding.

LEGEND:

- MONITORING WELL

DIP 30 / STRIKE — AVERAGE STRIKE (COMPASS DIRECTION) AND DIP (DOWNWARD ANGLE) OF FRACTURES IN BOREHOLE. STRIKE AND DIP OF INDIVIDUAL FRACTURES AND FRACTURE SETS IN OUTCROP.

RED = GRANITE
GREEN = SCHIST/GNEISS

NOTES AND REFERENCE:

1. FENCES, PARKING AREAS, BUILDINGS, ROADWAYS, RIVER, AND RESIDENTIAL LOTS TAKEN FROM PLAN ENTITLED 'CENTREDALE MANOR RESTORATION SITE WOONASQUTUCKET RIVER NORTH PROVIDENCE AND JOHNSTON, R. I. INUNDATION 100 YEAR FLOOD SITE PLAN 'A'', 'B', AND 'C', WHICH PLAN WAS PROVIDED BY CLIENT.

2. HORIZONTAL DATUM TAKEN FROM THE ABOVE MENTION PLAN. VERTICAL DATUM = NGVD 1929. ALSO TAKEN FROM ABOVE REFERENCED PLAN.

3. ELEVATION FOR BENCHMARK TOP OF DRILL HOLE IN CONCRETE CURB WAS OBSERVED TO BE DIFFERENT FROM PLAN REFERENCED IN NOTE #1.

4. BASEMAP: LOUIS FEDERICI & ASSOCIATES

GRAPHIC SCALE

0' 200' 400'

1 INCH = 200 FEET

BEDROCK FRACTURE ORIENTATIONS

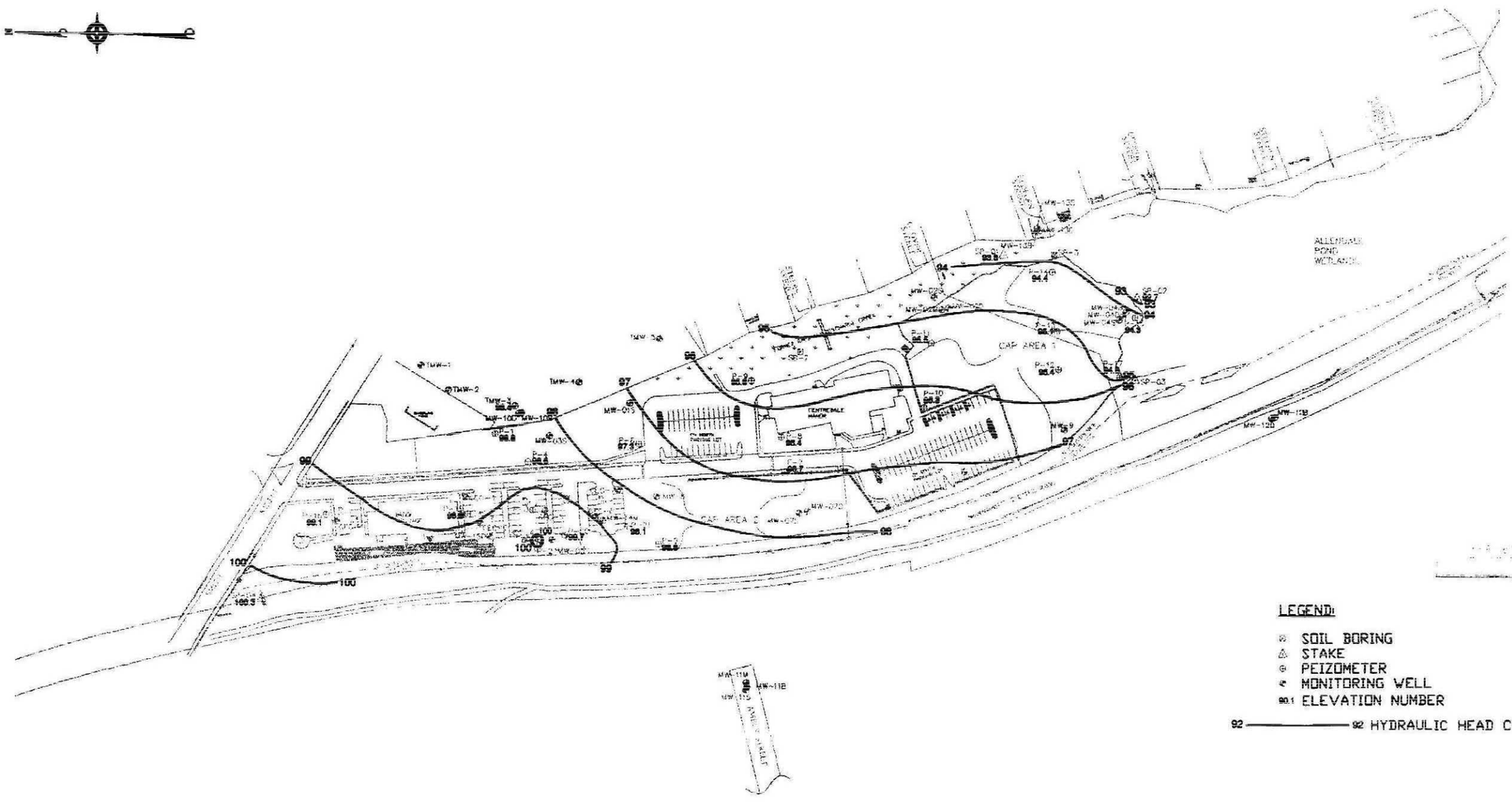
CENTREDALE MANOR RESTORATION PROJECT

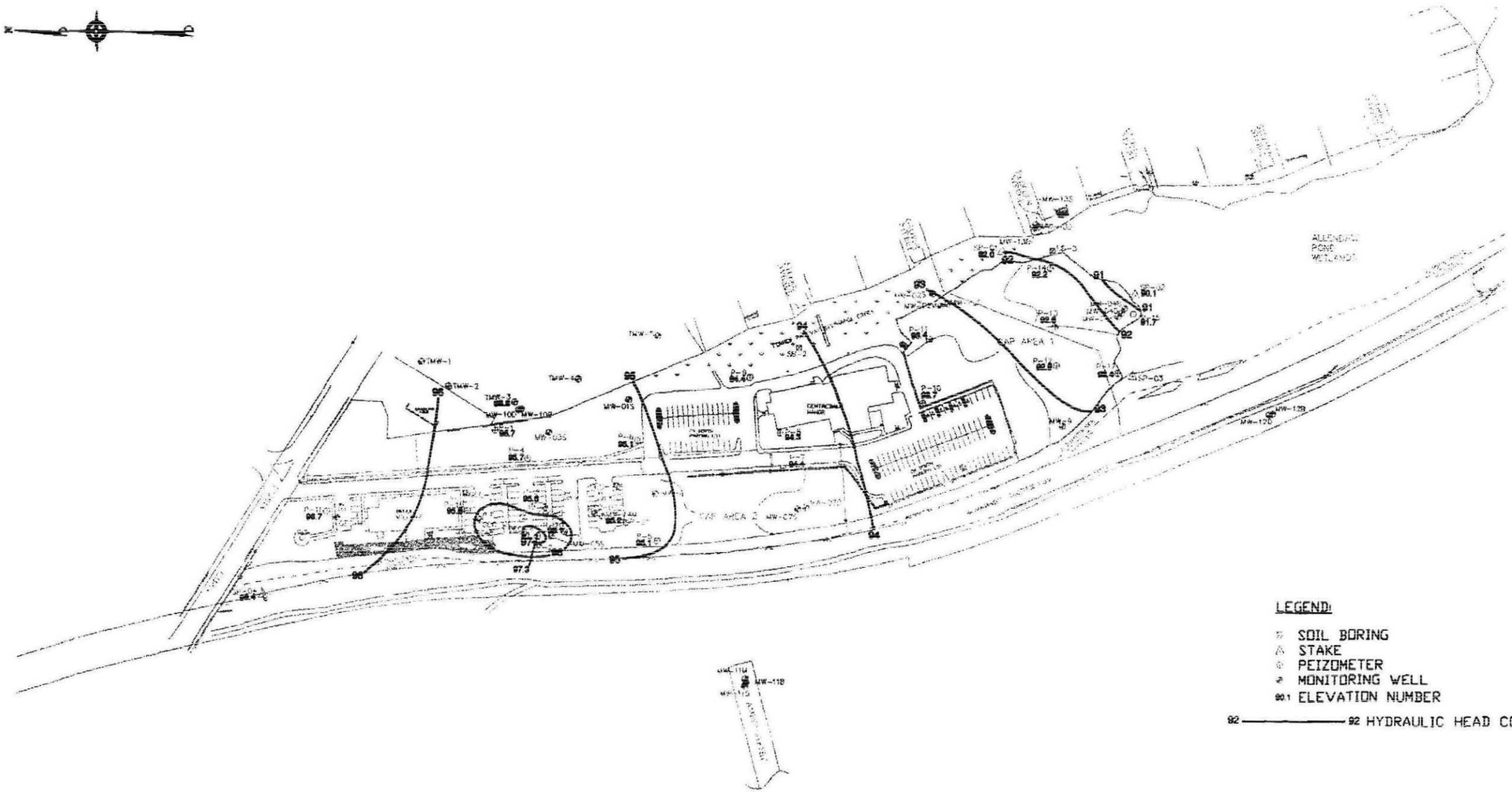
NORTH PROVIDENCE, RHODE ISLAND

DRAWN BY:	D.W. MACDOUGALL	REV.:	0
CHECKED BY:	G. STURGEON	DATE:	DECEMBER 13, 2001
SCALE:	1" = 200'	FILE NO.:	DWG\4104\0611\FIG_4-4.DWG

FIGURE 4-4

TETRA TECH NUS, INC.
55 Jonspin Road Wilmington, MA 01887
(978)658-7899


CAP AREA 1
CAP AREA 2
CENTREDALE MANOR
ALLENDALE POND WETLANDS
MW-135
MW-136
MW-137
MW-138
MW-139
MW-120
MW-121
MW-122
MW-123
MW-124
MW-125
MW-126
MW-127
MW-128
MW-129
MW-130
MW-131
MW-132
MW-133
MW-134
MW-100
MW-101
MW-102
MW-103
MW-104
MW-105
MW-106
MW-107
MW-108
MW-109
MW-110
MW-111
MW-112
MW-113
MW-114
MW-115
MW-116
MW-117
MW-118
MW-119
TMW-1
TMW-2
TMW-3
TMW-4
TMW-5
P-1
P-2
P-3
P-4
P-5
P-6
P-7
P-8
P-9
P-10
P-11
P-12
P-13
P-14
P-15
P-16
P-17
P-18
P-19
P-20
P-21
P-22
P-23
P-24
P-25
P-26
P-27
P-28
P-29
P-30
P-31
P-32
P-33
P-34
P-35
P-36
P-37
P-38
P-39
P-40



LEGEND:

- SOIL BORING
- STAKE
- PEIZOMETER
- MONITORING WELL
- 90.1 ELEVATION NUMBER
- 92 ——— 92 HYDRAULIC HEAD CONTOUR

NOTES AND REFERENCE:

1. FENCES, PARKING AREAS, BUILDINGS, ROADWAYS, RIVER, AND RESIDENTIAL LOTS TAKEN FROM PLAN ENTITLED "CENTREDALE MANOR RESTORATION SITE WOONASQUTUCKET RIVER NORTH PROVIDENCE AND JOHNSTON, R. I. INUNDATION 100 YEAR FLOOD SITE PLAN 'A'', 'B', AND 'C', WHICH PLAN WAS PROVIDED BY CLIENT.

2. HORIZONTAL DATUM TAKEN FROM THE ABOVE MENTION PLAN. VERTICAL DATUM = NGVD 1929. ALSO TAKEN FROM ABOVE REFERENCED PLAN.

ELEVATION FOR BENCHMARK TOP OF DRILL HOLE IN CONCRETE CURB WAS OBSERVED TO BE DIFFERENT FROM PLAN REFERENCED IN NOTE #1.

4. BASEMAP: LOUIS FEDERICI & ASSOCIATES

GRAPHIC SCALE

0' 200' 400'

1 INCH = 200 FEET

WATER TABLE CONTOURS, MAY 4, 2001			FIGURE 4-6
CENTREDALE MANOR RESTORATION PROJECT			
NORTH PROVIDENCE, RHODE ISLAND			
DRAWN BY:	D.W. MACDOUGALL	REV.:	0
CHECKED BY:	G. STURGEON	DATE:	DECEMBER 11, 2001
SCALE:	1" = 200'	FILE NO.:	DWG\4104\0611\FIG_4-6.DWG

TETRA TECH NUS, INC.
55 Jonspin Road Wilmington, MA 01887
(978)658-7899

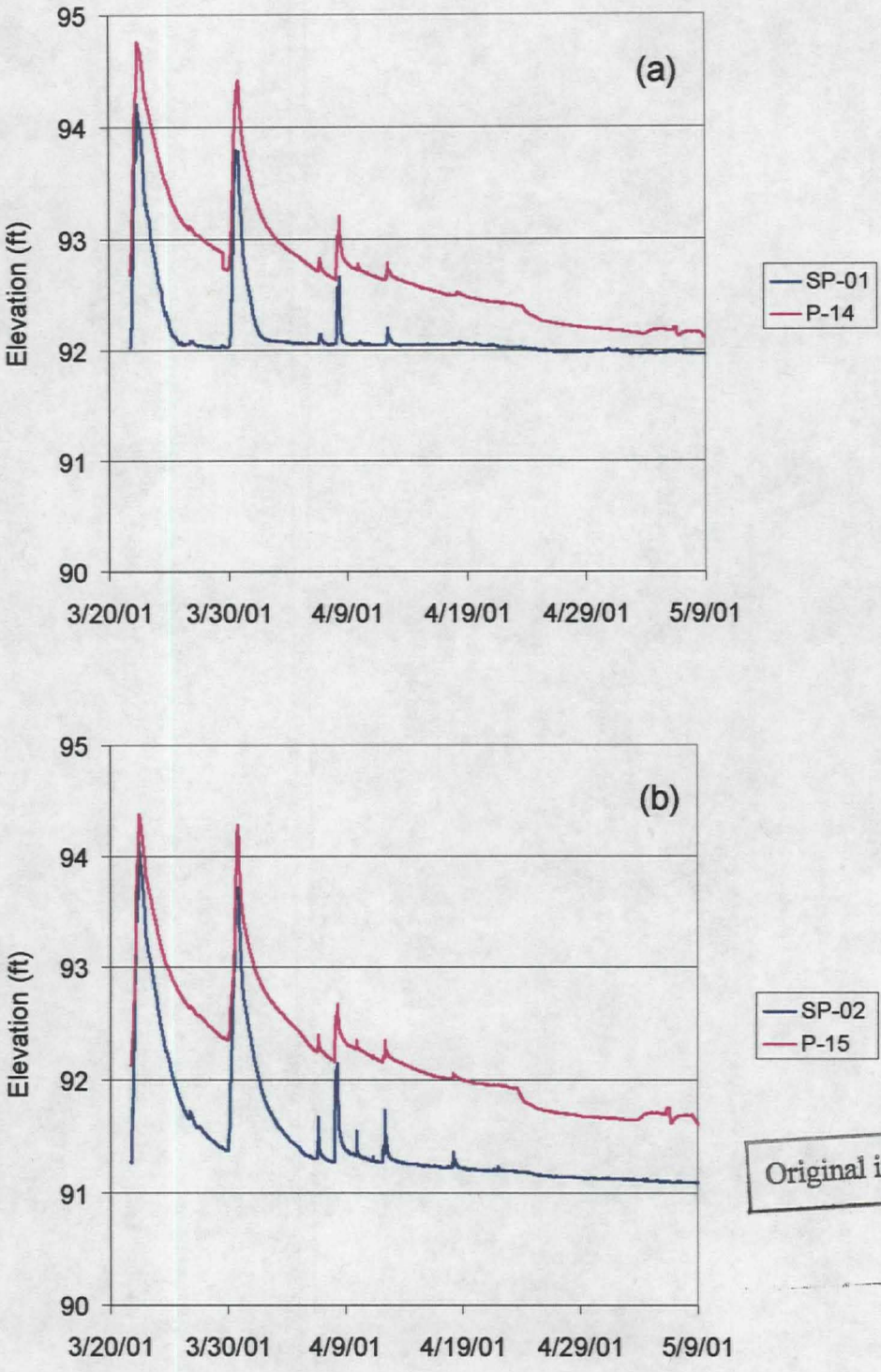


Figure 4-7. Comparison of water elevations (a) in the raceway at SP-01 and the aquifer at P-14, and (b) in the raceway at SP-02 and the aquifer at P-15.

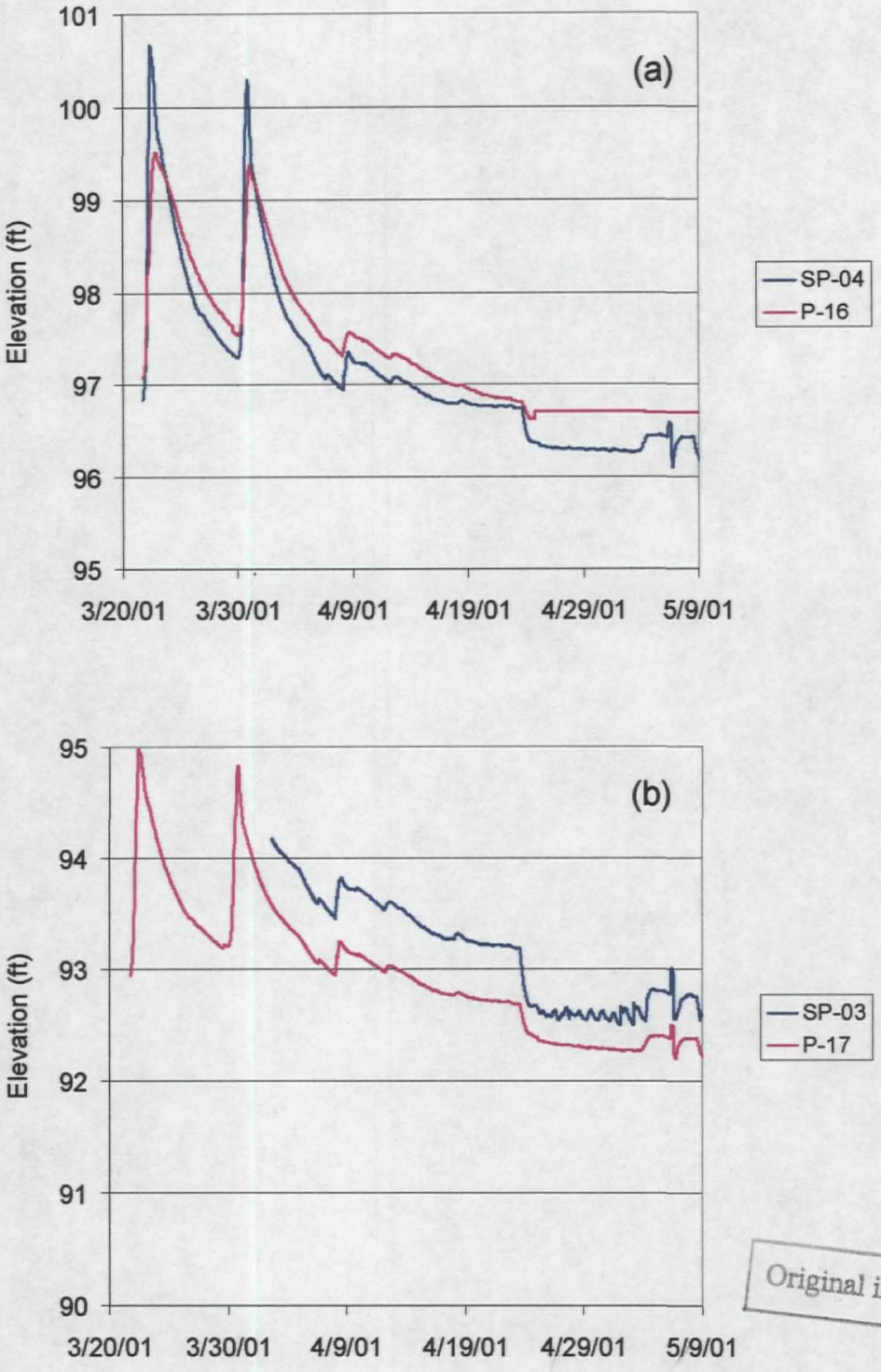
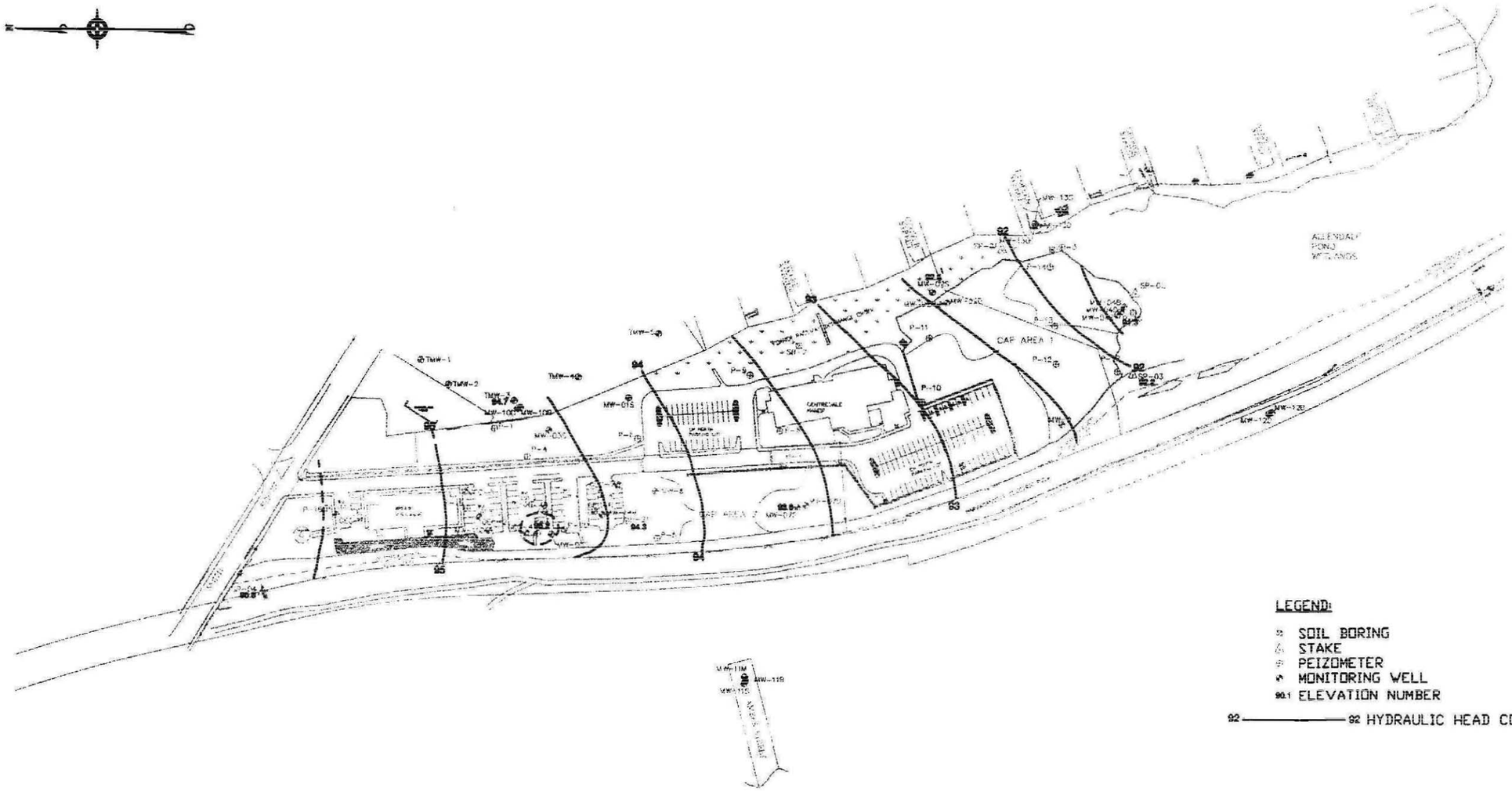
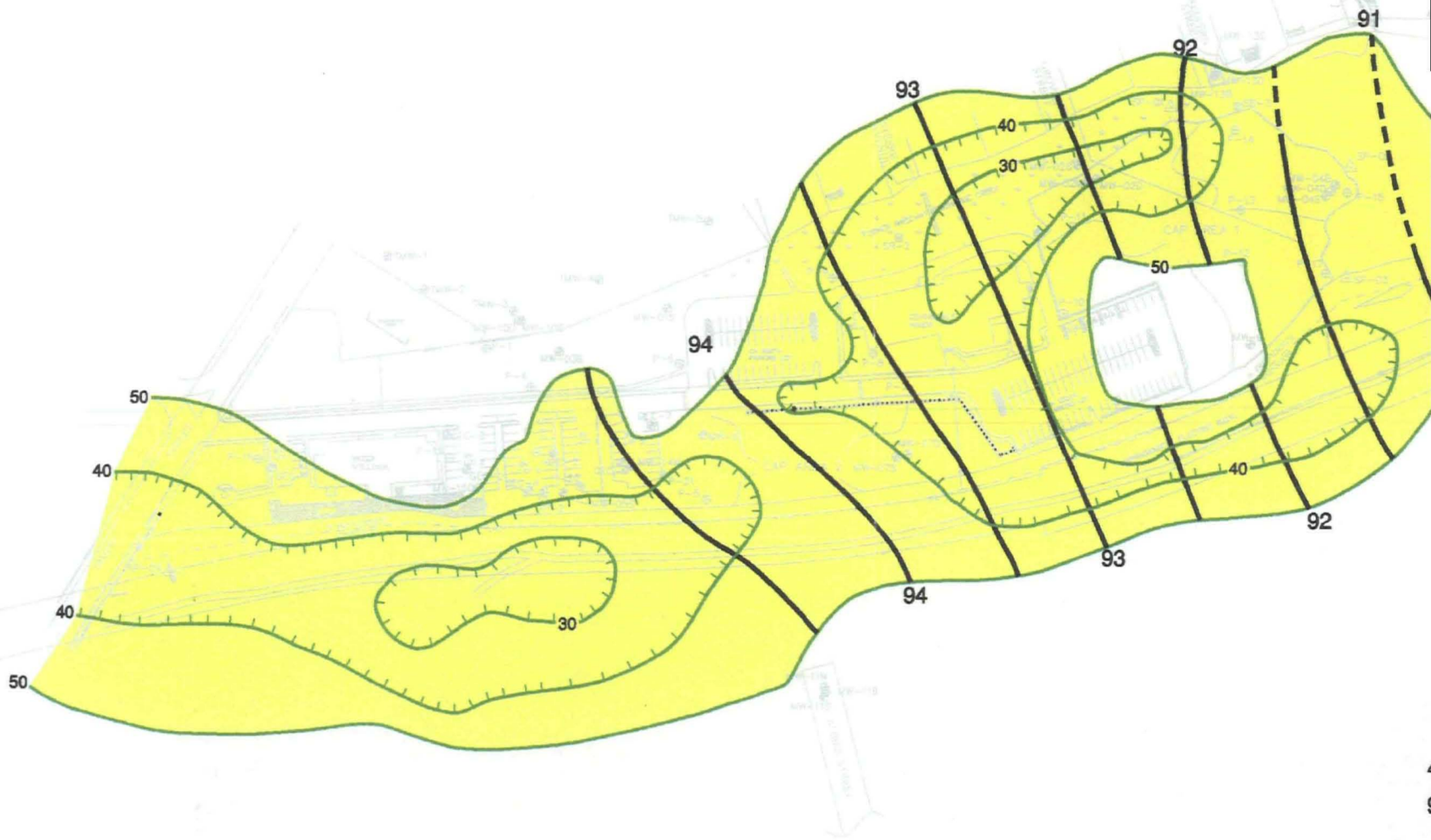


Figure 4-8. Comparison of water elevations (a) in the Woonasquatucket River at SP-04 and the aquifer at P-16, and (b) in the river at SP-03 and the aquifer at P-17.


CAP AREA 1
CENTREDALE MANOR
ALLEN DALEY POND WETLANDS
TMW-1
TMW-2
TMW-3
TMW-4
TMW-5
MW-01S
MW-03S
MW-100S
MW-100D
MW-120
MW-13S
MW-13D
SP-01
SP-02
SP-03
P-1
P-4
P-9
P-10
P-11
P-12
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131



NOTES AND REFERENCE:

1. FENCES, PARKING AREAS, BUILDINGS, ROADWAYS, RIVER, AND RESIDENTIAL LOTS TAKEN FROM PLAN ENTITLED 'CENTREDALE MANOR RESTORATION SITE WOONASQUTUCKET RIVER NORTH PROVIDENCE AND JOHNSTON, R.I. INUNDATION 100 YEAR FLOOD SITE PLAN 'A'', 'B', AND 'C', WHICH PLAN WAS PROVIDED BY CLIENT.

2. HORIZONTAL DATUM TAKEN FROM THE ABOVE MENTION PLAN. VERTICAL DATUM = NGVD 1929. ALSO TAKEN FROM ABOVE REFERENCED PLAN.

3. ELEVATION FOR BENCHMARK TOP OF DRILL HOLE IN CONCRETE CURB WAS OBSERVED TO BE DIFFERENT FROM PLAN REFERENCED IN NOTE #1.

4. BASEMAP: LOUIS FEDERICI & ASSOCIATES

GRAPHIC SCALE

0' 200' 400'

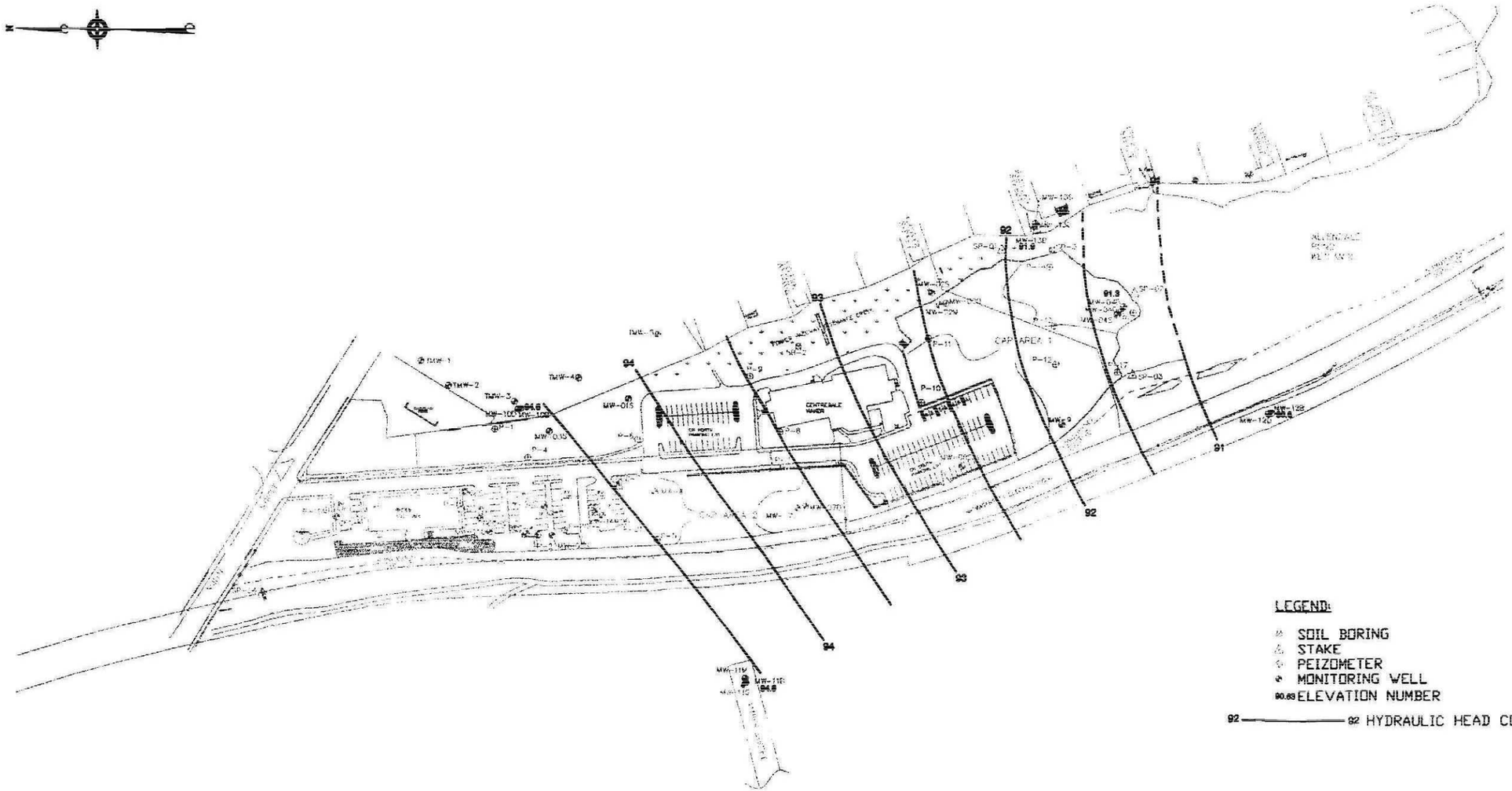
1 INCH = 200 FEET

DEEP OVERBURDEN CONTOURS, NOVEMBER

CENTREDALE MANOR RESTORATION PR

NORTH PROVIDENCE, RHODE ISLA

DRAWN BY:	D.W. MACDOUGALL	REV.:	0
CHECKED BY:	G. STURGEON	DATE:	JANUARY
SCALE:	1" = 200'	FILE NO.:	DWG\4104\0611\FI


N
TMW-1
TMW-2
TMW-3
TMW-4
MW-100
MW-101
MW-015
MW-013
MW-014
MW-110
MW-111
MW-112
MW-113
MW-114
MW-115
MW-116
MW-117
MW-118
MW-119
MW-120
MW-121
MW-122
MW-123
MW-124
MW-125
MW-126
MW-127
MW-128
MW-129
MW-130
MW-131
MW-132
MW-133
MW-134
MW-135
MW-136
MW-137
MW-138
MW-139
MW-140
MW-141
MW-142
MW-143
MW-144
MW-145
MW-146
MW-147
MW-148
MW-149

RHODE ISLAND STATE PLANE

MW-10B	
Parameter	Conc.
2,4,6 TCP	10U
Caprolactam	490*
TCE	10U
PCE	10U

MW-02		
Parameter	Conc.	
	MW-02M	MW-02D
2,4,6 TCP	10U	10U
TCE	2J	27
PCE	110	700*

MW-13		
Parameter	Conc.	
	MW-13D	MW-13B
2,4,6 TCP	10U	10U
TCE	6J	7J
PCE	340*J	220*

MW-04			
Parameter	Conc.		
	MW-04S (dup)	MW-04D	MW-04B
2,4,6 TCP	10U/10U	10U	10U
TCE	0.8J/0.8J	1J	0.9J
PCE	17U/17U	64	83

MW-12D	
Parameter	Conc.
2,4,6 TCP	10U
TCE	10U
PCE	18

MW-09S	
Parameter	Conc.
2,4,6 TCP	10U
TCE	1J
PCE	21U

MW-08S	
Parameter	Conc.
2,4,6 TCP	2J
TCE	10U
PCE	16U

MW-06S	
Parameter	Conc.
2,4,6 TCP	10U
TCE	10U
PCE	0.9J

GEC-6	
Parameter	Conc.
2,4,6 TCP	10U
TCE	10U
PCE	200*

MW-05S	
Parameter	Conc.
2,4,6 TCP	2900*
TCE	2500
PCE	61000*

ALLENDALE POND AND WETLANDS

WOODED

CAP AREA 1

CAP AREA 2

CENTREDALE MANOR

BROOK VILLIAGE

CN NORTH PARKING LOT

CN SOUTH PARKING LOT

FORMER RACEWAY

DISCHARGE CREEK

NARRAGANSETT ELECTRIC R.O.W.

N. PROVIDENCE JOHNSTON

SMITH STREET

STERRE AVENUE

GROVER STREET

REDFERN STREET

GEORGE STREET

STEPHEN STREET

ALDRICH STREET

AMBER STREET

NOTES AND REFERENCE:
1. FENCES, PARKING AREAS, BUILDINGS, ROADWAYS, RIVER, AND RESIDENTIAL LOTS TAKEN FORM PLAN ENTITLED "CENTREDALE MANOR RESTORATION SITE WOONASQUTUCKET RIVER NORTH PROVIDENCE AND JOHNSTON, R.I. INUNDATION 100 YEAR FLOOD SITE PLAN 'A'', 'B', AND 'C', WHICH PLAN WAS PROVIDED BY CLIENT.

2. HORIZONTAL DATUM TAKEN FROM THE ABOVE MENTION PLAN. VERTICAL DATUM = NGVD 1929. ALSO TAKEN FROM ABOVE REFERENCED PLAN.

3. ELEVATION FOR BENCHMARK TOP OF DRILL HOLE IN CONCRETE CURB WAS OBSERVED TO BE DIFFERENT FROM PLAN REFERENCED IN NOTE #1.

LEGEND:
- ■ SOIL BORING
- ▲ SURFACE WATER MONITORING STATION
- ● PEIZOMETER
- ● MONITORING WELL
- xxx-x TETRA TECH I.D.
- ∅ UTILITY POLE
- ○ MANHOLE COVER
- —→— DISCHARGE CREEK AND FLOW DIRECTION
- 2,4,6 TCP = 2,4,6 TRICHLOROPHENOL
- TCE = TRICHLOROETHENE
- PCE = TETRACHLOROETHENE
- ALL CONCENTRATIONS ARE EXPRESSED IN µg/liter.

GRAPHIC SCALE
80' 0' 80' 160'
1 INCH = 80 FEET

DRAWN BY: D.W. MACDOUGALL	
PREPARED BY: S. PARKER	
CHECKED BY: S. PARKER	
PROJECT MANAGER: S. PARKER	
PROGRAM MANAGER: G. GARDNER	

TITLE:
SELECTED CONTAMINANTS IN GROUNDWATER
CENTREDALE MANOR RESTORATION PROJECT
NORTH PROVIDENCE, RHODE ISLAND

SOURCE: BASE PLAN BY LOUIS FEDERICI & ASSOCIATES

SCALE:	DATE:	PROJ. NO:
1" = 80'	JANUARY 2002	4104

DRAWING NO:	ACFILE NAME:	REV:
FIGURE 4-12	DWG\4104\0611\FIG_4-12.DWG	0

TETRA TECH NUS, INC.
55 JONSPIN ROAD
WILMINGTON, MASSACHUSETTS 01887
(978)658-7899