MCP INTERIM PHASE II REPORT AND CURRENT ASSESSMENT SUMMARY FOR EAST STREET AREA 2/USEPA AREA 4

VOLUME I OF XII

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

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SECTION 1 - INTRODUCTION

1.1 General

This report has been prepared on behalf of the General Electric Company (GE) by Blasland, Bouck & Lee, Inc., to meet two sets of requirements applicable to the GE facility in Pittsfield, Massachusetts. First, the report constitutes an Interim Phase II-Comprehensive Site Assessment Report for the East Street Area 2 Site (ID No. 1-0146), as required by the Massachusetts Department of Environmental Protection (MDEP), pursuant to the Massachusetts Contingency Plan (MCP) and a Consent Order executed by GE and the MDEP in July 1990. Second, this report constitutes a Current Assessment Summary (CAS) report for the area designated as USEPA Area 4, pursuant to the requirements of a permit (the "Permit") issued to GE by the United States Environmental Protection Agency (USEPA) under the corrective-action provisions of the Resource Conservation and Recovery Act (RCRA) as amended by the Hazardous and Solid Waste Amendments of 1984 (HSWA). The Permit was originally issued in February 1991 and was reissued, as modified, effective January 3, 1994.

The MDEP and the USEPA have also executed a Memorandum of Understanding (MOU) that provides for coordination between them in reviewing GE's submittals related to the Consent Order and Permit. Pursuant to the MOU, this document has been prepared to facilitate a coordinated joint agency review.

A previous version of this report was submitted to the MDEP and USEPA on June 30, 1992. However, at that time, the USEPA Permit was stayed pending resolution of an appeal of the Permit by GE and others. Following that appeal, USEPA modified certain portions of the Permit and issued final Permit modifications on December 1, 1993. The modified Permit became effective on

January 3, 1994. This document is being reissued to incorporate new information that has become available since June 30, 1992.

As indicated above, this report is not only an MCP Interim Phase II Report, but also a Current Assessment Summary. Two other documents, one which constitutes an MCP Supplemental Phase II Scope of Work (SOW) and a RCRA Facility Investigation (RFI) Proposal for this site, and a second document, which constitutes a Preliminary Health and Environmental Assessment (HEA) Proposal for this site, are being submitted concurrently with this document.

1.2 Background Information

The East Street Area 2 Site is co-extensive with USEPA Area 4. It has been designated as a "disposal site" by the MDEP under the MCP and is considered to be in Phase II of the MCP process. It covers the entire western portion of the GE facility and is comprised of property owned by GE. However, it also includes railroad tracks and a public street that traverse the property. Figure 1-1 shows the general location of the East Street Area 2/USEPA Area 4 Site, and Figure 1-2 shows a more detailed site plan associated with the site.

The western portion of the GE facility in Pittsfield has been utilized by all three of the manufacturing divisions at the GE facility (Transformer, Ordnance, and Plastics). GE has been the owner/operator of most of this property since 1903, when it purchased the bulk of this property from the Stanley Electric Company, the property owner from 1890 to 1903. In addition, the Berkshire Gas Company (Berkshire Gas) and its predecessors had operations and facilities at a portion of the site from 1902 to 1973. Berkshire Gas has been designated by the MDEP as a potentially responsible party (PRP) at the site (MDEP, March 29, 1990). GE acquired the remaining portion of the site (a small strip of land along Newell Street) from the Beloit Corporation in 1968.

Over the years, GE has used this portion of its facility in various manufacturing operations, primarily the manufacture of electrical transformers and associated components. In addition, Berkshire Gas used a portion of the site for coal gasification activities. As a result of these operations, various oils, some containing polychlorinated biphenyls (PCBs), and other materials were inadvertently released to the environment. In addition, the site contains several other features of interest. These include: a former oxbow of the Housatonic River; former coal gasification facilities of the Berkshire Gas Company; and a scrap yard area. These features are discussed below, following a discussion of the subsurface oil at this site. A listing of the numerous studies that have been carried out at this site since 1980 is presented in Table 1-1.

1.2.1 Subsurface Oil

Although subsurface oil has been identified north of East Street, the majority of the oil plume currently exists south of East Street, extending toward the Housatonic River which borders the southern portion of the site. The occurrence of oil in this area has been extensively studied over the past decade.

Since the early 1960s, GE has implemented various programs to investigate and address environmental concerns at the East Street Area 2/USEPA Area 4 Site, including programs to locate and remove potentially leaking tanks and pipes and to collect oil already present in the ground. These programs focused initially on two sources: potential leaks in the oil storage/distribution system, and oils conveyed in the storm sewer system. In addition, oil collection systems were installed in the area south of East Street to remove oils from the subsurface oil plume in that area.

Starting in 1964, a new above-ground tank farm (Building 29 Area) was installed approximately 1,300 feet west of Building 12F (Figure 1-2). As part of this program, existing pipelines were removed and reinstalled above the ground surface or in subgrade conduits to facilitate visual inspection. In addition, process piping and holding tank use was evaluated and, where practical, rerouted. At the same time, potentially leaking pipes between tanks were replaced. The purpose of this work was to remove all known potentially leaking tanks and pipes from service.

During more recent years, GE has carried out numerous investigations and remedial measures at the East Street Area 2/USEPA Area 4 Site to address the oil plume on the water table and, in particular, to control and remove the oil portion of the plume as it migrates toward, and before it reaches, the Housatonic River. (A listing of studies and reports on these activities is included in Table 1-1.) The remedial measures implemented by GE include a source management and cleanup program, the installation and operation of several oil collection and recovery systems in the area, and the installation of a subgrade slurry cutoff wall at the site to prevent or reduce the migration of the free-floating oil plume on the groundwater toward the Housatonic River (see Figure 1-2).

There are four active oil collection and recovery systems within the East Street Area 2/USEPA Area 4 Site. These oil recovery systems generally consist of recovery wells and/or subgrade caissons, where water and oils are collected from the subsurface groundwater table. The wells/caissons allow the oils to separate from the groundwater, and the oils are then removed by an engineered pumping system positioned on top of the water table within each system. The removed oils are subsequently collected and incinerated at GE's Toxic Substance Control Act-regulated (TSCA-regulated) Thermal Oxidizer located in the south central portion of East Street Area 2. To date, more than 450,000 gallons of oil have been removed from the subsurface of the site.

Before October 1991, the recovered groundwater entered a retention structure to allow any remaining floating oils to separate. The separated water was then discharged to a pond known as the groundwater recharge pond (see Figure 1-2). According to the terms of the July 1990 Consent Order, GE submitted a Short-Term Measure (STM) plan for ceasing discharge of untreated, separated water from its oil recovery systems into the groundwater recharge pond in August 1990. That plan proposed the construction and operation of a groundwater treatment facility to remove PCBs, other organic constituents, and metals from the recovered groundwater prior to discharge. This treatment plant (named 64-G) was constructed during the summer of 1991 and became operational in October 1991. The majority of treated water from the treatment plant is discharged to the Housatonic River through a National Pollution Discharge Elimination System - permitted (NPDES-permitted) outfall. A small portion of the treated water, however, is still discharged to the groundwater recharge pond to maintain a groundwater mound in this area. The groundwater mound assists in restricting migration of the oil plume toward the river. A more detailed discussion of on-going and proposed oil recovery and Short-Term/Interim Measure activities is provided in Sections 4.2.4 and 4.2.5., respectively.

Site investigations have also identified the occurrence of small intermittent oil seeps along the banks of the Housatonic River at the East Street Area 2/USEPA Area 4 Site. Following identification of these occasional oil seeps, GE installed a temporary containment system, consisting of floating oil-absorbent booms, to collect the small amount of oil seeping into the river and prevent it from flowing downstream.

In addition, in 1989 and 1990, GE conducted a study to identify the source of the intermittent seepage and to evaluate potential prevention or control methods. This "River Bank Study" investigated the source of the oil seeps through the installation of a series of borings and piezometers. Details regarding this investigation, as well as the associated results, are presented in a report entitled "Area 2 River Bank Investigation" (GE, August 1990a) and are summarized in Section 4.2.1 of this report.

In general, as a result of this investigation, GE provided a proposal as part of the MCP process to the MDEP in August 1990 for the implementation of an STM for the oil seep in the riverbank area of the East Street Area 2/USEPA Area 4 Site (GE, August 1990b). (A copy of that report was also provided to the USEPA.)

The August 1990 STM proposal led to the implementation of a passive oil recovery program involving wells and piezometers near the riverbank in this area. The proposal also led to the performance of a specific study involving evaluation of the existing systems, various pumping tests, and use of a groundwater flow model to assess additional active recovery measures. The results of this specific study, together with a proposal for additional measures, were submitted to the MDEP on April 30, 1992 in a document entitled "Pumping Test Analyses and Evaluation of Recovery Measures" (Golder, April 1992). (A copy was again provided to the USEPA.) GE's proposal for additional measures called for a phased approach involving the installation of a new active oil recovery well and pumping equipment adjacent to the most active riverbank seep zone; operation of this new pumping well for a six-month period; and at the end of this period, an assessment of the effectiveness of these systems and, if appropriate, the need for additional active recovery wells.

GE implemented these activities and certain modifications with MDEP approval and provided a system evaluation to the MDEP on June 10, 1993 in a report entitled "Evaluation of River Bank Recovery Measures: RW-1(X)

System, East Street Area 2" (Golder, June 1993). A copy was also sent to the USEPA.

Further information related to the control of intermittent oil seepage into the Housatonic River is provided in Section 4.2.5.

1.2.2 Former Oxbow

At one time, an oxbow of the Housatonic River was present within the East Street Area 2/USEPA Area 4 Site (see Figure 1-2). (This former oxbow is referred to by GE as Oxbow Area H for purposes of its investigation of a number of former oxbow areas in this stretch of the river.) Due to a rechannelization project reportedly performed by the Army Corps of Engineers in the late 1930s or early 1940s, this oxbow was cut off from the flow of the Housatonic River. The oxbow was subsequently filled with materials from GE, Berkshire Gas, and possibly others. The only remaining indication of the former oxbow is the groundwater recharge pond (see Figure 1-2). Presently, the former oxbow channel appears to be influencing the direction and flow of the oil plume, as discussed in Section 4.2.3. This may be attributed to the variance of the physical properties of the fill deposits which are more permeable than native deposits in the vicinity.

1.2.3 Former Coal Gasification Facilities

A portion of the East Street Area 2/USEPA Area 4 Site, not purchased by GE in 1903, was owned by another company and used for the operation of a coal gasification plant. Specifically, the Pittsfield Coal Gas Company operated a gas manufacturing and gas storage plant at the site from 1902 until the advent of natural gas to the New England area in 1953. The plant generated coal tars, oil tars, and liquors as well as drip oils and sludges that were either sold or, if a market was not available, reused in the gas process. In addition to the production of gas and associated products, residual byproducts, such as iron oxide chips, heavy sludges, and cinders, were generated, and have been found in the former oxbow during subsequent investigative activities. The location of the former coal gasification facilities is shown in Figure 1-3.

With the introduction of natural gas supplies to the New England area, the Pittsfield Coal Gas Company reorganized, changing its name to the Berkshire Gas Company in 1954. During the next several years, construction and renovations were carried out to convert the facility from a coal gas manufacturing facility to a natural gas distribution facility. During that period, large portions of the coal gas equipment and structures, such as oil gas purifiers and retorts, were retired and disassembled.

In 1973, Berkshire Gas sold this property to GE. In preparation for the sale, the Berkshire Gas property and equipment on both the north and south sides of East Street were decommissioned. The decommissioning process involved a number of phases instituted by Berkshire Gas, which reportedly included the hauling of waste sludges and tars off-site, deposition of materials in the former oxbow, and in-place abandonment of waste tars, liquors, oils, sludges, and related equipment. These activities were completed prior to the 1973 sale, and GE has since retained ownership of the property on both sides of East Street.

In a letter dated March 29, 1990, the MDEP issued a Notice of Responsibility to the Berkshire Gas Company under the MCP regarding the Berkshire Gas Company's former operations at the East Street Area 2/USEPA Area 4 Site.

1.2.4 Scrap Yard

The southwest section of the GE facility contains a scrap yard (see Figure 1-2), which has been used since 1937 as a scrap metal crushing, sorting, and storage area. This area is also referred to as the Materials

Reclamation Center. The scrap yard, currently covered by asphalt and concrete, encompasses an area of approximately two acres.

1.2.5 MCP Phase II Scope of Work

Pursuant to the Consent Order executed by GE and the MDEP effective July 2, 1990, GE was required to undertake a Phase II Comprehensive Site Assessment of the site under the MCP, and to prepare and submit a report thereon. In accordance with the MCP and the 1990 Consent Order, GE prepared a SOW for the Phase II Comprehensive Site Assessment of the site. That SOW, which incorporated MDEP comments on a prior draft, was submitted to the MDEP in August 1990, accompanied by a Supplemental Data Summary, which presented the results of investigations conducted prior to that date. The revised SOW was approved by the MDEP (subject to certain conditions) in a letter dated November 7, 1990.

The principal objectives of the Phase II Comprehensive Site Assessment for the site were to: 1) identify the presence of PCBs and other contaminants in soils and fill materials; 2) determine the extent to which groundwater quality has been impacted by site activities; 3) characterize three potential source areas that had not been investigated in detail previously (namely, the former Housatonic River oxbow, the Scrap Yard Area, and the former Berkshire Gas facility locations and fill areas); and 4) determine the extent and impacts (if any) of site contaminants on human health and the environment.

The field investigations called for in the MCP Phase II SOW for the site began in November 1990. This report summarizes the scope and findings of the MCP Phase II investigations of this area to date.

1.2.6 RCRA-Regulated Units

There are two active RCRA-regulated units located within the East Street Area 2/USEPA Area 4 Site used in the treatment, storage, or disposal

(TSD) of hazardous constituents. These units are the groundwater recharge pond and the Thermal Oxidizer, both of which are currently regulated under USEPA's RCRA program for TSD facilities. (The Thermal Oxidizer is also regulated under the TSCA.) These units are described in this section.

The groundwater recharge pond is located in the south-central section of the site, north of the Housatonic River (Figure 1-2). The pond occupies an area approximately 100 feet long and 70 feet wide in a former oxbow section of the Housatonic River and is lined with gravel banks. Based on historical photographs, the unit reportedly did not appear as a pond until approximately 1969.

Prior to October 1991, the groundwater recharge pond was used to receive all the recovered, separated groundwater that was collected from the oil recovery systems in East Street Area 2. This continued influx of groundwater into the recharge pond was useful in creating a groundwater mound in this area, which assisted in restricting migration of the oil plume toward the river. Since the 64-G Groundwater Treatment Facility became operational in October 1991, a relatively small portion of the groundwater that is collected from the oil recovery systems and treated in that Treatment Facility is discharged to the groundwater recharge pond. This is done, as necessary, to maintain the water elevation in the pond and the associated groundwater mounding. (The remainder of the treated water is discharged to the river via a NPDES-permitted outfall.)

The Thermal Oxidizer Facility is located in the south-central portion of the Site, south of East Street, just east of the western limb of the former oxbow (see Figure 1-2). The commercially-operated Thermal Oxidizer facility includes all of the structures, equipment, storage tanks, and process equipment necessary to destroy liquids containing PCBs. Shipments of liquid PCB wastes are delivered to the facility and transferred to one of several storage tanks within an associated storage tank facility.

Depending on the characteristics of the liquids in the storage tanks, the liquids are blended by GE to achieve a desired PCB and chlorine content. Three storage tanks within the storage tank facility are designated as the PCB mix tanks, or the PCB "burn" tanks. The PCB liquids within these tanks are ultimately transferred via pipeline to the Thermal Oxidizer for incineration.

Liquid PCB waste oil is injected into the Thermal Oxidizer through a series of atomizing nozzles. The nozzles discharge the atomized waste into a high temperature oxidizing region where the waste is combusted and a gaseous product is produced. The Thermal Oxidizer provides a minimum of two seconds of residence time for the destruction of PCBs.

Combustion gases exit the Thermal Oxidizer and enter the downcomer section of the quench pot. In the downcomer, the gases are cooled by water which is sprayed across the gas stream. In addition to cooling the gas, the water spray also removes hydrochloric acid (HCl), which is present in the gas stream as a result of combustion of chlorinated compounds. As the water droplets containing HCl fall into the quench pot, the HCl is neutralized by a sodium hydroxide solution that enters the system at the quench pot.

The combustion gases leave the quench pot and are directed into a packed bed scrubber. The gas stream is drawn through 12 feet of packing material which is wetted from above with an alkaline water mixture. The remaining HCl in the gas stream is removed in the scrubber. The gas stream then passes through an induced draft fan and exits through the exhaust stack.

1.2.7 Background Information on Remainder of Site

A number of USEPA-designated SWMUs are present in the remainder of the East Street Area 2/USEPA Area 4 Site and generally consist of underground storage tanks, oil/water separators, and several miscellaneous areas. Further details regarding these SWMUs are included in Section 3.

To the immediate west of a portion of East Street Area 2/USEPA Area 4 is Silver Lake. NPDES-permitted discharges from the GE facility, as well as stormwater runoff from the City of Pittsfield storm sewer system, are routed to the lake, which in turn discharges to the Housatonic River. Silver Lake is subject to investigation as part of the Housatonic River site, and separate reports entitled "MCP Interim Phase II Report/Current Assessment Summary for Housatonic River" (Blasland & Bouck, December 1991) and "Addendum to MCP Interim Phase II Report/Current Assessment Summary for Housatonic River" (Blasland & Bouck, August 1992) provide details associated with the lake.

1.3 Format of Document

This document is divided into several sections. These sections include a detailed description of site location and history, a summary of previous investigations conducted at the site, the results of the MCP Phase II investigations to date, and characterization of the presence of PCBs and other hazardous constituents associated with the site.

Specifically, this Section 1 presents pertinent background information. Section 2 describes the physical and environmental setting of the site. It includes site maps and photographs, and discusses topography, surface drainage, vegetation, surface water and flooding potential, wetlands and critical wildlife habitats, geology and groundwater/hydrogeology, land use, climatology/meteorology, and utilities.

Section 3 provides an identification and characterization of potential sources of contamination at the site. This includes a description of various SWMUs, as identified in the Permit.

Section 4 presents and discusses the hydrogeologic investigations performed prior to and as part of the recent MCP activities, and provides an overall hydrogeologic characterization of the site. Sections 5 through 8 discuss the results of other field investigations associated with the site, both prior to and as part of the MCP activities. In particular, these sections present and discuss data associated with the surface water and sediments of the Housatonic River adjacent to the site, as well as surficial soils, miscellaneous soils investigations, and air monitoring at the site.

Section 9 presents fate and transport characteristics associated with hazardous constituents detected at the site. Section 10 discusses potential migration pathways based on the information contained in the previous sections, while Section 11 identifies remaining data needs. Finally, Section 12 presents conclusions and future activities.

SECTION 2 - PHYSICAL AND ENVIRONMENTAL SETTING

2.1 General

This section summarizes the current physical and environmental characteristics of the East Street Area 2/USEPA Area 4 Site located in Pittsfield, Massachusetts. Characteristics including site location, topography, surface drainage, vegetation, surface water, wetlands and critical habitat, geology, groundwater/hydrogeology, land use, climatology/meteorology, and utilities are described herein.

2.2 Geographic Location of Site

The general geographic location of the East Street Area 2/USEPA Area 4 Site is illustrated in Figure 1-1, and the boundaries of the site are shown in Figure 1-2.

The Universal Transverse Mercator (UTM) coordinates for the site are approximately 4,701,270m N, 646,660m E. The site is located at approximately 42° 27' 07" N latitude and 73° 13' 59" W longitude.

There are several parcels that border the East Street Area 2/USEPA Area 4 Site. Figure 2-1 illustrates the adjacent parcels and presents the corresponding City of Pittsfield Tax Assessors' property identification numbers. Table 2-1 lists the names and addresses of the owners of these adjacent parcels.

As illustrated in Figure 1-1, institutions located with a 500-foot radius of the East Street Area 2/USEPA Area 4 Site appear to include three churches. The population residing within a one-half mile radius of the site boundary is estimated to be approximately 4,000 individuals. This is based on a review of 1990 aerial photographs of the area that indicate approximately 1,000 homes are located within this radius. For purposes of estimating the population within one-half mile of the site, an average of four people were assumed to reside in each home.

2.3 Maps and Photographs

2.3.1 Site Mapping

Site mapping (1:1,200 scale) of a section of the East Street Area 2/USEPA Area 4 Site was prepared as part of the previous East Street Area 2 MCP Phase II Supplemental Data Summary (Blasland & Bouck, May 1990). In general, this mapping illustrates the location of a portion of the site in relation to Silver Lake and the Housatonic River, as well as the location of a former oxbow channel, existing structures and monitoring wells, and nearby city streets. The approximate location of the former oxbow channel was determined from mapping prepared by the City of Pittsfield in 1940, prior to the rechannelization of the river by the Army Corp of Engineers. This 1940 mapping is included in Appendix A.

In addition, GE has developed detailed topographic mapping of the East Street Area 2/USEPA Area 4 Site between East Street and the Housatonic River. This mapping (1:1,200 scale) consists of 2-foot elevation contours and was prepared during the initial planning of the construction of the Groundwater Treatment Facility (64-G) using aerial photographs taken in April 1990. This mapping is included in Appendix B.

USGS 7.5 x 15-minute quadrangle topographic mapping is also available for the East Street Area 2/USEPA Area 4 Site. This mapping covers the entire Housatonic River Basin and includes topographic contours and elevations, highways, roads, and other manmade structures, water features, and woodland areas. This mapping has been used to prepare a site location map which is presented as Figure 1-1.

2.3.2 Site Photographs

Table 2-2 presents a summary of available aerial photographs of the East Street Area 2/USEPA Area 4 Site. Representative aerial photographs have been reproduced to illustrate the progression of changes related to the rechannelization of the Housatonic River. These photographs are presented in Figures 2-2 through 2-4 for the years 1942, 1969, and 1990, respectively.

2.4 Topography, Surface Drainage, and Vegetation

The topography of the East Street Area 2/USEPA Area 4 Site is characterized by relatively flat land, which slopes southward toward the Housatonic River and westward towards Silver Lake. Topographic information is contained on mapping available from GE and USGS (discussed previously in Section 2.3).

Surface drainage in developed areas of the site occurs largely by means of a stormwater collection system, which is described in detail in a report entitled "Final Storm Water Management Plan, I. Facilities Description" (Blasland & Bouck, July 1990a) and in a figure included in Appendix C to the present report. The western portion of the site, north of East Street, is served by a stormwater collection system which discharges to Silver Lake via NPDES-permitted outfalls 001 and 004. Flows from the South Side Pumping Station, the 64W, 64X, and 64Z Oil/Water Separators, the 64-G Groundwater Treatment Facility, the 64T Wastewater Treatment Facility, North Side Drainage Basins 005 and 006, and the City of Pittsfield storm sewer system are connected by various diversion and bypass structures that ultimately discharge to the Housatonic River via NPDES outfalls 005 and 006 (or their bypass/overflow structures).

Although a substantial portion of the East Street Area 2/USEPA Area 4 Site is covered by buildings and pavement, wooded areas exist in the south central section of the site, as well as along the embankment bordering the Housatonic River. A grassy field exists in the eastern section, south of East Street (see Figure 2-5). These undeveloped portions of the site drain either directly to the Housatonic River (or, in the northwestern portion of the site, to Silver Lake) by means of surface runoff, or into the storm sewer system via miscellaneous yard drains as described in the Final Stormwater Management Plan (Blasland & Bouck, July 1990a).

Typical tree species in the wooded areas include American Elm, Ashleaf Maple, Cottonwood, Red Osier Dogwood, and Trembling Aspen. Other woody and herbaceous vegetation in the wooded and grassy areas may include grasses, Black Raspberry, Honeysuckle, Riverbank Grape, Wild Strawberry, Cypress Spurge, Dames Rocket, Rough Cinquefoil, Spotted Knapweed, and Yarrow.

2.5 Surface Water Locations

Surface water locations within or adjacent to the East Street Area 2/USEPA Area 4 Site include the groundwater recharge pond, the Housatonic River, and Silver Lake. The recharge pond, located in the south central portion of the site and illustrated in Figure 1-2, is being used as a discharge point for a portion of the treated groundwater from the 64-G Groundwater Treatment Facility.

The Housatonic River, which forms the southern border of the site, and Silver Lake, which forms the western boundary of a portion of the site, have been addressed in numerous investigations. Recently, the river and lake were the subject of a separate MCP Interim Phase II Report/Current Assessment Summary (Blasland & Bouck, December 1991 and August 1992).

2.6 Flooding Potential

The flooding potential of the East Street Area 2/USEPA Area 4 Site has been documented in several technical reports and studies. Portions of this site are located within the 100-year floodplain of the Housatonic River as determined by the Federal Emergency Management Agency's (FEMA's) National Flood Insurance Program (NFIP) (FEMA, January 1987). According to FEMA, Silver Lake and immediately adjacent areas, as well as portions of the site south of East Street, lie within the Housatonic River's 100-year floodplain. The area of the site located within the 100-year floodplain based on the FEMA Flood Insurance Rate Maps measures approximately 5 acres.

2.7 Wetlands and Critical Habitats

Wetlands in or adjacent to the East Street Area 2/USEPA Area 4 Site include the Housatonic River, and Silver Lake. The Massachusetts Wetland Protection Act identifies specific resource areas as wetlands subject to protection. Resource area designations applicable to the East Street Area 2/USEPA Area 4 Site include a buffer zone extending 100 feet from the north bank of the Housatonic River and the eastern bank of Silver Lake.

The National Wetlands Inventory, compiled by the U.S. Department of the Interior - Office of Biological Services (Office of Biological Services, October 1975), identifies the land cover within the East Street Area 2/USEPA Area 4 Site as Palustrine-Forested (wooded area and adjacent recharge pond in the south central section of the site). Land covers associated with the Housatonic River are identified as Riverine-Lower Perennial and Riverine-Open Water. Silver Lake is identified as Lacustrine-Limnetic Open Water.

As mentioned previously in Section 2.4, although a substantial portion of the East Street Area 2/USEPA Area 4 Site is covered by buildings and pavement, a wooded area exists in the south central section of the site, as well as along the embankment bordering the Housatonic River, while a grassy field exists in the east section, south of East Street (see Figure 2-5). Except as discussed above, these areas have not been designated as areas of critical environmental concern or protected areas, and there is no evidence that these areas constitute a critical habitat for any species.

2.8 Geology

Pittsfield is situated in the Housatonic River Basin between the Berkshire Hills to the east and the Taconic Range to the west. Bedrock in the Pittsfield area consists of an assemblage of north-south trending metamorphic units (mainly gneiss, schist, and marble), which has resulted from a series of Paleozoic mountain-building episodes that occurred between 520 to 480 million years ago. The bedrock is overlain by a series of unconsolidated materials formed by glacial scouring and deposition, as well as pre- and post-glacial fluvial modification of the landscape.

The main axis of the Housatonic River Valley is underlain by carbonate rock (marble, limestone, and dolomite) of the Ordovician-Cambrian Stockbridge Group. These rock types are less resistant and erode more easily than the gneiss and schist of the Berkshire Highlands.

The bedrock underlying the area is reported to be lower Ordovician age, tan-beige quartzose calcite and dolomite marble (USGS, 1983). Immediately west of the site the underlying bedrock is also reported as the Stockbridge Formation but the bedrock unit is described as Lower Cambrian age massive to finely laminated steel-grey calcitic dolomite marble containing a prominent zone of white quartz modules near the top (USGS, 1983).

The unconsolidated surficial geologic deposits within the basin (excluding swamps and alluvium) are of Pleistocene glacial origin (1.6 million to 10,000 years ago) and are classified as either stratified (glaciofluvial and glaciolacustrine) or nonstratified (till) deposits. Known thicknesses of stratified and till deposits have been documented at 240 feet and 90 feet, respectively (Norvitch et al., 1968). Till predominates in the upland areas, and stratified deposits occur primarily along the lower slopes. More recent alluvial and swamp deposits are found mainly in the valley bottoms.

Aquifers and water bodies within the basin are recharged by precipitation (rainfall and snowfall). The nearest mapped aquifers are within the Housatonic River Basin to the north and the Connecticut River Basin to the southeast, as indicated on the Pittsfield East quadrangle. According to the Pittsfield Department of Public Utilities, the city obtains its industrial and municipal water supply from the following surface water bodies located several miles to the south and to the east: Sand Washington Reservoir, Cleveland Reservoir, Farnham Reservoir, New Sackett Reservoir, Lake Ashley, and the Lower Ashley Intake. In the past, Onota Lake (approximately 3 miles to the north) has been used as an emergency municipal and recreational water supply.

The stratified and nonstratified surficial deposits are not considered productive aquifers (Norvitch et al., 1968), and the carbonate bedrock will provide sufficient water for domestic and industrial use only if a well is installed within a solution or fault zone.

The near-surface geologic characteristics of oxbow areas are influenced by alluvial (i.e., river) depositional conditions. Currents of varying velocity in the river channel, as well as in flood waters, cause the deposition of varying sediment types. Sands and gravels are generally deposited in or near the river channel itself and may form local ridges known as natural levees. Overbank deposits, consisting of fine sands and silts, are deposited from a suspended state onto a floodplain area during flooding episodes. Finally, clay can be deposited in flow areas where standing water remains after a flood.

Natural sediments in the study area south of East Street consist of recent floodplain sediments and glacial deposits. Most of the native deposits underlying the site have been covered by fill. The water transmitting ability of the deposits ranges from permeable fluvial sediments to relatively impermeable glacial till. Bedrock has not been encountered at the site, but boring logs of nearby Altresco, Inc. facility wells report bedrock to be at a depth of approximately 50 feet (Blasland, Bouck & Lee, February 1994).

A more detailed discussion of the geology associated with the East Street Area 2/USEPA Area 4 Site is presented in Section 4.1.1.

2.9 Hydrogeology

Groundwater is encountered at depths of 5 to 35 feet below the ground surface (995 to 962 feet above mean sea level). General site groundwater flow is south toward the Housatonic River. Groundwater from the site generally discharges to the Housatonic River, although a portion also discharges to Silver Lake. The upper aquifer (till surface to water table) ranges in thickness from five feet in the northern portion of the site to 40 feet in the southern portion of the site.

Site groundwater has been characterized through the semi-annual monitoring program, the 1989 East Street Area 2 Groundwater Treatability Study (Blasland & Bouck, July 1990b), and other technical studies. Topics covered include groundwater quality, delineation of oil plume boundaries, groundwater flow, and groundwater table elevations. The groundwater/ hydrogeology of the site is discussed further in Section 4.1.1.

2.10 Land Use

The land comprising the East Street Area 2/USEPA Area 4 Site has been used as an industrial facility since the late 1800s. Although the owners of portions of the property have changed, the land has consistently been used as a manufacturing/industrial facility. For the foreseeable future, GE will maintain its' present operations in this area.

2.11 Climatological and Meteorological Information

In general, the Pittsfield, Massachusetts, area is characterized by a temperate climate with warm humid summers and cold winters. The average precipitation varies from a low of 2.5 inches per month during the winter months, to a high of about 5 inches per month in the summer months. The Housatonic River Basin, which includes the site, receives an average of 46 inches of precipitation per year. Approximately 22 inches per year escape by evaporation and transpiration to the atmosphere, while the remaining 24 inches per year are lost as runoff or collected in reservoirs, lakes, and ponds (Norvitch et al., 1968).

Prevailing winds are from the west (See Figure 2-6). The mean annual temperature is approximately 46°F, based on data recorded at nearby Pittsfield Municipal Airport. The mean summer temperature is 68°F, while the mean winter temperature is 28°F.

Meteorological and air dispersion parameters have been measured for the East Street Area 2/USEPA Area 4 Site through an air monitoring program during the "20's Complex Demolition Project" in 1988. As part of this project, a meteorological station was constructed at the site. The station was used to collect and record data relative to wind speed, wind direction, temperature, relative humidity, and rainfall. In addition, as part of the on-going Facility Air Monitoring Program (discussed in more detail in Section 8.3.1), another meteorological station was constructed at the site in August 1991, and has been collecting data continuously since that time. Further, an ambient air investigation for polynuclear aromatic hydrocarbons (PAHs) was conducted at this site in August 1991, as discussed in Section 8.3.2. Thus, recent relevant meteorological and air dispersion data are available if needed. Figure 2-6 presents wind directional data collected during 1992 as part of the facility air monitoring program.

2.12 Site Utilities

Physical site characteristics such as subgrade utility lines, sewers, and water mains are documented by GE's Environmental and Facilities Operations (EFO) group. A number of figures showing these conveyances are presented in Appendix D. In general, utilities in the East Street Area 2/USEPA Area 4 Site include various municipal water supply lines (Plan No. 1-Appendix D), various sanitary sewer lines (Plan No. 2-Appendix D), numerous fire protection water supply lines (Plan No. 3-Appendix D), as well as a vast network of storm drainage lines (Plan No. 4-Appendix D). In addition, the site is also traversed by various electrical conduits (Plan No. 5 - Appendix D) and natural gas supply lines (Plan No. 6 - Appendix D). Information on site utilities outside the facility is available through the Pittsfield municipal engineer.

SECTION 3 - SOURCE IDENTIFICATION AND CHARACTERIZATION

3.1 General

The Corrective-Action Permit identifies 56 SWMUs as sources or potential sources of releases in USEPA Area 4. (Four of these SWMUs, SWMUs T-50, T-19, T-LL, and T-MM, are listed in the Permit as being in USEPA Area 3, but are in fact located in USEPA Area 4.) In addition, an underground storage tank potentially located northeast of Building 7 has been identified as an additional SWMU (SWMU T-A1). The SWMUs are summarized below:

SWMU Identification Number	SWMU Description
SWMU G-1	Building 60 Former Drum Storage Area
SWMU G-2	Scrap Yard
SWMU G-7	Old Coal Gasification Plant Storage Tank Area
SWMU G-8	Oxbow Fill Area
SWMU G-10	Building 60 Tank Truck Area
SWMU G-13	Building 64-W Oil/Water Separator
SWMU G-14	Building 64-X Oil/Water Separator
SWMU G-15	Building 64-Z Oil/Water Separator
SWMU G-16	Building 31-W Oil/Water Separator
SWMU T-2	Building 11 Interceptor Tank
SWMU T-5	Building 3C Yard Former Oil/Water Separator
SWMU T-6	Building 3C Vault
SWMU T-23	Building 12X Emergency Overflow Tanks
SWMU T-50	Building 12G Pyranol Unloading Station and Storage Area
SWMU T-42	Building 68 Drainage Pits
SWMU T-63	Building 61 Phenolic Dust Baghouse
SWMU T-65	Building 12Y Rainwater Sump
SWMU T-D	Building 29 Transformer Oil Transfer Area

SWMU Identification Number	SWMU Description
SWMUs T-19; T-O through T-V; T-LL T-MM; T-OO through T-DDD; T-GGG through T-QQQ; and T-A1	Underground Storage Tanks
N/A	Underground Pipes and Tunnels

The locations of the SWMUs that are not underground storage tanks (USTs) are shown on Figure 3-1, while the locations of the UST SWMUs are shown on Figure 3-2. All SWMUs are described in more detail below. The discussion of these SWMUs will also serve as the identification of sources and potential sources in this area, as required by the MCP for Phase II activities.

3.2 General SWMUs

3.2.1 Building 60 Former Drum Storage Area (SWMU G-1)

The Building 60 Former Drum Storage Area is located north of the Thermal Oxidizer in the south section of the site (Figure 3-1). The unit was formerly used as a "less-than-90-day" drum storage area and transfer facility for hazardous wastes generated throughout the plant. The wastes reportedly managed in the drum storage area included spent solvents, phenolic wastes, acids, and metal-containing wastes (USEPA, February 1988).

The unit was operated from the late 1960s until 1985. Waste materials managed at the unit were subsequently transferred to the Building 68 Drum Storage Area, incinerated in the Thermal Oxidizer, or shipped off-site.

The Building 60 Former Drum Storage Area occupies an area approximately 250 feet long and 200 feet wide, and consists of an outdoor above-ground concrete pad constructed in the early 1970s. The unit is presently inactive.

3.2.2 Scrap Yard (SWMU G-2)

The Scrap Yard is situated south of Building 64 in the southwest section of the site (Figure 3-1). The unit, also known as the Materials Reclamation Area, has been used as a scrap metal crushing and storage area.

The Scrap Yard Area has been in use since 1937, is currently covered by a combination of asphalt pavement and concrete, and covers an area of approximately two acres. Scrap metals generated throughout the facility are delivered to the unit, compacted using a pressure crusher located within and adjacent to Building 61-R (installed in 1953), and shipped off-site. Beneath the crusher, a subgrade sump exists. This sump was utilized to collect any liquids that were released during the crusher operations. The accumulated liquids were routed into GE's overall stormwater collection/conveyance system. Currently the discharge from the sump is blocked off and the crusher is inactive. Miscellaneous sampling and analysis data associated with the Building 61-R sump are discussed in Section 7.2. Solid wastes deposited in the scrap yard area may include waste materials from nearby areas.

3.2.3 Old Coal Gasification Plant Storage Tank Area (SWMU G-7)

The Old Coal Gasification Plant Storage Tank Area is located in the central section of the site (Figure 3-1). Soils at the site contain residual coal tars and oils (which include the constituents benzo(a)pyrene, anthracene, and other PAHs) originating from leaks and spills associated with the previous operation of the tanks. Coal tar liquors removed from the tanks were reportedly left in the area, disposed of in the Oxbow Fill Area (SWMU G-8), or taken off-site (Hertel, September 1986).

This two-acre site was originally owned and operated by the Berkshire Gas Company, and contained two 250,000 cubic foot (cu.ft.) and two

750,000 cu. ft. steel tanks. Three of the tanks were constructed in the early 1900s. One tank was constructed in 1946. The tanks were underlain by a concrete foundation, and backfilled with soil and other materials. One tank was removed in 1954, and the remaining three tanks were removed in 1972, prior to the 1973 purchase of the property by GE (Hertel, September 1986).

3.2.4 Oxbow Fill Area (SWMU G-8)

The Oxbow Fill Area is located in the south section of the site between Buildings 64X and 60 (Figure 3-1). The former oxbow is approximately 1.5 acres in size and is a former oxbow channel of the Housatonic River that has received solid wastes and soils. Historic photographs and other information indicate that the former oxbow was cut off from the flows of the Housatonic River during a river rechannelization project reportedly conducted by the Army Corps of Engineers in the late 1930s or early 1940s.

Solid wastes deposited in the former oxbow may include industrial waste materials as well as coal gasification byproducts and other fill material from GE, the Berkshire Gas Company, and possibly others.

3.2.5 Building 60 Tank Truck Area (SWMU G-10)

The Building 60 Tank Truck Area is located in the northeast corner of the Building 60 Drum Storage Area (SWMU G-1) in the southwest section of the site (Figure 3-1). This unit is used as a parking area for tank trucks that transport PCB-containing liquids, to the Building 60 Tank Farm prior to incineration in the Thermal Oxidizer.

The Building 60 Tank Truck Area consists of concrete pavement approximately 150 feet long and 40 feet wide. The tank trucks, which are constructed of steel, also previously parked on adjacent soil. This unit is active.

3.2.6 Building 64-W Oil/Water Separator (SWMU G-13)

The Building 64-W Oil/Water Separator is located adjacent to the Housatonic River in the southern section of the site (Figure 3-1). This unit is a component of GE's past and current management of stormwater and other process wastewaters generated within the facility. Constructed in 1967, the unit consists of a concrete structure with approximate overall dimensions of 80 feet long, 20 feet wide, and 15 feet deep.

The primary function of the oil/water separator is to provide an area where any oils present in the stormwater/wastewater generated from within the facility can be separated and recovered. Each unit contains two parallel concrete channels that provide a sufficient volume and hydraulic retention time to allow gravity separation of oils. Oils that float to the water surface within these channels are removed through the use of belt skimmers and are subsequently transported to the Thermal Oxidizer for destruction.

When initially constructed and operated, this unit received process flows and stormwater runoff generated from areas throughout GE's Large Transformer Operations (LTO) area. More recently, with the elimination of the LTO area, the corresponding reduction in process-related flows, and the construction of ancillary water treatment/ management facilities, the unit primarily receives rainfall-related flows from the existing stormwater collection/conveyance system. Although some process-related flows enter the unit, these flows are typically from non-contact cooling water sources and are an insignificant component of the overall volume handled by the unit.

Flow that exits the oil/water separator is discharged to the Housatonic River via NPDES-permitted Outfall 05A. In addition, in the event that the flow rate entering the unit exceeds the hydraulic capacity of the unit, a portion of the incoming flow will bypass the oil/water separator and discharge directly to the Housatonic River through a different NPDES-permitted outfall (Outfall 05B). Finally, the unit is monitored as part of GE's Stormwater Management Plan (Blasland & Bouck, July 1990a), which was developed in accordance with the NPDES permit.

Miscellaneous soil/sediment sampling and analysis data associated with the Building 64-W Oil/Water Separator are discussed in Section 7.3

3.2.7 Building 64-X Oil/Water Separator (SWMU G-14)

The Building 64-X Oil/Water Separator is located adjacent to the Housatonic River in the southeastern section of the site (south of the groundwater recharge pond) (Figure 3-1). Similar to the Building 64-W oil/water separator, the primary function of this unit is to remove any floating oils that may be present in GE's NPDES-permitted plant water discharges. Constructed in 1970, this concrete structure has approximate overall dimensions of 60 feet long, 20 feet wide, and 15 feet deep. Also, the oil/water separator has two parallel channels, flow regulating devices, and oil removal equipment (i.e., belt skimmers). Any recovered oils are transported to the Thermal Oxidizer for destruction.

In the past, the unit received stormwater runoff and certain process-related wastewaters from the north-central area of the plant. Flow to the unit is almost entirely comprised of stormwater runoff. Flow that passes through the unit is discharged to the Housatonic River via NPDES-permitted Outfall 006. Water that flows to the unit but bypasses the unit (due to hydraulic limitations) is discharged to the Housatonic River via NPDES-permitted Outfall 06A. This unit is also included in GE's Stormwater Management Plan (Blasland & Bouck, July 1990a) and is monitored on a routine basis.

Miscellaneous soil/sediment sampling and analysis data associated with the Building 64-X Oil/Water Separator are discussed in Section 7.3.

3.2.8 Building 64-Z Oil/Water Separator (SWMU G-15)

The Building 64-Z Oil/Water Separator is located south of East Street and northeast of the Building 64-W Oil/Water Separator (Figure 3-1). In terms of physical characteristics and operational functions, this unit is similar to the two oil/water separators previously described. However, the Building 64-Z Oil/Water Separator differs from the other units in that it functions as an intermediate oil removal unit within GE's overall stormwater/process water collection and conveyance system. Constructed in 1978, this unit has approximate overall dimensions of 110 feet long, 25 feet wide, and 15 feet deep. The unit is comprised of parallel concrete channels, and the necessary flow control and removal equipment to facilitate oil recovery and subsequent destruction at the Thermal Oxidizer.

Flows into, out of, or potentially bypassing this unit are not specifically regulated under GE's existing NPDES permit since they do not represent a point source discharge. However, this unit is included in GE's Stormwater Management Plan (as mandated by the NPDES permit conditions) and is operated in conjunction with other NPDES-regulated facilities as discussed below.

Under normal, dry-weather flow conditions, water entering this unit is discharged into the adjacent 64-T Wastewater Treatment Facility (the discharge from which is regulated as Outfall 005 under the NPDES permit). The amount of water that can pass through the oil/water separator and discharge in the treatment facility is limited by the hydraulic capacity of the treatment facility. Under wet-weather flow conditions, flows approaching the unit are subject to three flow scenarios (depending on the magnitude and intensity of the storm event):

1) Flows will pass through the unit and the discharge routed to the 64-T Wastewater Treatment Facility;

2) Flows that pass through the unit, but exceed the capacity of the treatment facility, bypass the treatment facility and are routed to the inlet of the Building 64-W Oil/Water Separator (SWMU G-13); or

3) Flows at the inlet of the unit exceed the unit's hydraulic capacity and bypass the unit altogether. In this event, the bypassed flows are routed to the Building 64-W Oil/Water Separator.

Miscellaneous soil/sediment sampling and analysis data associated with the Building 64-Z Oil/Water Separator are discussed in Section 7.3.

3.2.9 Building 31-W Oil/Water Separator (SWMU G-16)

The Building 31-W Oil/Water Separator is located in the west section of the site adjacent to Silver Lake (Figure 3-1). Essentially all of the water generated in the northwest area of the plant passes through this oil/water separator prior to discharge to Silver Lake via NPDES-permitted Outfall 001.

The Building 31-W Oil/Water Separator is constructed of concrete with overall dimensions measuring 80 feet long, 25 feet wide, and 15 feet deep. The unit was installed in 1972 and is currently in operation. Operations are consistent with those previously discussed for the Building 64-W, 64-X, and 64-Z oil/water separators.

Miscellaneous soil/sediment sampling and analysis data associated with the Building 31-W Oil/Water Separator are discussed in Section 7.4.

3.3 Transformer Division SWMUs

3.3.1 Building 11 Interceptor Tank (SWMU T-2)

The Building 11 Interceptor Tank, located south of Building 11 in the north-central section of the site (Figure 3-1), was installed in 1967 and is currently in use, although in a function different from its initial use.

The 6,500-gallon concrete tank, constructed with a series of overflow/underflow baffles, was formerly used for settling out solids and the oil/water separation of various flows generated within Building 11. The flows include laboratory waste water, roof drains, and air conditioning non-contact cooling water. The discharge from this tank is discharged to Silver Lake via NPDES Outfall 001. In 1990, GE performed several drainage modifications to Building 11 which resulted in the removal of all contributions of water to the interceptor tank, except for laboratory wash water. The laboratory wash water includes water from laboratory sinks used for washing hands or rinsing clean glassware to maintain analytical accuracy.

3.3.2 Building 3C Yard Former Oil/Water Separator (SWMU T-5)

The Building 3C Yard Former Oil/Water Separator is located along the south side of Building 3C in the north-central section of the site (Figure 3-1). The unit was in operation from 1917 to 1977 and was filled with sand and convered with a concrete slab in 1980. The unit received stormwater from the main drain system (Building 2, 3, 14, and 100 areas, respectively), as well as PCB-containing waste water originating from spills in the Building 3C Yard area.

The Building 3C Yard Former Oil/Water Separator measured 37 feet long, 12 feet wide, and 14 feet high. The former location of this unit is in an area that is completely covered by concrete.

3.3.3 Building 3C Vault (SWMU T-6)

The Building 3C Vault is in the basement of Building 3C in the north-central section of the site (Figure 3-1).

The vault is constructed of concrete and is approximately 125 long, 50 feet wide, and 12 feet high. A total of 13 10,000-gallon tanks lined the west wall of the vault. The storage tanks were fabricated from three quarter-inch thick plate steel. One of the tanks was used to store waste pyranol. It was cleaned and removed in 1979. The other tanks contained either kerosene or transformer oil used in the vapor phase treating and oil impregnation of transformers. The 12 other tanks were cleaned and removed in the first quarter of 1992. Removal activities consisted of cleaning, cutting into manageable sections, and processing through a high pressure water wash prior to shipping as scrap for meltdown.

3.3.4 Building 12X Emergency Overflow Tanks (SWMU T-23)

The Building 12X Emergency Overflow Tanks were located in the north-central section of the site, as illustrated on Figure 3-1, and consisted of two above-ground steel tanks (with operating capacities of 35,000 gallons each) surrounded by a concrete pit used to vacuum treat large transformers from approximately 1925 to 1984.

From 1984 to 1989 the tanks received steam condensate and residual oil, which originated from transformer operations in Building 100. Oil was skimmed from the surface, placed in drums, and disposed of in accordance with applicable regulations. Decanted water was discharged to the Building 64-Z Oil/Water Separator (SWMU G-15). In 1984, steam condensate was rerouted to the Building 31 powerhouse by means of condensate return lines. The Building 12X overflow tanks were cleaned and removed in 1989. The former location of these tanks is now enclosed in a sealed vault.

3.3.5 Building 12G Pyranol Unloading Station and Storage Area (SWMU T-50)

The Building 12G Pyranol Unloading Station and Storage Area was located in the northeast section of the site, east of Building 12-Y, approximately where Building 100-A is located today (see Figure 3-1).

This unit, in use from the 1930s until 1966, was used as an unloading and storage station for raw materials and in the blending of these materials to create Pyranol. The 12G building was approximately 235 feet long by 60 feet wide and included both storage and blending tanks for new materials and blended Pyranol.

Based on process instructions dated June 1, 1966, raw hexachlorodiphenyl and a tri/tetrachlorobenzene mixture were received at the 12-G facility by railcar. Once received, the hexachlorodiphenyl was heated within the railcar with steam to 40 degrees Celsius (°C), sampled, and analyzed. It was then heated to 75°C and pumped to a holding tank within Building 12G where it was heated to 85°C. The tri/tetrachlorobenzene mixture was also tested once received, but was not heated. Upon testing, the heated hexachlorodiphenyl was blended with the tri/tetrachlorobenzene mixture at a ratio of 1 to 1.23 (6,000 gallons to 7,400 gallons). The blend mixture was then tested. Following any necessary volume corrections, based on the lab tests, tetraphenyl tin was added to the blended mixture, and it was pumped to a cooling tank where it was cooled to room temperature. The blended mixture was then tested again. If mixture specifications were acceptable, it was then passed through a filter press to remove moisture and chlorides. At that point, the final mixture testing was performed and the Pyranol product was either stored within Building 12G), or distributed by pipeline for use in Building 29. In

1966, these operations were discontinued at this location and were initiated in Building 68.

Spills and leaks periodically occurred as part of Building 12G unloading and storage station operations. Spills and leaks (when they occurred) were soaked up with sorbent, which was placed in drums and taken to the Scrap Yard (SWMU G-2).

In 1966 and 1967 Building 12G, as well as the unloading station and storage area were razed and Building 100-A was constructed at this location.

3.3.6 Building 68 Drainage Pits (SWMU T-42)

The Building 68 "Drainage Pits" are located to the south and northeast of the Building 68 Drum Storage Area as illustrated on Figure 3-1. These pits, referred to by GE as Pits "A", "B", and "C", were installed in approximately 1970 to collect precipitation runoff from an impervious area adjacent to Building 68 (constructed in 1966). This area, approximately 8,500 square feet in size, contained several above-ground storage tanks used by GE to store transformer insulating fluids. Along the perimeter of this impervious area, a curb was constructed to contain any direct precipitation and to minimize inadvertent run-on flows. The function of the drainage pits was to provide an intermediate area where precipitation runoff from the impervious area could be retained so that any oils contained in this water could be recovered. A drain line from each pit allowed for overflow discharge (once the pit was full) to enter GE's stormwater collection/conveyance system.

Approximate dimensions and volumes of the drainage pits are as follows:

Pit Designation	Overall Dimensions (Ft.)			Approximate Storage Volume (Gallons)
	Length	Width	Depth	
A	11	4	4	1,000
B	8	8	8	3,300
C	3	2	2	50

The function and operation of these drainage pits were as described above until approximately 1971, when an overhead canopy structure was constructed, which essentially eliminated the generation of precipitation runoff from this impervious, curbed area. As such, the drainage pits are inactive. The canopied area referenced above was later upgraded to include sidewalls such that Building 68 and the adjacent area are now totally enclosed.

3.3.7 Building 61 Phenolic Dust Baghouse (SWMU T-63)

The Building 61 Phenolic Dust Baghouse is located in the southwest section of the site, adjacent to the Housatonic River (Figure 3-1). The unit operated from the 1950s until mid-1987, and was used to collect emissions resulting from the manufacture and application of phenolic insulating material for transformer components.

The unit consists of a two-compartment, steel fabricated baghouse, elevated 10 feet above a concrete pad. Overall dimensions are 15 feet high and 10 feet wide.

Prior to the 1970s, waste materials from this unit, which contained phenol, were reportedly disposed of on-site. During the 1970s, the wastes were managed at the Building 60 Drum Storage Area (SWMU G-1). From the late 1970s until 1987, the drums were managed at either the Building 68 Drum Storage Area or the Building 78 Drum Storage Area. The unit is inactive.

3.3.8 Building 12Y Rainwater Sump (SWMU T-65)

The Building 12Y rainwater sump (SWMU T-65) is located in the eastern half of the basement pit in Building 12Y (Figure 3-1). The area comprising this SWMU consists of two smaller sump areas (each approximately 4 feet in length and 2 feet in width) and a connecting pipe tunnel. This area is located adjacent to, south of, and at a slightly lower elevation than the former Building 12Y transformer testing area. This testing area was used for the testing of large transformers from 1950 through approximately 1970. Spills from this test area or releases from the pipelines contained in the pipe tunnel would enter the sumps through either flow over the concrete surface or as assisted by various floor drains and the associated drainage system.

Water from the sump in the past had been conveyed to the Building 64-Z Oil/Water Separator for treatment prior to discharge to the Housatonic River. Sump liquid (if any) is now placed in 55-gallon drums and managed in accordance with RCRA/TSCA regulations.

3.3.9 Building 29 Transformer Oil Transfer Area (SWMU T-D)

The Building 29 Transformer Oil Transfer Area is located in the central section of the site, south of Buildings 1 through 3 and west of Building 29B, as presented on Figure 3-1. The unit included a former railroad spur and a former rail car loading/unloading area extending southwest from the main railroad line, which traverses the center of the facility, toward former Building 24.

The unit was remediated in August 1989 with the removal of all related facilities and contaminated soil. The majority of this unit is currently covered by a paved parking lot.

3.3.10 Transformer Division Inactive USTs (SWMUs T-19, T-O through T-V, T-LL, T-MM, T-OO through T-DDD, T-GGG through T-QQQ, and T-A1)

Numerous inactive underground product storage tanks associated with the Transformer Division are or have been present at the site. The majority of the tanks were installed prior to World War II, and many have been out of service since at least the mid-1960s. Products known to have been stored in these units include corrosives, fuels, insulating fluids, oils, solvents, and varnishes. The tanks range in size from 750 to 15,000 gallons, although the sizes of two tanks installed in 1910 are unknown. Due to the large number of USTs involved, they have been grouped into categories to facilitate more detailed discussions as presented below.

In addition, as the presence and/or location of several of these USTs were in question, GE conducted a Ground-Penetrating Radar Survey (GPRS) associated with certain USTs (SWMUs T-V, T-A1, T-OO through T-UU, T-PPP, and T-QQQ) in an attempt to obtain information regarding their status or location. These activities were performed on behalf of GE by Blasland & Bouck during the week of August 30, 1993. The details and results associated with these activities are included in Appendix E. The results are also summarized below.

SWMU T-O through SWMU T-T

These SWMUs consist of six USTs formerly located adjacent to Building 3-C (Figure 3-2). SWMU T-O (GE Tank ID. 3C-01) was constructed of unknown materials and had a capacity of 15,000 gallons. This UST was used to store varnish, and was in use from 1928 to 1951. Efforts to locate this tank, including review of available files and mapping and visual inspection (i.e., presence of vent pipes, fill pipes, manholes, etc.), have not been successful. Furthermore, a concrete ramp has been constructed in the suspected location of this tank, which would prevent the effective use of a GPRS.

SWMUs T-P and T-Q (GE Tank ID. 3C-02 and 3C-03, respectively) are 750-gallon USTs constructed of concrete that held caustic (sodium hydroxide) and were in use from 1947 to 1975. These tanks were filled in place with a concrete slurry by Clean Berkshires, Inc. on November 6, 1990 under a permit from the Pittsfield Fire Department.

SWMUs T-R, T-S, and T-T (GE Tank ID. 3C-04, 3C-05, and 3C-06, respectively) were constructed of steel and were used to hold up to 5,000 gallons of kerosene, 10,000 gallons of 10c oil, and 3,000 gallons of an unknown liquid, respectively. All three tanks were last used in 1965 and were filled in place with a concrete slurry on November 16, 1989 by Clean Berkshires, Inc. under a permit from the Pittsfield Fire Department.

SWMUs T-U, T-V, and T-A1

SWMUs T-U and T-V (GE Tank ID. 7-01 and 7-02, respectively) were located adjacent to Building 7 (Figure 3-2). These USTs were constructed in 1918 of steel and were last used in 1965. SWMU T-U contained 10c oil, while SWMU T-V contained fuel oil. One of these USTs (7-01) was removed during the construction of Building 100, while the other UST (7-02) was partially removed during a consolidation project in Building 100. SWMU T-A1 (GE Tank ID 7-04) is a potential additional SWMU located to the northeast of Building 7, in the northern portion of the site (Figure 3-2). The materials of construction and period of operation of this suspected UST is unknown. It is believed that SWMU T-A1 had a capacity of 2,000 gallons and contained 10c oil.

An attempt was made to locate Tank 7-02 as part of the August 1993 GPRS; although the GPRS results showed no presence of this tank. An attempt was also made to locate Tank 7-04 as part of the August 1993 GPRS, but the GPRS results were inconclusive due to the presence of a 5' x 15' concrete pad over the suspected UST location that caused severe attenuation of the GPR signal. See Appendix E for additional details regarding the GPRS. Additional activities to attempt to locate this suspected UST are warranted as described in the Supplemental Phase II SOW/RFI Proposal.

SWMU T-19

SWMU T-19 (GE Tank ID. 12T-01) is located near Building 12-T, in the eastern portion of the site (Figure 3-2). This tank, constructed of unknown materials, has a capacity of 5,000 gallons. The tank was used from 1954 to 1974 and received waste oil containing PCBs and other hazardous constituents originating from the drainage of transformers in Building 12-T. The tank is inactive and the waste oil is no longer present. The final disposition of the oil when this unit was in use is not known. This tank is scheduled to be removed as discussed in the Supplemental Phase II SOW/RFI Proposal.

SWMUs T-LL and T-MM

SWMUs T-LL and T-MM (GE Tank ID. 14-01 and 14-02, respectively) were located near Building 14, in the northeast portion of the site (Figure 3-2). UST T-LL had a capacity of 10,000 gallons and was used from 1935 to 1958 to contain monoethanolamine solution. The materials of construction of this tank are unknown. The current status of this tank is unknown, and additional activities to attempt to located this tank are warranted as described in the Supplemental SOW/RFI Proposal. UST T-MM had a capacity of 2,500 gallons and was used from 1941 to 1960 to contain Solvesso-100. The materials of construction of this tank are unknown. This tank was likely removed during the construction of Building 14-A in 1970.

SWMU T-OO through SWMU T-UU

These SWMUs consist of seven USTs (GE Tank ID. 18-01 through 18-07, respectively) located near Building 11 (Figure 3-2). The capacity of these tanks ranged from 2,250 to 10,000 gallons, and each UST contained either kerosene, alcohol, solvatone, benzene, machine oil, or cutting oil. These tanks were in use from 1942 to 1949 and were constructed of steel. These tanks are believed to be located under the ramp south of Building 11. An attempt was also made as part of the August 1993 GPRS to locate Tanks 18-01 through 18-07. The GPRS results showed no presence of any of these tanks (see Appendix E).

SWMU T-VV

SWMU T-VV (GE Tank ID. 24A-02) was located in the vicinity of former Building 24 (Figure 3-2) and was used to store up to 10,000 gallons of fuel oil. This UST was constructed of unknown materials and was installed in 1917. It is not known when this tank was taken out of service. Despite efforts to locate this tank, including a review of available files and mapping and visual inspection, its location remains unknown. It is significant to note that this tank, if not previously removed, is in the area of the 20's complex demolition which took place in 1987. Demolition rubble (building construction material) from former Buildings 24A, 27, and 28 and associated facilities was placed, compacted, and sealed within the confines of the basement of former Building 29 (Phase I Activities). Demolition rubble from former Buildings 26, 26A, 26B, 26F, and 29 and associated facilities was placed, compacted, and sealed in the lower portion of former Building 24 (Phase II Activities). The area associated with former Buildings 24 and 29 was sealed by a covering of concrete and asphalt pavement that now constitutes the GE Parking Lot as shown on Figure 3-2. Surface water runoff from the parking lot and the surrounding area is diverted through oil/water separators 64Z and 64W and discharges through Outfall 005. Also, a 6-inch diameter perforated PVC leachate collection pipe was placed along the south wall (inside) of former Building 24. This pipe was connected to an existing stormwater manhole east of the former Building 24 which also diverts stormwater through oil/water separators 64Z and 64W and discharges through Outfall 005.

No observations of SWMU T-VV were noted during the 20's complex demolition. Further, the use of a GPRS to locate this tank would not be feasible due to likely interferences caused by the presence of the 20's complex rubble.

SWMU T-WW through SWMU T-YY

SWMU T-WW, T-XX, and T-YY (GE Tank ID. 26-01, 26-02, and 26F-01, respectively) were located adjacent to former Building 26 (Figure 3-2). SWMU T-WW had a 10,000-gallon capacity and held 10c oil, SWMU T-XX had a capacity of 3,700 gallons and held varnish, and SWMU T-YY held 3,000 gallons of fuel oil. SWMU T-YY was filled in place with a concrete slurry on December 15, 1988 under a permit from the Pittsfield Fire Department. SWMUs T-WW and T-XX may have been removed before a silicone unloading area was constructed over the tanks. The fact that the mapped location of a stormwater line passes through the approximate centerline of SWMU T-WW further supports the assumption that these USTs were previously removed. The presence of the unloading area would prohibit the use of a GPRS to locate these tanks.

SWMU T-ZZ and SWMU T-AAA

SWMU T-ZZ and SWMU T-AAA (GE Tank ID. 29-02 and 29-03, respectively) were located adjacent to the former location of Building 26 (Figure 3-2). These USTs were constructed of unknown materials and were used to store 10,000 gallons of 10c oil each. They were constructed in 1937 and 1940, respectively, and have not been located to date. However, concrete slabs had been poured over the area associated with SWMU T-ZZ. As a result, it is believed that SWMU T-ZZ has been removed. A storm sewer catch basin invert is currently in place over the location of SWMU T-AAA. This invert extends to a depth of 6 feet while the top of the UST is shown on maps as being 5 feet below grade. This information suggests that this UST was removed previously. The presence of the unloading area would prohibit the use of a GPRS to locate this tank.

SWMU T-BBB through T-DDD

SWMUs T-BBB, T-CCC, and T-DDD (GE Tank ID. 33-01, 33A-01, and 33A-02, respectively) were formerly located in and adjacent to Building 33 (Figure 3-2) and were constructed of unknown materials. SWMU T-BBB held 10,000 gallons of varsol while SWMUs T-CCC and T-DDD held an unknown quantity of fuel oil. SWMU T-BBB was filled in place with a concrete slurry on November 6, 1990 by Clean Berkshires, Inc., while SWMUs T-CCC and T-DDD were filled in place with a concrete slurry on August 27, 1990 by J.H. Maxymillian, Inc. All three USTs were filled under a permit from the Pittsfield Fire Department.

SWMUs T-GGG through T-KKK

These five USTs were located adjacent to Building 61 (Figure 3-2) and were constructed of unknown materials. SWMUs T-GGG and T-HHH (GE Tank ID 61-01 and 61-02, respectively) were each used to store 10,000 gallons of Formex and were in use between 1955 and 1986. These tanks were taken out of production on May 19, 1986 and, at that time, contained 792 and 3,373 gallons of product, respectively. On June 25, 1986, process pumps were used to remove the material, except for the last 180 gallons, which were emptied by Clean Harbors, Inc. on August 8, 1986. These tanks were cleaned and removed from the ground on September 28, 1987 by J.H. Maxymillian, Inc., in accordance with all applicable local, state, and federal regulations. The tanks were then cut up for disposal.

SWMU T-III (GE Tank ID. 61-03) formerly held 5,000 gallons of Cellusolve and was used between 1949 and 1980. This tank was removed from the ground on September 20, 1989 by Clean Berkshires, Inc. under a permit from the Pittsfield Fire Department, in accordance with all applicable local, state, and federal regulations.

SWMUs T-JJJ and T-KKK (GE Tank ID. 61-04 and 61-05, respectively) each held 10,000 gallons of Formex and were used between 1920 and 1972. In 1989, the presumed location of these USTs was determined from existing drawings. Existing drawings show SWMUs T-JJJ and T-KKK to be approximately 2 feet below grade. Excavations were performed to a depth of 5 feet at the location of SWMU T-JJJ and 6 feet at the location of SWMU T-KKK. No evidence of the USTs was found. In addition, storm sewer lines were found to be approximately five feet below grade and running in the direction of SMWU T-JJJ, thereby supporting the conclusion that these USTs were removed previously.

SWMU T-LLL through T-OOO

SWMUs T-LLL, T-MMM, T-NNN, and T-OOO (GE Tank ID. 62-01, 62-02, 62-03, and 62-04 respectively) were constructed of steel and are located adjacent to Building 61 (Figure 3-2). Each UST had a capacity of 5,000-gallons, and each was used to store varsol, cellusolve, xylol, or solvatone. The tanks were constructed in 1955 and it is not known when they were last used. In April 1986, it was observed by opening the access manholes that these tanks had been filled with sand at some time in the past.

SWMU T-PPP and T-QQQ

These two USTs were located adjacent to Building 64Y, as illustrated on Figure 3-2. SWMU T-PPP (GE Tank ID. 64Y-01) had a 10,000-gallon capacity and was used to store fuel oil. SWMU T-QQQ (GE Tank ID. 64Y-02) had a 1,000-gallon capacity and was also used to store fuel oil. It is not known when these USTs were constructed, although both USTs were taken out of service in 1974. Efforts were made in 1986 to locate these tanks using metal detectors, but their locations could not be determined at that time. Further attempts to locate these tanks were made as part of the August 1993 GPRS. The results of these efforts showed an excavation area at the suspected location of Tank 64Y-01, and indicated Tank 64Y-02 to be present (see Appendix E). Tank 64Y-07 is scheduled to be removed as discussed in the Supplemental Phase II SOW/RFI Proposal.

3.4 Underground Pipes and Tunnels

The East Street Area 2/USEPA Area 4 Site is traversed by a series of underground electronic, electric, power, and water conduits, which provide a variety of services throughout the area. Design drawings for these service lines were obtained from GE and the City of Pittsfield Municipal Engineer, and are included in Appendix E. The portion of the GE facility within the East Street Area 2/USEPA Area 4 Site is also underlain by a series of pipelines and tunnels carrying steam, electricity, telephone service, security surveillance, potable water, stormwater, and process wastewater. Drawings of these systems are also included in Appendix D.

SECTION 4 - HYDROGEOLOGIC INVESTIGATIONS

4.1 General

Prior to and as part of MCP work efforts, the soil/fill and groundwater within individual portions of East Street Area 2/USEPA Area 4 have been sampled and characterized. Prior to the initiation of MCP work efforts, investigations focused primarily on mapping and characterizing the oil plume underlying portions of the site and on determining the PCB levels in soils. The recent MCP work efforts have included further investigation of the oil plume, as well as investigations of the soils, fill material, and groundwater in the scrap yard; the former oxbow; the former coal gasification plant area; and other areas of the site. MCP Phase II work activities have focused, in particular, on evaluating the extent of PCBs and other constituents in the soil/fill at the scrap yard and at the former locations of the oxbow and gas plant. The locations of the soil borings and monitoring wells installed at the East Street Area 2/USEPA Area 4 Site, are illustrated on Figure 4-1.

Sections 4.1.1 and 4.1.2 present descriptions of geology and groundwater flow within the study area. These descriptions are based largely on the data contained in the East Street Area 2 MCP Phase II Supplemental Data Summary (Blasland & Bouck, May 1990). Specific hydrogeologic investigation activities are described in the following Sections 4.2 through 4.7.

4.1.1 Geology

Geologic deposits in the area can be categorized by three primary methods of deposition: glacial, glacio-fluvial, and fluvial. Several hydrogeologic cross-sections were completed through the site and their locations are shown on Figure 4-2. Figure 4-3 is a cross-section illustrating the geology just south of the railroad tracks along an east-west transect, while Figure 4-4 is an illustrative cross-section along a north-south transect through the site to the Housatonic River. Four additional cross sections (C-C', D-D', E-E', and F-F') are presented and discussed where appropriate later in this report.

The oldest and deepest unconsolidated deposits that have been found during drilling consist of a brown till. The till deposit is a heterogeneous mixture of unsorted sediment that was formed along the bottom of glacial ice. Since till is made up of tightly packed, poorly sorted material ranging in size from clay to boulders, its permeability is very low. Till was encountered at 30 borings at the site ranging from 0 feet (B1) to 43 feet (ES2-6). Till was penetrated at depths ranging from 1 foot (23, BB, FF, GG, II, and JJ) to 20 feet (B1). Additional discussion regarding the till is provided in Section 4.7.4.

Younger outwash deposits of glacio-fluvial origin overlie the till. These outwash deposits may have been formed during glacial retreat by meltwater, which sorted the material previously carried by the ice. The outwash deposits are composed of soil with more uniform grain sizes and hence are more permeable than the till deposits. The contact between the till and outwash is easy to distinguish because of differences in color and soil type. Moreover, because of differences in porosity and permeability, the outwash deposits below the water table are visually saturated while the underlying till appears to be relatively dry.

In the area south of the railroad tracks, the outwash consists of greenish-gray coarse sand to fine gravel. Lenses of fine sand to silt size material are found intermittently, indicating that short periods of quiet water occurred (probably resulting from temporary damming of the meltwater streams), during which finer-sized sediments were deposited. The thickness of the outwash ranges up to 44 feet.

The outwash deposits thin to the east. Samples from Well WW (see Figure 4-2) suggest that the coarse outwash may grade laterally and vertically into a less permeable silt. To the south of East Street and in the scrap yard areas, the outwash interfingers in places with silts containing brown peat layers and scattered organic matter. This suggests that localized swampy conditions were present at the time of deposition.

North of Building 29B the outwash deposits interfinger with a greater than 25-foot-thick sequence of poorly sorted sediments that may have been part of a braided stream complex or alluvial fan emanating from the hills to the north.

The coarse deposits underlying the 3-C yard area (shown by the borings for Wells 29 and 24; Figures 4-2 and 4-4) grade vertically upward into brown floodplain deposits. These soils are finer grained and contain a higher percentage of silt. South of Building 29B, the contact between more recent floodplain deposits and the underlying outwash is distinguished by changes in both color and grain size.

The floodplain sediments are the youngest naturally occurring deposits in the area. The rapidly changing floodplain environment caused discontinuous lenticular deposits to be formed, thereby making lateral correlations difficult. Two general groups of floodplain deposits are present in the study area: 1) low-permeability, silty swamp deposits; and 2) sandier deposits formed during flooding when the river topped its banks. South of East Street, lenses of gray, micaceous silty deposits, approximately 2 to 5 feet thick, predominate. These materials grade into coarser deposits both laterally (toward the north) and vertically. The coarser deposits were probably laid down as the meandering Housatonic River periodically overflowed its banks (Geraghty & Miller, August 1981).

Bedrock, which has been described as the Stockbridge Limestone belonging to the Stockbridge Formation, underlies the till. The Stockbridge Formation in this area is described as being a coarsely crystalline, white to light gray, blue-gray, and white-mottled, layered or massive, white calcitic marble (Pitts. East Quad, Mass, USGS). The Stockbridge Limestone is reported to generally be a low yielding formation for groundwater due to its metamorphosed state, but yields may be higher depending on the degree and extent of the fractures present. This unit is reported to vary in thickness from 500 to 800 feet and to have a porosity of 1.38 percent (Bagg, 1929).

4.1.2 Groundwater Flow

The general groundwater flow direction at the site is to the south, towards the Housatonic River with a limited component of groundwater flow toward Silver Lake in the western portion of the area. Water-level measurements have been taken periodically since January 1980 and are included in Appendix F. Groundwater contour maps derived from data obtained in October 1982, April 1986, October 1989, and April 1994 are shown on Figures 4-5, 4-6, 4-7, and 4-8, respectively. The water-table configurations shown on these four figures are similar. Water-table elevations throughout the site range from 1,020 to 958 feet above sea level for the years illustrated, descending in a generally southern direction. (It is important to note that beginning in September 1988 the datum against which groundwater elevations were measured was shifted approximately 11 feet higher.) The water table gradient is variable in East Street Area 2. A steep gradient (typically greater than 0.1 ft/ft) is present north of East Street, and flattens out south of East Street where gradients of less than 0.01 ft/ft are typically observed. The presence of the groundwater recharge pond and several operating recovery systems influences groundwater flow direction. The influence of these features on groundwater flow can be observed by comparing the groundwater contour map from 1982 (Figure 4-5), prior to operation of recovery systems, with the 1989 contour map (Figure 4-7).

4.2 Oil Plume Investigations

The East Street Area 2 Site has been the subject of a number of remedial investigations designed to characterize the occurrence of subsurface oil. Although a portion of the oil plume appears to originate in the area between East Street and Buildings 12-X, 12-Y, and 3-C, it extends south of East Street to recovery systems 64S and 64V, the recharge pond, and slurry wall. Tar liquors and oils released by Berkshire Gas as part of their manufactured gas operations at the site appear to have contributed certain constituents to the subsurface oil at the site. Prior investigations, as well as the MCP Phase II investigation, have attempted to identify the sources of the oil and the extent of the releases associated with each source. The data collected during pre-MCP investigations is summarized in Section 4.2.1. A discussion of data collected as part of MCP Phase II activities is included in Section 4.2.2. A discussion of the historic oil plume migration is presented in Section 4.2.3, while Sections 4.2.4 and 4.2.5 discuss activities related to the subsurface oil seepage into the Housatonic River, as well as on-going and proposed recovery operations. An interpretation of the data collected is provided in Section 4.2.6.

4.2.1 Pre-MCP Oil Plume Investigations

This section presents a brief summary of oil plume investigation activities that were performed prior to the MCP Phase II investigations within East Street Area 2. This information is taken from the "East Street Area 2, MCP Phase II Supplemental Data Summary" (Blasland & Bouck, May 1990), the semiannual monitoring summary reports entitled "Occurrence of

Oil, East Street Area 2," prepared by Geraghty & Miller and Groundwater Technology, as well as the "Area 2 River Bank Investigation" (GE, August 1990a).

Over 170 monitoring wells and piezometers have been installed to obtain water-level and oil-thickness data, and to determine the extent and movement of the oil plume. Figure 4-9 shows the monitoring well and piezometer locations and illustrates the sequence of installation. Table 4-1 presents a summary of associated well construction data.

Soil samples were collected at each well location for visual characterization. A hollow-stem auger rig was used to drill to the appropriate depth, and soil samples were collected as needed through the stem of the augers using split-spoon samplers. The well casings and screens were installed through the hollow auger flights which were then pulled back to complete the well.

The wells are constructed of polyvinyl chloride (PVC) casing and pre-slotted (0.020-inch slot) screen. The screens bridge the water table and any apparent oil-stained zone in the subsurface. The monitoring wells were finished either approximately 3 feet above the ground surface or in flush-mount curb boxes.

The wells were initially developed by bailing. Two to three liters of oil/water were removed from each of the wells and the recovery was measured. This activity was performed periodically and yielded data that determined the connection of the well to the oil plume, as well as the relative size of the oil plume. Initially, oil thickness and water-level measurements were taken approximately one week after the wells were bailed.

The first group of wells was installed by Geraghty & Miller, Inc., in December 1979 (Figure 4-9) to measure water levels as part of a general groundwater mapping program. Oil was detected in some of these wells, and a broader study was initiated to determine its source and extent. in January 1980, a second group of wells was installed (Figure 4-9). These wells contained a sheen or trace of oil, but the source of the plume was not confirmed.

A third group of wells was installed under the supervision of O'Brien & Gere Engineers, Inc., from June 1980 through August 1980, in an attempt to locate the northern extent of the oil plume. This group consisted of 45 wells located north of the railroad tracks and in the field south of East Street. These well locations are illustrated on Figure 4-9. The data from these wells indicted that oil was present to some degree over a wide area north of the tracks between wells 19 and 14. Oil was also found in the field south of East Street indicating that the scope of the problem was greater than initially anticipated. In addition, more than one type of oil was identified, which suggested that more than one source may have been responsible for the plume (Geraghty & Miller, August 1981).

In September through December 1980, Geraghty & Miller, Inc., installed 39 additional monitoring wells south of Buildings 12 and 3C, and in the area south of East Street, as illustrated on Figure 4-9. Data from these wells located the eastern and western boundaries of the plume and the areas of greatest oil accumulation. In addition, five different types of oil were identified based on visual characteristics. Twenty additional wells were installed in the field south of East Street in May 1981 to locate the southern terminus of the plume (Figure 4-9).

Additional wells and piezometers were installed after 1981 and before MCP activities to: 1) fill in data gaps; 2) assist in evaluating the effectiveness of oil recovery systems; 3) replace damaged wells; and 4) better define oil thickness and groundwater flow direction (Figure 4-9).

Sources contributing to the oil plume have been tentatively identified based on the historical configuration of the plume's thickness and observations of the oil itself. One source is associated with Buildings 3-C and 12G and possibly their associated pipes and sewer lines. Oil from this source is amber colored, darkening with distance from the 3-C yard. The amber colored oil emanating from the 3-C yard area has apparently spread eastward toward Building 12, and then southward under the railroad tracks into the area of Building 29-B. Wells CC, DD, and PP, located adjacent to and south of the railroad tracks and adjacent to Building 29-B, contain both an amber and a colorless oil. The colorless oil was reported to overlie the amber-colored oil.

The oil in the area south of former Building 24 (tank farm area) has a dark color. This oil may have originated from the tank farm area. A significant amount of dark-colored oil has been recovered in wells SS, TT, J, K, L, M, A, B, and wells 6, 7, and 8. A black, viscous oil has been observed south of East Street. The oil in this area appears to be a mix of the amber-colored oil and the dark oil. The oil found in wells south of Building 64 in the scrap yard area (wells 11, 12, 13, 14, and 15) is described as similar in color and odor to cutting oil used in the area around Building 64.

Data concerning the oil plume were initially generated during a quarterly water-level measurement program conducted in 1980 and 1981. All wells with positive oil thickness readings were included in a periodic bailing program. During the bailing program, two to three liters of oil, or all of the oil in each well, were removed and the recovery responses of the wells were recorded. Plume boundaries and oil thickness within the subsurface were delineated using this procedure.

A semiannual oil monitoring program involving select monitoring wells has been conducted at the East Street Area 2/USEPA Area 4 Site since 1981. The purpose of this program is to determine the groundwater flow pattern in the area and to monitor the extent and thickness of oil present. Monitoring occurs in the spring (when groundwater levels are expected to be seasonally high) and in the fall (when groundwater levels are generally low). The semiannual monitoring reports are submitted to the MDEP and USEPA, and contain a detailed description of the methodologies and the results of each monitoring event. A summary of historic groundwater elevations, oil thicknesses, and oil recovery volumes in select wells is provided in Appendix F.

In 1988, an oil-absorbent boom system was installed along the north bank of the Housatonic River adjacent to the site. This action was taken to contain oil that was seeping intermittently into the Housatonic River from the bank.

In 1989 and 1990, GE conducted a two-phased investigation of the oil seep area along the riverbank adjacent to the site. The objectives of this investigation were to define the extent of subsurface oil, characterize subsurface stratigraphy, and design and implement a remedial plan to limit the impact of the oil. The investigation included the completion of a series of borings and piezometers. The riverbank study area and the boring and piezometer locations are shown on Figure 4-14.

The riverbank investigation was undertaken in phases. The first phase was implemented during October and November 1989 and involved the drilling of 21 soil borings (SB-1 through SB-21) and the installation of six piezometers (PZ-1S, PZ-1D, PZ-2S, PZ-3S, PZ-3D, and PZ-4S). The borehole depths ranged from 10 to 20 feet below ground surface.

A total of 18 of the 21 Phase I soil borings encountered oil-stained soil. The staining was observed in two zones, a stained zone, and a lightly stained zone. The stained zone, extending from SB-8 to SB-18, was approximately 7 feet thick and was most prevalent in the vicinity of the water table. The lightly stained zone was dispersed vertically above and below the stained zone and varied in thickness. The majority of the stained soil appeared to be in the saturated zone, which indicated that oil had migrated with groundwater. Some staining was found to exist in the unsaturated zone which was probably the result of oil being adsorbed onto the soil particles during seasonal water table fluctuations. A cross-section (C-C') depicting the stained zones is presented on Figure 4-15. (The location of this cross-section is shown on Figures 4-2 and 4-14.)

The Phase I investigation established that the occurrence of subsurface oil is "diffuse" in nature. No oil pockets were encountered; rather, the subsurface oil was observed as a zone of oil-stained soil. During Phase I, water-level and oil thickness measurements in all piezometers were recorded. The only detection of floating oil was in piezometer PZ-3S, where an apparent thickness of 0.11 feet was noted.

The Phase I investigation led to a second phase to further understand the presence of oil and mechanisms controlling its movement in this area and to develop a remedial plan. The Phase II investigation was conducted in June 1990. This investigation included the installation of six soil borings (SB-22 through SB-27) and 15 piezometers (PZ-5S, PZ-6S, PZ-7S, and WP-1 through WP-12), visual observations of the riverbank and the riverbed, and the performance of hydraulic conductivity tests.

The piezometers were constructed of 2-inch-diameter PVC with 6 feet of 0.020-inch slotted screen. Piezometers WP-1 through WP-12 were driven into the river bank and into river bed sediments. A 10-pound sledge hammer was used to manually drive these piezometers to the desired depths. The piezometer depths range from 7 to 24 feet below ground surface. The driven piezometers consisted of 2-inch-diameter, threaded steel casing with 2 or 4 feet of 0.020-inch slotted stainless steel screen. Each piezometer was developed to ensure hydraulic connection between the screened zone and the formation.

During Phase II of the investigation, water-level and oil thickness measurements were recorded in all (i.e., both Phase I and Phase II) piezometers. Floating oil was measured in three piezometers, PZ-3S, PZ-7S, and WP-3. These piezometers contained 0.07, 0.08, and 0.10 feet of floating oil, respectively. In addition, oil thickness measurements recorded on June 19, 1990, indicated between 0.01 and 1.05 feet of oil in piezometers PZ-3S, PZ-5S, PZ-7S, PZ-6S, and WP-3.

Visual observations were made of the presence of oil along the riverbank and in the riverbed (shoreline). An oil sheen was observed on the surface of the river water near NPDES Outfall 006. Oil seepage was also observed at the southeastern corner of the headwall of Outfall 006 and approximately 8 feet from the western end of the outfall head wall. Further, while digging near the southeastern corner of the head wall, a golden brown oil film was observed at the seam of the concrete head wall and in the surrounding soil.

Outfall 006 was constructed in the early 1970s. The outfall consists of a 36-inch diameter reinforced concrete pipe, which is used to discharge water from GE recovery system 64X. The pipe runs from the western end of the Building 64-X oil water separator unit to the river, where it meets the concrete head wall and a discharge ramp. The Outfall 006 pipe, was exposed during the installation of piping connecting oil recovery systems 64X(S) and 64X(W). (The oil recovery system piping was being installed in a gravel packed trench with a vertical 1-foot-thick clay barrier wall along the downgradient side of the trench.) To decrease the potential for fluids to migrate along the discharge pipe, the pipe was wrapped with the clay material used to construct the barrier wall, thus creating a hydraulic seal around the pipe. However, this clay seal has been observed to be deteriorated, increasing the potential for oil to migrate along the pipe into the river. Based on these observations, and the oil measured in piezometer PZ-5S, which is screened adjacent to the outfall, it appears that oil may be migrating along the outfall discharge pipe.

As a result of these investigations and as part of the MCP process, GE provided a proposal to the MDEP in August 1990 for implementation of an STM for the oil seep in this area (GE, August 1990b). Details regarding ongoing and proposed STM activities are presented in Section 4.2.5.

4.2.2 MCP Oil Plume Investigation

As part of MCP Phase II activities, two samples of oil -- one from caisson 64V and one from caisson 64S -- were collected and analyzed for the constituents listed in Appendix IX of 40 CFR Part 264, plus three additional constituents: benzidine, 2-chloroethyl vinyl ether, and 1,2-diphenylhydrazine (Appendix IX+3). The analytical data are presented in Table 4-2.

The volatile organic compounds (VOCs) detected in oil samples from caissons 64V and 64S were chlorobenzene (250 and 540 ppm, respectively), ethylbenzene (800 and 64 ppm), total xylenes (830 and 71 ppm), and 2-butanone (170 and 100 ppm). Benzene was detected at 64V (190 ppm), but not at 64S.

In many cases, the detected concentrations of semivolatile organic compounds (SVOCs) in the oil exceeded 1,000 ppm (Table 4-2). The SVOCs detected at the highest concentrations in caissons 64V and 64S were acenaphthene (10,300 and 546 ppm), naphthalene (49,270 and 7,700 ppm), phenanthrene (22,090 and 1,592 ppm), and 1-methylnaphthalene (11,970 and 1,539 ppm). In general, the concentrations of SVOCs were an order of magnitude higher in caisson 64V than in 64S.

Total polychlorinated dibenzo-p-dioxin (PCDD) compound concentrations of 0.00086 ppm and 0.0118 ppm and total polychlorinated dibenzofuran (PCDF) compound concentrations of 0.0024 ppm and 0.0257 ppm were detected in the oil at 64V and 64S, respectively. Maximum PCB concentrations of 14,000 and 53,000 ppm were detected in the oil from caissons 64V and 64S, respectively. Five metals were detected in the oil at one or the other caisson at concentrations of less than 2 ppm.

4.2.3 Oil Plume Migration Assessment

The historical migration of the oil plume can be observed through time from oil thickness contour maps. Oil plume thickness maps for October 1982, April 1986, October 1989, and April 1994 are provided as Figures 4-10, 4-11, 4-12, and 4-13, respectively. With the exception of April 1994 data, measured oil thicknesses are grouped into three categories: thicknesses greater than 0.8 feet, thicknesses between 0.01 and 0.8 feet, and thicknesses less than 0.01 feet (referred to as trace levels). Trace levels are not indicated for the April 1994 data. A summary of the oil thickness data collected during the semiannual monitoring program and oil recovery volumes is included in Appendix F.

In October 1982 the area of the main oil plume with measured thicknesses greater than 0.8 feet was primarily located north of East Street. The area of the main oil plume in 1982 extended south to the former oxbow channel, and it encompassed half of the parking lot to the west. By April 1986, the area of the oil plume with measured thicknesses greater than 0.8 feet was located primarily south of East Street. The southeastern edge of the oil plume in 1986 extended to the Housatonic River; however, the southwestern edge had not migrated further than its October 1982 boundary. Between April 1986 and October 1989, oil recovery systems 64X and 64V were constructed and operating. As a result, the area of the main oil plume with measured thicknesses greater than 0.8 feet decreased in size and "retreated" somewhat to the north as the southeastern edge of the plume was contained by recovery system 64V and the recharge pond. The southwestern plume edge formed a lobe that migrated south of the former oxbow channel. However, the western edge retreated east of the parking lot.

Based on the April 1994 oil thickness map (Figure 4-13), the overall area of the plume has been reduced. The lobe that was present in the southwestern edge in 1989 has retreated north, toward recovery system 64S. The extent of the oil plume in the area north of the railroad tracks remains essentially the same, but the oil thickness has been reduced.

The southeastern leading edge of the main oil plume is contained by recovery system 64V and the recharge pond. The edge of the plume in this area has migrated within the former oxbow channel to the northern boundary of the recharge pond. Since the recharge pond functions as a groundwater recharge mound, the migration of oil with groundwater should be directed toward recovery system 64V and the slurry wall. Only small amounts of oil have historically been measured in the wells and piezometers located between the recharge pond and 64X, indicating that oil is not escaping between the recharge pond and the recovery system. Oil measured periodically in wells 55 and 58, located downgradient of the slurry wall, appears to be attributable to migration that occurred prior to the construction of recovery system 64V and the slurry wall. Because this is a hanging slurry wall extending approximately 22 to 24 feet below ground surface and not to the top of till, the area just south of the wall is influenced by the pumping at 64V. This has apparently created a stagnant pocket of oil near well 55 that appears to be localized. A number of wells in this area have been monitored by GE on a weekly basis since 1989.

Other small accumulations or "pockets" of oil are present in East Street Area 2. These pockets are located outside the main plume area. In the area south of Building 64 and north of the scrap yard area, oil has been measured in wells 12, 13, 14, and 15R. This oil pocket does not appear to extend west to well 16, east to well 11, or south to well ES2-5, since oil has not historically been measured in these wells. Another oil pocket has historically been measured around recovery system 64X in the three caissons, 64(N), 64X(W), and 64X(S). Oil thicknesses have decreased through time and have not exceeded 0.1 foot since 1990 in these caissons. Oil has not historically been measured in wells 53, 54, and 63, located east and west of system 64X, indicating that oil does not extend beyond the recovery system in these directions. An isolated pocket of oil has also been measured in well 50. Oil has historically been measured in this well since 1988, but does not appear to be migrating since oil has not been measured in well 51 to the west or well 64 to the south.

In September 1993, GE installed eight new wells to better assess oil occurrences in East Street Area 2 (Figure 4-9). Two of these wells were specifically installed in the vicinity of well 50 to assess the small pocket of oil found at that location. Information related to these activities is included in a report entitled "East Street Area 2 - Supplemental Monitoring Wells" (RUST, December 1993).

4.2.4 Summary of Oil Recovery Operations

In general, GE has implemented various programs to address environmental concerns at the site including measures to control and remove the oil. The primary activities performed by GE have involved source management and cleanup, including the operation of oil recovery collection systems, installation of a subgrade slurry wall, and installation and operation of a groundwater treatment facility.

There are four active oil collection systems which actively pump groundwater and recover any accumulated oil. They are referenced as 64S, 64V, RW-1(X), and RW-2(X) (Figure 4-1). Recovery system 64S is located near the former oxbow channel. Recovery system 64V is located east of the recharge pond and upgradient (north) of the "V" shaped slurry wall that aids in the collection and control of the oil plume. Systems RW-1(X) and RW-2(X) are located between the slurry wall and the Housatonic River, just south and west of the 64X system [although oil collection equipment is not currently in place at RW-2(X)]. A fifth recovery system, 64X, is currently inactive, and a sixth recovery system, 64R, located north of the recharge pond, has been utilized intermittently. System 64X is located between the slurry wall and the Housatonic River.

Recovery systems 64S and 64R consist of 5- to 8-foot-diameter caissons with 8-inch-diameter lateral pipes that collect oil and water and move it to the caissons. System 64V consists of a 2-foot- diameter caisson and utilizes a well screen rather than collection laterals to collect oil and water. The caissons are equipped with groundwater pumps and oil skimmer pumps.

The 64X system is comprised of three caissons, 64X(N), 64X(S), and 64X(W). A collector trench runs between caissons 64X(W) and 64X(S), parallel to the Housatonic River. This collection trench is approximately 10 feet deep and 3 feet wide. A series of 8-inch-diameter lateral pipes are present inside the trench to collect oil and water and direct it to the caisson. The south wall of the trench has a double layer comprised of a one-foot thick layer of clay, underlain by a 60 millimeter, high density polyethylene (HDPE) liner.

Systems RW-1(X) and RW-2(X) were installed and are operated as part of a STM/interim measure program to recover oil along the Housatonic River. These systems are equipped with groundwater depression pumps and floating product is skimmed off as necessary. The oil recovered from these systems is collected for disposal at the Thermal Oxidizer.

The historical oil recovery volumes for the three currently operating systems 64S, 64X, and 64V, are presented in Appendix F. A fourth recovery system, 64R, located upgradient of 64V and the recharge pond, operated from May 1985 to November 1988. With the exception of a few months starting in November 1991, system 64R was taken out of service due to the limited oil recovery achieved in comparison to system 64V. Recovery system 64S has operated since 1983 and has recovered between 9,000 and 25,800 gallons of oil per year. The successful recovery of oil from the western edge of the main plume by recovery system 64S is reflected in the decreasing oil thicknesses measured in wells in the vicinity of 64S. Recovery system 64X has been operating since 1985 and has recovered between 500 and 11,000 gallons of oil per year. The volume of oil recovered in 64X has decreased with time as the oil pocket in this area has been successfully recovered. Recovery system 64V has been operating since 1988 and has recovered between 17,000 and 39,500 gallons of oil per year. Recovery system 64V, in conjunction with the slurry cutoff wall and recharge pond, successfully maintains and recovers oil from the southeastern edge of the main plume.

Prior to October 1991, groundwater recovered from these systems was discharged to the on-site recharge pond. However, also as part of the MCP STM program, the discharge of untreated groundwater to the recharge pond was halted and the 64-G Groundwater Treatment Facility was constructed to provide treatment of the recovered groundwater. The majority of the treated water is discharged to the Housatonic River through NPDES Outfall 005, while a smaller portion is discharged to the groundwater recharge pond to maintain a constant water elevation. The groundwater mound created by the recharge pond creates an additional hydraulic barrier which further limits flow of oil toward the river.

A more detailed discussion of the on-going and proposed STM activities concerning dealing with oil recovery operation associated with the site are presented in Section 4.2.5.

4.2.5 Summary of Short-Term/Interim Measure Activities

4.2.5.1 General

GE has been active in recovery and containment of the subsurface oil plume found at the East Street Area 2/USEPA Area 4 Site as well as in the containment and abatement of the intermittent oil seeps along the bank of the Housatonic River adjacent to the site.

These on-going activities have been performed to date under MDEP review and approval as STMs under the MCP. Now that the Corrective-Action Permit has become effective, these activities will now be conducted as an STM/Interim Measure under the review and approval of the MDEP and USEPA. To this end, Interim Measure Proposals entitled "Oil Recovery Programs in East Street Areas 1 and 2" (Blasland, Bouck & Lee, February 1994a) and "Control of Oil Seepage Into the Housatonic River" (Blasland, Bouck & Lee, February 1994b) have been developed and submitted to USEPA under separate cover, with a copy to MDEP. Section 4.2.5.2 describes the STM activities that have taken place at the East Street Area 2/USEPA Area 4 Site to date and Section 4.2.5.3 summarizes GE's plan for future

STM activities under the MCP and as an Interim Measure under the Permit. [Although the recently revised MCP now refers to STMs as Immediate Response Actions (IRAs), this report continues to refer to GE's seepage control activities as STMs for convenience, since they began as STMs. In the present context, the term STM should be deemed equivalent to an IRA under the revised MCP.]

4.2.5.2 Review of Prior STM Activities

Oil Recovery Operations

The August 1990 STM proposal under the MCP (GE, August 1990b) included several provisions regarding the existing oil recovery facilities at the East Street Area 2/USEPA Area 4 Site. The STM proposal was modified and refined based on communications between the MDEP and GE, as well as supplemental technical studies. The STMs proposed for this area included the construction of a Groundwater Treatment Facility (GWTF) for the groundwater removed from the active recovery systems. The GWTF was designed to remove PCBs, VOCs, SVOCs, and metal constituents contained in the groundwater. The plans for the proposed facility were submitted to the MDEP in October 1990, approval was received on November 28, 1990, and the facility began operation in October 1991. This facility, known as Building 64-G, is shown on Figure 1-2.

Since the GWTF has been on-line, the oil recovery systems have operated with limited down-time. The caissons at both ends of the main oil plume (64S and 64V) have separate pumps for both groundwater and oil. The groundwater is received by the retention structure which serves as a pumping station for the Building 64-G GWTF. The groundwater depression pumps in the 64X recovery system were deactivated in November 1993 when well RW-2(X) was installed;

however, the oil skimmers located at the 64X recovery system remain in operation.

Active groundwater pumping and oil recovery along the Housatonic River bank is also on-going as part of the MCP STM program using recovery wells RW-1(X) and RW-2(X), which are located near the 64X recovery system. These activities are discussed in more detail below.

In addition, GE has evaluated the adequacy of the slurry wall to perform its intended operation (oil plume containment) through monitoring of wells adjacent to the slurry wall (both upgradient and downgradient). This program has been performed by GE for several years and includes weekly monitoring of the following wells: 42, 48, 49R, 49RR, 53, 54, 55, 56, 57, 58, and 59 (see Figure 4-1). At each well, the position and depth of water and oil (if any) is recorded.

GE has also conducted an overall oil monitoring program for East Street Area 2 on a semiannual basis for over 10 years. This program occurs in the spring and fall and includes maps of groundwater flow and oil occurrence, as well as a six-month summary of oil and groundwater removed from the various recovery systems.

Control of Riverbank Oil Seepage

As mentioned previously in Section 4.2.1, GE installed an oil-absorbent boom system along the north bank of the Housatonic River adjacent to the site in 1988 to contain oil that was seeping intermittently into the Housatonic River.

The boom system has been maintained and is typically inspected three times per week. During the more severe winter months, the booms are inspected five times per week. Each inspection involves a number of activities, including checking the integrity of the boom system and the removal/replacement of the absorbent materials as needed. If the oil sheens are extensive within the boomed area, they are manually removed from the water surface using oil absorbent materials. However, according to the Clean Berkshires' personnel that perform the inspection, this is seldom necessary since RW-1(X) and RW-2(X) were installed.

As further explained in Section 4.2.1, GE conducted a two-phase investigation of the oil seep in this area in 1989 and 1990 (GE, August 1990a). The results of that study led to GE's preparation and issuance of a proposal for the implementation of STMs as part of the MCP process (GE, August 1990b). In the STM proposal, GE proposed to initiate passive oil recovery from existing piezometers. Passive oil recovery consisted of oil removal (by either the use of portable skimmers or manual bailing) for any piezometers where 0.1 feet of oil or greater was detected during weekly monitoring. GE proposed to perform this weekly monitoring (and removal) for 90 days, and at the end of this 90-day period to provide an evaluation of this passive oil recovery program and any recommendations for further actions.

During the fall of 1990, the MDEP and GE entered into a dialogue regarding the contents and scope of the August 1990 proposal. As a result of this dialogue, the following STM activities were identified:

1. Passive oil recovery activities would be performed on the following existing 2-inch piezometers: PZ-1S, PZ-3S, PZ-4S, PZ-5S, PZ-6S, PZ-7S;
2. One gravel-packed, 4-inch passive recovery well (RB-1) would be installed where passive recovery on the two-inch piezometers indicated that oil recovery would be the greatest; and
3. Within 90 days following implementation of the STM, GE would submit a report addressing the following items:

- Drilling logs for the 4-inch recovery well (RB-1);
- Evaluation of passive recovery efforts on the existing 2-inch piezometers;
- Preliminary evaluation of the passive recovery effort on recovery well RB-1;
- Evaluation of active groundwater pumping by the 64X(W) oil recovery caisson;
- Evaluation of the effectiveness of sheet piling or an additional slurry wall along the riverbank area to inhibit oil migration toward the river and to enhance active groundwater/oil recovery in the area; and
- Recommendations for future active groundwater recovery in the area, including possible additional active groundwater/oil recovery systems located south of the 64X(W) system.

In accordance with the MDEP requirements, GE carried out these activities and prepared an evaluation of the effectiveness of the STM in a letter report to the MDEP dated February 5, 1991 (with a copy to USEPA). That report presented the following findings:

1. Passive oil recovery efforts in the riverbank area were not greatly successful;
2. The effectiveness of sheet piling as an oil plume barrier was unclear; and
3. Pumping the existing 64X(W) oil recovery system at a rate of 50 to 100 gallons per minute (gpm) might be more effective than the use of sheet piling in controlling oil migration in this area.

Based on these findings, GE proposed to perform controlled pumping tests of oil recovery system 64X(W). The MDEP approved this proposal and Golder Associates was retained by GE to perform an evaluation of oil recovery system 64X(W) and a pump test of well RB-1. The results of the pump tests were submitted to the MDEP on April 30, 1992 in a report entitled "Pumping Test Analyses and Evaluation of Recovery Measures - East Street Area 2" (Golder, April 1992). A copy was again provided to the USEPA.

As a result of the evaluation of pumping tests at 64X(W) and RB-1, as well as several groundwater flow models, a program of active oil recovery was recommended in the April 1992 Golder report to effectively control oil seepage into the river. Specifically, the following program was recommended:

1. Install an extraction well between 64X(W) and the riverbank;
2. Install groundwater depression, floating product skimmer pumps, and associated piping;
3. Begin pumping the new extraction well at a rate of approximately 30 gpm, pump the collected groundwater to the 64-G Groundwater Treatment Facility, and dispose of recovered oils at the Thermal Oxidizer;
4. Over a period of approximately one month, make adjustments to the pumping rate, if necessary, to expand the zone of influence (i.e., cone of depression) to achieve oil capture down to the riverbank;
5. Continue pumping for a period of six months to collect data for an assessment of the effectiveness of the recovery well; and

6. Passively collect oil on a weekly basis from any piezometers in the riverbank area that are not within the capture zone of the new extraction well.

The MDEP conditionally approved the proposal for active recovery on July 10, 1992, and additionally requested that GE begin active recovery within six months and prepare a report detailing the results of the program within 11 months. GE installed recovery well RW-1(X) along the riverbank and began actively pumping groundwater on December 7, 1992.

On January 5, 1993, GE transmitted a letter to the MDEP (with a copy to USEPA) proposing modifications to the passive oil collection and monitoring program in the riverbank area. These modifications included:

1. Passive oil recovery from piezometers PZ-2S, PZ-3S, PZ-7S, and well RB-1 would be discontinued since these monitoring points are within the zone of influence of oil recovery well RW-1(X).
2. Passive oil recovery from piezometers WP-1 and WP-3 would continue since they are adjacent to the river, despite being within the zone of influence of RW-1(X). However, it was proposed that oil be bailed from these piezometers when the accumulated oil thickness reached 0.5 feet (as opposed to 0.1 feet previously suggested in the August 1990 proposal).
3. Passive oil recovery from piezometer PZ-1S would continue because it is not within the zone of influence of RW-1(X). Again, however, it was proposed that oil be bailed from this piezometer when the accumulated oil thickness reached 0.5

feet (as opposed to 0.1 feet previously suggested in the August 1990 proposal).

In a letter dated April 20, 1993, the MDEP agreed to the above modifications subject to the condition that oil bailing of piezometers WP-1, WP-3, and PZ-1S be performed when the oil thickness reached 0.25 feet, as opposed to the proposed 0.5 feet. The MDEP additionally requested that a report evaluating the performance of the RW-1(X) oil recovery well be submitted by June 10, 1993.

Golder Associates was retained by GE to perform the evaluation of the RW-1(X) recovery well as requested by the MDEP. The results of this evaluation were submitted to the MDEP (with a copy to the USEPA) on June 10, 1993, in a report entitled "Evaluation of River Bank Recovery Measures: RW-1(X) System East Street Area 2" (Golder, June 1993). Based on the evaluation of the RW-1(X) system, GE proposed the following modifications to the ongoing STM in the riverbank area:

1. To extend hydraulic control to the remainder of the seep area, an additional recovery well RW-2(X) would be installed approximately 80 feet west of RW-1(X) (constructed in a similar fashion). The anticipated pumping rate of well RW-2(X) would be 20 to 30 gpm. The recovered groundwater would be treated at the 64-G Groundwater Treatment Facility and recovered oil would be disposed of at the Thermal Oxidizer.
2. Passive oil recovery from piezometer PZ-1S would be discontinued since it would be within the zone of influence of proposed oil recovery well RW-2(X).

3. Passive oil recovery from piezometers WP-1 and WP-3 would continue if the oil thickness was greater than 0.25 feet.
4. An additional piezometer (WP-13) would be installed at the midpoint between piezometers WP-4 and WP-5 to monitor the effectiveness of proposed oil recovery well RW-2(X).
5. Monitoring of piezometers in the riverbank area and riverbank inspections would continue. Data on the volume of oil and water recovered from both RW-1(X) and RW-2(X) would be submitted in the MCP monthly reports. Further evaluations related to oil and water recovery from wells RW-1(X) and RW-2(X) and future recommendations as to the need for the continued operation of these oil recovery wells would be described in the semi-annual oil monitoring report for East Street Area 2.

The MDEP approved these STM modifications and active pumping of well RW-2(X) began on November 12, 1993. While WP-13 has not been installed to date, it is anticipated to be installed in 1994.

4.2.5.3 Current and Planned Oil Recovery and Seepage Control Measures

GE's current plans for continued efforts to address oil recovery at the East Street Area 2/USEPA Area 4 Site and oil seepage along the riverbank of this area are described in Interim Measure Proposals on these topics submitted to the USEPA (Blasland, Bouck & Lee, February 1994a,b) and involve the following elements:

Oil Recovery Operations

1. Continue the operation of the active groundwater and oil recovery systems (64S and 64V) at both ends of the main oil plume south of East Street;

2. Continue to assess the effectiveness of the slurry wall to prevent migration of the main oil plume toward the river through weekly monitoring of wells 42, 48, 49R, 49RR, 53, 54, 55, 56, 57, 58, and 59 for the presence and depth of oil and groundwater and evaluation of these monitoring results;
3. Provide the MDEP and USEPA with monthly status reports to include data from the wells near the slurry wall and the volume of groundwater and oil recovered via the active oil recovery systems; and
4. Continue the semiannual oil and groundwater monitoring program in all other respects as well to verify the effectiveness of the current recovery systems.

Control of Riverbank Oil Seepage

1. Continue operation and maintenance of the boom system in the Housatonic River in the area of this seep, including an inspection of the boom system three times per week (five times per week in winter conditions), with maintenance as necessary (including lengthening of the booms, if that should become necessary);
2. At a minimum of once per month, remove oil sheens (if present) using oil absorbent materials (e.g., pads, pillows, and manual skimmers);
3. Continue active oil recovery utilizing recovery wells RW-1(X) and RW-2(X), and submit data on volumes of oil and groundwater recovered from both RW-1(X) and RW-2(X) to the USEPA and MDEP in monthly status reports and evaluate the

data further in the East Street Area 2 semiannual oil monitoring reports;

4. Perform weekly monitoring at RW-1(X), RW-2(X), 64X(S), 64X(W), WP-1, WP-2, WP-3, WP-4, WP-5, WP-6, PZ-1S, and PZ-6S (WP-13 will be included when installed) and weekly monitoring of the river stage as well as monthly monitoring at PZ-2S, PZ-4S, PZ-5S, RB-1 and 64X(N); and
5. Perform passive oil recovery in piezometers WP-1 and WP-3, if greater than 0.25 feet of oil is detected in those piezometers.

4.2.6 Interpretation of Oil Plume Results

This section presents a summary and interpretation of the oil plume data.

- The semiannual monitoring program provides information on oil thickness as well as groundwater elevation data to aid in delineating and monitoring the oil plume. The semiannual program has been conducted for over ten years and representative maps depicting the historic oil plume configuration and thicknesses are presented in Figure 4-10 for October 1982, Figure 4-11 for April 1986, Figure 4-12 for October 1989, and Figure 4-13 for April 1994. Based on the April 1994 monitoring results, the thickest oil accumulation is south of East Street. As of April 1994, the plume covers an area of approximately 6 acres. At its maximum width, the plume extends approximately 870 feet from east to west. Based on the April 1994 oil thickness map, the overall area of the plume has been reduced compared to its configuration in October 1989.

- The southeastern edge of the main oil plume is contained by recovery system 64V and the recharge pond. The southwestern edge of the main oil plume is located in the vicinity of recovery system 64S, which is actively recovering oil. The oil pocket south of Building 64 has been laterally delineated from oil thickness data provided by the semiannual monitoring program, and appears to be stable. Oil thicknesses in the oil pocket around recovery building 64S have decreased through time and in this area have not exceeded 0.1 feet since 1990.
- Recovery systems operating at the East Street Area 2/USEPA Area 4 Site have successfully recovered approximately 450,000 gallons of oil from 1983 to 1994.
- The occurrence of oil along the riverbank area, south of recovery system 64S, is diffuse and identified as a stained zone. Seepage of oil is occurring intermittently along the riverbank in this area. An oil collection system consisting of absorbent floating harbor booms is in place in the Housatonic River along the seep area. In addition, various oil recovery systems maintain control of the oil and prevents downstream migration within the river. GE has also implemented a weekly monitoring and recovery program along the riverbank seep area. Oil is collected by handbailing from wells and piezometers along the riverbank whenever oil is measured at a thickness of greater than 0.1 feet. Further discussion of the oil plume interaction with the Housatonic River is presented in Section 4.7.2.

4.3 Scrap Yard Investigations

The following section summarizes the investigative activities that were performed prior to and as part of the MCP Phase II investigations to characterize soils/fill and groundwater in the scrap yard area. The scrap yard area is located in the southwest portion of the site and includes the open paved lot between Building 63 to the west and Buildings 64 and 66 to the north. The scrap yard area is bounded by the former oxbow to the east and the Housatonic River to the south (Figure 4-1).

Pre-MCP activities included the installation of eight monitoring wells to aid in delineating the extent of oil in the subsurface. The pre-MCP activities are described in Section 4.3.1. The MCP Phase II activities included the installation of 26 soil borings and three monitoring wells. The MCP soil boring program was primarily designed to identify the presence of PCBs and other constituents in fill and soils that may have the potential to impact groundwater quality. The MCP monitoring well program was designed to determine the extent (if any) to which groundwater quality has been impacted by site activities. The scope of the MCP activities is summarized in Section 4.3.2. The results of the MCP Phase II investigation are summarized in Section 4.3.3. Section 4.3.4 presents an interpretation of the scrap yard investigation results.

4.3.1 Pre-MCP Scrap Yard Investigations

The pre-MCP investigative activities performed in the scrap yard area included the installation of eight monitoring wells (12, 13, 14, 15, 18, 19, 20, and 21) in 1980 (Figure 4-9). Borings were advanced through the fill material and into the underlying native deposits. The soil was characterized from samples retrieved during the drilling of the monitoring wells. These monitoring wells were installed to identify the possible presence of oil as part of the overall East Street Area 2 monitoring program. The available boring logs for these monitoring wells are provided in Appendix H. Well construction details are summarized in Table 4-1.

Monitoring wells 12, 13, and 14 are located downgradient of Building 64 and well 15 is located downgradient of Building 66 in the northern portion of the scrap yard area. The wells extend to a depth of 30 feet below grade, and include a 20-foot section of screen. These wells have been used to measure oil thickness associated with the oil pocket present directly downgradient of Buildings 64 and 66.

Wells 18, 19, and 21 are located in the downgradient portion of the scrap yard. These wells all extend to depths between 20 and 24.5 feet. Wells 18 and 19 include 15-foot sections of screen, while well 21 has a 10-foot screen length. Well 20 was destroyed.

The historical oil thickness measurements from these wells are included in Appendix F. As shown in the historical oil information, oil has been consistently detected in wells 12, 13, 14, and, at times, in well 15 in this area during the semiannual monitoring program. Based on this information (and ongoing monitoring in nearby wells), it appears that this is a localized and stable occurrence of oil. As discussed in Section 11, an evaluation will be performed to determine the need for and type of oil recovery in this area.

4.3.2 MCP Scrap Yard Investigations

The MCP investigation activities performed in the scrap yard consisted of the installation and soil sampling of 26 soil borings (Y-1 through Y-24, Y-26, and Y-27) and three monitoring wells (ES2-3, ES2-4, ES2-5), as shown in Figure 4-17. Soil boring Y-25 was not completed because its proposed location overlapped with boring X-4 (which is described in the oxbow/gas plant investigation in Section 4.4). The monitoring wells were installed in January 1991 and the scrap yard borings were advanced in June 1991.

The MCP soil boring program was designed to assess whether soil and fill material had been affected by scrap yard activities. The groundwater investigation was designed to determine whether activities in the scrap yard area have impacted groundwater quality and the nature of any impacts to groundwater quality.

MCP Soil Borings - The 26 soil borings were located so the lateral and vertical extent of the fill material in the scrap yard area could be defined. The locations of the borings were determined in an iterative process in order to define the extent of fill materials. Six lines of borings were placed approximately parallel to the Housatonic River, and spaced at approximately 100-foot intervals between the Housatonic River and East Street (Figure 4-17). The MCP boring and monitoring well logs are included for reference in Appendix H.

The soil borings were advanced in accordance with the Sampling and Analysis Plan (SAP) (Blasland & Bouck, September 1990) to a predetermined depth just above the expected surface of the oil plume or water table, based on data from nearby existing wells. The boreholes were advanced using hollow-stem augers. Soil and fill samples were obtained at 2-foot intervals from each boring using standard split-spoon samplers. The depth at which soil and fill samples were obtained from the borings ranged up to 14 feet. The soil samples from well locations ES2-3 (14-16 feet) and ES2-5 (18-20 feet) were obtained from native deposits at deeper intervals. Soil and fill samples were placed in coolers with ice immediately after sampling and shipped to the laboratory with standard chain-of-custody forms.

Soil and fill samples obtained from the borings were analyzed for Appendix IX+3 constituents. Soil and fill samples were selected for chemical analysis based on field screening with a portable photoionization detector (PID) and visual observation. Specifically, one sample was selected from each boring from the depth interval with the highest PID screening value or exhibiting visual indications of contamination. Samples were submitted to CompuChem Laboratories of Research Triangle Park, North Carolina for Appendix IX+3 analysis, with the exception of PCB analysis. Each 2-foot sample from each boring was submitted to IT Analytical Services of Knoxville, Tennessee for PCB analysis. The analytical results are discussed in Section 4.3.3.1.

MCP Monitoring Wells - One MCP monitoring well (ES2-5) is located in the northeast portion of the scrap yard, while the other two wells (ES2-3 and ES2-4) are located hydraulically downgradient adjacent to the Housatonic River. (Wells ES2-2 and ES2-7 are located adjacent to the scrap yard very close to the former oxbow location, and hence the results from these wells are discussed in Section 4.4.) Wells ES2-3, ES2-4, and ES2-5 were constructed with 4-inch-diameter, Schedule 40 PVC casing and screen material. The screen slot size opening is 0.01-inch. The sand pack material was a No. 2 clean silica sand. At least a 2-foot-thick bentonite seal was placed above the sand pack. The annular space was grouted to the surface with a cement/bentonite mixture. Six-inch-diameter, 5-foot-long, locking protective casings or flush-mounted curb boxes were installed over all wells. The monitoring well logs are presented in Appendix H. A summary of the well construction details is presented in Table 4-1.

Monitoring well ES2-3, located hydraulically downgradient of the scrap yard, near the Housatonic River, was designed with the well screen set approximately 5 to 15 feet below the water table. The purpose of this well was to obtain data on the quality of groundwater below the floating oil (if present). Monitoring wells ES2-4 and ES2-5 were designed so the well screens (15-feet long) straddle the top of the water table. The purpose of these wells was to determine whether floating oil was present.

To avoid cross-contamination, all sampling and drilling equipment were decontaminated between use, as described in the SAP. Each well was developed with a surge block and centrifugal pump until relatively sediment-free water was observed from the pump discharge.

The analytical groundwater investigation was designed as a two-tiered assessment. The Tier 1 groundwater sampling was performed in February 1991, and involved obtaining samples from wells ES2-3, ES2-4, and ES2-5. Groundwater samples were submitted to CompuChem Laboratories to be analyzed for VOCs, SVOCs, and Appendix IX inorganic constituents. In addition, groundwater samples from wells ES2-4 and ES2-5 were analyzed for PCBs, pesticides, and herbicides. In accordance with a previous agreement with the MDEP, not all groundwater samples from the site needed to be analyzed for pesticides and herbicides. Unfortunately, when the pesticide/herbicide scan was canceled at select locations, the corresponding PCB analyses were also canceled by the laboratory. The SOW for the MCP Phase II investigation in this area also proposed sampling at existing monitoring wells 10 and 20. However, it was found that well 20 had been previously destroyed, while well 10 was inadvertently omitted from the sampling round. The results of the Tier 1 monitoring are discussed in Section 4.3.3.2. According to the SOW, supplemental Tier 2 groundwater monitoring would be conducted if necessary or appropriate to further define the extent of constituents detected in Tier 1. Supplemental groundwater monitoring activities are discussed in Section 11.

4.3.3 Scrap Yard Area Investigation Results

This section presents the physical description of soil and groundwater observed during the scrap yard soil boring and monitoring well installation programs, and discusses the resulting analytical soil quality data and analytical groundwater quality data. An interpretation of the results is presented in Section 4.3.4.

4.3.3.1 Soil Investigations

Physical Description of Soil

The subsurface material in the scrap yard area is generally comprised of 5 to 15 feet of fill material underlain by native geologic deposits. A geologic cross-section (D to D') extending generally north-south through the scrap yard is provided as Figure 4-16. The location of the cross-section is shown on Figure 4-2. Descriptions of the fill, depth of fill, and depth to groundwater, when encountered during drilling, are provided on Figure 4-17.

The fill material generally consists of brown to black, fine to coarse poorly sorted sand with various amounts of gravel and assorted debris material. The assorted debris material includes cinders, coal, brick, glass, plastics, metal, ceramic, and wood fragments. Debris material was not observed at a number of the boring locations (Y-1, Y-3, Y-6, Y-21, Y-24, Y-26, and Y-27) around the northern and southern perimeter of the scrap yard area. The remainder of the boring locations contained fill material with approximately 10 to 40 percent debris material incorporated into the matrix. Cross section D to D' (Figure 4-16) illustrates the variability of the fill material depths. Several boring logs associated with fill in this area indicated the presence of petroleum odors similar to those detected in the oxbow/gas plant area.

The native deposits underlying the fill material are generally described as either a brown to gray or an olive-brown, fine to coarse slightly micaceous sand with small amounts of gravel and silt. The native deposits at some boring locations (Y-3, Y-10, Y-20, Y-21, and Y-23) include black/brown organic material such as roots and leaves. Native deposits exhibiting an olive-brown color are found at boring Y-9 and at a majority of the boring locations in the northern portion of the scrap yard, (boring locations Y-12 through Y-24). At boring Y-19, brown to grey deposits are underlain by the olive-brown deposits.

The fill material is stained black at a number of boring locations (Y-4, Y-9, Y-10, Y-11, Y-12, Y-14, Y-16, Y-19, Y-23, ES2-3, ES2-4, and ES2-5) at varying depths (Figure 4-17). The intervals of staining are sporadic and generally contained in the fill material (Figure 4-16). The native deposits are also stained black at some locations (Y-5, Y-9, Y-16, Y-17, and ES2-3). An oil sheen was observed extending to the native deposits at a depth of 18 to 26 feet at location ES2-5. The boring logs are contained in Appendix H.

The geologic descriptions of material observed during installation of the pre-MCP monitoring wells in the scrap yard area are similar to the descriptions for the MCP borings and monitoring wells. The available boring logs are presented in Appendix H.

The existing database is generally successful in determining the extent of fill material over most of the scrap yard area. However, there is a gap in the delineation of fill material in the southwest corner of this area. At boring location Y-5 in that corner, fill material was detected to a depth of approximately 12 feet, while at location RF-1, located approximately 250 feet to the west, no fill material was found. This data gap is further discussed in Section 11.

Groundwater was observed during drilling of the MCP soil borings at depths ranging from 8 to 16 feet. Groundwater is present below the bottom of the fill material at a majority of the boring locations

(Figures 4-16 and 4-17). The average elevation of the water table in the scrap yard area based on previous boring and well measurements is approximately 973 feet. A summary of groundwater elevations collected during the semiannual monitoring program is included in Appendix F.

Soil Quality

The analytical results for MCP soil and fill samples from the scrap yard borings submitted for analysis of Appendix IX+3 parameters are summarized in Tables 4-3 through 4-7 for VOCs, SVOCs, inorganic constituents, PCBs, and pesticides/herbicides, respectively. The analytical results for soil/fill samples collected from monitoring well borings are summarized in Tables 4-8 through 4-11 for VOCs, SVOCs, inorganics, and PCBs, respectively. Only the constituents detected in one or more samples are shown in these tables. Analytical data sheets are presented in an organized way in Appendix I.

VOCs - The analytical results of the soil samples from borings and monitoring wells submitted for Appendix IX+3 VOCs are summarized in Tables 4-3 and 4-8, respectively. A visual presentation of the distribution of total VOCs detected in the soil in this area is presented on Figure 4-18. Although acetone and methylene chloride were detected in a majority of the samples analyzed, both of these compounds were nearly always detected in the associated method blanks and are common laboratory contaminants, thus indicating that the sample results are likely due to laboratory contamination. Likewise, 1,1,2-trichloro-1,2,2-trifluoroethane was detected at estimated concentrations below the quantitation limit in a majority of the samples analyzed, as well as in the laboratory blanks. These three VOCs are excluded from further consideration and are not included in the value of total VOCs reported on Figure 4-18.

VOCs were not detected in soil samples from 13 of the 29 soil borings and monitoring wells installed in the scrap yard area, including samples from borings Y-17 through Y-19 and Y-21 through Y-27, located in the northern portion of the area. The northern portion of the scrap yard is within the area observed during drilling to visually contain less than 10 percent debris material or black-stained soil (Figure 4-17). VOCs were also not detected in soil samples from borings Y-3, Y-6, Y-7, and Y-11 which are generally located in the western portions of the scrap yard (Figure 4-18).

Of the soil samples collected from the remaining 16 borings, total VOCs (including estimated concentrations) were detected at concentrations of less than 0.1 ppm in 14 of the 16 locations (Figure 4-18). The sole exceptions were the samples collected from borings Y-12 and Y-15, which contained total VOCs of 0.21 and greater than 1.69 ppm, respectively. The somewhat undefined result for boring Y-15 is due to the laboratory reporting the concentration of xylene at greater than 1.2 ppm. Although this concentration is greater than the calibration range of the instrument, a reanalysis was not performed by the laboratory.

The most prominent VOCs detected in the scrap yard soil samples were two aromatic hydrocarbons (toluene and xylenes) and three chlorinated hydrocarbon compounds [1,2-dichloroethene (DCE), trichloroethane (TCE), and chlorobenzene]. Three additional chlorinated compounds [tetrachlorethane (PCE), trichlorofluoromethane, and chloroform] were also detected. Chloroform was detected only in well borings ES2-3 and ES2-5. In general, the soil samples analyzed from the eastern portion of the scrap yard, near the former oxbow channel at Y-20 and extending downgradient to locations Y-2 and ES2-3, contained the majority of the aromatic and chlorinated hydrocarbon compounds detected.

SVOCs - The analytical results of the soil samples from borings and monitoring wells submitted for Appendix IX+3 SVOCs analysis are summarized in Tables 4-4 and 4-9, respectively. A visual presentation of the distribution of total SVOC results for soil in this area is presented in Figure 4-18. Although bis(2-ethylhexyl)phthalate was detected in a majority of the samples analyzed, this compound was nearly always detected in the associated method blank and is a common laboratory contaminant, indicating that the sample results were likely due to laboratory contamination. Bis(2-ethylhexyl)phthalate is excluded from further consideration and is not included in the value of total SVOCs reported.

A total of 29 soil samples were analyzed initially for SVOCs and four diluted samples were reanalyzed for a total of 33 samples analyzed. The laboratory analyses of samples Y-2, Y-5, Y-14, and Y-22 were performed twice because concentrations of some SVOCs exceeded the calibration range for the first analysis. A second analysis was performed to quantify the out-of-range concentrations. The total concentrations of SVOCs were higher in the reanalyzed samples, with the exception of sample Y-22. Some SVOCs quantified in the first analysis were not detected in the reanalysis because concentrations were below the higher calibration range. Therefore, both the initial analysis and the reanalysis are considered in evaluating the SVOCs. Several of the SVOC concentrations discussed below are reported at estimated concentrations below the quantitation limit.

The majority of the detected SVOCs were polynuclear aromatic hydrocarbons (PAHs). The detected concentrations of the majority of PAHs were above 100 ppm and ranged up to 500 ppm. The PAHs constitute the group of SVOCs with the highest concentrations. The 18 most prominent PAHs detected in a majority of the soil samples in the scrap yard are listed below:

Acenapthene
Anthracene
Benzo(a)anthracene
Benzo(b)anthracene
Benzo(k)anthracene
Benzo(a)pyrene
Benzo(g,h,i)perylene
Chrysene
Dibenzo(a,h)anthracene
Dibenzofuran
Fluorene
Fluoranthrene
Indeno(1,2,3-cd)pyrene
1-Methylnaphthalene
2-Methylnaphthalene
Naphthalene
Phenanthrene
Pyrene

In addition to the PAHs, several chlorinated hydrocarbon compounds were detected. The highest concentration of chlorinated hydrocarbon compounds detected was 5.4 ppm of 1-4,dichlorobenzene at Y-15. Phenol and phenolic compounds were also detected in the scrap yard soil, although they were detected less frequently. The highest concentration of phenolic compounds detected was 13 ppm at Y-20. Analysis was also performed to determine total phenols. Total phenol concentrations ranged between 0.19 ppm (Y-21) and 16 ppm (Y-15). A few PCDDs and PCDFs were also detected in soil. The highest concentration of PCDDs/PCDFs was 0.117 ppm of pentachlorodibenzofuran at boring Y-1. Additional groups of SVOCs that were detected less frequently and at lower concentrations than the PAHs and chlorinated SVOCs include nitrogen and amine compounds.

The greatest number of different SVOCs detected were present in the soil sample from boring location Y-9 (which contained 64 of the total 76 SVOCs). However, the total concentration of SVOCs in sample

Y-9 is 28 ppm, which is below that of several other borings. Boring Y-9 was observed to have a white pasty material and chemical odor present in the fill material. The highest total concentration of SVOCs was detected in sample Y-5 at 1,914 ppm in the initial analysis and 2,436 ppm in the reanalysis (Figure 4-18). Boring Y-5 was observed to have a "soft, green, black and white speckled, wax-like" material and a fibrous material present in the fill material. Six boring locations had total SVOC concentrations that were greater than 100 ppm, Y-1 (187 ppm), Y-2 (246 ppm), Y-4 (416 ppm), Y-14 (205 ppm), Y-20 (327 ppm) and Y-22 (102 ppm). The detected concentrations of SVOCs in the remainder of the samples ranged from less than to 56 ppm.

The soil samples analyzed from well locations ES2-3, ES2-4, and ES2-5 contain fewer SVOCs and at lower concentrations. No SVOCs were detected in ES2-4, and only two SVOCs (acenaphthene and 1,4-dichlorobenzene) were detected in ES2-3 at estimated concentrations totaling 0.14 ppm and 0.053 ppm, respectively, in the first and second analysis. The PAH compounds detected in ES2-5 were at estimated concentrations totaling 15 ppm.

Inorganics - The analytical results of the soil samples from borings and monitoring wells submitted for Appendix IX inorganics analysis are summarized in Tables 4-5 and 4-10, respectively.

A total of 24 inorganics were detected in the scrap yard samples, some of which were detected at levels higher than the concentrations detected at Y-26 and Y-27 (located north of the scrap yard). These inorganics included the following metals: arsenic, barium, cadmium, chromium, copper, lead, magnesium, mercury, and zinc. While these inorganics were detected in the scrap yard at concentrations in excess of those found at the two locations north of the scrap yard, it is important to note that, in general, this occurred at only some locations (out of the 29 locations sampled). It is not surprising to find relatively high levels of such inorganics in this area as it once was an unpaved area where metals of various types were stored and recycled. Furthermore, as discussed in Section 4.3.3.2, the metals detected in the soil do not appear to be migrating significantly in groundwater.

PCBs - The analytical results for PCBs in soil samples collected from the scrap yard area are presented in Table 4-6(a through d) for the soil borings and Table 4-11 for the well borings. The distribution of total PCB results for soil is also presented on Figure 4-19. The depth intervals at which the samples were obtained range from 0 to 2 feet to 16 to 18 feet in the soil borings and 0 to 2 feet to 28 to 30 feet in the monitoring well borings.

A total of 192 soil samples (excluding duplicates) were collected from the scrap yard area and analyzed for PCBs during Phase II activities. Of these 192 samples, 91 had PCB concentrations equal to or less than 1 ppm, while an additional 34 samples exhibited PCB concentrations between 1 and 10 ppm. Fifty-one samples had PCB concentrations between 10 and 200 ppm, while an additional 16 samples had PCBs between 200 and 2,400 ppm.

The highest PCB concentrations were observed in fill samples collected from the intervals between 0 to 12 feet. In the majority of soil borings, the lowest concentrations observed (including non-detects) were found in the deepest intervals sampled, generally in the native deposits. While PCBs were found in native soil in the majority of borings, the levels were relatively low in comparison to those observed in fill material. With the exception of Y-15, the highest concentration of PCBs detected in each boring was found in fill material. Moreover, the highest PCB concentrations were generally found in borings in the eastern and southeastern portions of the scrap yard, near the western limb of the former oxbow (borings Y-1, Y-2, Y-3, Y-9, Y-10, Y-15 and Y-20).

Herbicides/Pesticides

The analytical results for Appendix IX+3 pesticides/herbicides in soil samples collected from the soil borings in the scrap yard area are presented in Table 4-7. In accordance with a previous agreement with the MDEP, soil samples collected from the well borings were not analyzed for pesticides/herbicides

A total of four pesticides/herbicides were detected in three of the 26 soil borings in the scrap yard area (Y-4, Y-20, and Y-22) at low concentrations. Specifically, dieldrin (0.0052 ppm) and p,p'-methoxychlor (0.024 ppm) were found in Y-22, aldrin (0.26 ppm) was detected in Y-4, and delta-BHC (0.16 ppm) was detected in Y-20.

4.3.3.2 Groundwater Investigations

Observations of Oil in Groundwater

A floating oil layer was not found on the water table in monitoring wells ES2-4 or ES2-5 during MCP Phase II activities, even though, as described above, their screens spanned the water table. (Well ES2-3, as discussed above, was not designed to detect floating oil.)

Wells 18, 19, and 21 have been sampled for the possible presence of separate-phase oils during the semiannual monitoring program since 1981. No oil has been measured in these wells from March 1981 through April 1994. Oil associated with

Buildings 64 and 66 has historically been measured in wells 12, 13, and 14 since 1980 and in well 15 since 1982. Well 12 has not been monitored since April 1990 due to an obstruction in the well. Historical oil thickness data are presented in Appendix F. The presence of oil in the vicinity of Buildings 64 and 66 is discussed in more detail in Sections 4.2.3 and 4.2.6.

Groundwater Quality

The analytical results for groundwater samples submitted for Appendix IX+3 parameters are summarized in Tables 4-12 through 4-14. The results that are discussed in this section relate to wells ES2-3, ES2-4, and ES2-5. Laboratory data sheets are provided in an organized way in Appendix I.

VOCs - The analytical results for groundwater samples submitted for Appendix IX+3 VOC analysis are summarized in Table 4-12. A visual presentation of the distribution of total VOCs in groundwater is presented in Figure 4-20. Although acetone and methylene chloride were detected in a majority of the samples analyzed, both of these compounds were detected in the associated method blanks and are common laboratory contaminants, indicating that their detection is likely due to laboratory contamination. The concentrations of these two VOCs are not included in the total concentrations or number of VOCs reported.

Few VOCs were detected in groundwater in the scrap yard area. In fact, VOCs were not detected at all in the groundwater sample from well ES2-5. Four chlorinated hydrocarbon compounds, TCE, DCE, 1,1-dichloroethane, and 1,1,1-trichloroethane, were detected in well ES2-4 at a total concentration of 0.02 ppm. Three chlorinated VOCs, chlorobenzene (0.03 ppm), chloroethane (0.003 ppm), and vinyl chloride (0.001 ppm), were detected in well ES2-3 (Figure 4-20).

SVOCs - The analytical results for the groundwater samples submitted for Appendix IX+3 SVOC analysis are summarized in Table 4-13. The distribution of total SVOCs in groundwater is presented in Figure 4-20. The laboratory analysis of each groundwater sample was performed twice because the concentration of some SVOCs exceeded the calibration range of the first analysis. A second analysis was performed to quantify those SVOCs that were out of range. However, the concentrations of SVOCs were generally lower in the second analysis.

The total concentration of SVOCs from the initial analysis of sample ES2-3 was 0.329 ppm, of which 0.3 ppm is attributed to the presence of pentachlorophenol. However, sample ES2-3 was reanalyzed because this concentration of pentachlorophenol exceeded the calibration range of the first analysis. The total concentration of SVOCs in the reanalysis was lower, 0.191 ppm, of which only 0.18 ppm of pentachlorophenol was detected. The total concentration of SVOCs in sample ES2-4 was 0.151 ppm in the first analysis and 0.114 ppm in the reanalysis, of which 1,2,4-trichlorobenzene accounted for 0.13 ppm and 0.093 ppm, respectively, in each sample analysis. The total concentration of SVOCs in sample ES2-5 was 0.058 ppm in the initial analysis and 0.033 ppm in the reanalysis, of which 2-methylnaphthalene accounted for 0.029 ppm and 0.019 ppm, respectively. The only common SVOC detected in all three groundwater samples from the scrap yard area was 1,4-dichlorobenzene at estimated concentrations between 0.003 and 0.005 ppm.

Inorganics - The analytical results of the groundwater samples submitted for analysis of Appendix IX inorganics are summarized in Table 4-14. Inorganics were analyzed as total inorganics from unfiltered samples. A total of nine inorganic compounds were detected in groundwater samples from the scrap yard area above the detection limit. Of these nine inorganics, six were metals. The metals detected were arsenic, barium, iron, magnesium, manganese, and zinc. Sodium, calcium, and magnesium were also detected in all three samples.

PCBs/Herbicides/Pesticides - The analytical results of groundwater samples obtained from wells ES2-4 and ES2-5 indicate that no PCBs, pesticides, or herbicides were detected. The PCB analysis of groundwater from well ES2-3 was inadvertently canceled by the laboratory. The analytical data sheets are provided in Appendix I.

4.3.4 Interpretation of Scrap Yard Results

This section presents a summary and interpretation of the analytical data and visual descriptions presented in Section 4.3.3. The following observations have been made regarding the occurrence of organic and inorganic constituents in the scrap yard area.

Soils/Fill

Various hazardous constituents were detected in soils/fill in the scrap yard area, consisting mainly of SVOCs, PCBs, and inorganics. Constituent levels were generally higher in the eastern and south-central portions of the scrap yard, including areas adjacent to the former oxbow. A summary of the soils/fill results is as follows:

- VOCs were not detected in 13 of the 29 soil borings taken in the scrap yard area, while VOC concentrations were less than 0.1 ppm in 14 of the remaining 16 borings. Where detected, the VOCs were composed primarily of aromatic hydrocarbon compounds.
- Several SVOCs were detected in the scrap yard soil and fill. These SVOCs consist primarily of PAHs. With the exception of one boring in the southwestern corner of the yard (Y-5), the highest concentration of total SVOCs at any one location was 416 ppm. In 22 of the 29 borings, total SVOC concentrations were less than 100 ppm.
- Inorganic constituents, primarily certain metals, were detected in the scrap yard at concentrations exceeding those present in soil borings north of the scrap yard area (Y-26 and Y-27). This is not surprising given the fact that the scrap yard area has been used for metals storage and recycling. However, as discussed below, these metals do not appear to be migrating significantly to groundwater.
- Of 192 soil/fill samples analyzed for PCBs, 125 (65%) had PCB concentrations below 10 ppm (with 91, or 47%, at or below 1 ppm), while only 16 (8%) had PCB concentrations greater than 200 ppm. Most of the soil borings with higher PCB concentrations are located in the eastern and southeastern portion of the scrap yard area, near the western limb of the former oxbow. PCB concentrations generally decreased with depth and were relatively low in the native deposits.

The estimated area of soil/fill material in the scrap yard containing greater than 10 percent debris material, visual staining, and the majority of organic and inorganic constituents detected, is approximately 8 acres. The estimated volume of affected soil/fill material in the scrap yard area, based on an average soil/fill thickness of 9.2 feet (determined from the borings in this area), is approximately 110,000 cubic yards.

Groundwater

Despite the presence of various constituents in the soil/fill in the scrap yard area, certain site-specific features would be expected to minimize the potential for such constituents to migrate from the soil/fill to groundwater. Two such features are the depth of the water table and the presence of surface pavement. The water table is generally below the bottom of the fill material throughout the majority of the scrap yard area (Figure 4-17), thus reducing the potential for constituents in the fill material to dissolve into and migrate with groundwater toward the Housatonic River. Moreover, most of the scrap yard area is covered with pavement, thus reducing the potential for vertical migration of constituents during precipitation events.

Additional observations of the MCP Phase II analytical data in this area are described below.

- VOCs were not detected in one of the three groundwater monitoring wells in the scrap yard area (ES2-5), while the total VOC concentrations in the other two wells were quite low (0.02 and 0.034 ppm, respectively).
- Total concentrations of SVOCs in the three monitoring wells were 0.029, 0.058, and 0.329 ppm, respectively. The majority of these SVOCs consist of chlorinated compounds. The number of PAHs detected in groundwater is lower than the number detected in the scrap yard soil/fill. This is not surprising since PAHs generally have relatively low water solubilities, and thus have a strong tendency to absorb to soil particles and organic matter.

- The number and concentrations of metals detected in groundwater are significantly lower than in soil/fill. Of the metals detected in soil/fill (at generally higher concentrations), only magnesium was detected in all three groundwater samples in this area. Moreover, the groundwater inorganic results were obtained from unfiltered samples, which may be influenced by the presence of suspended solids, resulting in an overestimation of the dissolved inorganic concentrations. The lower levels of metals in groundwater than in the soil/fill is consistent with the data presented in Section 7 showing that the soils/fill in this area do not exhibit toxicity characteristics under USEPA's Toxicity Characteristic Leaching Procedure (TCLP), and thus are unlikely to leach metals to groundwater in significant concentrations.
- PCBs were not detected at all in the groundwater in the scrap yard area.

Moreover, floating oil was not measured in any of the MCP wells located in the scrap yard area. Based on the absence of floating oil in well ES2-5, it appears that the oil pocket associated with Building 64 is localized and does not extend downgradient into the scrap yard area.

4.4 Oxbow and Gas Plant Area Investigations

The following sections summarize the findings of the investigative activities performed in the former oxbow and gas plant area. Pre-MCP activities performed in this area included the installation and monitoring of numerous wells. These monitoring wells were installed primarily to aid in delineating the extent of oil in the subsurface. The pre-MCP activities are described in Section 4.4.1. The MCP Phase II activities in this area consisted of the installation and sampling of 18 soil borings, the installation and sampling of four monitoring wells, and the sampling of several additional existing wells. The MCP investigation activities were designed to provide information to characterize fill materials placed into the oxbow, gas plant, and other adjacent areas and groundwater underlying these areas. The boring program includes locations within the former oxbow channel and locations within the former gas plant area. The scope of the MCP activities is summarized in Section 4.4.2. The results of the MCP Phase II and subsequent investigations are summarized in Section 4.4.3. Section 4.4.4 presents an interpretation of the oxbow and gas plant investigation results.

As previously described, the oxbow area was formerly an oxbow of the Housatonic River. The former oxbow channel was cut off from the flow of the Housatonic River as a result of a river rechannelization project performed by the U.S. Army Corp of Engineers in the late 1930s or early 1940s. All that remains of the oxbow is the groundwater recharge pond located within the eastern limit of the oxbow, near oil recovery system 64X (Figure 4-20).

The former Berkshire Gas Company plant (gas plant) and its predecessor, the Pittsfield Coal Gas Company, operated within a portion of the East Street Area 2/USEPA Area 4 Site from 1903 to 1972. A number of gas plant buildings were located north of East Street and four gas holders and certain other facilities were located south of East Street. The location of gas plant facilities are shown on Figure 1-3. It should be noted that the main oil plume extends into a majority of the gas plant area and a portion of the oxbow.

4.4.1 Pre-MCP Oxbow and Gas Plant Investigations

The pre-MCP investigative activities performed in the former oxbow and gas plant areas included the installation of numerous groundwater monitoring wells, mostly in the early 1980s. These wells were installed primarily to aid in delineating the boundaries of the main light non-aqueous phase liquid (LNAPL) plume and identifying other LNAPL pockets within these areas, although limited groundwater sampling was conducted in 1989. The soil was visually characterized from samples retrieved during drilling.

Monitoring wells north of East Street were generally installed at depths ranging between 20 and 40 feet. Wells installed south of East Street were generally installed at depths ranging between 15 and 30 feet. The locations of these wells are shown on Figure 4-9. The majority of the wells were installed with a 10-foot section of screen, although some wells were installed with up to 20 feet of screen. As noted in the semiannual monitoring reports (Geraghty & Miller), some of these wells do not have screens that straddle the water table and therefore do not provide accurate measurements of oil thickness. A number of the wells with appropriately placed screens are currently monitored for the presence of oil as part of the semiannual monitoring program. The available boring logs for monitoring wells installed prior to the MCP investigations are provided in the Appendix H. Well construction details are provided in Table 4-1. The historic oil thickness monitoring measurements in these wells are included in Appendix F.

Soil investigations included observation of subsurface materials during installation of monitoring wells. In addition, as part of the preparation for the construction of the south side pump station, the wastewater treatment facility, and the installation of the slurry cut-off wall, pre-construction soil sampling programs were performed. The purpose of these programs was to determine the concentrations of PCBs present to assist in disposition of excavated materials. The details and results of these soil sampling programs are discussed in Section 7.3.

In March 1989, groundwater was sampled from wells 4, 17, 27, and 32 north of the railroad tracks, upgradient of the former oxbow/gas plant, and analyzed for priority pollutants (Figure 4-9). Only one VOC was detected in wells 4 and 27, while benzene and chlorobenzene were detected in wells 17 and 32, and ethylbenzene was detected in well 32 only. A summary of this analytical data is presented in Table 4-15.

Few SVOCs were detected in groundwater during this sampling round except at well 17 where dichlorobenzenes and 1,2,4-trichlorobenzene were detected between 0.3 and 27 ppm. A number of pesticides and PCBs were also detected in well 17. Well 17 is located within the oil plume and the presence of this oil may explain these anomalous results in this area. As discussed in Section 4.2.2, oil samples were collected from 64-S and 64-V during Phase II activities. As summarized in Table 4-2, a number of the constituents detected at these locations in the oil were also found in groundwater at well 17.

In February 1992, as part of the RCRA groundwater monitoring for the recharge pond, groundwater from wells 22, 43, 44, and P-6 (both upgradient and downgradient of the recharge pond) was sampled on a weekly basis for four weeks and analyzed for VOCs, SVOCs, and PCBs. As summarized in Table 4-16, the principal VOCs found were chlorobenzene, benzene, ethylbenzene, and xylenes at concentrations up to 0.5 ppm. SVOCs included naphthalene at concentrations of up to 145 ppm as well as other constituents at much lower concentrations. PCBs were detected in each of the wells.

4.4.2 MCP Oxbow and Gas Plant Investigations

The MCP investigation activities performed in the former oxbow and gas plant area consisted of the installation and soil sampling of 18 soil borings (X-1 and X-4 through X-20) and four monitoring wells (ES2-1, ES2-2, ES2-6, and ES2-7). Monitoring wells ES2-2 and ES2-7 are on the edge of the scrap yard adjacent to the former oxbow location, but are discussed in this section. Borings X-2 and X-3 were not completed in the western limb of the former oxbow because their locations duplicated borings Y-10 and Y-20. The monitoring wells were installed in January 1991 and the former oxbow and gas plant borings were advanced in July 1991. The soil boring program was designed to identify the presence of Appendix IX+3 constituents in the soil/fill. The groundwater sampling program in this area was designed to determine the extent to which groundwater quality has been impacted by site conditions, including the fill material in the former oxbow and gas plant area. In addition to the four wells installed during Phase II activities, seven existing wells (4, 24, 43, 54, 61, 63, and 64) were included in the groundwater sampling. The locations of soil borings and monitoring wells installed during Phase II activities are shown on Figure 4-1.

<u>MCP Soil Borings</u> - The boring program was intended to characterize both fill materials placed into the former oxbow channel and areas associated with the former gas plant. Borings X-1, X-4 through X-11, Y-10, and monitoring wells ES2-1, ES2-2, ES2-6, and ES2-7 were placed within or directly adjacent to the former oxbow channel (see Figure 4-23). To address fill areas associated with the gas plant, borings X-12 through X-17 were placed in an east-west trending line, between the oxbow and the location of the former gas plant structures. Two borings, X-19 and X-20, were placed as close as possible to the approximate location of the former tar separator and gas holder #2, respectively. The location of these structures was determined by taking measurements from historical aerial photographs and maps. The MCP boring and monitoring well logs are included for reference in Appendix H.

The soil borings were advanced in accordance with the SAP to a depth just above the expected surface of floating oil or the water table. The depths were predetermined based on data from nearby existing wells. The boreholes were advanced using hollow-stem augers. Soil and fill samples were obtained at 2-foot intervals from each boring using standard split-spoon samplers. Soil and fill samples were obtained in the borings from ground surface to a depth of 12 feet. Samples were obtained from deeper intervals (14 to 16 feet) at well locations ES2-1 and ES2-6. A second soil sample was obtained from well location ES2-6 from native deposits at a depth of 42 to 44 feet. Samples were placed in coolers with ice immediately after sampling and shipped to the laboratory with standard chain-of-custody forms.

Soil and fill samples obtained from the borings were analyzed for Appendix IX+3 constituents. Soil and fill samples were selected for analysis based on PID field screening and visual observation. Specifically, one sample was selected from each boring from the depth interval with the highest PID screening value or exhibiting visual indications of contamination. Samples were submitted to CompuChem Laboratories for analysis of Appendix IX+3 constituents with the exception of PCBs. Each 2-foot sample increment of soil and fill from the X-series borings was submitted to IT Analytical Services for PCB analysis. The analytical results are discussed in Section 4.4.3.1.

MCP Monitoring Wells - The four MCP monitoring wells were constructed with 4-inch-diameter, Schedule 40 PVC casing and screen material. The screen slot size was 0.01 inch and the sand pack material was a No. 2 clean silica sand. A minimum of a 2-foot-thick bentonite seal was placed above the sand pack. The annular space was grouted with a cement/bentonite mixture to the surface. Six-inch-diameter, 5-foot-long, locking protective casings or flush-mounted curb boxes were installed over all wells. The monitoring well logs are presented in Appendix H. A summary of the well construction details is presented in Table 4-1.

Monitoring wells ES2-1 and ES2-2 were designed such that the well screen was set approximately 5 to 15 feet below the water table. The purpose of these wells was to obtain data on the quality of groundwater below any floating oil (if present). Monitoring wells ES2-6 and ES2-7 were designed as deeper wells, with the screens placed at the top of the underlying glacial till. The purpose of these wells was to obtain data at depth to detect the presence of any dense non-aqueous phase liquids (DNAPLs), and to determine vertical hydraulic gradients.

To avoid cross-contamination, all sampling and drilling equipment was decontaminated between use as described in the SAP. Each well was developed with a surge block and centrifugal pump until relatively sediment-free water was observed from the pump discharge.

The analytical groundwater investigation was designed as a two-tiered assessment. The Tier 1 groundwater sampling was performed in February 1991. In this area, groundwater samples were obtained and analyzed from the four MCP wells and seven existing wells (4, 24, 43, 54, 61, 63, and 64) as illustrated in Figure 4-1. Monitoring wells 63 and 64 are located adjacent to the Housatonic River between the eastern and western limbs of the former oxbow (and also between the ES2-1/ES2-6 cluster and the ES2-2/ES2-7 cluster). Wells 43 and 54 are located downgradient of the recharge pond and adjacent to recovery system 64X, respectively. Well 61 is located in the eastern portion of the area, near Newell Street. Well 4 is located north of East Street, south of Building 100A, and well 24 is located north of East Street downgradient of Building 3C and between Buildings 3 and 12.

Groundwater samples from these wells were collected and submitted to CompuChem Laboratories to be analyzed for Appendix IX VOCs, SVOCs, and inorganic constituents. In addition, a groundwater sample from well 61 was analyzed for PCBs and pesticides/herbicides. The analytical results of this monitoring are discussed in Section 4.4.3.2. According to the SOW, supplemental Tier 2 monitoring would be conducted if necessary or appropriate to further define the extent of constituents detected in Tier 1. Supplemental groundwater monitoring activities are discussed in Section 11.

4.4.3 Oxbow and Gas Plant Investigation Results

This section presents the physical description of soil and groundwater observed during the boring and well installation programs and the related soil and groundwater quality data. An interpretation of the results is presented in Section 4.4.4.

4.4.3.1 Soil Investigation

Physical Description of Subsurface

The subsurface material in both the former oxbow and gas plant areas is generally comprised of 7 to 18.5 feet of fill material underlain by native geologic deposits. A geologic cross-section (E to E'), extending generally east to west across the line of borings located between the oxbow channel and the gas plant, is provided on Figure 4-21. A geologic cross-section (F to F'), extending generally north to south from the gas plant area through the recharge pond to the river, is provided on Figure 4-22. (The locations of the cross-sections are shown on Figure 4-2). The depth of fill, depth to groundwater, and description of the fill are delineated on Figure 4-23.

The fill material generally consists of brown, grey and black, fine to coarse poorly sorted sand with various amounts of gravel and assorted debris material. The assorted debris material includes brick, wood, glass, ceramic fragments, and coal slag. Fill material observed in borings X-16, X-17, X-18, located to the east of the oxbow and gas plant area, contained little debris or staining.

The native deposits underlying the fill material are generally described as an olive-grey, olive-brown, or brown-grey moderately sorted sand and gravel (in varying percentages). Intervals of silt were observed interspersed with the sand and gravel at wells ES2-2, ES2-6, and ES2-7 (Figure 4-22).

There does not appear to be a distinct difference between fill material and debris type found in the former oxbow compared to the gas plant area. The fill material is described as being black/oil-stained with a hydrocarbon odor at nearly all of the boring locations. No staining was observed at borings X-1, X-9, X-12, X-13, X-16, X-17, and X-20 (Figure 4-23). The black/oil staining and a hydrocarbon odor were observed to continue down into the upper portion of the native deposits at some of the boring locations. No black/oil staining or odor was observed in the native deposits in borings X-9, X-13, X-16, X-17, and X-20.

A black tar was observed adhered to the fill material at boring locations X-10, X-14, and X-19 (Figure 4-23). The soil and fill material at boring X-10 is described as saturated with thick coal tar and as giving off a strong hydrocarbon odor from a depth of 4 feet to the bottom of the boring at a depth of 12 feet. The black coal tar observed in the fill material at boring X-10 continued into the native deposits. Boring X-11, located on the downgradient side of the recharge pond, had a strong hydrocarbon odor, but did not contain tar. Boring X-14 contained a tar-like substance that adhered to pieces of wood from a depth of 4 to 8 feet.

At boring location X-19, located over the former tar separator, the subsurface material is described as a black "tar-like substance" that adhered to soil and wood from a depth of 6 feet to the bottom of the boring at 10 feet (Figure 4-22). Boring X-19 was advanced to the concrete bottom of the former tar separator. Boring X-20 was advanced within the former gas holder #2. A concrete pad, approximately 10 inches thick, was encountered at a depth of 2 feet, but no other debris or black/oil staining was observed at boring X-20 (Figure 4-23).

In addition to coal tars and oily soil and fill, some borings encountered miscellaneous types of debris. Boring location X-13, located in the line of borings downgradient of the gas plant, contained crushed coal (and coal slag) and cinders from a depth of 2 feet to the top of native deposits at 9 feet. A chemical odor was observed at boring locations X-1, X-12, X-14, and X-15. At boring X-14, the strong chemical odor coincided with the presence of black tar and "blue particles" from a depth of 4 to 8 feet (Figure 4-21).

The fill material and native deposits observed at well boring locations ES2-1, ES2-2, ES2-6, and ES2-7 also showed evidence of black/oil staining and a hydrocarbon odor.

The fill material at well boring ES2-1 contained glass shards in the upper 4 feet. The native deposits at well boring ES2-1 were stained black and saturated with oil from a depth of 10 feet to 22 feet. Well boring ES2-6, located adjacent to ES2-1, contained cinders and fill material to a depth of 4 feet. The native deposits at well ES2-6 were stained black and exhibited an odor at a depth of 12 feet, and continued with some degree of black staining to 22 feet. Slight black staining at well ES2-6 was again observed at a depth of 35 feet, and at 40 feet an odor and slight sheen were observed. At 42 feet a golden brown, separate-phase oil was encountered. (A sample of this oil was collected in March 1994 and analyzed for VOCs, SVOCs, and PCBs as described in Section 4.4.3.3.) Till was encountered at well ES2-6 at a depth of 44 feet. An oil sheen was observed during drilling in the upper 2 feet of till, and the odor persisted to the bottom of the boring at 50 feet.

At well boring ES2-2, the sand and gravel deposits were stained black and saturated with oil from a depth of 2 to 16 feet. At well ES2-7, located adjacent to ES2-2, the fill material was black-stained and had an oily sheen at a depth of 2 feet. Black staining and oil sheen observed in the fill at well ES2-7 at a depth of 8 feet continued into the native sand and gravel deposits to a depth of 12 feet. Black staining, odor, and a slight oily sheen were again observed in the native deposits in well ES2-7 at a depth of 18 to 24 feet, but not at depths below 24 feet.

Groundwater was observed in the MCP soil borings at depths below ground surface ranging from 7 to 16 feet. Groundwater is present below the bottom of the fill material at a majority of the boring locations (Figure 4-23).

<u>Soil Quality</u>

The analytical results for soil samples from the oxbow and gas plant borings submitted for analysis of Appendix IX+3 parameters are summarized in Tables 4-17 through 4-21 (VOCs, SVOCs, inorganics, PCBs, and pesticides/herbicides, respectively). The analytical results for soil samples from monitoring well borings are summarized in Tables 4-8 through 4-11 for VOCs, SVOCs, inorganics, and PCBs, respectively. These tables present only the constituents that were detected in one or more samples. Analytical data sheets are presented in an organized way in Appendix I.

VOCs - The analytical results for Appendix IX+3 VOCs in soil samples collected from the former oxbow and gas plant area are presented in Table 4-17 for the soil borings and Table 4-8 for the monitoring well borings. A visual presentation of the distribution of total VOCs in soil is provided in Figure 4-24.

Although acetone and methylene chloride were detected in the majority of the samples analyzed, both of these compounds were nearly always found in the associated method blanks and are common laboratory contaminants, thus indicating that these sample results are likely due to laboratory contamination. In addition, 1,1,2-trichloro-1,2,2-trifluoroethane was detected at estimated concentrations below the quantitation limit in five of the samples analyzed, as well as in the laboratory blank for four of those samples. 2-Butanone was detected at estimated concentrations below the quantitation limit in three samples, as well as in the associated laboratory blanks, thus indicating that sample results are likely due to laboratory contamination. These four VOCs detected in the blanks are excluded from consideration on that basis and are not included in the value of total VOCs reported.

The laboratory analyses of samples from X-10 and ES2-6 (14-16 foot interval) were performed twice because concentrations of some VOCs exceeded the calibration range for the first analysis. Therefore, a second analysis was performed to quantify the concentrations. The results from both sample analyses are considered in the following discussion.

One or more VOCs were detected at a number of the soil borings (X-1, X-4, X-5, X-7, X-8, X-9, X-10, X-14, X-18, X-19, X-20, and Y-10) and in the samples from the four well borings (ES2-1, ES2-2, ES2-6, and ES2-7) in this area. It is important to note, however, that in 18 of 24 samples, total VOCs (including estimated values) were detected at less than 2 ppm. A total of 11 different VOCs were detected. Many of the VOC concentrations were very low and are reported at estimated concentrations below the quantitation limit.

The most commonly detected VOCs in the oxbow and gas plant samples were four aromatic hydrocarbons [benzene, toluene, ethylbenzene, and xylene (BTEX)] and one chlorinated compound (chlorobenzene). The highest concentrations of these constituents (and in some cases the only concentration above quantitation limits) were detected in the "sludge" sample taken from the former tar separator at location X-19. VOCs less commonly detected in soil samples were: 1,2-dichloroethane (X-5); styrene (X-8, X-14, X-19, and X-20); trichloroethane (X-5); trichlorofluoromethane (X-10); carbon disulfide [ES2-6 (14 to 16 feet)]; chloroform (ES2-1); and crotonaldehyde (ES2-2). With the exception of concentrations reported for crotonaldehyde (one sample) and styrene (two of four samples), the concentrations reported for these less common compounds are estimated values below the quantitation limit.

As discussed above, the highest total VOC concentrations in the samples collected from the oxbow and gas plant area were detected in the tar sample from boring X-19 (831 ppm) (Figure 4-24). It should be noted that boring X-19 was advanced into the location of a former tar separator. Compounds identified in X-19 consisted of ethylbenzene, toluene, xylenes, and styrene. Sample X-19 is one of the few soil samples containing VOCs that did not contain chlorobenzene. No chlorinated VOCs were found in the two samples (X-19 and X-20) collected in the area of the former gas plant structures (former tar separator or the former gas holder #2).

There were a total of three soil samples that contained total VOCs at concentrations exceeding 100 ppm -- X-19 (831 ppm), X-4 (130 ppm), and ES2-2 (217 ppm). Soil samples from X-5, X-7, X-20, ES2-6 (14 to 16 feet), and ES2-6 (42 to 44 feet) contained between 1 to 12 ppm total VOCs. The majority of the remaining soil samples contained less than 0.1 ppm total VOCs. No VOCs were detected in soil/fill samples from X-6, X-11, X-12, X-13, X-15, X-16, and X-17.

Chlorobenzene was detected above the quantitation limit in six samples in this area. Four of those samples showed concentrations below one ppm, and one showed a concentration of 2.9 ppm. Chlorobenzene was detected at 92 ppm at location X-4 in the western limb of the former oxbow (Table 4-15).

<u>SVOCs</u> - The analytical results for Appendix IX+3 SVOCs detected in soil and fill samples collected from the former oxbow and gas plant area are presented in Table 4-18 for the soil borings and Table 4-9 for the well borings. A visual presentation of the distribution of total SVOCs in this area is provided on Figure 4-24. Although bis(2-ethylhexyl)phthalate was detected in the majority of the samples analyzed, this compound was also detected in some of the method blanks and is a common laboratory contaminant, thus indicating that its presence in samples was likely due to laboratory contamination. Benzoic acid was detected at estimated concentrations below the quantitation limit in two samples, as well as in the associated laboratory blanks; thus, benzoic acid detections are interpreted to be due to laboratory contamination. These two SVOCs detected in blanks are excluded from further consideration and are not included in the value of total SVOCs reported. Several of the SVOC concentrations

discussed are reported at estimated concentrations below the quantitation limit.

The laboratory analyses of samples X-7, X-14, X-18, X-20, and ES2-2 were performed twice because concentrations of some SVOCs exceeded the calibration range during the first analysis. Therefore, a second analysis was performed to quantify the concentrations. The results from both analyses are considered in the following discussion.

The majority of the SVOCs detected were PAHs. The 19 most prominent PAHs (which were detected in a majority of the soil/fill samples in the former oxbow and gas plant area) are listed below:

Acenaphthene
Acenaphthylene
Anthracene
Benzo(a)anthracene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(g,h,i)perylene
Benzo(a)pyrene
Chrysene
Dibenzo(a,h)anthracene
Dibenzofuran
Fluoranthene
Fluorene
Indeno(1,2,3-c,d)pyrene
1-Methylnaphthalene
2-Methylnaphthalene
Naphthalene
Phenanthrene
Pyrene

In addition to the PAHs, several chlorinated hydrocarbon compounds were detected. The highest concentration of chlorinated hydrocarbon compounds detected was 54 ppm of 1,4-dichlorobenzene at location X-5, although this appears to be an anomaly as 1,4-dichlorobenzene was not detected above the quantitation limit in 19 of the 23 samples analyzed in this area.

Phenol and phenolic compounds were also detected in the oxbow and gas plant areas, although less frequently than the PAHs and chlorinated compounds. Phenols were detected above the quantitation limit at only two of 23 locations. The highest concentration of phenolic compounds detected was 5.8 ppm of phenol at X-4. Total phenol concentrations ranged between 0.12 ppm (X-15) and 22 ppm (X-19) with approximately half of the samples less than 1 ppm.

A few PCDDs and PCDFs were also detected in soil generally at concentrations of a few ppb or less. The highest concentration of PCDDs/PCDFs was 0.56 ppm of hexachlorodibenzofuran at X-5. Additional groups of SVOCs that were detected less frequently and at lower concentrations than the PAHs and chlorinated SVOCs include nitrogen and amine-based compounds.

The highest total concentration of SVOCs was found in X-19. Boring X-19 was advanced into the former tar separator in the gas plant area (Figure 4-24). Total SVOC concentration in soil from X-19 was 217,053 ppm in the first analysis and 291,750 ppm in the reanalysis. The majority of SVOCs detected were PAHs with many at concentrations greater than 1,000 ppm. The total SVOC concentration in boring X-14, located in the vicinity of the former gas holders, was 57,790 ppm. Total SVOC concentrations were also greater than 100 ppm in samples X-4, X-5, X-7, X-8, X-18, X-20, ES2-2, ES2-6 (42-44 ft), and ES2-7. The detected concentrations of SVOCs in the remainder of the samples ranged from less than one ppm to 66 ppm.

<u>Inorganics</u> - The analytical results for Appendix IX+3 inorganics in soil samples collected from the former oxbow and gas plant area are presented in Table 4-19 for the soil borings and Table 4-10 for the well borings.

As would be expected in an area that received fill materials, the concentrations of inorganics in the former oxbow and gas plant area are somewhat variable. One or two locations exhibited substantially higher concentrations of inorganics when compared to data from the remaining locations. As described in Section 4.4.3.2, groundwater data collected in this area and analyzed for inorganics indicates that little migration of these constituents is occurring.

A total of 21 inorganics were detected in the oxbow and gas plant area samples, some of which were detected at levels higher than the concentrations detected at X-17 (located east of the former oxbow/gas plant area). These inorganics included the following metals: arsenic, barium, cadmium, chromium, copper, lead, magnesium, mercury, and zinc. While these inorganics were detected in the former oxbow/gas plant area at concentrations in excess of those found at the one location east of the former oxbow/gas plant area, it is important to note that, in general, this occurred at only some of the locations (out of the 18 locations sampled). It is not surprising to find relatively high levels of such inorganics in this area as it had received fill materials in the past. Furthermore, as discussed below, the metals detected in the soil do not appear to be migrating significantly to groundwater.

PCBs - The analytical results for PCBs in soil samples collected from the gas plant and oxbow area are presented in Table 4-20 for the soil borings and Table 4-11 for the monitoring well borings. A visual presentation of the distribution of total PCB results for soil in this area is presented in Figure 4-25. The depth intervals at which the samples were obtained for PCB analysis ranged from 0-2 feet to 16-18 feet for the soil borings and 0-2 feet to 48-50 feet for the well borings.

A total of 193 samples were analyzed for PCBs (excluding duplicates) in the former oxbow/gas plant area. Of these samples, a total of 79 exhibited PCB concentrations of less than 1 ppm, while an additional 43 samples had PCB concentrations between 1 and 10 ppm.

Fifty-three samples had PCB concentrations between 10 and 200 ppm, while a total of 18 samples had a PCB concentration of between 200 and 5,480 ppm.

The highest PCB concentrations were detected in soil samples collected from the upper 14 feet. The lowest concentrations observed in the borings (including non-detects) were distributed throughout the various depth intervals, but tend to be found near the bottom of a majority of the borings.

With the exception of X-7, X-11, X-15, ES2-1, and ES2-6, the highest concentration of PCBs detected in each boring was found in fill material. Although PCBs were also found in native soil in the majority of borings, these concentrations were relatively low in comparison to those observed in fill material. In the four borings containing greater than 500 ppm total PCBs (X-1, X-4, X-5, and ES2-2), the water-table depth was within 0 to 2 feet of the soil interval containing the elevated levels of PCBs.

In general, the level of PCBs in soil samples collected from the borings placed within the gas plant area were found to be less than in the former oxbow area (Figure 4-25). In particular, the highest levels of PCBs tended to be found in the western limb of the oxbow. With one exception, the highest concentrations of PCBs in the gas plant borings (X-12 through X-20) was 40 ppm in X-12 (2-4 ft). Total PCB concentrations did not exceed 1.1 ppm in any given sample interval in borings X-16, X-17, X-18, and X-19.

<u>Pesticides/Herbicides</u> - The analytical results for Appendix IX+3 pesticides/herbicides in soil samples collected from the former oxbow and gas plant area soil borings are presented in Table 4-21. Soil samples collected from the well borings were not analyzed for

pesticides/herbicides in accordance with a prior agreement with the MDEP.

One or more pesticide/herbicide(s) were detected in five of the 18 soil borings (X-1, X-7, X-15, X-16, and X-20) at low concentrations. The most commonly detected pesticide/herbicide in the oxbow and gas plant area samples was 2,4,5-T which was detected in soil samples from X-7, X-15, and X-16 at concentrations of less than 0.1 ppm. The other pesticides/herbicides that were detected were: aldrin (two locations at 12 and 0.0020 ppm); 4,4'-DDE (one location at 0.0052 ppm); 2,4-D (two locations at 0.28 and 0.16 ppm); and 2,4,5-TP (also known as silvex), at two locations at 0.072 and 0.038 ppm.

4.4.3.2 Groundwater Investigation

Observations of Oil in Groundwater

The presence of floating oil in the former oxbow and gas plant area has been measured in select wells during the semiannual monitoring program. The presence of oil in this area is discussed further in Section 4.2 and 4.7.

Floating oil was not observed on the water table in monitoring wells ES2-1, ES2-2, and ES2-7; however, these wells are not designed to monitor for floating oil as they are screened below the water table. Monitoring Well ES2-6 did have an oil sheen present on the water table during sampling in February 1991.

Groundwater Quality

The analytical results for groundwater samples submitted for Appendix IX+3 parameters are summarized in Tables 4-12 through 4-14. These tables present only those compounds that were detected. Analytical data sheets are presented in an organized way in Appendix I.

VOCs - The analytical results for groundwater samples submitted for Appendix IX+3 analyses are summarized in Table 4-12. A visual presentation of the distribution of total VOCs in groundwater is provided in Figure 4-20. Acetone and methylene chloride were detected in several of the samples analyzed; however, both these compounds were always detected in the associated blanks and are common laboratory contaminants, thus indicating that the sample results are likely due to laboratory contamination. The concentrations of these two VOCs are not included in the total concentrations or number of VOCs discussed below.

The VOCs detected in groundwater samples consisted of aromatic hydrocarbon and chlorinated hydrocarbon compounds. The two most common VOCs detected were chlorobenzene and benzene. Chlorobenzene was detected at concentrations ranging from 0.008 ppm in well ES2-7 to 0.87 ppm in well 64. Benzene was detected at concentrations ranging from below detection in well 61 to 1.1 ppm in well 54.

Two VOCs were detected in wells 4 and 24 located north of the railroad tracks. Total VOC concentration in well 24 was 0.473 ppm and in well 4 was 0.013 ppm. Chlorobenzene was detected in wells 24 and 4 at concentrations of 0.43 ppm and 0.009 ppm, respectively. Benzene was detected in well 24 (0.043 ppm) and TCE (0.004 ppm) was detected in well 4. VOCs were not detected in well 61, located in the far eastern portion of East Street Area 2.

The concentration of VOCs varied in the two MCP well clusters (ES2-1/ES2-6 and ES2-2/ES2-7) located near the ends of the oxbow limbs. The total VOC concentration in the shallow well, ES2-1, was 0.632 ppm and in the deeper well, ES2-6, was 3.29 ppm. Benzene and chlorobenzene were detected at concentrations of 0.018 ppm and 0.6 ppm, respectively in ES2-1, and at 0.14 ppm and 0.34 ppm, respectively in ES2-6. Well ES2-6 contained three aromatic hydrocarbon VOCs, ethylbenzene (1.3 ppm), toluene (0.31 ppm), total xylenes (1.2 ppm) not detected in ES2-1. Conversely, vinyl chloride was not detected in ES2-6, but was detected in ES2-1.

In the ES2-2/ES2-7 cluster, the shallower well, ES2-2, contained several additional aromatic and chlorinated VOCs not detected in the deeper well ES2-7. The only VOC detected in well ES2-7 was chlorobenzene at a concentration of 0.008 ppm. A total of five chlorinated VOCs [chlorobenzene (0.3 ppm), 1,1-dichloroethane (0.017 ppm), DCE (0.008 ppm), TCE (0.003 ppm), and vinyl chloride (0.015 ppm], as well as aromatic hydrocarbons [consisting of BTEX (0.32 ppm)] were detected in sample ES2-2 at a total concentration of 0.663 ppm.

The concentration of VOCs in two wells, 63 and 64, located downgradient and adjacent to the Housatonic River, also varied in VOC concentrations. The highest concentration and greatest number of VOCs detected in the oxbow area were in the sample from well 64 which had a total of 14 VOCs with a total concentration of 28.19 ppm. Several of the chlorinated compounds were detected at concentrations greater than 1 ppm. The highest concentration of any individual VOC in well 64 was 11 ppm of 1,1,1-trichloroethane. Only two VOCs, benzene (0.05 ppm) and chlorobenzene (0.19 ppm) were detected in well 63, located approximately 440 feet east of well 64.

BTEX and chlorobenzene were detected in monitoring wells 43 and 54, located downgradient of the recharge pond and adjacent to recovery systems 64X and 64V, respectively. However, the total concentrations varied. Chlorobenzene and BTEX were detected in wells 43 and 54 at total concentrations of 0.212 ppm and 3.395 ppm, respectively. The concentrations of chlorobenzene in the two wells were comparable; however, the concentration of BTEX was significantly higher in well 54.

<u>SVOCs</u> - The analytical results for groundwater samples submitted for Appendix IX+3 SVOCs are summarized in Table 4-13. A visual presentation of the distribution of total SVOCs is presented in Figure 4-20. The laboratory analysis of several samples (from wells ES2-1, ES2-3, ES2-4, ES2-6, 43, and 63) was performed twice, and one sample (from well 54) was analyzed three times because concentrations of some SVOCs exceeded the calibration range of the first analysis. A second and third analysis were performed to quantify those SVOCs that were out-of-range.

The concentration of bis(2-ethylhexyl)phthalate was detected in several samples at estimated concentrations below the quantitation limit (0.001 to 0.008 ppm). A reanalyzed sample from well 54 had a concentration of 1.6 ppm. However, the first analysis and a third reanalysis for sample 54 both detected bis(2-ethylhexyl)phthalate at an estimated concentration of 0.001 ppm, indicating the detection of 1.6 ppm is suspect. Hence, that concentration is not included in evaluating total concentrations.

The majority of SVOCs detected in the groundwater samples from the oxbow and gas plant areas were PAHs. The highest concentrations of SVOCs were detected in well ES2-6, the deep well in the cluster in the eastern limb of the former oxbow near the river. The total concentration of SVOCs in ES2-6 was 7.296 ppm and 10.831 ppm, respectively, in the first and second analyses. With the exception of an estimated concentration of 0.022 ppm of 1,4-dichlorobenzene, the remainder of the SVOCs detected in ES2-6 were PAHs (17 in total). In the adjacent well ES2-1, PAHs were detected less frequently (six in total) and at considerably lower concentrations (0.001 ppm to 0.016 ppm). Four chlorinated hydrocarbons and one chlorinated phenolic compound were detected in ES2-1. The total concentration of SVOCs in ES2-1 was 0.14 ppm in the first analysis and 0.154 ppm in the reanalysis, of which 0.084 ppm and 0.096 ppm, respectively, were attributed to 1,4-dichlorobenzene.

The relative relationship of the concentrations detected in the ES2-2/ES2-7 cluster are different than those observed in the ES2-1/ES2-6 cluster. The total concentration of SVOCs in ES2-7 (the deeper well) was 0.011 ppm, and all the concentrations were reported as estimated concentrations below the quantitation limits. In well ES2-2, the total concentration of SVOCs was 0.758 ppm. The SVOCs (16 in total) in ES2-2 were primarily PAHs, ranging in concentration between 0.001 ppm (2-methylnaphthalene) and 0.1 ppm (acenaphthene). A total of five chlorinated hydrocarbon SVOCs were detected in ES2-2. The highest concentration in ES2-2 was 0.13 ppm of 1,4-dichlorobenzene. Hexachlorodibenzofuran was detected at a concentration of 0.0000037 ppm in ES2-2.

The total concentration of SVOCs in well 63 was 0.091 ppm in the first analysis and 0.084 ppm in the reanalysis, of which 0.037 ppm and 0.044 ppm was attributed to 1,4-dichlorobenzene. The total concentration of SVOCs in well 64 was 0.486 ppm. The SVOCs detected in well 64 were primarily phenolic and chlorinated compounds. The highest concentrations were for 3-methylphenol (0.078 ppm), 2-methylphenol (0.096 ppm), and 4-methylphenol (0.078 ppm).

The total concentration of SVOCs in well 43, located downgradient of the recharge pond, was 0.051 ppm in the first analysis and 0.069 ppm in the reanalysis. These compounds were primarily detected at estimated concentrations below the quantitation limit. Heptachlorodibenzofuran and hexachlorodibenzofuran were detected in well 43 at concentrations of 0.000003 ppm and 0.000002 ppm, respectively. The total SVOC concentrations in the three analyses performed on the sample from well 54 were 3.136 ppm, 8.346 ppm, and 2.101 ppm, respectively. The main SVOCs in well 54 are five PAHs: acenaphthene, fluorene, 2-methlnaphthalene, naphthalene, and phenanthrene. Naphthalene was detected at a concentration of 2.2 ppm, 7.6 ppm, and 1.2 ppm in the three analyses.

The groundwater samples from monitoring wells 4 and 24, located north of the railroad tracks, showed only an estimated concentration of 0.001 ppm of 1,2,4-trichlorobenzene in each well. No SVOCs were detected in well 61.

Inorganics - The analytical results of the groundwater samples submitted for Appendix IX+3 inorganics are summarized in Table 4-14. Inorganics were analyzed as total inorganics from unfiltered samples. The concentration of dissolved inorganics was determined from one filtered sample (well 24). Calcium and magnesium were detected in all samples. The remainder of the detected inorganics are metals. In general, the number and highest concentration of metals were detected in wells ES2-6, 24, and 43.

The number and concentration of inorganics varied in the well clusters (ES2-1/ES2-6 and ES2-2/ES2-7). As in the case of SVOCs, the number of inorganics in the ES2-1/ES2-6 cluster was less in the shallower monitoring well, ES2-1. The reverse was observed for wells ES2-2 and ES2-7.

Analysis for both total and dissolved metals was performed on the groundwater sample from well 24. Calcium, magnesium, manganese, potassium, and sodium were detected in the dissolved sample at lower concentrations than the sample analyzed for total inorganics. However, no other metals were detected in the dissolved sample. The difference between the filtered and non-filtered metals results is most likely the result of sample preservation techniques.

PCBs/Pesticides/Herbicides - The analytical results obtained for well 61 indicate that no PCBs, pesticides, and herbicides were detected.

4.4.3.3 Oil Investigation at Monitoring Well ES2-6

As noted in Section 4.4.3.1, during the drilling of deep well ES2-6 in the eastern limb of the former oxbow, a separate-phase oil was detected above the till layer (Figure 4-1). In addition, the levels of PAHs detected in groundwater from this well during MCP Phase II activities were significantly higher than the adjacent shallow well, suggesting the potential presence of DNAPL at this location.

The presence of DNAPL at this location was confirmed in March 1994. A sample of DNAPL was collected on March 2, 1994, and analyzed for VOCs using USEPA Method 8260, SVOCs using USEPA Method 8270, and PCBs using methods outlined in USEPA Document No. 600/4-81-045 ("Analysis of PCBs in Transformer Fluids and Waste Oil").

As shown in Table 4-22, the analytical results for this sample indicate that this oil contains primarily PAHs with several VOCs also being detected at various concentrations. No PCBs were detected at a detection limit of 5.0 ppm.

Some of the PAHs detected at higher concentrations include naphthalene at 75,000 ppm, phenanthrene at 39,000 ppm, 2-methylnaphthalene at 28,000 ppm, pyrene at 22,000 ppm, acenaphthene at 18,000 ppm, and fluoranthene at 13,000 ppm. Other PAHs detected at concentrations ranging from 4,900 ppm to 9,200 ppm include: benzo(a)pyrene, chrysene, acenaphthylene, benzo(a)anthracene, and benzo(b,k)fluoranthene. VOCs detected include ethylbenzene at 3,700 ppm, xylenes at 2,900 ppm, 1,2,4-trimethylbenzene at 1,700 ppm, and toluene at 250 ppm.

A comparison of these data to the analytical results of the "sludge" sample taken from the former tar separator at boring X-19 (Tables 4-17 and 4-18) shows a common presence of nearly all the constituents found in the DNAPL sample from well ES2-6.

4.4.4 Interpretation of Oxbow and Gas Plant Results

This section presents a summary and interpretation of the analytical data and visual descriptions described above. The following observations have been made regarding the occurrence of organic and inorganic constituents in the former oxbow and gas plant area.

Soils/Fill

Various constituents were detected in soils/fill in the former oxbow and gas plant area, consisting mainly of SVOCs, PCBs, and inorganics (primarily metals). SVOC concentrations were generally higher in the area of the former gas plant. PCB concentrations were higher in the western section of the oxbow (adjacent to the scrap yard area). Inorganic concentrations were somewhat variable throughout the area. A summary of the soil/fill results is as follows:

- VOCs were not detected in seven of the 24 samples analyzed (including duplicates), while total VOC levels in nine of the remaining samples were less than 1 ppm, and less than 2 ppm in two additional samples. The highest levels of total VOCs were detected at boring X-19 (831 ppm) in the area of the former tar separator, and at two borings (X-4 and ES2-2) in the western limb of the former oxbow (130 and 217 ppm, respectively). Where detected, the VOCs were composed primarily of BTEX and chlorobenzene.
- SVOC levels were higher than VOC concentrations, particularly in the area of the former gas plant and those portions of the former oxbow in the vicinity of the former gas plant. Twelve of the 24 samples exhibited SVOC concentrations less than 66 ppm. The highest SVOC concentrations (by two and three orders of magnitude) were detected at X-19 (in the area of the former tar separator) and X-14 (in the area of the former gas holder) -- 217,053 and 57,790 ppm, respectively. Both of these borings were described as containing significant amounts of tar-like material. The remainder of the samples had total SVOC concentrations ranging between 134 and 797 ppm. The majority of SVOCs detected were PAHs.
- Inorganics, primarily metals, were detected at some locations at concentrations exceeding those present in soil borings north and west of the gas plant/oxbow area (X-16 and X-17). However, as discussed below, the metals do not appear to be migrating significantly to groundwater.
- Of 193 soil/fill samples analyzed for PCBs, 122 had PCB levels less than 10 ppm (with 79 at or below 1 ppm), while 18

exhibited PCB concentrations greater than 200 ppm. Most of the soil borings with high PCB concentrations are located in the western limb of the oxbow, near the scrap yard. PCB concentrations generally decreased with depth and were generally not detected, or detected in low concentrations, in the native deposits.

Groundwater

Despite the presence of various constituents in the soil/fill, certain site-specific factors would be expected to limit the potential for such constituents to migrate from the soil/fill to groundwater in the former gas plant area and the western limb of the former oxbow. The water table is generally below the depth of fill in areas north of the former oxbow (including the gas plant area) and in the western limb of the former oxbow, thereby somewhat reducing the potential for constituents in the fill to dissolve into and migrate with groundwater. In addition, portions of these areas are covered with pavement or vegetation, which can reduce the degree of infiltration and thus the degree of dissolution and leaching of constituents from soil/fill to groundwater.

Water elevations in the eastern limb of the oxbow, however, are generally at or above the depth of fill. These elevations may be influenced by the groundwater recharge pond, which creates a localized groundwater mound. Due to these elevations, a greater potential exists that certain constituents (particularly more water-soluble compounds such as VOCs) will dissolve into groundwater. In addition, this potential is also suggested by the fact that free product, primarily LNAPL, is in contact with the groundwater underlying tne eastern limb of the former oxbow and that DNAPL found in well ES2-6 is in contact with the groundwater at that location.

The actual groundwater monitoring data in general are consistent with the above expectations:

- Total VOC concentrations in groundwater were, with three exceptions, at or below 0.66 ppm. The exceptions were wells 54 (3.4 ppm) and ES2-6 (3.3 ppm), both of which are located in the eastern limb of the oxbow, and well 64 (28 ppm), which is located near the western oxbow limb. The VOCs detected consisted primarily of aromatic hydrocarbons (including BTEX) and chlorinated hydrocarbon compounds.
- Total SVOC concentrations in eight of the 11 wells tested were less than 0.5 ppm, with five of these eight wells showing concentrations less than 0.1 ppm. The highest SVOC concentrations (by more than an order of magnitude) were detected in groundwater samples from wells ES2-6 (10.8 ppm) and 54 (8.3 ppm) in the eastern limb of the oxbow. Most of the SVOCs detected were PAHs.
- The number and concentrations of metals detected in groundwater are significantly lower than in soil/fill. Moreover, with the exception of well 24, the groundwater inorganic results were obtained from <u>unfiltered</u> samples, which can result in an overestimation of the dissolved inorganic concentrations. In the groundwater sample from well 24, which was analyzed for both dissolved and total metals, the concentrations of metals were greatly reduced in the dissolved phase. The lower levels of metals in groundwater than in soil/fill are consistent with the data presented in Section 7 showing that soil samples from this area did not exhibit the RCRA TCLP characteristics.

- No PCBs, pesticides, or herbicides were detected in the groundwater in the former oxbow and gas plant area.
- As noted above, elevated concentrations of certain constituents were found in wells 64, ES2-6, and 54. Well 64 showed anomalously high levels of VOCs. These concentrations may be attributable to a localized source present within the fill material in that area and probably do not reflect the quality of groundwater migrating between the limbs of the former oxbow. As discussed in Section 11, further study of groundwater in this area seems appropriate to better define the source of these constituents. Wells ES2-6 and 54 showed relatively high concentrations of BTEX; this may be explained by contributions from the oil-stained zone remaining in the soil/fill near well 54 and by the oil observed at depth in the native deposits at well ES2-6. In addition, well ES2-6 exhibited high levels of PAHs, which appear to be attributed to the oil observed at depth and the downward migration of the denser PAHs. The analytical results of the DNAPL sample obtained at Well ES2-6 in March 1994 confirm the presence of elevated concentrations of PAHs at this location. The potential impact to groundwater associated with this DNAPL will be investigated further as discussed in Section 11.

4.5 Remainder of East Street Area 2/USEPA Area 4 Investigations

Prior to the initiation of MCP activities, a number of subsurface investigations were completed within the remainder of the East Street Area 2/USEPA Area 4 Site.

The pre-MCP activities are described in Section 4.5.1. The MCP Phase II activities include soil and groundwater sampling at 11 locations across the site. The scope of these MCP activities is presented in Section 4.5.2. The results of the MCP activities are presented in Section 4.5.3. Section 4.5.4 presents an interpretation of investigation results.

4.5.1 Pre-MCP Investigations

Prior to the initiation of MCP activities, two monitoring well installation and sampling programs were completed within the remainder of the East Street Area 2/USEPA Area 4 Site to address groundwater and soil quality in this area. In February and March 1990, three borings, designated A7, B1, and C1, were completed in the vicinity of Building 100. These borings, located in the northeast portion of the site at the locations shown on Figure 4-1, were subsequently completed as monitoring wells (Geraghty & Miller, May 1990a). This investigation was designed to provide baseline soil and groundwater quality data for the area in preparation for the possible rental of a number of GE buildings located along the northern property boundary.

Soil samples were collected continuously in 2-foot intervals from the borings and were screened in the field with a PID. Because PID readings did not exceed 10 PID units, soil samples were not submitted for VOC analyses. Soil from each of the sampled intervals was, however, submitted for PCB analysis. The results are discussed in Section 4.5.3.1.

On March 22, 1990, groundwater samples were collected from two of the three monitoring wells. Monitoring well B1 was dry and could not be sampled. The collected samples were submitted to IT Analytical Services for analyses of priority pollutant VOCs, SVOCs, metals, pesticides, PCBs, cyanide, and phenols. The results are discussed in Section 4.5.3.2.

A second investigation involving the installation of monitoring wells and the collection of soil and groundwater samples was also implemented in March 1990. This study involved the drilling of two soil borings that were subsequently completed as monitoring wells. The locations of these borings/monitoring wells, 17A and 17C, are shown on Figure 4-1 (Geraghty & Miller, May 1990b). This boring program was also completed in conjunction with the possible rental of property by GE.

As with the investigation at Building 100, soil samples were obtained continuously in 2-foot intervals from the borings and were screened in the field with a PID. Because the field screening results did not exceed 10 PID units, soil samples were not submitted for VOC analysis. Each of the collected soil samples was, however, submitted for PCB analysis, and the results are discussed in Section 4.5.3.1.

On March 22 and March 26, 1990, groundwater samples were collected from monitoring wells 17C and 17A, respectively. Samples were submitted to IT Analytical Services to be analyzed for priority pollutant VOCs, SVOCs metals, pesticides, PCBs, cyanide, and phenols. The results are discussed in Section 4.5.3.2.

In addition, in accordance with protocols developed for the management of excavation activities (Blasland & Bouck, March 1990), soil samples are collected for analysis as part of routine excavation activities.

The soil sampling activities completed in conjunction with excavation activities within the remainder of the East Street Area 2/USEPA Area 4 Site are discussed in Section 7.4.

4.5.2 MCP Investigations

The MCP work activities for the remainder of the East Street Area 2/USEPA Area 4 Site are described in the MCP Phase I Scope of Work for the Remainder of GE Facility (Blasland & Bouck, August 1990a). This document details an investigative program consisting of the completion of 11 borings at the GE facility, including locations along the western boundaries of the site, to be completed as shallow monitoring wells. Soil and groundwater samples were collected and analyzed. The boring locations along the western boundary are RF-1, RF-2, RF-3, RF-4, and RF-16 (Figure 4-1). Originally, a series of monitoring wells, RF-5 through RF-10, were also proposed to be completed across the facility. However, due to the completion of pre-MCP investigations described in Section 4.5.1 above, analytical data from the pre-MCP wells was substituted for additional MCP investigations. The following substitutions were made with MDEP approval:

SOW Well	Replacement Well
RF-5	17A
RF-7	17C
RF-8	A7
RF-9	B1
RF-10	C1

In addition, monitoring well RF-6 was not installed, as previous attempts to drill in this area were unsuccessful due to the presence of a buried steam line. However, a soil sample from 0 to 4 feet was collected from boring

17B and analyzed for PCBs as discussed below (Geraghty & Miller, May 1990b).

Monitoring well RF-4 was installed on May 28 and 29, 1991. The remaining wells in this area, RF-1, RF-2, RF-3, and RF-16, were installed between October 21 and October 24, 1991. The boring depths ranged from 18 feet at RF-2 to 26 feet at RF-4, and the depth to groundwater ranged from 8 to 15 feet below grade. At RF-2 and RF-4, subsurface materials predominately consist of sand and gravel outwash deposits. At the remaining locations, heterogeneous fill material containing various percentages of wood and brick, in addition to sand and gravel, were encountered. Due to the presence of coarse fill material, soil sample recovery was generally poor. The boring logs are included in Appendix H.

Soil samples from each of the MCP borings that had a PID reading of greater than 10 PID units were submitted to CompuChem Laboratories, and analyzed for VOCs and SVOCs. Each soil sample collected was also submitted to IT Analytical Services and analyzed for PCBs. One soil sample, collected at RF-4 from a depth of 10 to 12 feet, was also analyzed by CompuChem Laboratories for pesticides, herbicides, metals, cyanide, phenols, and sulfide, as well as VOCs, SVOCs, and PCBs. Table 4-22 lists the analyses completed for each sample.

Groundwater samples were collected in December 1991 from wells RF-1, RF-2, RF-3, RF-4, and RF-16 and submitted to CompuChem Laboratories, for analyses of VOCs, SVOCs, pesticides/herbicides, PCBs, and inorganics, and from wells RF-1, RF-2, RF-3, and RF-16 for dioxins and furans. The analyses completed for each well are also listed in Table 4-23.

4.5.3 Investigation Results

Data collected as part of pre-MCP investigations across the facility and as part of MCP activities along the western boundary of the site are considered jointly in this section. Tables 4-24 through 4-27 present summaries of soil analytical data and Tables 4-28 through 4-30 present summaries of groundwater analytical data, for the remainder of the East Street Area 2/USEPA Area 4 Site. Only those parameters detected in each sample matrix are reported.

4.5.3.1 Soil

Table 4-24 presents a summary of the VOCs detected in the soil borings. VOCs were detected at very low concentrations in soil samples collected from RF-2, RF-3, RF-4, and RF-16. In fact, with the exception of one sample (RF-2), the noted concentrations were reported as estimated values below quantitation limits and/or were detected in the associated laboratory blanks. Acetone was detected in the soil sample collected at RF-2 (0 to 2 feet) at a concentration of 0.015 ppm. Because acetone is a common laboratory contaminant, and was present in only one sample at a low concentration, the noted detection is not believed to be significant.

As shown in Table 4-25, detected SVOC concentrations were typically low (less than 1 ppm) and were often less than the quantitation limit. The highest SVOC concentration in any of the analyzed soil samples was 5.3 ppm of fluoranthene detected in boring RF-2 from 0 to 2 feet.

Tables 4-26a, 4-26b, and 4-26c present PCB analytical data for sampled soils. Of the 77 soil samples (excluding duplicates) analyzed for PCBs from the soil borings, a total of 55 samples had PCB concentrations of less than 1 ppm while an additional 12 samples had PCB concentrations between 1 and 10 ppm. Of the other 10 samples, nine had PCB concentrations between 10 and 44 ppm while one sample exhibited a concentration of 290 ppm. At a number of borings (B1, 17A, 17B, and 17C) PCBs were not detected in any of the soil samples (Table 4-26a).

Inorganic soil analyses were completed at boring RF-4 and the results are summarized in Table 4-27. This boring is located north of Silver Lake (Figure 4-1). The inorganic constituents detected in soils at boring RF-4 are of similar magnitude as those detected in other parts of the site outside of the scrap yard and oxbow fill areas. As discussed below, the groundwater analyses for inorganics do not indicate any significant migration of these constituents from the soils.

4.5.3.2 Groundwater

Table 4-28 presents a summary of the VOC analytical data for both the pre-MCP and MCP monitoring wells in this area. With the exception of tetrachloroethene and trichloroethene, no VOCs were detected above quantitation limits. Tetrachloroethene was detected at monitoring wells RF-16 and A7 at concentrations of 0.011 ppm (0.012 ppm in the duplicate sample) and 0.010 ppm, respectively. Trichloroethene was detected in the sample from C1 at a concentration of 0.036 ppm.

SVOC analytical data are summarized in Table 4-29. A total of 11 SVOCs were detected in at least one groundwater sample at quantifiable concentrations. Of these compounds, only N-nitrosodiphenylamine, phenanthrene, and phenols were detected at more than one monitoring well location. N-nitrosodiphenylamine was detected at C1 (0.011 ppm) and 17C (0.017 ppm), while phenanthrene was detected at RF-3 (0.025 ppm) and RF-16 (0.01 ppm). Phenols were the most frequently detected SVOC compound in groundwater. Total phenols concentrations of 0.03 ppm were detected at A7 and C1, and a concentration of 0.01 ppm was detected at 17A. At RF-1, located in the southern part of the site, a total phenols concentration of 0.018 ppm was detected. The greatest number of SVOCs were detected at RF-3.

A number of inorganic constituents were detected in groundwater, as summarized in Table 4-30. In general, the highest inorganic concentrations were noted at RF-3. At this location, aluminum, arsenic, calcium, copper, iron, lead, mercury, and potassium were detected at concentrations an order of magnitude higher than the concentrations noted for the remaining wells. It should be noted, however, that this analysis was performed on an unfiltered sample. As discussed in Section 11, during supplemental Phase II activities, it would be appropriate to collect and analyze for inorganics a filtered groundwater sample from well RF-3 to determine the soluble fraction of these constituents.

No other constituents, including PCBs, were detected in the groundwater in this area.

4.5.4 Interpretation of Remainder of East Street Area 2/USEPA Area 4 Results

This section presents a summary and interpretation of results based on the analytical data and visual descriptions described above. The following observations have been made regarding the occurrence of organic and inorganic constituents in the remainder of the East Street Area 2/USEPA Area 4 Site.

Soils

The concentrations of constituents detected in soils in the remainder of the East Street Area 2/USEPA Area 4 Site were quite low. A summary of the soil sampling results is as follows:

- VOCs were either not detected or detected in very low concentrations in soil samples. In fact, with the exception of one sample (from RF-2), detected concentrations were reported as estimated values below quantitation limits and/or were detected in the associated laboratory blanks. The RF-2 sample showed a concentration of one VOC (acetone) at 0.015 ppm.
- Detected SVOC concentrations in soils were also very low (less than 1 ppm) and were often less than the quantitation limit.
- Only one soil sample (from RF-4) was analyzed for inorganics. The inorganics detected were of similar magnitude as those detected in other parts of the site outside of the scrap yard and oxbow/gas plant areas.
- Of the 77 soil samples (excluding duplicates) analyzed for PCBs, 55 (or 71.4%) had concentrations less than 1 ppm, while 67 (or

87%) had concentrations less than 10 ppm. Only one sample exhibited a PCB concentration greater than 50 ppm.

Groundwater

As expected, given the low concentrations of constituents in soils, constituents detected in groundwater were few in number and very low in concentration.

- With the exception of tetrachlorethane found in two wells (at concentrations of about 0.01 ppm in both wells) and trichloroethene found in one well (at 0.036 ppm), no VOCs were detected in groundwater at values above the quantitation limits.
- With minor exceptions, SVOCs were detected at levels above quantitation limits at only one well (RF-3). SVOCs were detected at RF-3 at a total concentration of 0.156 ppm (exclusive of estimated values below the quantitation limit).
- Very low concentrations of inorganics were detected at several wells, with the highest concentrations (by an order of magnitude) detected at RF-3. However, groundwater inorganic results were obtained from unfiltered samples, which can result in an overestimation of the dissolved inorganic concentrations. As discussed in Section 11, additional sampling and analysis of a filtered groundwater sample from RF-3 would be appropriate to better assess the levels of inorganics dissolved in groundwater at this location.
- No PCBs were detected in any groundwater samples.

4.6 Summary of Soil Gas Data

As discussed in Sections 4.3 through 4.5, during the installation of the various soil borings at this site, headspace screening of split-spoon samples has been performed with a PID. PID headspace readings give a qualitative estimate of the concentration of volatile constituents present in the soil gas. The PID readings from the various borings at the site are included in Table 4-31.

PID readings obtained at the site ranged from 0 to 113 PID units. Samples with elevated PID readings were principally found at depth. The vertical profile of PID readings in most borings in these areas shows an increase from background levels (less than 1 PID unit) near the surface to higher levels at a depth of 4 to 6 feet or greater below grade. This PID information indicates that volatile constituents may be present in subsurface materials, but that vertical migration of constituents in subsurface gas to the ground surface does not appear to be occurring to any appreciable extent in the majority of the site.

The PID data indicate further that the extent of materials with elevated PID readings is primarily associated with those areas of the site containing the former oxbow and the immediately surrounding area.

4.7 Site-Wide Hydrogeologic Characterization

This section summarizes the hydrogeologic investigative activities performed at the East Street Area 2/USEPA Area 4 Site. Aquifer characteristics are discussed in Section 4.7.1. The hydrogeologic interaction between the oil plume and the Housatonic River is discussed in Section 4.7.2, and site-wide groundwater quality is discussed in Section 4.7.3.

4.7.1 Aquifer Characteristics

The unconsolidated material in the East Street Area 2/USEPA Area 4 Site consists primarily of fill, underlain by native outwash deposits of fine to coarse sand and gravel. The water table within the unconsolidated deposits slopes gently to the south, toward the Housatonic River. Site data indicate that the saturated portion of the unconsolidated material is approximately 29 feet thick. Glacial till was encountered below the outwash deposits at a depth of 44 feet at monitoring well ES2-6. Because the till is believed to be relatively impermeable, the top of the till is interpreted as the base of the water bearing unit.

Engineering features present south of East Street that influence groundwater elevations and flow directions include:

- The V-shaped slurry wall located immediately south of oil recovery caisson 64V;
- Oil recovery systems 64S, 64X, 64V, RW-1(X), and RW-2(X);
- The recharge pond located in the former oxbow channel, approximately 250 feet north of the river; and
- The interceptor trench that connects caissons 64X(W) and 64X(S).

Pumping at caisson 64V induces a groundwater depression upgradient of the slurry wall. The slurry wall does not extend to the top of till and, therefore, also produces a more subtle effect downgradient of the slurry wall (Figure 4-8). Continuous pumping as part of the on-going oil recovery efforts at 64V, 64S, RW-1(X), and RW-2(X) produces a constant cone of depression in the water table near their associated locations. The interceptor trench connecting caissons 64X(W) and 64X(S) represents a zone of relatively high permeability that influences groundwater flow when the caissons are pumped. Additionally, pumping at 64S also influences groundwater flow by creating a localized groundwater capture zone. A constant head is maintained in the recharge pond at an elevation of approximately 984 feet, producing a groundwater mound.

Slug Tests

Slug testing of wells and piezometers has been performed on two occasions, in June 1990 (GE, 1990a) and October 1993 (Rust, 1993). The methods and findings from each round of testing are summarized below. Table 4-32 presents a summary of the slug test results.

June 1990

On June 19, 1990, Blasland & Bouck personnel performed slug testing on three recently installed piezometers (PZ-2S, PZ-3D, and PZ-4S) and one existing well (well 62) (GE, August 1990a). The slug tests were performed using the rising head method by pumping or bailing the piezometer/well and then measuring water levels at timed intervals until a static (pre-pumping) water level was obtained. Hydraulic conductivity values calculated using the Hvorslev method (Hvorslev, 1951) ranged from approximately 0.2 ft/day (6.7×10^{-5} cm/sec) to 1.7 ft/day (5.9×10^{-4} cm/sec), with an arithmetic mean of 0.9 ft/day (3.2×10^{-4} cm/sec).

October 1993

On October 4, 1993, Rust Environment and Infrastructure personnel performed slug testing on seven recently installed wells (ES2-2A, ES2-9, ES2-10, ES2-11, ES2-12, 1R, and 9R) (Rust, December 1993). The slug tests were performed using the falling head method by introducing a volume of water into the well and then measuring water levels at timed intervals until a static (pre-test) water level was obtained. Hydraulic conductivity values were calculated using both the Hvorslev method and the Bouwer and Rice method. The estimated hydraulic conductivity ranged from 0.09 ft/day (3.19×10^{-5}) to 2.97 ft/day (1.05×10^{-3} cm/sec). The arithmetic mean hydraulic conductivity was 7.82 ft/day (2.76×10^{-3} cm/sec) using the Hvorslev method and 4.19 ft/day (1.48×10^{-3} cm/sec) using the Bouwer and Rice method.

Pump Tests

Hydrogeologic pumping tests have been performed on several occasions between August 1978 and February 1992. The methods and findings from each round of testing are summarized below.

August 1978 - Pumping Caissons 64X(N), 64X(S), and 64X(W)

In August 1978, GE personnel performed several pumping tests of short duration at caissons 64X(N), 64X(S), and 64X(W). The primary aim of these tests was to qualitatively assess whether water-table depression would enhance the migration of oil to the caissons. No appreciable increase in oil thickness was observed in any of the tested caissons during these tests. Because the pumping phase of each of these tests lasted only 5 to 95 minutes, the benefits of creating a water-table drawdown area in the vicinity of the caissons may have been underestimated. In addition, the hydraulic parameters as a whole were not quantifiable based on the data from the short-term tests performed.

September 1988 - Pumping From Caisson 64X(S)

Geraghty & Miller performed three pump tests at caisson 64X(S) between September 8, and 15, 1988 (Geraghty & Miller, 1988). The pump tests lasted from 3.5 to 44 hours and pumping rates were between 44 and 100 gpm. The results from these tests showed relatively systematic drawdown of the water table within the vicinity of caisson 64X(S), with drawdown zones that extended in an east-west orientation, parallel to the Housatonic River approximately 300 feet to the east and 200 feet to the west. Hydraulic parameters were not determined from these tests.

January 1992 to February 1992 - Pumping Caisson 64X(W)

A six-day pumping test was performed at caisson 64X(W) between January 29 and February 3, 1992. The details of the pump test are presented in the report, "Pumping Test Analyses and Evaluation of Recovery Measures," (Golder, 1992). The pumping rate was 20 gpm for the first three hours and 40 gpm for the remainder of the test. Drawdown data obtained during the first three hours of pumping at 20 gpm were used to calculate hydraulic parameters. The data were analyzed by the Neuman method, which is appropriate for tests using partially-penetrating wells in unconfined aquifers. Hydraulic conductivity (K) values calculated by Golder Associates ranged from approximately 11.62 ft/day (4.1×10^{-3} cm/sec) to 212.62 ft/day (7.5×10^{-2} cm/sec), with an arithmetic mean of 70.87 ft/day (2.5×10^{-2} cm/sec). The calculated transmissivity values ranged from approximately 52 to 6,100 ft^2/day, with an arithmetic mean of 1,400 ft^2/day. No estimates of vertical hydraulic conductivity or specific yield were calculated from the data.

February 1992 - Pumping From Well RB-1

Golder Associates performed a pumping test at well RB-1 located in the riverbank area on February 26-27, 1992. The test included a 24-hour drawdown phase with a pumping rate of 50 gpm, followed by a 12-hour recovery phase. Drawdown data were used to calculate hydraulic parameters by the Neuman method. The estimated hydraulic conductivity

(K) values ranged from approximately 9.64 ft/day (3.4×10^{-3} cm/sec) to 147.42 ft/day (5.2×10^{-2} cm/sec), with an arithmetic mean of 39.69 ft/day (1.4×10^{-2} cm/sec.) The vertical hydraulic conductivity (Kv) estimates ranged from approximately 0.6 ft/day (2.1×10^{-4} cm/sec) to 79.38 ft/day (2.8×10^{-2} cm/sec) with an arithmetic mean of 23.81 ft/day (8.4×10^{-3} cm/sec). The calculated aquifer transmissivity values ranged from approximately 340 to 4,300 ft^2/day, with an arithmetic mean of 1,200 ft^2/day. The calculated specific yield values ranged from 0.21 to 0.43, with an arithmetic mean of 0.34 (dimensionless).

Recovery data were used to calculate the hydraulic parameters by the Theis recovery method. The resulting transmissivity estimates ranged from 1,400 to 4,900 ft^2/day, with an arithmetic mean of 2,500 ft^2/day. The horizontal hydraulic conductivity values calculated by the Theis recovery method ranged from 45.36 ft/day (1.6×10^{-2} cm/sec) to 170.1 ft/day (6.0×10^{-2} cm/sec) with an arithmetic mean of 85.05 ft/day (3.0×10^{-2} cm/sec). Vertical hydraulic conductivity and specific yield were not calculated.

Although the range of calculated parameter values noted above is reasonable for a stratified sand and gravel aquifer, these values likely exceed the actual values for this aquifer, due to the influence of the more permeable fill material within the collector trench located between caissons 64X(W) and 64X(S).

Summary of Pumping Tests

Based on the results of these pumping tests, the unconfined water bearing unit appears to have been adequately characterized in terms of hydraulic parameters. Numerical model calibration performed by Golder using the aquifer parameters calculated from the pumping test results yielded a realistic simulated water table (Golder, April 1992).

In summary, the average aquifer parameters based on the 1992 pumping tests performed at the site to date are as follows:

Parameter	Mean Value
Hydraulic conductivity	65.20 ft/day ($2.3x10^{-2}$ cm/sec)
Vertical hydraulic conductivity	23.81 ft/day ($8.4x10^{-3}$ cm/sec)
Transmissivity	1,700 ft^2/day
Specific yield	0.34
Static saturated thickness	29 feet

Vertical Hydraulic Gradients - The vertical hydraulic gradient was calculated using groundwater measurements obtained in March 1992 from the two MCP well clusters ES2-1/ES2-6 and ES2-2/ES2-7, as well as other wells located near these clusters. Monitoring wells ES2-6 and ES2-7 are screened at the base of the sand and gravel zone and provide a measure of potentiometric levels at the top of the till.

The calculations indicate an upward hydraulic gradient. The calculated vertical gradients are as follows:

Wells	Gradient
ES2-1 & ES2-6	0.003 ft./ft.
ES2-2 & ES2-7	0.002 ft./ft.
ES2-7 & ES2-3	0.019 ft./ft.

The till deposits probably overlie a deeper confined aquifer that is under higher pressure. This, in combination with the fact that groundwater discharges to the river, results in an upward pressure and upward vertical gradient. Therefore, downward vertical migration of groundwater from the unconsolidated sand and gravel through the till deposits is likely precluded. The till deposits observed during MCP drilling activities confirm that groundwater flow in the till is limited. The till deposits were described as damp to moist, whereas the sand and gravel was saturated.

Information generated as part of the Unkamet Brook Area MCP Phase II activities indicates that the Housatonic River acts as a hydraulic divide. This conclusion is supported by groundwater flow profiles near the confluence of Unkamet Brook and the Housatonic River that contour the vertical distribution of hydraulic head. These profiles show upward flow and discharge to the river, and indicate that the Housatonic River is influenced by groundwater flow producing an upward vertical gradient from a depth of at least 150 feet (MCP Interim Phase II Report for Unkamet Brook Area and Current Assessment Summary for USEPA Area 1, Blasland & Bouck, April 1992a). This conclusion is also supported by data from the Lyman Street Parking Lot/USEPA Area 5a Site wells (Blasland, Bouck & Lee, February 1994c).

4.7.2 Oil Plume Interaction with Housatonic River

The downgradient southern extent of the main oil plume in East Street Area 2 is successfully being captured at the eastern edge by recovery system 64V and the slurry wall and at the western edge by recovery system 64S. However, residual oil remaining in the vicinity of recovery system 64X may presently be the primary contributing source of the oil seeps along the bank of the Housatonic River. The oil seeps along the river appear to be due to the slow flushing of residual oil from the soil, downgradient of the 64X recovery systems.

An oil collection system consisting of absorbent floating booms is in place in the Housatonic River along the seep area. To monitor the effectiveness of the system, GE has implemented a weekly monitoring and recovery program along the riverbank seep area. In addition, as discussed in Section 4.2.4, oil is collected by hand bailing from wells and piezometers along the riverbank on a weekly basis, and active groundwater pumping since January 1992 from caisson 64X(W) has created a cone of depression along the riverbank in this area, resulting in enhanced hydraulic control.

As also discussed in Section 4.2.5, GE has implemented additional recovery and control systems in an attempt to reduce the potential for bank seeps in the vicinity of the 64X system. Golder Associates completed a numerical groundwater flow model to assess the effectiveness of various additional pumping scenarios to control and collect oil in the 64X vicinity (Golder, April 1992). These scenarios included pumping at one to four extraction wells located along the seep area. The pumping scenarios were then further evaluated with the inclusion of either a partially penetrating wall located along the riverbank or a barrier wall enclosing most of the 64X system. Following this evaluation, with MDEP concurrence, GE installed a new recovery well (RW-1(X)) along the riverbank and began active pumping in December 1992. An additional recovery well (RW-2(X)) was placed on-line in November 1993. Active pumping from these wells will be continued as part of proposed STM activities, as discussed in Section 4.2.5.

4.7.3 Site-Wide Groundwater Quality Summary

This section presents a summary of the findings on groundwater quality in the East Street Area 2/USEPA Area 4 Site.

The groundwater throughout a majority of the gas plant area and the eastern portion of the former oxbow is in contact with the main oil plume in East Street Area 2. The extent and thickness of this oil plume, however, have been limited by the slurry wall and oil recovery systems installed and operated by GE. In addition to the main oil plume, a few small pockets of oil are also present in portions south of East Street -- to the south of Building 64, around the 64X recovery system, and near well 50. These oil accumulations appear to be stable.

The soil/fill material in the scrap yard area, gas plant, and former oxbow area contains a variety of organic and inorganic constituents, including some VOCs, several SVOCs (primarily PAHs), PCBs, and metals. Several site-specific factors in these areas, however, limit the potential for these constituents to migrate to groundwater. The water table is generally below the depth of fill in the scrap yard area, the former gas plant area, and the western limb of the former oxbow, thereby reducing the potential for constituents in the fill to dissolve into and migrate with groundwater. Water table elevations in the eastern limb of the former oxbow, however, are generally at or above the depth of fill; these elevations may be influenced by the groundwater recharge pond in this area, which creates a localized groundwater mound. The scrap yard area and portions of the gas plant and oxbow areas are covered with pavement or vegetation, which can reduce the degree of infiltration and thus the degree of leaching of constituents from soil/fill to groundwater. In addition, as discussed in Section 7, TCLP analyses of certain soils in these areas did not show toxicity characteristics, which further supports the lack of leaching of inorganic constituents from the soils to groundwater.

As discussed in Section 4.3.4 and 4.4.4, no PCBs were detected in the groundwater in the scrap yard area or the former gas plant/oxbow area, and the other constituents found in the groundwater in those areas were much fewer in number than the constituents found in the soil/fill and, where detected, were generally at low concentrations, both in absolute terms and in relation to the constituents found in the soil/fill.

Additionally, as part of an investigation of former Housatonic River Oxbow Area E, a groundwater sample was collected from well E-1 located west of the scrap yard area and analyzed for Appendix IX+3 constituents. Additional details regarding this investigation are included in the report entitled "MCP Phase I and Interim Phase II Report for former Housatonic River Oxbow Areas A, B, C, E, F, J, and K" (Blasland & Bouck, April 1992b). PCBs and PCDD/PCDF compounds were not detected in the groundwater sample from well E-1. Total phenols were detected at 0.013 ppm while phenanthrene and phenol were detected at estimated concentrations of 0.002 and 0.001 ppm. (methylene chloride was detected in the sample and the associated method blank.) Metals results were observed to be typical of background groundwater quality conditions. This information supports the lack of migration to west of the site of hazardous constituents in groundwater.

Figures 4-26, 4-27, and 4-28 present a consolidated summary of hazardous constituents detected in groundwater at the site. In general, detected constituents include BTEX and several chlorinated volatiles (Figure 4-26) as well as various PAHs and chlorinated semivolatiles (Figure 4-27). In addition, various inorganics are noted to be present (Figure 4-28).

As also discussed in Section 4.4.4, it is noteworthy that well 64 showed anomalously high concentrations of VOCs (probably due to a localized source), while wells ES2-6 and 54 showed relatively high concentrations of BTEX (probably due to the oil-stained zone in the soil/fill near well 54 and the DNAPL observed at well ES2-6). In addition, well

ES2-6 (the deep well in the eastern limb of the oxbow) exhibited high levels of PAHs, which appear to be attributable to the DNAPL at depth, as the analysis of the DNAPL exhibited the presence of elevated concentrations of PAHs and several volatile constituents. As discussed in Section 11, further investigations would be appropriate to evaluate the potential impacts to groundwater of the DNAPL at ES2-6. In addition, as also discussed in Section 11, further investigations should be performed to investigate the source of the high VOC concentrations at well 64.

In the remainder of the site, as discussed in Section 4.5.4, few organic or inorganic constituents were detected in the soils, and groundwater analyses of samples from nine monitoring wells similarly found few constituents above detection limits. As in other areas, no PCBs were found in the groundwater in this area.

It is also important to consider the potential effects of groundwater and oil migration from the site upon the Housatonic River. As shown in Section 5, the water column data from the river indicate that the possible influx of groundwater and/or oil from the site has no significant impact on the surface water quality of the Housatonic River.

4.7.4 Continuity and Nature of Till

Available subsurface logs for borings and monitoring wells (Appendix H) at the East Street Area 2/USEPA Area 4 Site and several logs from adjacent areas were examined and interpreted for the presence of till, which is typically described on the logs as very dense silt, dense sand, silt and gravel till, and gravel till. Table 4-33 presents a summary of till surface data.

Of the East Street Area 2/USEPA Area 4 subsurface logs examined, 30 borings penetrated 1 to 20 feet into the top of the till layer. Using the interpreted surface elevation of the till from these logs as determined by lithology and significant increases in bulk density as determined by blow counts ("n" values > 25), and by using an estimated maximum elevation of till from five additional deep boring logs, a till surface elevation map was prepared (Figure 4-29). This map illustrates the interpreted subsurface topography of the top of the till unit.

The location of the borings that penetrated the surface of the till was spatially distributed throughout the East Street Area 2/USEPA Area 4 Site. The surface of the till decreases in elevation on the order of 80 feet (at a gradient of approximately four percent) from the northern part of the site to the Housatonic River. The map also suggests the presence of relatively narrow north-south oriented valley that extends from the railroad tracks to the recharge pond. This feature may be the remnant of a pleistocene glaciofluvial stream channel.

Soil borings located between the railroad tracks and Tyler Street (northern area) (borings A7, B1, C1, 17A and 17C) penetrated 5 to 20 feet of till. The depth to the till in this northern area ranged from 0 to 10 feet below grade. Adjacent to East Street, borings penetrated 1 to 8.5 feet of till which was observed to be 17.5 to 38 feet below grade. Along the southern border of the site, adjacent to the Housatonic River, two borings (ES2-6 and ES2-7) penetrated seven and six feet of till which was encountered at 36 and 43 feet, below grade, respectively.

SECTION 5 - INVESTIGATION OF ADJACENT WATER BODIES

5.1 General

The investigation of water bodies adjacent to the East Street Area 2/USEPA Area 4 Site has involved the sampling and analysis of both surface water and sediment from the Housatonic River and Silver Lake in the vicinity of the site as part of the Housatonic River and Silver Lake MCP Phase II activities. These sampling efforts were described and the analytical results presented in the MCP Interim Phase II Report/CAS for the Housatonic River and Silver Lake (Blasland & Bouck, December 1991 and August 1992) (Housatonic River Report). A brief description of these activities and a summary and interpretation of the results, as relevant to the East Street Area 2/USEPA Area 4 Site, are provided in Sections 5.2 and 5.3 below.

5.2 Housatonic River

5.2.1 Surface Water

To enhance the current understanding of impacts (if any) of the East Street Area 2/USEPA Area 4 Site on the water quality of the Housatonic River, Housatonic River surface water samples were collected and analyzed at three locations in the vicinity of the site, as illustrated in Figure 5-1. Specifically, surface water samples were collected from the Housatonic River at the Newell Street Bridge (upstream of the site), near the "boomed" area adjacent to the site, and at the Lyman Street Bridge (immediately downstream of the site). Surface water samples were collected from these locations during high-flow and low-flow conditions (April 22, 1991 and September 9, 1991, respectively) and analyzed for Appendix IX+3 constituents.

The results associated with the 1991 Housatonic River surface water sampling are presented in the Housatonic River Report. In general, these results showed the presence of some inorganic constituents during both high-flow and low-flow conditions, but did not show the presence of any organics above the quantitation limit except for chlorobenzene during low-flow conditions.

In reviewing the 1991 Housatonic River surface water data presented in the Housatonic River Report a number of observations have been made specific to the East Street Area 2/ USEPA Area 4 Site. These observations are summarized below:

- The East Street Area 2/USEPA Area 4 Site appears to make no detectable contribution of PCBs or other organic constituents to the surface water of the Housatonic River. The only organic constituent detected above the quantitation limit in the surface water in the vicinity of this site was chlorobenzene, which was detected at concentrations ranging from 0.006 ppm to 0.011 ppm under low-flow conditions. However, as shown in Table 5-6B of the Housatonic River Report, chlorobenzene was detected at 0.024 ppm during low-flow conditions at the station just downstream of the Unkamet Brook confluence with the Housatonic River, which is upstream of the site (Blasland & Bouck, December 1991). This finding suggests that the source of the chlorobenzene detected in surface water adjacent to the site may be in the Unkamet Brook Area. In any event, all the concentrations of chlorobenzene detected in the river water are below the USEPA chronic and acute ambient water quality criteria (AWQC) for aquatic life protection and below the AWQC for consumption of aquatic organisms. (We note that GE does not necessarily accept the validity of these AWQCs, but has used them here solely for comparison purposes.)

- The data on inorganic constituents reveal no obvious influx of such constituents from the site to the water column of the Housatonic River. Between the Newell Street Bridge and the "boomed" section of the river adjacent to the site, the inorganic data from both flow regimes are variable, with some metals showing increases and others showing decreases. From the "boomed" section of the river to the Lyman Street Bridge, the high-flow data do show slight increases in most of the observed metals, but the low-flow data are variable, with some (e.g., barium, calcium, iron, manganese, and sodium) showing slight increases and others (e.g., aluminum, lead, and zinc) showing decreases. In any event, as shown in Tables 5-6A and 5-6B of the Housatonic River Report (Blasland & Bouck, December 1991), all the inorganics detected at the stations adjacent to or immediately downstream of the site were also observed at upstream locations and, in general, were found at concentrations that were not significantly higher than those detected upstream. Further analysis supporting this observation is presented in the Addendum to the Housatonic River Report (Blasland & Bouck, August 1992).

Based on these observations, the surface water sampling and analytical data show no significant effect of the site on the water quality of the Housatonic River. However, additional sampling and analysis of Housatonic River surface water for Appendix IX+3 constituents has been proposed in the Supplemental Phase II SOW/RFI Proposal for the Housatonic River and Silver Lake (Blasland, Bouck & Lee, June 1994). An evaluation of this data will be performed as it relates to the East Street Area 2/USEPA Area 4 Site and will be presented in the Phase II/RFI Report for this site.

5.2.2 Sediment

As part of the Housatonic River MCP Phase II sediment investigations, river sediment samples were collected in the fall of 1990 at a number of locations in the vicinity of the GE facility, including three locations in the vicinity of East Street Area 2/USEPA Area 4 Site. The samples were analyzed for Appendix IX+3 constituents. These samples were collected near the Newell Street Bridge (upstream of the site), the "boomed" area adjacent to the site, and the Lyman Street Bridge (immediately downstream of the site), as illustrated in Figure 5-1.

The analytical results of this investigation are presented in the Housatonic River Report. These results indicate the presence of PCBs and a number of Appendix IX+3 organic and inorganic constituents in the Housatonic River sediments in the vicinity of the site. These data have been reviewed in conjunction with the other data from the sampling and Appendix IX+3 analysis of sediments in the vicinity of the GE facility, presented in Tables 4-6 and 4-7 of the Housatonic River Report (Blasland & Bouck, December 1991) and Tables 2-12 through 2-14 of the Addendum to the Housatonic River Report (Blasland & Bouck, August 1992). Based upon this review, the following general observations have been made:

- The only organic constituents detected at the "boomed" area adjacent to the site were methylene chloride (0.011 ppm), chlorobenzene (0.035 ppm), and pyrene (0.96 ppm). However, methylene chloride was also detected at the Newell Street Bridge (upstream of the site), and chlorobenzene was not detected either upstream or downstream of the site, suggesting that its presence at a low level in the "boomed" area may be an isolated occurrence. While pyrene was not detected upstream, it was detected not only at the "boomed" area but also at the Lyman Street Bridge immediately downgradient of the site (at 2.4 ppm), thus suggesting a slight contribution of pyrene to the river sediments in this area. However, as shown in Table 4-6 of the Housatonic River Report, pyrene was not detected at any of the further downstream sediment sampling locations (upstream and downstream of the Silver Lake outfall and at Elm Street Bridge).

- In addition to pyrene, a number of other organic constituents were detected at the Lyman Street Bridge that were not detected at the Newell Street Bridge or the "boomed" area. These include low levels of several polynuclear aromatic hydrocarbons (PAHs), as well as 1,2,4-trichlorobenzene, PCBs, and three polychlorinated dibenzofuran compounds (although interferences from polychlorinated diphenylethers are suspected by the laboratory in the dibenzofuran analyses). However, as shown in Table 4-6 of the Housatonic River Report, none of the PAHs or the 1,2,4-trichlorobenzene detected at the Lyman Street Bridge were detected at any of the three further downstream sediment sampling locations in the river, and neither PCBs nor dibenzofurans were detected at the furthest downstream location sampled (Elm Street Bridge). The localized presence of these constituents at or near the Lyman Street Bridge may be attributable to prior releases from the site (from GE sources and/or from former Berkshire Gas sources). It is also possible that these constituents originate from the Lyman Street Parking Lot MCP site (Oxbow Area D) located on the north bank of the river immediately upstream of the Lyman Street Bridge. Details associated with the Lyman Street Parking Lot Site are presented in a separate report entitled "MCP Phase I Report for Lyman Street Parking Lot (Oxbow Area D) and Current Assessment Summary for USEPA Area 5A" (Blasland, Bouck & Lee, February 1994c).

- In addition to the Appendix IX+3 organic constituents detected in the sediments in the vicinity of the site, several inorganic constituents were also detected. In general, the concentrations of these constituents (except sulfide) increased slightly from the Newell Street Bridge to the "boomed" area, and then increased somewhat again (except for barium and nickel) from the "boomed" area to the Lyman Street Bridge, with the concentrations of lead and tin being substantially and anomalously higher at the Lyman Street Bridge. However, it appears that the increased concentrations of these constituents in the sediments in this stretch of the river may be a localized condition. The inorganics data presented in Table 4-7 of the Housatonic River Report show a decrease in the concentrations of most such constituents at further downstream locations, with the concentrations at the furthest downstream location sampled (Elm Street Bridge) being in all cases (except for barium) lower than those at the Lyman Street Bridge.

As noted in the Housatonic River Report, the Appendix IX+3 sediment data presented in that report did not reflect high PCB concentrations and thus may not have been taken from the most efficient sediment depositional area. To address this concern, under an MDEP-approved proposal made by GE to evaluate the need for an STM in the river floodplain (GE, April 1992), additional sediment samples were taken from the river at locations of higher PCB concentrations. These samples were collected in May 1992 from two river locations between the Silver Lake Outfall and the Elm Street Bridge which showed PCB concentrations of 60 and 140 ppm, respectively. These samples were submitted for Appendix IX+3 analysis. In addition, to further define local background levels of the inorganics, samples were collected for inorganics analysis from four sediment locations in the river upstream of the GE facility and four soil sampling locations along a floodplain transect upstream of the facility.

The results of the inorganics analyses of the downstream sediment samples as well as the upstream sediment and soil samples were presented to the MDEP in a letter report dated June 18, 1992 as well as the Addendum to the Housatonic River Report (Blasland & Bouck, August 1992). That report also presented a comparison of the prior and new inorganics data from the sediment samples adjacent to or downstream of the GE facility with the data from upstream (background) locations. This comparison demonstrates that the concentrations of inorganic metal constituents detected in the sediments downstream of the site were not significantly higher than local background levels, with the exception of few constituents (including lead and tin) at the Lyman Street Bridge and a couple of constituents at other isolated locations, but not at further downstream locations. Indeed, the metals concentrations detected at the Elm Street Bridge are all within the range of background levels.

These data thus support the conclusion that, with the possible exception of the localized sediment deposit at the Lyman Street Bridge, releases from the site do not appear to have had a significant impact on concentrations of inorganic constituents in Housatonic River sediments.

However, additional sampling and analysis of Housatonic River sediment for Appendix IX+3 constituents have been proposed in the Supplemental

Phase II SOW/RFI Proposal for the Housatonic River and Silver Lake (Blasland, Bouck & Lee June, 1994). An evaluation of this data will be performed as it relates to the East Street Area 2/USEPA Area 4 Site and will be presented in the Phase II/RFI Report for this site.

5.3 Silver Lake

As previously documented in the Housatonic River Report, Silver Lake is located adjacent to the western portion of the East Street Area 2/USEPA Area 4 Site. The lake receives stormwater runoff from several municipal outfalls as well as treated process water, non-contact cooling water, and stormwater from a portion of the site. The lake is hydraulically connected to the Housatonic River by an overflow weir which conveys flow to a 48-inch diameter concrete conduit located near the intersection of Fenn Street and East Street. This conduit conveys intermittent discharge from Silver Lake and stormwater from Fenn Street and East Street to the Housatonic River.

5.3.1 Surface Water

5.3.1.1 PCBs

The existing data base for Silver Lake surface water related to PCB presence and migration has been generated as part of the Stewart investigation and the more recent MCP Phase II investigation.

In April 1982, Stewart collected surface water samples from the Silver Lake Outfall during three days of a storm event. The results of this monitoring showed minimal discharge of PCBs to the Housatonic River (Stewart, December 1982).

The MCP Phase II water-column investigation included the monitoring of Silver Lake surface water for PCBs. PCB monitoring performed for Silver Lake included the collection of surface water samples from the center of Silver Lake and at its discharge point (the

Silver Lake Outfall) to the Housatonic River. These locations were sampled on a monthly basis for one hydrologic cycle (one year) and analyzed for PCBs (total and dissolved), total suspended solids (TSS), and several other water quality parameters. Flow discharge was also measured at the outfall during several monitoring events. The results of these activities are presented and discussed in Section 5.4.3.3 of the Housatonic River Report. The sampling locations are shown on Figure 5-4 of that report.

As discussed in the Housatonic River Report, the data show that the PCB concentrations in the water column of Silver Lake are generally at similar levels to those found in the river water, with most PCB concentrations either very close to or below the detection limit.

5.3.1.2 Other Hazardous Constituents

The MCP Phase II investigation of the Housatonic River surface water also included the investigation of a full range of hazardous constituents in the surface water of Silver Lake. That study, as described in Section 5.4.4 of the Housatonic River Report, included the collection of surface water samples from the center of Silver Lake and the Silver Lake Outfall during "high-flow" and "low-flow" conditions. These samples were analyzed for Appendix IX+3 constituents. The results are presented in Section 5.4.4.3 of the Housatonic River Report.

As discussed in that report, the data on the presence of Appendix IX+3 constituents in the water column of Silver Lake indicate that, apart from PCBs, the only hazardous constituents detected in the water column of the lake were inorganics. Under both high-flow and low-flow conditions, concentrations of the observed metals were generally similar in the lake center and at the outfall, except for a few that were higher in the center than at the outfall.

5.3.1.3 Future Activities

To further investigate the potential impact of Silver Lake on the Housatonic River, additional sampling and analysis of Silver Lake surface water for PCBs and Appendix IX+3 VOCs, SVOCs, and inorganics as well as water level measurements and velocity profiles (to assess lake mixing characteristics) have been proposed in the Supplemental Phase II SOW/RFI Proposal for the Housatonic River and Silver Lake (Blasland, Bouck & Lee, June 1994). An evaluation of this data will be performed as they relate to the East Street Area 2/USEPA Area 4 Site and will be presented in the Phase II/RFI Report for this site.

5.3.2 Sediment

Silver Lake sediments were studied as part of both the Stewart and MCP Phase II investigations mentioned above. As a result, a significant data base is available for Silver Lake sediments regarding PCBs and, to a lesser degree, Appendix IX+3 constituents. A discussion of these investigations and an evaluation of the corresponding data are presented in Section 4.5 of the Housatonic River Report, as well as the Silver Lake Data Summary (Blasland & Bouck, November 1993). A summary is provided below.

5.3.2.1 PCBs

The Stewart investigations performed in 1982 on the Housatonic River included Silver Lake. For this portion of the study, a total of 25 sediment cores were collected. These sediment cores consisted of six deep-water sediment cores and 19 peripheral sediment cores, from which 120 sediment samples were analyzed for PCB content. The sampling locations are illustrated on Figure 4-14 of the Housatonic River Report while Section 4.5.1 of that report describes the investigation results.

MCP Phase II activities included the collection and PCB analysis of six sediment samples from three locations in the eastern portion of Silver Lake as part of Appendix IX+3 analyses of these samples. The results of these analyses indicated PCBs at elevated concentrations as discussed in Section 5.3.2.2.

Subsequent to MCP Phase II activities, in November 1992, three composite sediment samples were collected from Silver Lake and submitted for PCB analysis at the request of GE. The results of these analyses were reported to the MDEP and USEPA in the Silver Lake Data Summary (Blasland & Bouck, November 1993).

As described above, a large number of sediment samples have been collected from Silver Lake and analyzed for PCBs. With respect to the issue of potential migration of PCBs from the East Street Area 2/USEPA Area 4 Site to Silver Lake, the existing sediment data, which include data from the eastern portion of the lake adjacent to the sites, are sufficient to assess the impact of the facility on the extent of PCBs in the sediment.

5.3.2.2 Other Hazardous Constituents

MCP Phase II activities included the collection and Appendix IX+3 analysis (including PCBs) of six sediment samples from three locations in the eastern portion of Silver Lake, adjacent to the East Street Area 2/USEPA Area 4 Site. The results of these analyses, which are included in Section 4.5.2 of the Housatonic River Report, indicate the presence of more constituents, at generally higher concentrations, than in the sediments of the Housatonic River. The constituents detected include numerous metals (at elevated concentrations, in some cases over 1,000 ppm) and other organic constituents (at low concentrations, generally below 1 ppm), as well as PCBs (at elevated concentrations). In addition, trace levels of PCDDs and PCDFs were detected, although 2,3,7,8-tetrachlorodibenzodioxin was not detected.

The data on Appendix IX+3 constituents in the sediments of Silver Lake are less extensive than the sediment data on PCBs. Nevertheless, they do provide a reasonably good picture of the types and concentrations of other hazardous constituents present in the deep sediments. Moreover, since the samples analyzed for Appendix IX+3 were taken from the eastern portion of the lake adjacent to the East Street Area 2/USEPA Area 4 Site, they provide characterization of the hazardous constituents present in areas of the lake likely to be most affected by releases from the site.

5.3.2.3 Future Activities

Additional sampling and analysis of Silver Lake sediment for PCBs and Appendix IX+3 SVOCs, metals, cyanides, and PCDDs/PCDFs as well as supplemental analyses for oil & grease, TOC, and several physical parameters (i.e., grain size, density, specific gravity, etc.) have been proposed in the Supplemental Phase II SOW/RFI Proposal for the Housatonic River and Silver Lake (Blasland, Bouck & Lee, June 1994). In addition, geochronologic dating of Silver Lake sediments using Cs-137 analysis will be performed as proposed in that Supplemental Phase II SOW/RFI Proposal. An evaluation of this data will be performed as they relate to the East Street Area 2/USEPA Area 4 Site and will be presented in the Supplemental Phase II/RFI Report for this site.

SECTION 6 - SURFICIAL SOILS INVESTIGATION

6.1 General

Surficial soil samples from five locations were collected as part of MCP Phase II activities associated with the East Street Area 2 Site. These samples were collected from various locations and analyzed to assess the potential presence of various hazardous constituents. A description of these activities is presented in Section 6.2, while the analytical results and an overall interpretation of the results are presented in Sections 6.3 and 6.4, respectively.

6.2 Description of Sampling Program

The sampling of surface soils within the East Street Area 2/USEPA Area 4 Site included the collection and analysis of soils from five separate locations. These locations, illustrated in Figure 6-1, were selected to include areas representative of certain critical portions of the site that have surficial soil, including soils that overlie the oil plume, the former gas plant, the former oxbow, and the area adjacent to the scrap yard area.

Surficial soil samples were collected from each of these locations in accordance with protocols presented in the Sampling and Analysis Plan (Blasland & Bouck, September 1990). Soil samples were obtained by compositing the soil from a 3-foot by 3-foot by 4-inch deep area at each location. Soil from each location was submitted to ITAS for PCB analysis and to CompuChem for Appendix IX+3 analysis.

6.3 Analytical Results

The analytical results associated with the surficial soil sampling described in Section 6.2 are presented in Table 6-1. This table also presents data associated with various constituents for which the laboratory reported estimated values below the quantitation limit. As shown in Table 6-1, the constituents found in the surficial soils include numerous PAHs and inorganics. Other constituents found include PCBs and various phenolic and dioxin/furan compounds. A summary of the constituents found above the quantitation limit and their corresponding concentration ranges is presented below:

Organic Compounds

Analyte [1]	Concentration Range (ppm-dry weight)
Acenaphthylene	ND to 1.9
Aldrin	ND to 0.0062
Aniline	ND to 1.9
Anthracene	ND to 0.61
Aroclor 1260	0.32 to 17.0
Benzo(a)anthracene	0.14J to 2.1
Benzo(b)fluoranthene	0.32J to 2.6
Benzo(k)fluoranthene	0.3J to 4.5
Benzo(g,h,i)perylene	ND to 2.1
Benzo(a)pyrene	ND to 1.9
Chrysene	0.21J to 2.3
Di-n-Butylphthalate	ND to 3.0
Dibenzo(a,h)anthracene	ND to 0.78
Dimethylphenol	ND to 0.54
bis(2-Ethylhexyl) phthalate	0.13J to 0.88
Fluoranthene	0.26J to 3.1
Indeno(1,2,3-cd)pyrene	ND to 1.8
1-Methylnaphthalene	ND to 0.41
3-Methylphenol	ND to 0.63X
4-Methylphenol	ND to 0.63X
Phenanthrene	0.14J to 2.2
Phenol	ND to 1.7
Phenols (total)	ND to 1.1
Pyrene	0.32J to 3.1
2,3,78 - TCDF	ND to 0.00042
Total TCDF	ND to 0.0029
Total PeCDF	ND to 0.006
Total HxCDF	ND to 0.0044
Total HpCDD	ND to 0.00049
Total HpCDF	ND to 0.0066
Total OCDD	ND to 0.0018
Total OCDF	ND to 0.0017

Inorganic Compounds

Analyte[1]	Concentration Range (ppm-dry weight)
Aluminum	4,050 to 10,700
Arsenic	ND to 11.5
Barium	38.8 to 51.2

Inorganic Compounds (Continued)

Analyte[1]	Concentration Range (ppm-dry weight)
Cadmium	ND to 1.1
Calcium	2,710 to 14,200
Chromium	7.5 to 29.6
Cobalt	5.6 to 10.8
Copper	8.5 to 83.8
Cyanide	ND to 55
Iron	13,800 to 24,000
Lead	4.8 to 81.5
Magnesium	2,950 to 9,930
Manganese	281 to 635
Mercury	ND to 0.52
Nickel	8.8 to 18.1
Potassium	590J* to 1,030
Selenium	ND to 0.83
Vanadium	9.5 to 21.8
Zinc	30.2 to 652

Notes:

[1] Analytes for which only estimated values were reported or which were also found in associated method blanks are not summarized.
ND -Not detected above the detection limit.
J -Indicates an estimated value below the quantitation limit.
J* -Analyte was detected at a level less than the Contract Laboratory Procedure (CLP)-required detection limit but greater than the instrument detection limit.
X -Coeluting isomers were noted by the analytical laboratory.

6.4 Interpretation of Surface Soils Results

Upon review of the analytical data presented in Table 6-1, it is apparent that the highest concentration of PAHs (but still at concentrations less than 5 ppm total) were found at location 204S, which is located just south of the former gas holding facilities historically used by Berkshire Gas. Considering that PAHs are commonly found in manufactured gas byproducts such as coal tar, it seems likely that these constituents are attributable, at least in large part, to the former coal gasification facilities in this area. Low concentrations of PAHs (generally less than one ppm, but in some instances up to 3.1 ppm) were also found at the other locations, with the exception of location 201S. PAHs were not detected above quantitation levels at location 201S, located within the former river oxbow just downgradient of the groundwater recharge pond and near the existing oil/water separator 64X.

Various polychlorinated dibenzodioxins/furans were also detected at low concentrations at locations 202S, 203S, 204S, and 205S. Octachlorodibenzodioxin was detected at four of the five surficial soil sampling locations. Concentrations varied from less than detectable to 0.0018 ppm. Octa- and pentachlorodibenzofurans (OCDF and PCDF, respectively) were detected at three of the five locations at concentrations ranging from less than detectable to 0.0017 ppm of OCDF and less than detectable to 0.0060 ppm of PCDF.

PCBs were detected at all five locations. However, levels were less than or equal to one ppm at locations 201S, 202S, and 203S. Concentrations of 4.1 ppm and 17 ppm were found at locations 204S and 205S, respectively.

Although each of the five samples was analyzed for VOCs, no VOCs were detected except acetone and methylene chloride, which were also detected in the method blanks.

With a few exceptions, all Appendix IX+3 inorganic constituents were detected at varying concentrations at each of the five locations sampled. For most of these constituents, generally similar order-of-magnitude concentrations were found at these various locations. Thus, no apparent trends are obvious.

Several data gaps exist with respect to surficial soils data. First, the Permit requires soil sampling in connection with certain identified SWMUs. Three of those SWMUs -- SWMU G-1 (the Building 60 Former Drum Storage Area), G-10 (the Building 60 Tank Truck Area), and T-63 (the Building 61 Phenolic Dust Baghouse) -- are most appropriately investigated through surficial soil sampling. No such samples have yet been taken. In addition, further surficial soil information in the areas of the site covered by grass is needed to assist with the subsequent risk assessment.

SECTION 7 - MISCELLANEOUS INVESTIGATIONS

7.1 General

In accordance with agreements between GE and the MDEP, certain excavation activities at the GE facility, whether they are associated with construction, demolition, landscaping, or other miscellaneous site work, are to be accompanied by a sampling and analysis program to assess the potential presence of chemical constituents in the excavated soils and thus to assist in determining the appropriate disposition of the materials. This section summarizes the sampling and analysis activities that have been performed in connection with such excavations, as well as various other miscellaneous sampling and analysis activities, at the East Street Area 2/USEPA Area 4 Site. Figures 7-1 and 7-2 show the approximate locations of the various areas that have been subject to such investigations. This section provides only a brief summary of these investigations and the analytical results. Further details regarding these investigations are included in Appendix J. Available boring logs are included in Appendix H.

7.2 Scrap Yard Area

A-1 Building 65 Hydrant Excavation

Soils associated with the excavation of a hydrant in the vicinity of Building 65 were deposited in eight piles north of Building 65. On May 1, 1990, 21 locations were sampled within these piles, as shown in Appendix J, Section A-1. A total of 15 soil grab samples were collected from sample locations 7 through 21, at a depth of 0 to 2 feet, and analyzed for PCBs by OBG Labs. In addition, two composite samples were prepared: one consisting of subsamples from locations 7 through 11 and the other from locations 12 through 21. These samples were analyzed for VOCs and SVOCs.

Measurable levels of PCBs were detected in all 15 samples, and ranged in concentration from 36 to 160 ppm, as shown in Appendix J, Section A-1. The SVOC compounds detected in the two composite samples were acenaphthene (2.2 ppm, one sample), benzo(a)anthracene (14 and 5.1 ppm), benzo(a)pyrene (14 and 4.7 ppm), benzo(b)-fluoranthene (17 and 6.3 ppm), benzo(g,h,i)perylene (8.6 and 3.7 ppm), benzo(k)fluoranthene (12 and 4.6 ppm), chrysene (14 and 6.2 ppm), fluoranthene (25 and 8.1 ppm), fluorene (1.9 ppm, one sample), indeno(1,2,3-cd)pyrene (8.6 and 3.8 ppm), phenanthrene (6.5 and 6.1 ppm), and pyrene (26 and 7.5 ppm). The only VOC detected was acetone, which was measured at a concentration of 0.15 ppm in each of the two samples analyzed.

A-2 Building 61-R Sampling

On March 30, 1994, three discrete oil grab samples were collected for PCB analysis from former crushing pits located outside of Building 61-R. The purpose of collecting the samples was to determine the proper disposal method for oily water located in these pits. The samples were analyzed by the Pittsfield GE Laboratory with the results indicating the presence of PCBs at concentrations of 602 ppm, 674 ppm, and 356 ppm (see Appendix J, Section A-2). The oil present in this pit appears to have come from the metal crushing machine in Building 61R which connects to the pits. The presence of PCBs is believed to be attributable to residues in the pits and the water is believed to be surface drainage from the surrounding pavement. The drainage pits have since been enclosed with plastic and are being monitored for accumulation of additional liquids.

In addition, on April 13, 1994, a field-composite sample was collected from Drum No. 32180 stored in Building 12-STS. The contents of this drum contained oil removed (skimmed) from the pits outside of Building 61-R. The sample was forwarded to Alpha Analytical Laboratories for analysis by the TCLP for the metal constituents listed in Table 1 of 40 CFR 261.24. The sample did not show characteristics of toxicity (see Appendix J, Section A-2).

A-3 Building 68-1 Steam Line Excavation Sampling

On July 31, 1991, discrete grab samples (five for PCBs, four each for VOCs and SVOCs, and two each for cyanide and RCRA metals) were collected from a total of six locations in four piles of soil excavated from beneath the Building 60 concrete floor. PCBs were detected in all five samples at concentrations ranging from 270 to 8,500 ppm. VOCs detected in the samples were acetone (0.019 to 0.036 ppm in all four samples) and toluene (0.008 to 0.029 ppm in three samples). Only three of the four SVOC samples were analyzed by the laboratory; the SVOCs detected were hexachlorobenzene (16 ppm in one of three samples) and 1,2,4-trichlorobenzene (36 ppm in one of three samples). RCRA metals detected were barium (120 and 64 ppm), chromium (39 and 22 ppm), lead (700 and 420 ppm), silver (26 and 2 ppm), arsenic (3.9 ppm in one sample), and cadmium (one ppm in one sample). No detectable levels of cyanide were reported in the samples (see Appendix J, Section A-3).

Additional steam line excavation sampling was performed on February 25, 1992. On this date, a total of 14 discrete grab samples were collected from 14 drums stored at the Building 78-1 Drum Storage Area. These drums contained soils excavated during repair of the Building 68-1 Steam

Line. Total lead was analyzed for and detected in each of the samples, ranging from 100 to 2,900 ppm (see Appendix J, Section A-3).

A-4 Sweeper Soil Sampling, Scrap Yard

On June 20, 1990, two discrete grab samples for PCB analysis were collected from two sweeper soil piles generated from the Scrap Yard in the southern section of the facility. Samples were taken from a depth of 0 to 2 feet. PCBs were detected in one of the two samples at a concentration of 6.2 ppm (see Appendix J, Section A-4).

In addition, five discrete soil grab samples were collected on October 16, 1991 from sweeper soil generated at the Building 64 yard. These samples were analyzed for PCBs and showed PCB concentrations ranging between 2.9 and 42 ppm. One field composite sample was also collected as part of these activities and analyzed by the TCLP for the toxicity characteristic constituents listed in Table 1 of 40 CFR 261.24; no toxicity characteristics were noted (see Appendix J, Section A-4).

A-5 Building 63 Foundation Sampling (Soil)

On August 2, 1990, two discrete grab samples were collected at the 0 to 2 foot depth interval from a 3.5 cy soil pile. The soil pile was excavated during installation of a new foundation inside Building 63. No detectable levels of PCBs were reported (see Appendix J, Section A-5).

A-6 Scrap Yard Sampling

On March 4, 1992, a total of two discrete grab samples were collected from two drums stored at the Building 12 Drum Storage Area. These drums contained soils displaced during drilling of 15 borings within the Scrap Yard Area. One sample was from a drum containing drill cuttings from Borings

Y-1, Y-2, Y-3, Y-5, and Y-7. The second sample was collected from a drum containing drill cuttings from Borings Y-11 through Y-20. The samples were analyzed for TCLP Metals by Alpha Analytical, but showed no characteristics of toxicity (See Appendix J, Section A-6).

7.3 Former Oxbow and Gas Plant Areas

B-1 Strain Pole Excavation Soil Sampling

On October 16, 1990, three discrete grab samples were collected from soils excavated during installation of three strain poles along East Street between Gates 15 and 16. These samples were analyzed for PCBs, SVOCs, TCLP metals, phenol, and cyanide. PCBs were detected in all three samples at concentrations ranging from 1.4 to 38 ppm. SVOCs were detected in two of the three samples and include benzo(a)anthracene (0.47 and 0.59 ppm), benzo(a)pyrene (0.59 and 0.72 ppm), benzo(b)fluoranthene (0.84 and 1.0 ppm), benzo(g,h,i)perylene (0.43 and 0.48 ppm), bis(2-ethylhexyl)phthalate (0.47 and 0.57 ppm), chrysene (0.60 and 0.74 ppm), fluoranthene (0.60 and 0.90 ppm, indeno(1,2,3-cd)pyrene (0.41 and 0.45 ppm), phenanthrene (0.46 and 0.55 ppm), pyrene (1.8 ppm in two samples), and benzo(k)fluoranthene (0.42 ppm in one sample). No detectable levels of TCLP Metals, phenol, or cyanide were reported in the samples. PID measurements, recorded for soils from the three sampling locations, measured less than 10 PID units and, as a result, no VOC laboratory analysis was conducted for these samples (see Appendix J, Section B-1).

B-2 Heli-Pad Wind Sock Mast Soil Sampling

On June 20, 1991, PCBs were detected at concentrations that range from 38 to 93 ppm in three discrete grab samples collected from a soil pile located on the Building 60 Truck Pad. Samples were collected from depth intervals of 0 to 0.5 feet, 0 to 1 feet, and 0 to 1.5 feet (see Appendix J, Section B-2).

B-3 Weather Station Soil Sampling

On June 26, 1991, three discrete grab samples for PCBs, VOCs, and SVOCs were collected from a soil pile located on a concrete pad north of Building 60. PCBs were detected in all three samples at concentrations ranging from 73 to 110 ppm. Based on results of PID measurements, VOC and SVOC analysis was conducted on two of the three samples. SVOCs detected in the samples were pyrene (2.4 and 3.4 ppm in two samples), fluoranthene (2.4 ppm in one sample), naphthalene (26 ppm in one sample), 2-methylnaphthalene (9.6 ppm in one sample), and phenanthrene (2.1 ppm in one sample). No detectable levels of VOCs were reported in the samples (see Appendix J, Section B-3).

B-4 Sediment Sampling Associated with Oil/Water Separators 64W, 64X and 64Z

Nine discrete sediment grab samples were collected from both the 64W and 64Z oil/water separator facilities (18 samples total) on July 17, 1992 and analyzed for PCBs. These samples were collected to determine the proper method of disposal of cleanout material. As shown in Appendix J, Section B-4, PCB concentrations of these sediment samples ranged between 150 and 44,000 ppm for 64W and between 160 and 830 ppm for 64Z.

Additional miscellaneous drum sampling and analysis activities were conducted on November 2, 1992 and December 16, 1992 related to the cleanout of oil/water separators 64W, 64X, and 64Z. Five discrete soil/sediment grab samples were collected from five separate drums associated with each of the three units (one sample per drum; five drums per unit; 15 total samples) and analyzed for PCBs. The results of these analyses showed PCB concentrations ranging from 33.7 to 1,311.8 ppm, 19.8 to 34.8 ppm, and 39.6 to 197.9 ppm for 64W, 64X, and 64Z, respectively (see Appendix J, Section B-4).

In addition, on December 16, 1992, a total of 23 discrete soil/sediment grab samples were collected from 23 separate drums originating from oil/water separator 64W and analyzed for PCBs. As shown in Appendix J, Section B-4, the results of these analyses showed PCB concentrations ranging from 18 to 2,958 ppm.

Additional sand/sediment sampling was performed at oil/water separator 64Z on May 19, 1994. One field composite sample of sand/sediment was collected for PCB analysis. The sample was analyzed by OBG Laboratories and the results indicated the presence of PCBs at a concentration of 86 ppm.

B-5 Pre-Construction Sampling at Building 64T Wastewater Treatment Facility

A total of nine soil borings were drilled by Geraghty and Miller prior to construction of the Building 64T Wastewater Treatment Facility, as shown in Appendix J, Section B-5. On February 17 through 19, 1987, soil samples from five of the borings (B-1 through B-5) were collected and analyzed for PCBs. Samples were collected in 2-foot intervals between 0 and 20 feet.

Measurable levels of PCBs were detected in all five borings, and ranged in concentration from one to 486 ppm. PCB levels greater than 50 ppm were reported in each of the five borings, but were limited to samples collected in the intervals between 12 and 20 feet below grade.

Four additional miscellaneous soil samples were collected by Geraghty and Miller and analyzed for PCBs. One sample was from the west electrical trench (2,485 ppm), one was from the east electrical trench (one ppm), one was from the Building 66 trench (2 ppm), and one sample was from unsuitable foundation material (less than 50 ppm). These results are also shown in Appendix J, Section B-5.

B-6 Pre-Construction Sampling at Building 64G Groundwater Treatment Facility

A total of 10 soil borings were drilled by Geraghty and Miller prior to construction of the Building 64G Groundwater Treatment Facility, as shown in Appendix J, Section B-6. Soil samples from the borings were collected between August 28 and 30, 1990 and analyzed for PCBs, VOCs, SVOCs, RCRA metals, cyanide, and phenols, as shown in Appendix J, Section B-6.

Samples were collected in two 4-foot intervals between 0 and 20 feet. Composite samples were prepared for each boring using soils from the three sampling intervals between 0 and 6 feet, except for GW-1 and GW-5, which were prepared from the 0 to 2 feet and 4 to 6 feet intervals only. Samples from the intervals between 6 and 20 feet were retained for possible future analysis. In addition, one grab sample of drummed drill cuttings was also analyzed for PCBs.

Measurable levels of PCBs were detected in nine of the 10 composite samples, and ranged in concentration from 0.15 to 2.8 ppm. PCBs were reported at a concentration of 150 ppm in the single grab sample of drill cuttings. The VOCs detected were benzene (130 ppm in one sample), ethyl benzene (240 ppm in one sample), methylene chloride (5 to 13 ppm in seven samples), and toluene (400 ppm in one sample). SVOCs detected were acenaphthene (18 ppm, one sample), acenaphthylene (45 ppm, one sample), anthracene (28 ppm, one sample), benzo(a)anthracene (110 and 140 ppm, two samples), benzo(a)pyrene (52 and 150 ppm, two samples), benzo(b)fluoranthene (72 and 97 ppm, two samples), benzo(g,h,i)perylene (20 and 32 ppm, two samples), benzo(k)fluoranthene (13 to 140 ppm, three samples), chrysene (13 to 150 ppm, three samples), dibenz(a,h)anthracene (14 ppm, one sample), fluoranthene (240 and 280 ppm, two samples), fluorene (85 and 90 ppm, two samples), indeno(1,2,3-cd)pyrene (19 and 240 ppm, two samples), naphthalene (2,000 and 2,300 ppm, two samples), phenanthrene (590 and 890 ppm, two samples), and pyrene (350 and 520 ppm, two samples).

RCRA metals detected in the composite samples included arsenic (4 to 15 ppm, three samples), barium (7.6 to 31.3 ppm, 10 samples), chromium (4 to 19 ppm, ten samples), lead (10 to 102 ppm, 10 samples), silver (0.8 to 11 ppm, five samples), and mercury (0.2 ppm in two samples). Cyanide was detected at concentrations ranging from 0.92 to 6.8 ppm in eight samples, while phenols were detected in all ten samples at levels ranging from 0.99 to 2.2 ppm.

On December 4 through 7, 1990, a total of 28 additional soil samples were collected. These samples were obtained from supplemental soil borings drilled by Geraghty and Miller prior to construction of the Building 64G Groundwater Treatment Facility. Samples were collected in 2-foot intervals to the total depth of the boring. Composite samples were prepared for each boring as indicated in Appendix J, Section B-6.

Various analyses were performed on these samples, including PCBs (on all 28 samples), VOCs (on eight of the 28 samples, based on PID measurements), and SVOCs, RCRA metals, cyanide, and phenols (on 17 of the 28 samples). In addition, one grab sample of drummed drill cuttings was also analyzed for PCBs.

Measurable levels of PCBs were detected in 23 of the 28 composites, and ranged in concentration from 0.033 to 10.5 ppm. PCBs were reported at a concentration of 0.26 ppm in the single grab sample of drill cuttings. The two VOCs detected in the samples were methylene chloride (0.011 to 0.014 ppm, three samples) and toluene (0.028 ppm, one sample). The SVOCs detected were acenaphthene (1.1 ppm, one sample), acenaphthylene (2.3 ppm, one sample), anthracene (0.82 and 6.1 ppm, two samples), benzo(a)anthracene (1.3 to 10 ppm, ten samples), benzo(a)pyrene (1.7 to 13 ppm, nine samples), benzo(b)fluoranthene (1.6 to 16 ppm, ten samples), benzo(g,h,i)perylene (0.94 to 5 ppm, seven samples), benzo(k)fluoranthene (1.4 to 13 ppm, nine samples), bis(2-ethylhexyl)phthalate (0.81 ppm, one sample), chrysene (1.7 to 15 ppm, nine samples), dibenz(a,h)anthracene (0.96 and 2.3 ppm, two samples), dibenzofuran (2.2 ppm, one sample), 2,4-dinitrotoluene (2.1 ppm, one sample), fluoranthene (1 to 19 ppm, ten samples), fluorene (2.9 ppm, one sample), indeno(1,2,3-cd)pyrene (0.82 to 1.9 ppm, five samples), 2-methylnaphthalene (2 to 21 ppm, four samples), naphthalene (0.96 to 520 ppm, ten samples), phenanthrene (1 to 28 ppm, seven samples), and pyrene (0.84 to 19 ppm, ten samples).

RCRA metals detected in the composite samples were arsenic (2.9 to 16.2 ppm, four samples), barium (15.6 to 110 ppm, 15 samples), chromium (8 to 27.6 ppm, 17 samples), lead (10.7 to 96.1 ppm, 17 samples), mercury (0.1 to 11.8 ppm, six samples), and selenium (78.7 and 112, two samples). Cyanide was detected at concentrations ranging from 0.6 to 29 ppm in 13 samples, while phenols were detected in one sample at level of 8 ppm (see Appendix J, Section B-6).

B-7 Building 64G (East Side Driveway) Soil Sampling

On October 29, 1991, PCBs were detected at a concentration of 1.9 ppm in one of five discrete grab samples collected from soils beneath an asphalt driveway east of Building 64G. Samples were taken from a depth of 0 to 1 foot. PID readings measured less than 10 PID units for all five samples and, as a result, no VOC analysis was conducted (see Appendix J, Section B-7).

B-8 Soil Pile at Building 64G Groundwater Treatment Facility

On June 5, 1991, three soil piles located outside of Building 64G (approximately 110 total cubic yards) were sampled and analyzed. As shown in Appendix J, Section B-8, a total of 15 discrete grab samples were collected, with 12 samples being analyzed for PCBs and three samples being analyzed by the TCLP (excluding herbicides and pesticides). The results of these analyses showed PCB concentrations ranging from less than 1 to 67 ppm and no toxicity characteristics (see Appendix J, Section B-8).

B-9 Retention Tank Sampling (South Side)

On February 28, 1989, PCBs were detected at concentrations ranging from 10 to 22 ppm in seven soil grab samples collected from a soil pile located in the south section of the plant, northwest of the recharge pond. The soil had been removed previously as part of the Retention Tank excavation. Samples were collected at various depth intervals including 0 to 12, 0 to 15, 0 to 16, 0 to 18, and 0 to 20 inches (see Appendix J, Section B-9).

B-10 Caisson 64R Sampling

On February 11, 1992, PCBs were detected at a concentration of 27 ppm in one discrete grab sample of sediment and water collected from Caisson 64R, located at a depth of 22 feet below the land surface. The sample was collected from an interval of 0 to 1.5 feet. A similar grab sample collected for TCLP testing for metals showed no characteristics of toxicity (see Appendix J, Section B-10).

B-11 Building 64R (South) Soil Sampling

On June 24, 1991, PCBs were detected at concentrations ranging from 3.8 to 7.7 ppm in five discrete grab samples collected from a soil pile (18 cy) located south of Building 64R. Samples were taken from depth intervals of 0 to 1, 0 to 2, and 0 to 3 feet. Based on results of PID measurements, VOC analysis was conducted on four of the five samples. Acetone was the only VOC detected, and was measured at a concentration of 0.011 ppm in two of the five samples. In addition, one composite sample compiled from all five locations showed no characteristics of toxicity (see Appendix J, Section B-11).

B-12 Sampling Related to Groundwater Recharge Pond

The soils within and adjacent to the groundwater recharge pond have been sampled on several occasions.

On September 12, 1989, one grab sample was collected for analysis of pesticides/PCBs, VOCs, and SVOCs from a soil pile excavated from a trench located on the south side of the recharge pond, as shown in Appendix J, Section B-12. PCBs were detected at a concentration of 9 ppm. VOCs detected were benzene (0.008 ppm), chlorobenzene (0.007 ppm), ethyl benzene (0.006 ppm), and methylene chloride (0.007 ppm). No detectable levels of pesticides or SVOCs were reported for these samples.

On February 11, 1991, one discrete grab sample was collected from soils excavated from a trench located on the south side of the recharge pond. These soils had been excavated and placed in 159 drums for subsequent disposal. This soil sample was analyzed by the TCLP which showed no characteristics of toxicity, as shown in Appendix J, Section B-12.

In the fall of 1991, a more complete sampling of the soil and sediments of the recharge pond was conducted as part of activities under GE's RCRA Part B permit for TSD facilities. A total of 18 discrete grab samples were collected on October 24, 1991, from nine locations in and around the recharge pond, as shown in Appendix J, Section B-12. Ten samples consisted of sediments collected at five locations within the recharge pond, while eight samples consisted of soils collected at four locations on the banks of the recharge pond. Two samples were collected at each sampling location from depth intervals of 0 to 1 foot and 1 to 2 feet. All 18 samples were analyzed for PCBs by OBG Labs.

Measurable levels of PCBs were reported in all 10 sediment samples, and ranged in concentration from 66 to 2,000 ppm, as shown in Appendix J, Section B-12. PCBs were detected at much lower levels in the eight soil samples, ranging from 1.2 to 44 ppm.

In addition, a total of four composite samples were prepared from the nine sampling locations in and around the recharge pond. Two composites consisted of subsamples from all five sediment sampling locations within the recharge pond, one each from depth intervals of 0 to 1 foot and 1 to 2 feet. The other two composites were prepared from subsamples collected at all four soil sampling locations on the banks of the Recharge Pond. All four composite samples were analyzed for toxicity characteristics by the TCLP. The results of these analyses, presented in Appendix J, Section B-12, showed that none of the samples exhibited any toxicity characteristics.

B-13 Sampling Related to Building 64X Pipeline

Numerous soil sampling activities were conducted in connection with the installation of the Building 64X pipeline. Sampling locations and analytical results are presented in Appendix J, Section B-13. These investigations are summarized as follows:

- On December 20, 1989, three composite samples for PCB analysis were collected from three soil piles of 23, 30, and 15 cy, respectively, intended for use as backfill in the pipeline trench. Subsamples were collected from five locations in each pile at depth intervals of 0 to 2 feet. PCBs were detected in all three samples, ranging in concentration from 1.9 to 16 ppm.
- On April 10, 1990, one composite sample for PCB analysis was collected from an 11 cy soil pile intended for use as backfill. Subsamples were collected from five locations in the pile, at depth intervals of 0 to 2 feet. PCBs were detected at a concentration of 58 ppm.
- On May 22, 1990, PID readings were taken on three samples from soil piles excavated during installation of the Building 64X Pipeline. These readings measured less than 10 PID units and, as a result, no VOC laboratory analysis was conducted for the samples.
- On July 10, 1990, one discrete grab sample was collected from one of four soil piles excavated during installation of the Building 64X Pipeline and analyzed for PCBs, SVOCs, metals, phenol, and cyanide. PCBs were detected in the sample at a concentration of 11 ppm, cyanide at 1.1 ppm, and phenol at 0.74 ppm. The SVOCs detected in the sample were benzo(a)anthracene (0.79 ppm), benzo(a)pyrene (0.76 ppm), benzo(b)fluoranthene (0.82

ppm), benzo(g,h,i)perylene (0.49 ppm), benzo(k)fluoranthene (0.77 ppm), chrysene (0.98 ppm), fluoranthene (1.4 ppm), indeno(1,2,3-cd)pyrene (0.52 ppm), phenanthrene (1.1 ppm), and pyrene (1.9 ppm). In addition, bis(2-ethylhexyl)phthalate was detected at a level of 0.5 ppm, although this compound was also detected in the sample blank at a concentration of 0.26 ppm. Metals detected in the sample were arsenic (7.5 ppm), chromium (12 ppm), copper (42 ppm), nickel (27 ppm), lead (50 ppm), and zinc (97 ppm).

B-14 Pre-Construction Slurry Wall Sampling

A total of 12 soil borings were drilled by Geraghty and Miller prior to construction of the East Street Area 2 Slurry Wall, as shown in Appendix J, Section B-14. On August 7 through 12, 1986, soil samples from five of the borings (SW-1, 2, 4, 5, and 8) were collected in 2-foot intervals between 0 and 28 feet, and analyzed for PCBs.

Measurable levels of PCBs were detected in four of the five borings, and ranged from 3 to 84 ppm as shown in Appendix J, Section B-14. PCB concentrations greater than 50 ppm were reported in Boring SW-4 only, and were limited to the samples collected in the intervals between 16 and 28 feet below grade. There were no detectable levels of PCBs reported in samples collected from Boring SW-1, while PCBs in all but two samples from SW-2 were less than the detection limit.

B-15 Building 60-Field Hydrant Removal

Soils associated with the excavation of a hydrant in the vicinity of Building 60 were deposited in six piles. On July 30, 1990, a total of 18 soil grab samples were collected; three samples from each pile, as shown in Appendix J, Section B-15. Samples were collected from 1-foot depth intervals between 0 and 3 feet. All 18 samples were analyzed by OBG Labs for PCBs, VOCs, SVOCs, cyanide, and the metals listed in USEPA's RCRA regulations at 40 CFR 261.24 for defining hazardous waste (RCRA metals).

Measurable levels of PCBs were detected in eight of the 18 soil samples, and ranged in concentration from 0.7 to 4.6 ppm, as shown in Appendix J, Section B-15. SVOC compounds detected were fluoranthene (0.68 to 13 ppm in seven samples), phenanthrene (0.51 to 12 ppm in seven samples), pyrene (0.58 to 11 ppm in seven samples), benzo(a)anthracene (0.55 to 6.1 ppm in six samples), benzo(a)pyrene (0.49 to 4.5 ppm in six samples), benzo(b)fluoranthene (0.57 to 4.9 ppm in six samples), benzo(k)fluoranthene (0.48 to 4.2 ppm in six samples), chrysene (0.58 to 6.7 ppm in six samples), anthracene (0.40 and 0.97 ppm in two samples), benzo(g,h,i)perylene (0.70 and 1.1 ppm in two samples), indeno(1,2,3-cd)pyrene (0.68 and 1.2 ppm in two samples), acenaphthene (0.65 ppm in one sample), dibenzofuran (0.48 ppm in one sample), fluorene (0.69 ppm in one sample), and naphthalene (0.49 ppm in one sample).

Acetone was the only VOC detected, measured at a concentration of 0.15 ppm in one sample. There were no detectable levels of cyanide or RCRA metals reported in the 18 samples.

B-16 Building 64Y Floodplain Compensation Study

A total of 39 soil grab samples were collected on June 8, 1989, from 13 locations in a grassy area situated between the Building 64X Oil/Water Separator and Building 64Y, as shown in Appendix J, Section B-16. Three samples were collected in consecutive 1-foot depth intervals, between 0 and 3 feet at each of the 13 locations. All 39 samples were analyzed for PCBs by OBG Laboratories, Inc. (OBG Labs). Measurable levels of PCBs were reported in two of the 39 soil grab samples, as shown in Appendix J, Section B-16. In both cases, PCBs were detected in the 0- to 1-foot sampling interval, at concentrations of 49 ppm (Location 1) and 36 ppm (Location 2).

In addition, eight discrete grab samples were collected on October 8, 1990, at four locations west of Building 64Y, adjacent to the Housatonic River and analyzed for PCBs. Two samples were collected at each of these four locations at depths of 0 to 6 inches and 6 to 12 inches. No detectable levels were reported in any of the samples.

B-17 Pre-Construction South Side Pump Station Sampling

A total of 31 soil borings were drilled by Geraghty and Miller prior to construction of the South Side Pump Station and related pipelines, as shown in Appendix J, Section B-17. On November 5 to 7, 1986, soil samples from these borings were collected in 2-foot intervals between 0 and 10 feet. A total of 31 composite samples, prepared from the subsamples from each of the borings, were analyzed for PCBs.

Measurable levels of PCBs were detected in 28 of the 31 composites, and ranged in concentration from one to 13,140 ppm. PCB concentrations greater than 50 ppm were reported in 15 of the 31 composites, including seven reports of approximately 1,000 ppm or more. PCB concentrations in the subsamples were reported as high as 53,307 ppm (Boring B-17, 4 to 6 feet) and 40,410 ppm (Boring B-5, 8 to 10 feet).

B-18 Thermal Oxidizer Sampling (Compensatory Storage Excavation for Fan)

On June 4, 1990, one discrete grab sample was collected from excavated soil outside the Thermal Oxidizer for analysis of PCBs, VOCs, SVOCs, RCRA metals, phenol, and cyanide. The sample was collected at a depth interval of 0 to 2 inches. PCBs were detected at a concentration of 0.023 ppm. Bis(2-ethylhexyl)phthalate was detected at a level of 0.94 ppm, although this compound was also detected in the sample blank at a concentration of 0.86 ppm. No detectable levels of RCRA metals, phenol, or cyanide were reported for this sample. In addition, on November 2, 1990, PCBs were detected at concentrations of 5.2 and 320 ppm in two discrete grab samples collected from excavated soil outside the Thermal Oxidizer. Samples were taken from a depth interval of 0 to 1 foot (see Appendix J, Section B-18).

B-19 Thermal Oxidizer Combustion Air Duct Soil Sampling

On January 5, 1990, three composite samples for PCB analysis were collected from 15 locations in three soil piles previously removed from beneath the existing stairway at the combustion air duct. PCBs were detected in all three composites at concentrations ranging from 8.3 to 103 ppm (see Appendix J, Section B-19).

B-20 Thermal Oxidizer Sampling Outside Building 60-A.

On August 17, 1990, PCBs were detected at concentrations ranging from 45 to 1400 ppm in three discrete grab samples collected from soil beneath asphalt pavement outside Building 60-A. Samples were taken from consecutive 1-foot depth intervals between 0 and 3 feet (see Appendix J, Section B-20).

B-21 Building 60 (Outside) Condensate Drain Pipe Repair Excavation Sampling

On January 17, 1992, PCBs were detected at a concentration of 15 and 35 ppm in two discrete grab samples of soil excavated from a trench located adjacent to the Thermal Oxidizer. One sample was collected at a depth of 0 to 16 inches from excavated soil (less than one cy) which had been placed back in the trench, while the other sample was collected at a depth of 0 to 12 inches from excavated soil (less than one cy) which had been deposited in the Scrap Yard east of Building 68. Similar grab samples were collected at each of the two locations and analyzed for VOCs, SVOCs and cyanide, and TCLP metals. VOCs were detected in both samples, and consisted of acetone (0.042 ppm in one sample) and toluene (0.010 and 0.008 ppm in two samples). No detectable levels of cyanide were reported in the samples, although several SVOCs were detected, namely benzo(a)anthracene (0.4 and 1.4 ppm), benzo(a)pyrene (0.44 and 1.2 ppm), benzo(k)fluoranthene (0.4 and 2.7 ppm), chrysene (0.45 and 1.3 ppm), fluoranthene (0.89 and 2.9 ppm), phenanthrene (0.51 and 3.2 ppm), pyrene (0.72 and 4 ppm), acenaphthene (0.46 ppm in one sample), anthracene (0.95 ppm in one sample), benzo(b)fluoranthene (0.55 ppm in one sample), benzo(g,h,i)perylene (0.74 ppm in one sample), dibenzofuran (0.43 ppm in one sample), fluorene (0.72 ppm in one sample), and indeno(1,2,3-cd)pyrene (0.71 ppm in one sample). Since no phenolic compounds were detected as part of the SVOC analysis, phenols were not analyzed separately. Finally, the two grab samples collected for TCLP metals showed no characteristics of toxicity see Appendix J, Section B-21).

B-22 East Street Grab Samples

On September 24, 1990, three additional grab samples, collected from three piles of soil removed from the previous sampling locations in East Street were analyzed by the TCLP for toxicity characteristics (excluding herbicides and pesticides). The samples showed no characteristics of toxicity. Samples were taken from a depth of 0 to 2 feet (see Appendix J, Section B-22).

B-23 Building 64X Electrical Line Repair

On April 14, 1993, as part of the repairs of an electrical line associated with Building 64X, excavated soil was sampled and analyzed for PCBs, VOCs, SVOCs, cyanides, and TCLP metals. These activities included the collection of three discrete grab samples and one field composite sample from a soil pile outside of 64X. These soils were excavated from a trench measuring approximately 20 feet long by 2 feet wide by 3 feet deep.

As shown in Appendix J, Section B-23, each of the grab samples was screened for VOCs using a PID and analyzed for PCBs, while the composite sample was analyzed for VOCs, SVOCs, cyanides, and TCLP metals. PID readings of the grab samples ranged from 5.4 to 8.4 PID units, while PCB concentrations ranged from 1.1 to 2.6 ppm. The field composite sample did not exhibit the presence of any detectable constituents for which it was analyzed.

B-24 Sampling in Vicinity of Slurry Wall

On October 14, 1991, a total of three discrete grab samples were collected from three drums stored at the Building 12 Drum Storage Area. These drums contained soils displaced during drilling of two borings located in the vicinity of the slurry wall. One sample was from a drum containing drill cuttings from Boring B4, while the two other samples were from two drums containing drill cuttings from Boring B5. All three samples were analyzed for toxicity using the TCLP by Alpha Analytical. The samples showed no characteristics of toxicity (see Appendix J, Section B-24).

B-25 Sampling Northeast of Building 64G

On March 4, 1992, a total of two discrete grab samples were collected from two drums stored at the Building 12 Drum Storage Area. These drums contained soils displaced during drilling of two borings located northeast of Building 64G. One sample was collected from a drum containing drill cuttings from Borings X-19 and X-20. The second sample was from a drum containing drill cuttings solely from Boring X-19. The samples were analyzed for PCBs by OBG Labs, and for TCLP metals by Alpha Analytical. Measurable levels of PCBs were detected in both samples at concentrations of 9.3 and 1.3 ppm, respectively. The samples showed no characteristics of toxicity (see Appendix J, Section B-25).

B-26 Sampling South of Building 64T

On March 4, 1992, one discrete grab sample was collected from a drum stored at the Building 12 Drum Storage Area. The drum contained soils displaced during drilling of boring X-14, located south of Building 64T. The sample was analyzed for reactive sulfide and reactive cyanide by OBG Labs. No reactive sulfide or reactive cyanide were detected in the sample (see Appendix J, Section B-26).

B-27 Former Oxbow Sampling

On March 4, 1992, one discrete (ab sample was collected from a drum stored at the Building 12 Drum S)rage Area. The drum contained soils displaced during drilling of borii X-8, located within the former oxbow. The sample was analyzed for r .ctive sulfide and reactive cyanide by OBG Labs. Reactive sulfide was rep(:ed at a concentration of 76 ppm, while no reactive cyanide was detecte(in the sample (see Appendix J, Section B-27).

7.4 Sampling in Remainder of East Street A :a 2/USEPA Area 4

C-1 Building 40A Sump Water Samplinc

On November 12, 1993, a total of our field-composite samples were collected from 20 drums stored at Buildi) 12-STS. These drums contained sump water generated during the pump g of a sump located in Building 40A. Three of the four composite sam es were analyzed for PCBs, while the fourth composite was analyzed for CLP Metals. The four composite samples were analyzed by OBG Laborat ies with the results indicating the presence of PCBs at concentrations < 080 ppb and the metals analysis showed no characteristics of toxicity (s Appendix J, Section C-1).

C-2 Building 41-1 Brick Wall (Palm Oil oom) Sampling

On November 17, 1993, two disc e full-core (0-3 inches) samples were collected from brick walls locat within the Palm Oil Room of Building 41-1. The two core samples vere analyzed for PCBs at OBG Laboratories. The results indicated the resence of PCBs in one core at concentration of 1.3 ppm and the othe core at a concentration of < 1 ppm (see Appendix J, Section C-2).

C-3 Building 41-1 Concrete Floor (Test and Prototype Area) Sampling

On November 18, 1993, three discrete-core (1-centimeter core) sampl were collected from the concrete floor in the Test and Prototype area building 41-1. The core samples were collected for PCB and to petroleum hydrocarbons (TPH) analysis at OBG Laboratories. The laborat results indicated the presence of PCBs at concentrations of 1.5, 1.6 a 8.9 ppm, and did not indicate the presence of TPH at concentratio greater than laboratory detection limits (see Appendix J, Section C-3).

C-4 Building 40A Sump (Concrete Floor) Sampling

On November 9, 1993, two field-composite (1-centimeter core) sample were collected from a concrete floor located in a below grade sump a Building 40A. The field-composite samples were analyzed for TCLP Meta by OBG Laboratories. The results of the metals showed no characteristic of toxicity (see Appendix J, Section C-4).

C-5 Sludge/Residue Sampling from Building 40A-1 Trench

On December 13, 1993, one discrete grab sample was collected fro a drum stored at Building 78. The drum contained sludge/residue that wa generated during the cleaning of a trench in Building 40A-1. The sampl was collected for profile approval and no analytical report was provide (see Appendix J, Section C-5).

C-6 Red Lead Manhole Residue Sampling at Building 41A

On November 1, 1993, two discrete-grab samples of residue locate in manholes in the red lead area in Build 41A were collected for PCB a TCLP Metals analysis. The two samples were forwarded to OB Laboratories for analysis. The laboratory analytical results indicated th presence of PCBs at concentrations of 55 ppm and 34 ppm. The results of the metals analysis showed no characteristics of toxicity with the exception of lead in both samples at concentrations of 610 ppm and 51 ppm (see Appendix 1, Section C-6).

C-7 Building 41A-1 Red Lead Pit Sampling

On November 11, 1993, one discrete-core (1-centimeter core) sample was collected from the red lead pit cover located in Buidling 41A-1 for PCB and TCLP Metals analysis. The core sample was forwarded to OBG Laboratories for analysis. The results indicated both PCBs and TCLP Metals to be below laboratory detection limits.

One discrete-core sample from the concrete floor and two discrete-core samples from the concrete walls of the red lead pit were collected on November 16, 1993, for PCBs and TCLP Metals analysis. The core samples were collected after approximately 1/16" had been scarified from the pit walls and floor. The samples were forwarded to OBG Laboratories for analysis. The laboratory results indicated that PCBs were below laboratory detection limits, and metals showed no characteristics of toxicity.

Additional samples were collected on November 22, 1993. The sampling effort include the collection of one discrete-grab sample from one of four drums containing water and red lead sludge generated during steam cleaning of the red lead area in Building 41A-1 and the collection of one discrete-grab sample from one of 12 drums containing red lead sludge and residue generated during the cleaning of the red lead pit area in Building 41A-1. The grab sample collected from the drum that contained water and red lead sludge was analyzed for PCBs, TCLP metals, and profile approval. The grab sample from the drum that contained red lead sludge and residue was analyzed for profile approval only. OBG Laboratories performed the

PCB and TCLP Metals analysis on the one grab sample with the results indicating the presence of PCBs at 40 ppb and no characteristics of toxicity for metals. Analytical results were not provided for the analysis for profile approval. Details regarding the red lead pit sampling in Building 41A-1 are included in Appendix J, Section C-7.

C-8 Building 41-1 Galvanizing Pit Sampling

On November 3, 1993, two discrete-core samples of the concrete floor (outside of the galvanizing pit) located at Building 41-1 were collected for TCLP Metals and Total Zinc analysis. The two concrete core samples were analyzed by OBG Laboratories. The TCLP Metals analysis showed no characteristics of toxicity whereas the Total Zinc analysis indicated the presence of zinc at concentrations of 2,000 ppm and 170 ppm.

Additional sampling was performed on November 13, 1993, which consisted of the collection of two discrete-grab samples of in-situ soil (depth 0-1 feet) in the Building 41-1 galvanizing pit for PCB, Total Zinc, and TCLP Metals analysis. Two additional discrete-grab samples were collected from the same sampling locations but at a depth of 1-2 feet for Total Zinc analysis. The two samples analyzed for PCBs and TCLP Metals were forwarded to OBG Laboratories and the Total Zinc analysis on all four samples collected was performed at the Pittsfield GE laboratory. The results of the two samples, which were analyzed for PCBs and TCLP Metals indicated the presence of PCBs at concentrations of 3.3 ppm and 2.1 ppm, but the metals analysis showed no characteristics of toxicity. The four samples analyzed for Total Zinc indicated the presence of zinc at concentrations between 165 ppm and 534 ppm (see Appendix J, Section C-8).

C-9 Building 41-1 Galvanizing Area Pipe Cleaning

On November 22, 1993, one discrete-grab sample was collected from a drum stored at Building 12-1 that contained liquid generated from the cleaning out of piping in the old galvanizing area located in Building 41-1. The sample was collected for Total Zinc and TCLP Metals analysis at OBG Laboratories. The results of this analysis indicated total zinc at a concentration of 540 ppm and no characteristics of toxicity with the exception of chromium at 6.3 ppm. (See Appendix J, Section C-9).

C-10 Building 41A (Outside East End) Watermain Shutoff Excavation Sampling

On November 29, 1993, ten discrete-grab samples of soil, two field-composite samples of soil, and two discrete full-core samples of concrete were collected following excavation activities associated with the shut-off of a watermain outside the east end of Building 41A. Two additional discrete-grab samples of soil were collected for screening for VOCs using a PID meter. The ten discrete-grab samples of soil and the two discrete full-core samples of concrete were collected for PCB analysis whereas the two field-composite samples were collected for TCLP Metals analysis. The collected samples were analyzed by OBG Laboratories. No samples indicated the presence of PCBs greater than laboratory detection limits, with the exception of one concrete core sample that indicated the presence of PCBs at 1.1 ppm. The two field-composite soil samples did not indicate the presence of TCLP Metals greater than laboratory detection limits. PID measurements, recorded for soils from ten sampling locations, measured less than 10 PID units and, as a result, no VOC laboratory analysis was conducted for these samples (see Appendix J, Section C-10).

C-11 Building 41-1 Tile Pipe Excavation Sampling

On September 17, 1993, five discrete-grab samples of soil and one field-composite sample of soil were collected following excavation activities associated with the investigation of tile pipes in Building 41-1. The five discrete-grab samples of soil were analyzed for PCBs and the field-composite sample of soil was analyzed for TCLP Metals and Total Cyanide by OBG Laboratories. The results of the PCB analysis indicated the presence of PCBs ranging from <1 ppm to 11 ppm. The results of the TCLP Metals analysis showed no characteristics of toxicity with the exception of mercury indicated at 0.33 ppm. Total Cyanide was found to be 29 ppm. PID measurements, recorded for five sample locations, measured less than 10 PID units and, as a result, no VOC laboratory analysis was conducted for the samples collected.

Additional sampling related to the tile pipe area in Building 41-1 was performed on November 15, 1993. Four discrete (full-core) samples of concrete and two field-composite samples of concrete were collected from a concrete pile outside of Building 41-1 generated during the excavation of a floor in the tile pipe area within building 41-1. The four discrete core samples were collected for PCBs, Total Cyanide, and Amenable Cyanide analysis and the two field-composite samples were collected for TCLP Metals analysis. The laboratory analysis was performed by OBG Laboratories. The results indicated PCBs to be below laboratory detection limits, the presence of Total Cyanide and Amenable Cyanide in one sample at concentrations of 3.4 ppm and 1.1 ppm (respectively), and no characteristics of toxicity for any fo the TCLP metals in both composite samples (see Appendix J, Section C-11).

C-12 Building 41-1 Trichloroethane Tank Pad and Building 41A-1 Concrete Floor Sampling

On October 20, 1993, 12 discrete-core samples from the concrete floor located in Building 41A-1 were collected for PCB and TPH analysis following the completion of two passes of shotblasting of the concrete floor. Also on October 20, 1993, one discrete-core sample from the trichloroethane tank pad was collected for 1,1,1-Trichloroethane analysis after scarifying activities were completed on the tank pad. The collected samples were forwarded to OBG Laboratories for analysis. The results of the laboratory analysis indicated the presence of PCBs and TPH in all 12 of the core samples collected from the floor of 41A-1. The results indicated the presence of PCBs ranging between 2.6 ppm and 24 ppm and TPH between 9,800 ppm and 87,000 ppm. The laboratory results from the core sample collected from the Trichloroethane tank pad, indicated the presence of Acetone at a concentration of 36 ppb and 1,1,1-Trichloroethane at 6 ppb (see Appendix J, Section C-12).

C-13 Building 41-1 Shot Blast Residue Sampling

On December 13, 1993, one discrete-grab sample was collected from shot blast residue in a drum being stored at Building 78. The residue was generated during the shot blasting of the floor in Building 41-1. The grab sample was obtained for the profile approval; therefore, no analytical report was submitted (see Appendix J, Section C-13).

C-14 Building 41-1 Sampling

On July 3, 1990, PCBs were detected at concentrations ranging from 47 to 120 ppm in three discrete grab samples collected from soils beneath a concrete floor in Building 41-1. Samples were taken from a depth of 0 to 2 inches (see Appendix J, Section C-14).

C-15 Building 41-1 Sampling

On July 31, 1990, No detectable levels of PCBs were reported in one discrete grab soil sample collected from the bottom of a two-foot hole dug beneath a concrete floor in Building 41-1 (see Appendix J, Section C-15).

C-16 Building 41A UST Location Sampling

On July 28, 1993, PCBs were detected at 1.5 ppm in one of three discrete soil grab samples collected from soil excavated during an attempt to locate an UST near Building 41A. The other two samples showed no detectable PCBs. PID readings of these samples were all below 10 PID; therefore no VOC analyses were conducted. PCBs were not detected in two core samples of concrete material also excavated during these activities (see Appendix J, Section C-16).

C-17 Building 43-1 Water Line Excavation

Soils associated with the Building 43-1 water line excavation were deposited in three piles along a fence line east of Building 41A, as shown in Appendix J, Section C-17. On September 23, 1991, a total of 11 discrete grab samples were collected from these piles and analyzed for PCBs by OBG Labs. Ten of the samples were collected from 1-foot depth intervals between 0 and 3 feet, while one sample was collected between 0 and 2 feet.

Measurable levels of PCBs were detected in six of the 11 soil samples, and ranged in concentration from 1.1 to 15 ppm, as shown in Appendix J, Section C-17. A PID reading taken on one sample measured less than 10 PID units and, as a result, no samples were analyzed for VOCs.

C-18 Building 44 Water Main Soil Sampling

On May 22, 1990, PCBs were detected at concentrations of 4 and 6.8 ppm in two of four discrete grab samples collected from a soil pile located west of Building 44. Samples were collected at a depth interval of 0 to 2 feet (see Appendix J, Section C-18).

C-19 Building 42 (West Side) Sprinkler Excavation

On June 30, 1992, PCBs were detected at concentrations ranging from 1.5 to 2.6 ppm in three discrete soil grab samples collected from a soil pile (10 cy) generated during an emergency repair of a water curb for a sprinkler system outside Building 42. PID readings were all below 10 PID units; therefore, no VOC analyses were conducted (see Appendix J, Section C-19).

C-20 Building 31J Conduit Trench Excavation

On September 30, 1992, PCBs were detected at concentrations ranging from 34 to 86 ppm in three discrete soil grab samples collected from a soil pile (3 cy) generated during the excavation of the Building 31J conduit trench. PID readings of these samples were all below 10 PID units; therefore, no VOC analyses were conducted (see Appendix J, Section C-20).

C-21 Building 31W Oil/Water Separator Soil Sampling

On October 22, 1991, PCBs were detected at concentrations ranging from 6.4 to 19 ppm in three discrete grab samples collected from a soil pile located east of Building 68, adjacent to the railroad tracks. Samples were taken from depth intervals of 0 to 8 inches, 0 to 16 inches, and 0 to 24 inches. In addition, one composite sample, prepared from soils collected at the three sampling locations, was analyzed by the TCLP for toxicity characteristics. It showed no characteristics of toxicity (see Appendix J, Section C-21).

C-22 Building 31 (Outside) Waterline Close-Off Excavation

On February 4, 1993, PCBs were detected at concentrations up to 87 ppm in ten discrete grab samples collected from two soil excavation plies. These samples were also screened for VOCs using a PID. PID readings ranged from 0 to 0.4 PID units (see Appendix J, Section C-22).

C-23 Building 31 (West End Outside) Steam Line Soil Excavation Sampling

On February 10, 1992, PCBs were detected at concentrations ranging from 2.6 to 5.4 ppm in three discrete grab samples collected from three soil piles (each approximately 1 cy) excavated from a trench located west of Building 31. Samples were taken at depth intervals of 0 to 2 feet. PID readings measured less than 10 PID units for all three samples and, as a result, no VOC analysis was conducted (see Appendix J, Section C-23).

C-24 Building 31 Water Curb Sampling

On August 28, 1990, PCBs were detected at concentrations ranging from 1.0 to 4.6 ppm in four discrete grab samples collected around the perimeter of the Building 31 Water Curb. All samples were collected from depth intervals of 0 to 3 feet (see Appendix J, Section C-24).

C-25 Building 31 Soil Sampling (Altresco)

On September 21, 1989, seven composite samples for PCB analysis were collected from soil piles excavated from seven locations in the vicinity of Building 31. Subsamples were collected at depth intervals of 0 to 2.5 feet, 2.5 to 5 feet, and 5 to 7 feet, and composited on an equal weight basis. PCBs were detected in three of the seven composite samples, and ranged in concentration from 11 to 32 ppm (see Appendix J, Section C-25).

C-26 Building 36V Electrical Line Footing Excavation

On September 28, 1992, PCBs were detected at concentrations ranging from 4.3 to 200 ppm in five discrete soil grab samples collected from two soil piles (12 cy and 3 cy) generated during the excavations for the Building 36V electric line footings. PID readings of these samples were all below 10 PID units; therefore no VOC analyses were conducted.

Three discrete grab samples of concrete were also collected from a concrete pile (<1 cy) also generated as part of these excavations. No PCBs were detected in these samples (see Appendix J, Section C-26).

C-27 Storm Sewer Sampling

On August 4 through August 8, 1989, five sediment grab samples were collected from five storm sewer locations as shown in Appendix J, Section C-27. All five samples were analyzed for PCBs by OBG Labs. Measurable levels of PCBs were reported in all five samples at concentrations ranging from 6.4 to 89 ppm, as shown in Appendix J, Section C-27.

C-28 Building 31 (Southeast Side) Steam Tunnel Entry Excavation.

On September 28, 1992, PCBs were detected up to 10 ppm in three discrete grab samples collected from two soil excavation piles and three discrete grab samples collected from two concrete excavation piles. All three soil samples were also screened for VOCs using a PID, but no PID readings above zero were recorded (see Appendix J, Section C-28).

C-29 Excavations Related to UST 31-01 Removal

Approximately 18 cubic yards (cy) of soil were excavated from a tank pit located east of Building 31, north of the Building 31 Yard. More than 17 cy of the excavated soil were deposited in one pile, while the remaining soils, which were stained, were deposited in a separate pile east of the excavated pit. On November 14, 1990, a total of three composite samples were collected, as shown in Appendix J, Section C-29. One composite was collected from the larger soil pile (five subsamples), one from the stained soil pile (two subsamples), and one from the excavated pit (five subsamples). These composite samples were analyzed for PCBs by OBG Labs. Similarly, three separate composites samples were prepared in the same manner and analyzed for TPHs. On December 13, 1990, another 13 discrete grab samples were collected from 13 additional locations in the bottom and sides of the excavation and analyzed for TPHs.

Measurable levels of PCBs were detected in all three composite samples, and ranged in concentration from 1.9 to 2.3 ppm, as shown in Appendix J, Section C-29. TPHs were also detected in the three composites at levels ranging from 19 to 25 ppm, while TPH concentrations in the discrete samples ranged from 0.06 to 25 ppm.

In addition, 12 discrete grab samples, collected on November 27, 1990, were analyzed for VOCs by OBG Labs. Samples were collected from all previous locations in the excavation and soil piles. Acetone was the only VOC detected, and was measured at a concentration of 0.044 ppm in one sample from the north wall of the excavated pit. Results are shown in Appendix J, Section C-29.

Finally, two composites collected on November 27, 1990 were analyzed for TCLP Metals. One composite was prepared for each of the two excavated soil piles. No TCLP Metals were reported in the two composite samples (see Appendix J, Section C-29).

C-30 Building 33X (Northwest Side) Diesel Tank Removal

On August 31, 1992, TPH concentrations ranged from 690 to 980 ppm in three composite soil samples (three discrete grab samples per composite sample) collected from a soil pile (20 cy) generated as part of the removal of a diesel tank outside of Building 33X (see Appendix, Section C-30).

C-31 Building 31 Condensation Enclosure Excavation

On September 29, 1992, PCBs were detected at concentrations ranging from 1.8 to 6.0 ppm in three discrete grab samples collected from two soil excavation piles. All three samples were also screened for VOCs using a PID, but no readings above zero were recorded (see Appendix J, Section C-31).

C-32 Building 33X Waterline Close-off

On February 3, 1993, PCBs were detected at concentrations ranging from 1.2 to 2.4 ppm in ten discrete soil grab samples collected from a soil pile (37 cy) generated as part of the close-off of a waterline outside Building 33X. PID readings of these samples were all below 10 PID units; therefore no VOC analyses were conducted (see Appendix J, Section C-32).

C-33 Building 33X-1 Water Main Repair Excavation Sampling

On February 10, 1992, PCBs were detected at concentrations ranging from 2.1 to 3.7 ppm in three discrete grab samples collected from a soil pile (8 cy) that had been excavated inside Building 61-1. Samples were taken at depth intervals of 0 to 1 foot, 1 to 2 feet, and 2 to 3 feet. No detectable levels of PCBs were reported for one additional sample collected from a soil pile (one cy) excavated outside Building 33X-1. PID readings measured less than 10 PID units for all four samples and, as a result, no VOC analysis was conducted (see Appendix J, Section C-33).

C-34 Building 34 (North Side) Indicator Installation

On June 30, 1992, PCBs were detected at concentrations ranging from 4.7 to 20 ppm in five discrete soil grab samples collected from a soil pile (14 cy) generated during an emergency repair excavation for an indicator installation at valve #34-2. PID readings were all below 10 PID units; therefore, no VOC analyses were conducted (see Appendix J, Section C-34).

C-35 Excavations Related to UST 34-01 Removal

As detailed in Appendix J, Section C-35, on August 17 and 18, 1993, in connection with the removal of UST 34-01, 35 discrete soil grab samples were collected from the excavated area around that UST. These samples were screened for VOCs using a PID and analyzed for PCBs and TPHs. Also, as part of these activities, three concrete samples were collected and analyzed for PCBs and TPHs, and three asphalt samples were collected and analyzed for PCBs.

The results of these analyses showed the presence of PCBs in soil up to 3.9 ppm and in asphalt up to 1.2 ppm (no PCBs were detected in concrete). Mineral spirits were noted to be present in certain soil samples up to 2,600 ppm. Nine soil samples exhibited PID readings greater than ten PID units. As a result, these samples were submitted for laboratory analysis for VOCs, but none were detected.

On November 4, 1993, an additional soil composite sample was collected from excavated soil related to the removal of UST 34-01 and analyzed for TPHs. The analytical results of this analysis showed a TPH concentration of 420 ppm (see Appendix J, Section C-35).

C-36 Building 34 Parking Lot Soil Sampling

On July 11, 1990, PCBs were detected at a concentration of 4.4 ppm in one discrete grab sample collected from a 1 cy soil pile (resulting from a pavement subsistence) in the Building 34 Parking Lot. Samples were taken from a depth of 0 to 2 feet (See Appendix J, Section C-36).

C-37 Building 61-1 (West Side) Water Main Repair Excavation Sampling.

On February 3, 1992, PCBs were detected at concentrations ranging from 3.4 to 14 ppm in three discrete grab samples collected from a soil pile (10 cy) that had been excavated to repair a water main outside Building 61-1. Samples were taken at depth intervals of 0 to 1.5 feet, 1.5 to 2 feet, and 2 to 3 feet. PID readings measured less than 10 PID units for all three samples and, as a result, no VOC analysis was conducted (see Appendix J, Section C-37).

C-38 Building 61 Catch Basin Sampling

On June 12 through 13, 1990, three discrete grab samples for PCBs were collected from a 5 cy soil pile excavated from catch basins in the vicinity of Building 61A. PCBs were detected in two of the three samples at concentrations of 5.4 and 7.1 ppm (see Appendix J, Section C-38).

C-39 Building 66 (Outside West End) Sampling

On October 16, 1991, PCBs were detected at concentrations ranging from 1.1 to 2.6 ppm in five discrete grab samples collected from two soil piles located southwest of Building 66. Samples were taken from depth intervals of 0 to 1, 0 to 2, and 0 to 3 feet. In addition, one composite sample, prepared from soils collected from the five sampling locations and analyzed by the TCLP, showed no characteristics of toxicity (see Appendix J, Section C-39).

C-40 Building 63 Concrete Pad Removal Sampling

Soils ranging in depth from 0 to 6 feet beneath a concrete pad located inside Building 63 were sampled on three separate occasions in 1993 and analyzed for chromium. As shown in Appendix J, Section C-40, a total of 34 samples were collected and analyzed as part of these activities on November 8, November 17, and December 20, 1993. Chromium concentrations of these samples ranged from 9.5 to 3,930 ppm (see Appendix J, Section C-40).

C-41 Excavations Related to UST 64-01 Removal

Approximately 115 cy of soil excavated from a tank pit located between Buildings 64 and 66 were deposited in a pile east of Building 68. On November 17 and 21, 1990, a total of 30 locations were sampled within this pile, as well as seven locations in the walls and bottom of the excavation as shown in Appendix J, Section C-41.

A total of eight composite samples were analyzed for PCBs by OBG Labs. Subsamples taken from the 30 locations in the soil pile were used to prepare six of these composites for analysis, each composite consisting of five subsamples. The other two composites were prepared from stained soils collected from the seven locations in the excavation, and consisted of five subsamples and two subsamples per composite, respectively. Similarly, eight separate composite samples were prepared for analysis of TPHs.

Measurable levels of PCBs were detected in four of the eight composite samples and ranged in concentration from 0.64 to 4.2 ppm, as shown in Appendix J, Section C-41. TPHs were detected in all eight composites at levels ranging from 56 to 1,100 ppm.

In addition, 21 discrete grab samples collected on November 21, 1990, were analyzed for VOCs by OBG Labs. Samples were collected from all seven locations in the excavation and from 14 of the 30 locations in the excavated soil pile. The VOCs detected in these samples were ethylbenzene (62 ppm in one of three locations in the bottom of the pit, and 0.03 ppm in the south wall of the pit) and xylene (430 and 9.2 ppm in two of three locations in the bottom of the pit, and 0.2 ppm in the south wall of the pit). Results are shown in Appendix J, Section 19 C-41.

Finally, two composites collected on the same date were analyzed by OBG Labs for toxicity characteristics using the TCLP. One composite was prepared from grab samples taken from each of the 30 sampling locations in the excavated soil pile, while the other composite consisted of grab samples from two of the three sampling locations in the bottom of the excavated pit. These two composites exhibited no characteristics of toxicity, as shown in Appendix J, Section C-41.

C-42 Building 33-1 (East Side) Water Line Excavation

Approximately 13 cy of soil associated with the Building 33-1 water line excavation were deposited in two piles adjacent to a grassy area north of Building 33. On October 8, 1991, a total of ten discrete grab samples were collected from these piles and analyzed for PCBs by OBG Labs. Samples were collected alternately from 1-, 2-, and 3-foot depth intervals between 0 and 3 feet.

Measurable levels of PCBs were detected in nine of the ten soil samples, and ranged in concentration from 1.2 to 8.2 ppm, as shown in Appendix J, Section C-42. A PID reading taken on one sample measured less than 10 PID units, and therefore no units were analyzed for VOCs (see Appendix J, Section C-42).

C-43 Installation of New Gate at Building 64

On November 19-23, 1992, five soil excavation piles were sampled for PCBs (21 discrete grab samples), VOCs and 1,2,4-trichlorobenzene (one composite sample), and TCLP constituents (excluding herbicides and pesticides) (three composite samples). All discrete grab samples were screened for VOCs using a PID. PCB concentrations ranged from below detection to 10 ppm, and no other constituents were detected. TCLP results showed no toxicity characteristics and PID readings were all zero (see Appendix J, Section C-43).

C-44 Excavation for Parking Lot Sampling

On August 8 and 22, 1990, a total of six discrete soil grab samples for PCBs, SVOCs, VOCs, RCRA metals, and cyanide were collected from depth intervals of 0 to 2 feet beneath existing asphalt at two locations: 1) the north edge of East Street, northwest of the GE Helipad in East Street Area 2 (three samples), and 2) the south edge of East Street east of Gate No. 13 in USEPA Area 4 (three samples). PCBs were detected in four of the six samples at concentrations ranging from 1.4 to 10 ppm. SVOCs were detected in two of the three USEPA Area 4 samples and consisted of bis(2-ethylhexyl)phthalate (0.47 and 0.41 ppm in two samples), benzo(a)anthracene (0.51 ppm in one sample), benzo(a)pyrene (0.48 ppm in one sample), benzo(b)fluoranthene (0.64 ppm in one sample), chrysene (0.5 ppm in one sample), fluoranthene (0.96 ppm in one sample), phenanthrene (0.65 ppm in one sample), and pyrene (1 ppm in one sample). One VOC, acetone, was detected in the three East Street Area 2 samples at concentrations ranging from 0.017 to 0.024 ppm. However, acetone was also detected in the sample blank at 0.028 ppm. No detectable levels of RCRA metals or cyanide were reported in any of the samples (see Appendix J, Section C-44).

C-45 GE Parking Lot Resurfacing

On November 4, 1992, 12 samples were collected and analyzed for PCBs, with six of the 12 samples being analyzed for VOCs, SVOCs, phenols, cyanide and TCLP constituents (excluding herbicides and pesticides). Detected constituents included only: PCBs up to 4.6 ppm; trichloroethene up to 0.009 ppm; and tetrachloroethane up to 0.007 ppm (see Appendix J, Section C-45).

C-46 Building 15 Fence Excavation Sampling

On May 15, 1991, PCBs were detected at concentrations ranging from 1.2 to 100 ppm in eight discrete grab samples collected from two soil piles excavated during the Building 15 fence installation. Samples were collected from a depth of 0 to 2 feet (see Appendix J, Section C-46).

C-47 Steam Line Excavation Sampling Between Buildings 6 and 19.

On January 15, 1992, PCBs were detected at concentrations ranging from 1.1 to 1.9 ppm in three discrete grab samples collected from a soil pile associated with the Buildings 6 and 19 streamline excavation. Samples were taken at depth intervals of 0 to 0.5 feet, 0.5 to 1 foot, and 1 to 1.5 feet. PID readings measured less than 10 PID units for all three samples and, as a result, no VOC analysis was conducted (see Appendix J, Section C-47).

C-48 Building 11 Steam Line Sampling

A total of 12 soil samples were collected on September 27 and 28, 1990, at three locations in the Building 11 Streamline Trench, as shown in Appendix J, Section C-48. Six samples were collected on September 27, 1990, and consisted of one sample each from the 0- to 2-feet and 2- to 4-feet depth intervals at each of the three sample locations. These six samples included two discrete core samples (Location 1), and four discrete grab samples (Locations 2 and 3) which were analyzed for PCBs by OBG Labs. Similarly, six samples (collected in a similar manner as those described above) were collected on September 28, 1990, for VOC and SVOC analysis.

Measurable levels of PCBs were detected in five of six samples, and ranged in concentration from 1.4 to 7.8 ppm, as shown in Appendix J, Section C-48. SVOCs were detected in one sample, as follows: benzo(a)anthracene (0.43 ppm), benzo(a)pyrene (0.5 ppm), benzo(b)fluoranthene (0.56 ppm), benzo(k)fluoranthene (0.42 ppm), chrysene (0.45 ppm), fluoranthene (0.72 ppm), and pyrene (0.82 ppm). Although PID measurements greater than 10 PID units were recorded for soils from all three locations, the laboratory reported no detectable levels of VOCs for the six samples.

On November 28, 1990, PCBs were detected at concentrations ranging from 2.3 to 4.3 ppm in three discrete grab samples collected from two soil piles (7 cy and 9 cy) excavated during installation of the Building 11 steam line. Samples were taken from a depth interval of 0 to 2 feet (see Appendix J, Section C-48).

C-49 Building 11 Drainline Repair

On October 21, 1992, PCBs were not detected in three discrete soil grab samples collected from two soil piles (<1 cy and 2 cy) generated during the repair of a drainline outside Building 11. PID readings of each of these samples were also below 10 PID units; therefore, no VOC analyses were conducted. A discrete grab sample of an asphalt pile (1 cy) also generated during these excavations exhibited a PCB concentration of 9.3 ppm (see Appendix J, Section C-49).

C-50 Building 2 Floor Removal Sampling

On August 15, 1988, PCBs were detected at a concentration of 43 ppm in one composite sample collected from a soil pile excavated during the Building 2 Floor Removal (see Appendix J, Section C-50).

C-51 Building 7 Waterline Repair.

On February 17, 1993, PCBs were detected at 1.2 ppm in one of three discrete soil grab samples collected from a soil pile (5 cy) generated during the repair of a waterline outside of Building 7. PID readings of these samples were all below 10 PID units; therefore no VOC analyses were conducted. PCBs were not detected in three core samples of a concrete pile (1 cy) also generated during these excavations (see Appendix J, Section C-51).

C-52 North of Building 12 Sampling

On August 2, 1990, no detectable levels of PCBs were reported in a discrete grab sample collected from a soil pile removed from a subsided area north of Building 12. The sample was collected from a depth of 0 to 2 inches (see Appendix J, Section C-52).

C-53 Building 12-Y Sampling

On September 10, 1987, soils excavated from a pit drain located in Building 12Y were deposited in three soil piles. A total of three composite samples were prepared, one composite from each pile. In a given pile, subsamples were collected from the same depth interval at each of six locations. The subsamples from one pile were collected at the 0- to 2-foot depth interval, from the second pile at the 2- to 4-foot interval, and from the third pile at the 4- to 6-foot interval. PCBs were detected in two of the three composites at concentrations of 10 and 28 ppm (see Appendix J, Section C-53).

C-54 Building 100 Catch Basin Sampling

On June 13, 1988, PCBs were detected at concentrations of 11 and 22 ppm in two discrete sediment grab samples collected from a catch basin located outside Building 100 (see Appendix J, Section C-54).

C-55 Sweeper Soil Sampling, West of Building 12T

On June 20, 1990, PCBs were detected at concentrations of 4.4 and 7 ppm in two discrete grab samples collected from a sweeper soil pile placed west of Building 12T. Samples were taken from a depth of 0 to 2 feet (see Appendix J, Section C-55).

C-56 Building 12Y-100 Water Shutoff Sampling

On March 6, 1991, no detectable levels of PCBs were reported in two discrete grab samples collected from two soil piles (7 cy and 1 cy) excavated from a pit in a roadway adjacent to the east side of Building 12Y. The samples were collected at a depth of 0 to 2 feet. PID readings measured less than 10 PID units for both samples, and, as a result, no VOC analysis was conducted (see Appendix J, Section C-56).

C-57 Building 12Y (Outside) Valve No. 10 Sampling

On July 24, 1991, PCBs were detected at a concentration of 1.9 ppm in one of three discrete grab samples collected from a soil pile located outside Building 12Y. Samples were collected from depth intervals of 0 to 1 foot, 0 to 2 feet, and 0 to 3 feet. PID readings measured less than 10 PID units for all three samples and, as a result, no VOC analysis was conducted (see Appendix J, Section C-57).

C-58 Building 31 Oil/Water Separator Soil Sampling

On June 21, 1990, two discrete grab samples for PCB analysis were collected from a pile of soil and sand removed from the Building 31 Oil/Water Separator and placed in the Scrap Yard. Samples were taken from a depth of 0 to 2 feet. PCBs were detected in one of the two samples at a concentration of 7.6 ppm (see Appendix J, Section C-58).

C-59 Oil/Water Separator 31W Sediment Sampling

On September 1, 1992, 19 discrete grab samples were collected an analyzed from 19 tote bins being stored at Building 64. PCBs were detected at concentrations ranging from 1.1 to 88 ppm. Additionally, the results of TCLP analysis of three composite samples of sediments from these tote bins showed no toxicity characteristics (see Appendix J, Section C-59).

C-60 Building 100 Sampling

On February 21-22, 1994, soil samples were collected in two-foot intervals from grade to three-feet below grade from 16 soil borings installed at locations north of Building 100 and inside Building 14A. PID readings measured less than 10 PID units for all samples, and as a result, no VOC analysis was conducted. PCBs were present at concentrations ranging from non-detect to 44 ppm. Concrete core samples from 11 of the borings were also submited for PCB analysis; all samples were non-detect with the exception of one at 11 ppm (see Appendix J, Section C-60).

On October 14, 1991, soil from Boring B1, drilled during the above investigations, was placed in a drum and stored Building 12-1. A discrete grab sample was later collected from the drum and analyzed by Alpha Analytical for toxicity using the TCLP. The sample showed no characteristics of toxicity, as shown in Appendix J, Section C-60.

7.5 Soil Disposition

As described in Sections 7.2 through 7.4, a large number of soil samples have been collected in the East Street Area 2/USEPA Area 4 Site as part of activities under the MDEP-approved excavation protocols, as well as various other miscellaneous activities. In most cases where excavated soil was sampled, the soil samples were analyzed for PCBs, and at times, VOCs, SVOCs, metals, cyanide, phenols, and TPHs, to assist in defining disposition alternatives for the soil. If necessary, the soil was then transported and properly disposed. In addition, in cases where the analytical data obtained from excavation samples indicated the presence of contamination warranting the removal of additional soil from the excavation, additional soil was removed from the bottom and/or side walls of the excavation and properly disposed.

SECTION 8 - AIR MONITORING AND ASSESSMENT

8.1 General

Ambient air quality within or in the vicinity of the East Street Area 2/USEPA Area 4 Site was monitored on two occasions prior to MCP Phase II activities. In 1981, ambient air was monitored for the presence of PCBs in connection with a test burn of the Thermal Oxidizer located south of East Street. In addition, during the 1988 demolition of the Building 20 complex (20's Demolition Project), ambient air quality within the site was monitored for PCBs. The results of both of these air monitoring efforts are discussed in Section 8.2.

More recently, ambient air assessment activities related to this site have been or are being conducted under the MCP. These include implementation of a facility-wide air monitoring program, as well as specific air monitoring for PAHs in the southern portion of the site. These activities are discussed in Section 8.3.

8.2 Pre-MCP Air Monitoring

8.2.1 Monitoring Results related to Thermal Oxidizer Operation

Ambient air monitoring was conducted at two locations within the GE facility to measure the PCB concentrations in the air on November 30 and December 1, 2, 3, and 9, 1981. The December 1, 2, and 3 sampling coincided with a test burn at GE's Thermal Oxidizer. One air sampler was placed south of East Street, just west of Newell Street. The second sampling location was the Lyman Street Parking Lot located to the west of the study area.

The results of this air sampling showed that the average level of PCBs in ambient air on days when the Thermal Oxidizer was not being used was 27.8 nanograms per cubic meter (ng/m^3). During the test burn, the average concentration of PCBs in the ambient air was 4.4 ng/m^3. These results showed that ambient air concentrations of PCBs were independent of operation of the Thermal Oxidizer (Zorex, 1982).

8.2.2 Monitoring Results Related to 20's Complex Demolition Project

During the 1988 demolition of the Building 20 complex, ambient air was sampled for PCBs. The air monitoring was initiated on March 16, 1988, prior to demolition activities, to establish background concentrations. Air monitoring during demolition activities commenced on April 19, 1988.

Four predetermined sampling locations were identified:

- Station No. 1 - Building 100
- Station No. 2 - Building 34
- Station No. 3 - Parking lot south of East Street
- Station No. 4 - Open field south of East Street

The sampling program required a single air sample to be collected daily from one of the four predetermined sampling locations, based on wind direction relative to the location of the demolition activities.

In addition to the four sampling locations, two meteorological stations were constructed: 1) on the roof of Building 100, and 2) in an open field south of East Street adjacent to sampling Station No. 4. These meteorological stations were used to collect and record wind speed and direction, temperature, relative humidity, barometric pressure, and rainfall.

Analysis of the air samples collected during the 20's Complex Demolition Monitoring Program, which began on March 16, 1988, and concluded on December 15, 1988, revealed that the PCB analytical detection limit of 20 ng/m^3 was never surpassed by any of the samples.

8.3 MCP Air Monitoring and Assessment

8.3.1 Facility Air Monitoring Program for PCBs

From August 1991 through August 1992, GE conducted a facility air monitoring program to quantify levels of PCBs in the ambient air at and near its Pittsfield facility. This activity was performed in accordance with the "Facility Air Monitoring MCP Scope of Work" (Blasland & Bouck, August 1990b). In addition to the collection of meteorological information, air samplers were placed at certain locations based on an initial siting study. This program included two co-located air monitoring stations at Building 64Y south of East Street (Stations 001 and 007). In addition, a supplemental air monitoring station was added to the monitoring network on June 15, 1992, at former GE Building 32S (Station 008), located east of Silver Lake, northeast of Building 33A, to provide additional data on PCB levels (if any) in the ambient air near Silver Lake.

The year-long program was performed by Zorex Environmental Engineers (Zorex), of Pittsfield, Massachusetts, and involved the collection of air samples every 12 days with analysis for PCBs. The results of this program were submitted to the MDEP and USEPA on a quarterly basis and were presented in a final report submitted in November 1992 (Zorex, November 1992). Those results are summarized in Table 2 of that report, reproduced as Table 8-1 of this report. As shown in Table 8-1, ambient air PCB concentrations during the year-long study at the site averaged 0.0011 micrograms per cubic meter (ug/m^3), and ambient PCB concentrations during the summer months (June 15 to August 14, 1992) at the Building 32S station averaged 0.005 ug/m^3.

Based on the results of the 1991-1992 ambient air monitoring program, it was determined that additional ambient air PCB data were necessary to more accurately identify suspected sources of airborne PCBs observed at certain air monitoring stations. Silver Lake was determined to be a potential source of airborne PCBs, and as such was targeted for further assessment. A SOW was issued to the MDEP in January 1993 (Zorex, January 1993) and revised in March 1993. That SOW proposed the collection and analysis of air samples within the site at the Building 32S monitoring station as well as two new monitoring stations along the eastern shore of Silver Lake, adjacent to the site (Stations 11 and C). In a letter dated March 17, 1993, the MDEP conditionally approved that plan. The additional ambient air monitoring activities were conducted between May 4, 1993 and August 17, 1993. These activities included the assessment of high-elevation (2 to 6 meters above the ground) air at Building 32S (Station 008) and Silver Lake (Station 011) and low-elevation (near ground) air at Silver Lake (Station C).

The results of these additional monitoring activities were summarized and evaluated in a report submitted to the MDEP (with a copy to the USEPA) on November 8, 1993 (Zorex, November 1993). Book 1 of 3 of that report is included as Appendix K. The results of these activities, as discussed in Section 6.3.2 of Appendix K, indicate that Silver Lake appears to be "a principal source of PCBs in the ambient air in this area." It was further noted that "PCB concentrations appear to decrease rapidly with elevation above the lake surface and to decrease rapidly further with distance from the lake." The report also pointed out that the method used to obtain the low-elevation samples (a low-volume sampling technique) differed from the method used for the high-elevation samples (a high-volume sampler), and that there was some question about the validity of the low-volume method and the comparability of the two methods. Hence, it proposed additional air sampling (at the Silver Lake sampling locations) to evaluate the validity of the low-volume sampling method and its consistency with the high-volume method (see Section 8 of Appendix K).

It should be noted that in an appendix to the November 1993 Zorex Report (also included in Appendix K), GE's risk assessment consultant, ChemRisk, presented an analysis (based on use of standard MDEP exposure assumptions and toxicity values) indicating that the PCB concentrations in the ambient air in the vicinity of Silver Lake do not present a significant long-term or short-term risk to residents in the area.

8.3.2 Ambient Air Monitoring for PAHs and Assessment of Other Potential Emissions

In addition to the facility-wide air monitoring program, an MCP ambient air monitoring investigation for PAHs was conducted on August 1, 1991, at the East Street Area 2/USEPA Area 4 Site. The purpose of this monitoring was to determine ambient concentrations of PAH compounds present at the site south of East Street. This air monitoring program was conducted by Zorex Environmental Engineers, Inc., of Pittsfield, Massachusetts. The sampling procedures, analytical results, and related information associated with this program have been reported in a document entitled: "Ambient Air Monitoring for Polyaromatic Hydrocarbons at General Electric Company, Pittsfield, Massachusetts" (Zorex, 1991). That report is included as Appendix L.

In summary of this program, three sampling stations were set up downwind of the suspected source of buried coal tar residuals, and an upwind site was located northeast of the source area (Figure 1 of Appendix L). Sampling was conducted over an eight-hour period with the air temperature at 84°F and the wind speed averaging 10 mph, blowing from the west-southwest. No rainfall occurred during sampling activities. The air samples were analyzed for the following 17 PAH compounds:

Acenaphthene
Acenaphthylene
Anthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(g,h,i)perylene
Benzo(k)fluoranthene
Chrysene
Dibenzo(a,h)anthracene
Fluoranthene
Fluorene
Indeno(1,2,3-cd)perylene
2-Methylnaphthalene
Naphthalene
Phenanthrene
Pyrene

The results of this air sampling program showed that the levels of all of these PAHs were below the detection limit of 0.417 ug/m^3 (Zorex, 1991). GE believes, however, that it would be useful to attempt to achieve a lower detection limit in order to better quantify the concentrations of PAHs in ambient air at the Site. This is discussed further in Section 11 below and in the accompanying Supplemental Phase II SOW/RFI Proposal.

In addition to this air monitoring effort for PAHs, GE's "MCP Scope of Work for Air Migration Assessment for East Street Area 2" (Blasland & Bouck, August 1990c) called for a review and evaluation of the MCP surficial soil sampling results from this area of the site to determine whether those data show the presence in the surficial soil of other hazardous materials that could become airborne, and, if so, inclusion of those data in a desk-top dispersion model. The pertinent surficial soil sampling data described in Section 6, have been reviewed for this purpose, and the following observations can be made:

- The hazardous constituents detected in surficial soils consist primarily of the same group of PAHs which were monitored as part of the PAH air monitoring program described above. As noted above, GE will seek to determine whether a lower detection limit of PAHs in the ambient air can be achieved.
- Potential airborne migration of PCBs from surficial soils have been addressed as part of the facility-wide air monitoring program.

- Other hazardous constituents present in surficial soils are limited to low concentrations of PCDD/PCDFs, inorganics, and several other constituents.
- These data, including any necessary modeling, will be evaluated in the course of the risk assessment for this site.

SECTION 9 - FATE AND TRANSPORT CHARACTERISTICS

9.1 General

Various chemical constituents have been detected in the surface and subsurface soil and fill, groundwater, and oil plume at the East Street Area 2/USEPA Area 4 Site. The information presented in this section provides a general characterization of the environmental fate and transport properties associated with the constituents observed in one or more of these media. This section discusses only those compounds that were found at levels above the quantitation limit or CLP-required detection limit, and excludes those that were also found in associated blank samples (thus indicating laboratory contamination) or were detected in only one or two isolated samples at low concentrations. Information concerning the detected concentrations and areas of distribution for compounds observed in surface and subsurface soil/fill, groundwater, and oils are presented in Sections 4, 6, and 7. The fate and transport characteristics discussed in this section are intended to be general in nature for the various constituent groups and are not site-specific. Therefore, this section of the report is not intended to identify those processes actually occurring at the East Street Area 2/USEPA Area 4 Site, but only to provide information on potential fate and transport mechanisms.

9.2 Characterization of Detected Hazardous Materials

Due to the number of constituents detected, and the fact that many of these chemicals share common characteristics, discussions of compound-specific environmental fate and transport properties address representative groups of chemicals. These groups of chemicals and the constituents within each group exhibit specific properties that determine their potential behavior in the environment.

VOCs detected at the East Street Area 2/USEPA Area 4 Site include aldehydes, aromatics, halogenated hydrocarbons, and others. SVOCs detected include polychlorinated benzenes, phenols, PAHs, amines, phthalate esters, pesticides, PCBs, PCDD and PCDF compounds, inorganics, and others. These chemicals are discussed in the following sections.

Table 9-1 presents the water solubility, log octanol/water partitioning coefficient (log K_{ow}), vapor pressure, and Henry's Law Constant for the organic compounds detected at the East Street Area 2/USEPA Area 4 Site. These properties provide considerable insight into the fate and transport of a compound in the environment. Depending on their vapor pressure, highly water-soluble chemicals are less likely to volatilize and are generally more likely to biodegrade (Howard, 1989). Water solubility can also affect adsorption and desorption on soils. Compounds that are more soluble are more likely to desorb from soils. Water solubility can also affect possible transformation by hydrolysis, photolysis, oxidation, and reduction (Verchueren, 1983). The log octanol/water partition coefficient correlates well with a compound's tendency to bioconcentrate and adsorb to soil (Howard, 1989). Generally, the higher the compound's log octanol/water partitioning coefficient, the higher the compound's affinity for adsorption, and the lower its mobility in groundwater. Henry's Law Constant provides an indication of the tendency of a compound to volatilize, and thus provides a means for ranking the relative volatilities of chemicals from water (Verchueren, 1983). Henry's Law Constants can be obtained directly from literature or can be calculated by dividing a compound's vapor pressure by its water solubility. The Henry's Law Constant can be used to calculate the rate of evaporation from water. The information presented in Table 9-1 will be referenced, as appropriate, during the discussion of the various groups of compounds detected.

9.2.1 Volatiles

VOCs detected at the site include aldehydes, aromatics, halogenated hydrocarbons, and carbon disulfide. As indicated in Table 9-1, the water solubilities and vapor pressures of these compounds range from moderate to high and their log K_{ow} values are relatively low.

9.2.1.1 Aldehydes

Investigations have detected low concentrations of crotonaldehyde in soil/fill. As a chemical class, aldehydes are characterized by moderate water solubility and high volatility.

If present in surface soils, this compound is subject to competing processes of dissolution and volatilization. As such, crotonaldehyde is prone to dissolve into infiltrating precipitation and move into underlying soils or volatilize to the atmosphere. Upward transport in the soil-gas phase from deeper soils will be substantially limited, however, due to partitioning of the gas phase into the soil water, biodegradation, and the general heterogeneous nature of soils (USEPA, 1989).

In subsurface environments, crotonaldehyde tends to be mobile. In moist environments or during heavy precipitation events, this compound is prone to leaching mechanisms. Downward migration may occur as crotonaldehyde dissolves into the soil water, which is transported through the soil column. Biodegradation can limit transport within and to groundwater since biodegradation can occur under both aerobic and anaerobic conditions (Howard, 1989).

9.2.1.2 Aromatics

Aromatic compounds detected include benzene, ethylbenzene, toluene, xylenes, and styrene. In the upper soil, the competing processes of volatilization to the atmosphere and downward migration with infiltrating precipitation (both of which would be limited by the presence of pavement) are the dominant fate processes. Generally, aromatics are mobile (as liquid or gas) in soil (ATSDR, 1989a; 1989b; 1990; Swann et al., 1983). However, upward migration from subsurface soils in the soil-gas phase and subsequent volatilization to the atmosphere will be substantially limited by partitioning of the gas phase into the soil water, adsorption (to a small extent), biodegradation, and the general heterogeneous nature of soils (USEPA, 1989).

In deeper soil, the most likely transport mechanism is dissolution into soil water and downward migration through the soil. Competing processes of biodegradation and limited adsorption to soil organic matter may decrease the quantities of the chemicals released to groundwater. Aromatics are generally capable of biodegrading under both aerobic and anaerobic conditions. Ethylbenzene, however, has been found to be resistant to biodegradation under anaerobic conditions (Howard, 1989). Soil adsorption is expected to be moderate for ethylbenzene and xylenes, and low for benzene and toluene (Howard, 1989; 1990).

9.2.1.3 Halogenated Compounds

Halogenated VOCs detected include chlorobenzene, chloroform, 1,1- and 1,2-dichloroethane, 1,2-dichloroethene, tetrachloroethene, 1,1,1-trichloroethane, trichloroethene, and vinyl chloride. These halogenated VOCs are characterized by their volatility and relatively high water solubility. In the surficial soil, volatilization into the atmosphere may occur. Due to their high solubility in water, these compounds may leach downward through the soil column with percolating soil water. Biodegradation of the halogenated VOCs under aerobic conditions is generally regarded as being very slow to nonexistent. Biotransformation of halogenated organic compounds via reductive dehalogenation has been demonstrated under anaerobic conditions (Wilson, et al., 1986). Slow biodegradation may occur under anaerobic conditions where acclimated microorganisms exist (Howard, 1990).

9.2.1.4 Carbon Disulfide

Carbon disulfide was detected at low concentrations in subsurface soil/fill and groundwater. Carbon disulfide has a moderately high water solubility and is highly volatile. If present in soil surface layers, the primary loss mechanism is volatilization to the atmosphere. Carbon disulfide will dissolve readily in soil water, and as a result is mobile in deeper soil layers. The chemical may percolate downward with soil water and be released to groundwater (HSDB, 1990a).

9.2.2 Semivolatiles

Semivolatiles detected include polychlorinated benzenes, phenols, PAHs, amines, phthalate esters, and other miscellaneous compounds.

9.2.2.1 Polychlorinated Benzenes

The polychlorinated benzenes detected include pentachlorobenzene; 1,2,3,4-, 1,2,3,5-, and 1,2,4,5-tetrachlorobenzene; 1,2,3-, 1,2,4-, and 1,3,5-trichlorobenzene; and 1,2-, 1,3-, and 1,4-dichlorobenzene.

Polychlorinated benzenes exhibit moderate volatility. If present in surface soils, volatilization into the atmosphere is expected to occur. Adsorption to soil particles and residence within the soil matrix is also a dominant fate of polychlorinated benzenes. The potential for dissolution of these compounds into soil water and possible transport to underlying soils or groundwater may occur under certain circumstances (CHEMFATE, 1989). In sandy or mineral soils with low organic content, polychlorinated benzenes are more likely to leach through the soil, whereas in organic soils mobility should be greatly reduced. Biodegradation in soil and water is generally expected to be quite slow, but loss via this route may be significant in situations where acclimation of the microbial population has taken place (HSDB, 1990b).

9.2.2.2 Phenols

Phenols detected include 2,4-dimethylphenol, 3- and 4-methylphenol, pentachlorophenol, phenol, and 2,3,4,6-tetrachlorophenol. In the terrestrial environment, phenols exhibit low to moderate adsorption to soils and most biodegrade rapidly. Exceptions include those situations where the concentration of phenols is sufficient to inhibit or reduce microbial growth (Howard, 1989). Phenols are not expected to significantly hydrolyze under natural environmental conditions (Howard, 1989).

9.2.2.3 PAHs

A variety of PAHs were detected in the soil/fill and groundwater. PAHs are semivolatile compounds that have low water solubilities (Table 9-1). PAHs have a strong tendency to adsorb to soil particles and organic matter. The PAHs with higher molecular weights tend to be less water soluble and have a higher affinity for adsorption to soil. Within the soil environment, biodegradation of PAHs is also related to molecular weight. PAHs with lower molecular weights tend to undergo microbial degradation more rapidly than the PAHs with higher molecular weights. The lower molecular weight PAHs may also be subject to volatilization, but to a much lesser extent than VOCs.

9.2.2.4 Amines

The semi-volatile amines detected in the soil/fill and groundwater include aniline, diphenylamine, and n-nitrosodiphenylamine. In soil, loss of amines occurs through a combination of aerobic biodegradation, oxidation, and chemical binding with soil components. Amines are readily biodegraded, and substantial loss can be expected by this means (Howard, 1989; 1990).

In the terrestrial environment, amines exhibit a wide range of adsorption to soils, from low for non-aromatic amines to moderate for most aromatic amines. For aromatic amines, adsorption is dependent on pH and these compounds will undergo slow oxidation. This is a significant fate process in soils with high organic content. The amount of amines entering groundwater by desorption from soils is limited by biodegradation in the soil column. Once in groundwater, amines are fairly mobile and degrade slowly (HSDB, 1989). Releases to the atmosphere via volatilization from soil are expected to be minimal (HSDB, 1989).

9.2.2.5 Phthalate Esters

Phthalate esters detected include di-n-butylphthalate in soil/fill and groundwater, and butylbenzylphthalate in soil/fill. The relatively low solubility and low volatility of the phthalates should limit their mobility in soils, with the lower molecular weight phthalates being somewhat more mobile. Biodegradation screening studies indicate that di-n-butylphthalate and butylbenzylphthalate readily biodegrade in soil under aerobic conditions, and may also biodegrade under anaerobic conditions (Howard, 1989).

9.2.2.6 Acetophenone

Acetophenone was detected in the subsurface soil/fill. Based on the physical and chemical properties presented in Table 9-1 for acetophenone, it is expected to be mobile in soils. This mobility implies potential for transport through soil to groundwater via infiltrating precipitation. Acetophenone may volatilize slowly from soil surfaces.

9.2.3 PCBs

PCBs have been detected at varying concentrations in soil/fill, groundwater, and oils. The fate and transport of PCBs in the environment are greatly influenced by their low water solubility and high affinity for soil organic matter. This generally limits aqueous-phase concentrations to low parts-per-billion levels unless significant amounts of solvents, oils, or colloids are present (Baker et al., 1986; Dragun, 1989). In general, the adsorption of PCBs to soils and sediments increases with increasing soil organic content, decreasing soil particle size, and increasing congener chlorination (Lyman et al., 1982; Pignatello, 1989). PCBs could potentially volatilize from soil, but strong adsorption to soils tends to limit the extent of volatilization (ATSDR, 1993).

PCBs are fairly persistent in the environment, and degradation via chemical oxidation and hydrolysis in soil or aquatic systems is generally insignificant. PCBs may, however, be subject to loss via photolysis, biotransformation, and biodegradation (ATSDR, 1993). Experimental evidence indicates that PCBs are susceptible to biodegradation under both aerobic and anaerobic conditions. In general, the degradability of PCB congeners under aerobic conditions increases as the degree of chlorination decreases. Variations in this trend exist and are attributed to preferential degradation determined by chlorine substitution patterns (ATSDR, 1993).

Laboratory research has shown that the lesser chlorinated PCB congeners are subject to aerobic biodegradation by microorganisms indigenous to soils. Aerobic biodegradation results in a complete breakdown of the PCBs, causing a net decrease in total molar PCB concentration. Various breakdown products have been identified, and include chlorinated catechol, chlorobenzoic acid, and carbon dioxide (Bedard et al., 1987; Hankin and Sawhney, 1984; Fries and Morrow, 1984).

As with aerobic biodegradation, preferential degradation of meta- and para-substituted congeners has been observed under anaerobic conditions, although biotransformation is apparently also related to the chlorination pattern of the congeners (Rhee et al., June 1993, April 1993; Quensen et al., 1988). Laboratory research has shown that PCBs undergo reductive dechlorination under anaerobic conditions by indigenous microorganisms; however, the extent and rate of dechlorination varies among congeners and soil collection locales (Rhee et al., June 1993, April 1993; Nies and Vogel, 1990). Study results indicate that the more highly chlorinated PCBs are transformed to less chlorinated congeners by anaerobes (Quensen et al., 1988; Quensen et al., 1990) and that the lower chlorinated PCBs may be further degraded to carbon dioxide, water, and chloride by aerobes (Chen et al., 1988).

9.2.4 Polychlorinated Dibenzo-p-dioxin/Dibenzofuran Compounds

A number of PCDD/PCDF congeners were detected in groundwater, surface and subsurface soils and fill, and oil.

The majority of the information available on the fate and transport of PCDDs and PCDFs relates to 2,3,7,8-tetrachlorodibenzodioxin (TCDD), while some information is also available for 2,3,7,8-tetrachlorodibenzofuran (TCDF). Although there are significant differences in toxicity between these congeners and other PCDD/PCDF congeners, the environmental fate and transport data on 2,3,7,8-TCDD and 2,3,7,8-TCDF may be regarded as generally representative of the entire class of PCDDs and PCDFs due to similarities in physical/chemical properties.

This information indicates that, based on their very low water solubilities and consequently high organic carbon adsorption coefficients

(K_{oc} values), PCDDs and PCDFs are expected to strongly adsorb to most soils, thereby limiting migration of the compound (HSDB, April 1990c).

9.2.5 Pesticides

Pesticides detected include aldrin, dieldrin, 2,4,-D, methoxychlor, 2,4,5-T, and 2,4,5-TP (Silvex). The fate and transport properties of these compounds are likely to vary due to differences in their chemical and physical properties. Aldrin, dieldrin, methoxychlor, 2,4-D, 2,4,5-T, and 2,4,5-TP (Silvex) are organochlorine insecticides.

In soil, aldrin, dieldrin, methoxychlor, and 2,4,5-TP (Silvex) are expected to be essentially immobile; whereas, 2,4-D and 2,4,5-T are somewhat mobile and may enter groundwater under certain conditions. Migration of 2,4-D and 2,4,5-T may be limited, however, by biotransformation and biodegradation, depending on whether a suitable microbial population is present. Volatilization from soils is not expected to be significant for any of these pesticides (Hartley and Kidd, 1987; Howard, 1991).

9.2.6 Metals

Numerous naturally occurring metals were detected in the soil/fill, groundwater, and oil. Metals are cycled within the environment, forming various species with different physical and chemical properties. Metal species may be transformed from one inorganic or organometallic species to another, but the inorganic element itself does not degrade.

Certain inorganic species are highly water soluble, while others are extremely insoluble. The movement of a particular metal into and within groundwater is determined by the amount and form of the metal, the groundwater's chemical and physical properties, and the composition of the soil or waste solution with which the metal is associated (USEPA, 1988). The soil properties affecting metal retention/release and transport include bulk density, surface area, particle-size distribution, pH, redox conditions, ion exchange capacity, amount of organic matter, type and amount of metal oxides, and type and amount of clay minerals (USEPA, 1988). Adsorption to soil organic matter, at levels commonly found in soils and sediments, is one of the primary immobilizing processes for metals (USEPA, 1988). The form in which an inorganic element exists is highly dependent upon the chemical characteristics of the site such as pH, oxygen level, and ionic characteristics.

SECTION 10 - POTENTIAL MIGRATION PATHWAYS AND EXPOSURE POTENTIAL INFORMATION

10.1 General

This section discusses potential migration pathways associated with the chemical constituents that have been observed in soil/fill, groundwater, and oils at the East Street Area 2/USEPA Area 4 Site. In addition, information is presented on the potential for exposure of human and environmental receptors to hazardous constituents at the site.

10.2 Potential Migration Pathways

This section focuses on the principal groups of chemicals that have been found above the detection/quantitation limit in these media. To determine the potential migration pathways for these chemicals, this section takes into account the physical characteristics and environmental setting of the site (presented in Section 2), the results of current and past investigations (presented in Sections 4 through 8), and the fate and transport characteristics of the chemicals observed (presented in Section 9).

In order for a human or environmental receptor to be exposed to a given chemical, a transport pathway by which the chemical migrates from its source to a point of potential exposure must exist. A migration pathway includes the following three components: 1) a source of a chemical; 2) potential mechanisms of release from the source; and 3) a transport medium by which the chemical may potentially travel from the source to a potential receptor. Identification of potential migration pathways allows for an overall understanding of exposure potential and serves to direct the scope of subsequent exposure evaluations.

Prior sections of this report have described the investigative activities that have been performed to characterize the presence, quantity, and concentration of constituents at the East Street Area 2/USEPA Area 4 site. Based on that information, three primary source areas are considered in the following subsections: the main oil plume, the soil/fill material in the former oxbow and gas plant area, and the soil/fill in the scrap yard area. In addition to these source areas, the remainder of the East Street Area 2/USEPA Area 4 Site is collectively evaluated in the last subsection. Within these areas, the following potential transport media are considered, where applicable: 1) the main oil plume; 2) subsurface soil/fill through which the oil or affected groundwater has previously migrated; 3) subsurface soil/fill currently in contact with the oil; 4) groundwater in contact with the oil or soil/fill material; and 5) surficial soil/fill.

The fate and transport characteristics of the constituents detected have been discussed in the previous section of this report. Using this information and certain site characteristics, the potential release mechanisms addressed in the following subsections are: 1) volatilization and dust migration to the atmosphere; 2) surface runoff; 3) leaching or direct releases from subsurface soil/fill to groundwater; 4) subsurface transport via groundwater flow; and 5) subsurface transport via the main oil plume. These potential migration pathways are discussed in more detail in the following subsections.

10.2.1 Main Oil Plume Area

The main oil plume is located primarily in the eastern and central portion of the site. The SWMUs located in the area of the main oil plume are discussed in Section 3 of this report. Potential migration pathways in this area have been identified based on the available information concerning the constituents detected in soil/fill, groundwater, and oil. These pathways include:

- Volatilization, dust migration, and surface runoff from surface soil/fill;

- Leaching or direct releases from subsurface soil/fill to groundwater;
- Subsurface transport via the oil plume; and
- Subsurface transport via groundwater flow.

These potential migration pathways are discussed in the following subsections.

10.2.1.1 Migration from Surficial Soil/Fill

Investigation of the surficial soil/fill that lies above the main oil plume indicates concentrations of SVOCs, PCBs, PCDDs/PCDFs, and inorganics. As would be expected, volatile compounds were not observed in surface soil/fill samples.

Surficial soil/fill could provide a source of chemicals to the atmosphere via volatilization or dust migration and to surface water via surface runoff. The surface soil/fill samples collected from this part of the site show that the types of chemical compounds most likely to volatilize are not present, whereas less volatile compounds remain. This fact, combined with the presence of cover materials and extensive pavement and vegetation, limits the extent to which dusting and volatilization would occur. The potential for surface water runoff to mobilize constituents in surficial soil is also limited by vegetation and other cover, and would be expected to be less of a concern as distance from the river increases. In addition, much of the surface water runoff is routed through GE's NPDES outfall system and is therefore monitored for the presence of chemical constituents.

If soil/fill were disturbed during excavation activities, the potential for transport via volatilization, dusting, or surface runoff would be greater. However, excavation activities are of limited frequency and duration, and are unlikely to contribute significantly to the migration of chemical compounds within or from the site. In addition, GE's excavation protocols address releases of vapors and dusts from on-site excavations. These protocols define appropriate measures to mitigate potential chemical migration associated with on-site excavations.

To evaluate the potential for release of PCBs and gas plant residuals to the ambient air, air monitoring activities have been conducted. As shown in Section 8, the results of the PCB air monitoring indicate relatively low-level concentrations of PCBs in the ambient air in East Street Area 2, with somewhat higher concentrations near Silver Lake. This monitoring program has identified Silver Lake as a potential source of airborne PCBs; however, Silver Lake is under investigation as part of the Housatonic River Site (USEPA Area 6). In addition, air monitoring of PAHs, conducted at East Street Area 2 in August 1991 did not detect any concentrations of PAHs on ambient air. However, GE will seek to achieve a lower detection limit for PAHs in subseuqent activities at the site.

10.2.1.2 Migration from Subsurface Soil/Fill

Potential subsurface sources in the vicinity of the main oil plume are the soil/fill through which the oil plume has traveled. Both prior to and as part of MCP Phase II activities, monitoring wells have been completed in the area of the main oil plume to describe the subsurface material and determine the extent of oil in the area. Moreover, under the MCP, soil borings have been completed in the area to chemically characterize the soil/fill above the oil plume. Concentrations of PCBs, VOCs, SVOCs, PCDDs/PCDFs, pesticides, and inorganics were detected in the soil/fill. Potential migration pathways associated with the soil/fill are influenced by the: 1) type and concentration of the observed constituents; 2) vertical distribution of constituents; and 3) activities in the area.

Chemicals observed in the soil/fill may potentially act as sources of constituents to the groundwater due to direct contact or due to leaching by infiltrating precipitation. The potential for contact of subsurface soil/fill with infiltrating precipitation is limited by physical characteristics of the area. For example, some areas in the vicinity of the main oil plume are covered by concrete or asphalt surfaces or buildings that prevent infiltration and subsequent leaching from material in the unsaturated zone. Other portions are covered by vegetation, which limits infiltration but does not prevent it to the extent concrete or asphalt does.

Groundwater is in direct contact with constituents in the soil/fill in some, but not many, locations. Dissolution of the more water-soluble chemicals from the soil/fill matrix to groundwater will occur at these locations, but the extent to which this occurs will depend on the characteristics of the chemical in question and the amount of time the soils and groundwater are in contact.

Many of the chemicals observed, particularly PCBs and many PAHs, tend to adsorb strongly to the organic portion of soils and exhibit low water solubility. Typically, low aqueous-phase concentrations of these compounds would be expected unless significant amounts of solvents, colloids, or oils are present in the area. Therefore, the oil present in the subsurface soil/fill could increase the potential for migration of compounds that are typically less mobile.

The data available for this area show that the chemicals present in groundwater are principally the water-soluble aromatic VOCs (i.e., benzene, toluene, ethylbenzene, xylenes, and chlorobenzene) and the lower-molecular-weight PAHs (i.e., naphthalene, 2-methylnaphthalene, and acenaphthene). The concentrations of these constituents, although significant, are generally low, in comparison with the levels found in the soil/fill. As would be expected, the observed groundwater concentrations of the PAHs are much lower than the VOCs. No PCBs were observed in groundwater in this area. Based on this information, the oils present in the area do not appear to be significantly increasing the transport of chemicals from the subsurface soil/fill to groundwater. An additional discussion of the influence of the oil plume on migration is provided in the following subsection.

10.2.1.3 Migration via the Main Oil Plume

The results of analysis of two oil samples collected from oil recovery systems (64V and 64S), located in the area of the main oil plume, reveal the presence of PCBs, PCDDs/PCDFs, PAHs, chlorinated benzenes, benzene, ethylbenzene, and xylenes. For those chemicals with low water solubilities and high K_{ow}'s (i.e., PCBs, PCDDs/PCDFs, and high-molecular-weight PAHs), limited desorption from the oil to groundwater is expected to occur as a result of contact. Transfer from oil to groundwater is expected to be greater for the more water-soluble compounds (i.e., VOCs and low-molecular-weight PAHs). Thus, the most likely route for subsurface migration for the PCBs and other chemicals with low water solubility is via the oil plume itself rather than in a dissolved phase in groundwater. The opposite would likely be true for more water-soluble compounds such as benzene, ethylbenzene, xylenes, and chlorinated benzenes. In fact, the available data confirm that the more water-soluble compounds are the constituents that have entered groundwater, although at generally low concentrations.

The available sampling and analysis data also show that transport of PCBs and other constituents via the oil plume is occurring. However, the physical downgradient migration of the oil plume over the last ten years has been substantially restricted by the slurry wall and the oil recovery systems in place. Based on a review of the oil mapping associated with the continued monitoring activities, the oil recovery systems have limited the size of the oil plume and the amounts of oil entering the river. Thus it appears that continued migration of the plume and associated constituents to the river is being curtailed by the recovery systems. Moreover, small intermittent seeps of residual oil which do reach the river are contained by a floating boom system. These intermittent seeps are being further addressed as part of on-going and proposed STM activities as discussed previously in Section 4.2.5.

10.2.1.4 Migration via Groundwater

Movement of groundwater beneath this area is primarily in a southerly direction toward the Housatonic River. Although transport of constituents from groundwater to surface water is considered a potential migration pathway, the available sampling and analysis data from the river indicate that this migration does not result in significant impacts to the surface water or sediments of the river, as discussed in Section 5 of this report.

10.2.2 Former Oxbow and Gas Plant Areas

SWMUs identified in the area of the former oxbow and gas plant are discussed in Section 3 of this report. Based on available data concerning constituents detected in soil/fill and groundwater, the following potential migration pathways have been identified for the former oxbow and gas plant areas:

- Volatilization, dust migration, and surface runoff from surficial soil/fill;
- Leaching or direct releases from soil/fill to groundwater;
- Subsurface transport via oil; and
- Subsurface transport via groundwater flow.

These potential migration pathways are considered in the following subsections.

10.2.2.1 Migration from Surficial Soil/Fill

Investigations of surficial soil/fill in this area have revealed concentrations of SVOCs, PCBs, PCDDs/PCDFs, and inorganics.

Surficial soil/fill could potentially be a source of chemicals to the atmosphere via volatilization and dust migration or to surface water via surface water runoff. However, the most volatile compounds were not observed in surficial soil/fill samples collected, and soil dusting and surface runoff are limited due to the presence of vegetation. As discussed in Section 8, air monitoring activities for PCBs have shown relatively low levels of PCBs in the ambient air in this area. The air monitoring for PAHs, conducted in this area in August 1991 did not detect any PAHs in ambient air, although GE will seek to determine whether a lower detection limit can be achieved.

While transport via dust migration or surface runoff could potentially occur during excavation activities, the infrequency and short duration of such activities limit their significance. Moreover, GE's excavation protocols address releases of vapors and dusts from on-site excavations. According to these protocols, appropriate measures must be taken to mitigate potential chemical releases associated with on-site excavations.

10.2.2.2 Migration from Subsurface Soil/Fill

Potential subsurface sources in the former oxbow and gas plant area are primarily fill material. As part of MCP Phase II activities, investigations were completed to characterize the subsurface soils and fill material in the former oxbow and gas plant area. These investigations identified the presence of VOCs, PAHs, chlorinated benzenes, phenols, inorganics, PCBs, and PCDDs/PCDFs in the fill material and subsurface soils. The following characteristics of the area currently influence the potential migration of these constituents: 1) type and concentration of observed chemicals; 2) the vertical distribution of these chemicals; and 3) activities occurring in the area.

The migration of constituents detected in the soil/fill in the former oxbow and gas plant area may occur as a result of dissolution in groundwater via direct contact and/or as a result of leaching via infiltrating precipitation. Current conditions in the area (i.e., the presence of dense vegetation, concrete, asphalt, or buildings) limit the extent to which precipitation can infiltrate soil/fill. In the event leaching occurs, the chemicals most likely to reach groundwater are the more water-soluble compounds (e.g., VOCs). The data available for this area show low concentrations of VOCs in both the soil/fill and the groundwater. Moreover, the concentrations of other constituents (SVOCs, inorganics, PCDDs/PCDFs) in groundwater are low, particularly in comparison with the levels found in the soil/fill. These data indicate that, in general, there is limited migration of constituents from the soil/fill to groundwater. Two possible exceptions relate to the elevated levels of VOCs in well 64 (apparently due to a localized source) and the elevated levels of VOCs and SVOCs in wells ES2-6 and 54 (which are located in the oil plume area). In addition, DNAPL has been identified in well ES2-6. These anomalies need further investigation, as discussed in Section 11.

10.2.2.3 Migration via Oil

The presence of oil (LNAPL) is evident in wells at the eastern end of the oxbow adjacent to the river. LNAPL is also present in the area east of the oxbow, south of the oil recovery systems. This LNAPL most likely migrated to this location prior to installation of the recovery systems.

The most likely transport pathway for these LNAPLs and associated constituents would be to the river. Oil (LNAPL) seeps have been observed along the Housatonic River in this area, but the LNAPL is being contained by booms in the river and oil recovery systems in the riverbank area. These LNAPL seeps and the measures taken and proposed to prevent or minimize them are discussed in Section 4.2.5 of this report.

The migration of constituents from the DNAPL may be occurring as a result of leaching. The primary pathway of these constituents is via groundwater. The presence of various constituents in groundwater at Well ES2-6 indicates that leaching of certain constituents from DNAPL has probably occurred.

The impact of the oil (LNAPL) seeps on the river is not considered to be significant. This is based on the containment operations and a comparison of upgradient and downgradient concentrations of constituents in surface water samples collected from the river, as discussed in Section 5 of this report.

10.2.2.4 Migration via Groundwater

The results of a number of groundwater investigations have revealed the presence of VOCs, SVOCs, inorganics, and PCDDs/PCDFs in groundwater in the former oxbow (and recharge pond) and gas plant area. Overall, groundwater movement in this area is in a southerly direction toward the Housatonic River. The former oxbow is potentially acting as a conduit for transport of observed constituents, although the extent to which this is occurring is undefined. Moreover, the groundwater data from a deep well (ES2-6) in the eastern limb of the former oxbow near the river indicate a degree of downward migration of constituents, particularly the denser PAH compounds. Indeed, DNAPL comprised of PAH compounds and several volatile constituents has been detected in this well.

Groundwater impacts from this area on the Housatonic River are not considered to be significant. Based on data obtained from upstream and downstream sampling locations in the river, no significant impacts from this area on the water column or sediments of the river were observed, as discussed in Section 5 of this report.

10.2.3 Scrap Yard Area

A discussion and characterization of the SWMUs identified in the scrap yard area are presented in Section 3. In this area, there is no potential for significant migration from the surface, since the majority of the scrap yard area is covered by concrete and pavement. Moreover, the main oil plume is not present in this area. Hence, based upon the available information, the following potential migration pathways have been identified for the scrap yard area:

- Leaching or direct releases from subsurface soil/fill to groundwater; and

- Subsurface transport via groundwater flow.

These potential migration pathways are discussed in the following subsections.

10.2.3.1 Migration from Subsurface Soil/Fill

Potential subsurface sources in the scrap yard area include soil/fill and a small pocket of oil in the area of Building 64. A number of soil borings were completed in the scrap yard area to characterize the subsurface soil and fill material. Results of the MCP subsurface investigations identified the presence of PCBs, VOCs, SVOCs, PCDDs/PCDFs, and pesticides.

Characteristics of the scrap yard area that currently influence the potential migration pathways for the constituents identified in the soil/fill include the following: 1) the type and concentration of the chemicals present; 2) vertical distribution of the materials; 3) depth to groundwater; 4) the extent of cover; and 5) area activities.

The potential migration of constituents from soil/fill in the scrap yard area into groundwater could occur as a result of direct contact with, and dissolution of compounds into, groundwater. However, the potential for such migration to occur is limited by the fact that the water table is generally below the bottom of the fill material in the majority of the scrap yard area. Moreover, leaching from precipitation should not be a major concern in this area since the presence of concrete and pavement over a majority of the scrap yard significantly reduces the amount of leaching which may occur. However, cracks in the concrete surface may allow for limited amounts of precipitation to infiltrate scrap yard soil/fill. In the event some leaching does occur, the chemicals most apt to be transported via this pathway would be VOCs.

The groundwater data from the scrap yard area bear out the lack of a significant migration potential from the soil/fill to the groundwater. These data indicate that the concentrations of VOCs in groundwater are low, that the concentrations of SVOCs and inorganics are much lower than they are in the soil/fill, and that PCBs, pesticides, herbicides and PCDDs/PCDFs are not present in the groundwater. Thus, the data indicate that the impacts from the soil and fill on the groundwater are relatively small.

The presence of concrete and asphalt over a majority of the scrap yard also prevents volatilization of organic constituents or generation of dusts from the subsurface soil/fill. While subsurface excavations in the scrap yard could allow such releases, excavations in the area would be limited to construction or repair activities (e.g., utilities), and as such, are of limited frequency and duration and are unlikely to contribute significantly to the migration of chemical compounds within or from the scrap yard area. In addition, GE's excavation protocols address potential releases of vapors and dusts from on-site excavations. These protocols define appropriate measures to mitigate potential chemical migration associated with on-site excavations.

10.2.3.2 Migration via Groundwater

The results of groundwater investigations in the scrap yard area have shown the presence of VOCs, SVOCs, PCDDs/PCDFs, and inorganics at relatively low concentrations. Since movement of groundwater beneath this area is primarily in a southerly direction toward the Housatonic River, groundwater impacted by scrap yard soil/fill most likely discharges to the river. However, as noted above, concentrations detected in the two downgradient monitoring wells indicate that impacts on groundwater from soil/fill are minimal; and actual concentrations of constituents entering the river are probably lower than those observed in monitoring wells. Furthermore, comparison of surface water and sediment samples collected from the Housatonic River upstream and downstream of this area do not indicate a significant impact from scrap yard activities, as discussed in Section 5 of this report.

10.2.4 Remainder of East Street Area 2/USEPA Area 4

The SWMUs located in the remainder of the East Street Area 2/USEPA Area 4 Site are discussed in Section 3 of this report. Potential migration pathways for this area have been identified based on the available information concerning the constituents detected in soil and groundwater. These pathways include:

- Volatilization, dust migration, and surface runoff from surface soil;
- Leaching or direct releases from subsurface soil to groundwater; and
- Subsurface transport via groundwater flow.

These potential migration pathways are discussed in the following subsections.

10.2.4.1 Migration from Surficial Soil

Soil samples were collected from the top 2 feet of material from the five borings located adjacent to Silver Lake in the western portion of the site. Chemical constituents detected in the soil samples include acetone, methylene chloride, PAHs, phthalates, PCBs, and inorganics.

Surficial soil is a potential source of chemicals to the atmosphere via volatilization or dust migration or to surface water via surface runoff. However, no volatile compounds (other than those also found in the associated method blanks) were detected in surface soil samples collected from this part of the site. Hence, the compounds most apt to volatilize are not present in surface soils, thereby limiting the potential for transport via volatilization. The compounds that are present tend to remain adsorbed to soil particles, and therefore are more apt to be transported via dust.

Since most of this area of the site is covered by concrete, asphalt, or buildings, the extent to which dusting or volatilization occurs is limited. Excavation activities in this area would increase the potential for chemical transport via volatilization and dusting. However, excavation activities are expected to be infrequent and of short duration, thereby decreasing their significance. In addition, GE's excavation protocols address releases of vapors and dusts from on-site excavations. The protocols define appropriate measures to mitigate potential migration associated with excavation activities.

In addition, the potential for releases of PCBs to the air has been evaluated through air monitoring activities. As discussed in Section 8, GE's PCB air monitoring program detected PCBs in the air at Building 32S. However, that program identified Silver Lake as likely a primary source of the PCBs in the air in this area. Silver Lake is being addressed as part of the Housatonic River Site (USEPA Area 6).

Surface water runoff in the remainder of the site could potentially affect the Housatonic River or Silver Lake. The potential for soil in the northern portion of the area to affect the river or lake via runoff is limited by the distance between the soils and surface water bodies. The potential for transport of constituents via runoff from soils closer to the river or the lake is limited by the fact that most of those portions of the facility are covered by buildings, concrete, asphalt, or vegetation. In addition, most of the surface water runoff is directed through GE's NPDES outfall system, and is monitored for chemical constituents.

10.2.4.2 Migration from Subsurface Soil

Subsurface soil in the remainder of the East Street Area 2/USEPA Area 4 Site may be acting as a potential source of chemical constituents to groundwater. Concentrations of VOCs, PAHs, phthalates, PCBs, and inorganics have been detected in soil samples collected from borings in the area.

Transport to groundwater from subsurface soils may occur as a result of direct contact or due to leaching via infiltrating precipitation. The buildings, concrete, and asphalt which cover a majority of the area would substantially eliminate leaching of chemicals in those areas. However, there is a potential for transport of chemical constituents via leaching for soils not covered or covered only by vegetation.

Groundwater is in direct contact with constituents in the soil in some locations. At these locations, dissolution of the more water-soluble chemicals from the soil matrix to groundwater will occur, but the extent to which this occurs will depend on the characteristics of the chemical and the amount of time the soils and groundwater are in contact.

The data show that groundwater in this area of the site does not contain significant amounts of contamination. Localized sources may explain the presence of tetrachlorethane in two wells and trichloroethane in one well. The only SVOCs found at more than one well are N-nitrosodiphenylamine, phenanthrene, and total phenols. Overall, the data indicate minimal impact from the constituents in the soil on the groundwater in this area.

10.2.4.3 Migration via Groundwater

Chemical constituents detected in groundwater samples include VOCs, SVOCs, and inorganics. Movement of groundwater is primarily in a southerly direction toward the Housatonic River, except in the northwest corner of the area where flow is toward Silver Lake. Although transport of constituents from groundwater to the Housatonic River is considered a potential transport pathway, the available sampling and analysis data from the river suggest that this migration does not result in significant impacts to the river, as discussed in Section 5 of this report.

The potential also exists for migration of constituents in the northwest corner of the area via groundwater to Silver Lake. As shown in the MCP Interim Phase II Report/CAS for the Housatonic River (Blasland & Bouck, December 1991), PCBs and other constituents have been detected in the surface water and sediments of Silver Lake. It is unclear, however, whether the extent to which these constituents are attributable to migration from the site as opposed to other potential sources unrelated to GE. The recent MCP groundwater monitoring of wells on the western boundary of the site along Silver Lake (wells RF-2, RF-3, and RF-16) shows no PCBs in that groundwater and only a limited number of other constituents (a few SVOCs and inorganics) above the detection limit, at generally low concentrations (see Tables 4-25 through 4-28). These results indicate that there is unlikely to be any significant current migration of constituents in groundwater to Silver Lake.

10.3 Potential for Human Exposure

The present site conditions and foreseeable future site uses result in a low potential for human exposure at the East Street Area 2/USEPA Area 4 Site. The entire site is part of the GE facility and, as such, is entirely owned and operated by GE (except for railroad tracks and a public street that cross the site). It will continue to be owned by GE and used for industrial purposes in the foreseeable future.

As indicated in Section 2, a majority of the site is either paved or covered with buildings. The facility is fenced and access is further restricted by surveillance gates at access points. A portion of the fenced facility south of East Street is covered with grass and a small wooded area exists adjacent to the Housatonic River riverbank.

The potential for human exposure to hazardous constituents at the East Street Area 2/USEPA Area 4 Site is discussed in Section 2.3 of the Preliminary Health and Environmental Assessment (HEA) Proposal which is being submitted concurrently with this report. As shown there, potential human receptors at the site include GE workers and contract employees, as well as pedestrians, utility workers, and road maintenance workers along East Street. In addition, people living or working near the site may be exposed to off-site air that could be affected by constituents at the site.

10.4 Potential Impacts to Environmental Receptors

The only portion of the East Street Area 2/USEPA Area 4 Site that could be of any value to wildlife is the vegetated portion of the riverbank and the small wooded area near the former oxbow, as the rest of the site is either paved or covered by buildings. Although individual small mammals, song birds, amphibians, and reptiles may be present along the riverbank or in the small wooded area at the site, this area is too small to support a community of wildlife. As a result, an ecological risk assessment will not be conducted for this site. The HEA for the Housatonic River (Area 6) will evaluate, on an overall basis, potential risks to environmental receptors, not only in the river itself but also in riverbank and floodplain areas adjacent to the river. This overall evaluation should be sufficient to address potential environmental exposures (if any) in the riverbank and wooded area at the East Street Area 2/USEPA Area 4 Site.

SECTION 11 - REMAINING DATA NEEDS

11.1 General

Results from the prior site investigations summarized in Sections 4 through 8 of this document have satisfied many of the requirements for an MCP Phase II - Comprehensive Site Assessment. In addition, the existing information documented herein fulfills many of the requirements for an RFI for USEPA Area 4 pursuant to the Corrective-Action Permit.

Several data needs have been identified based on comparison of existing site information with the remaining MCP Phase II requirements and the RFI requirements of the USEPA Permit. These data needs are discussed in the following sections. These data needs will be addressed through activities described in the separately bound MCP Supplemental Phase II SOW/RFI Proposal for the East Street Area 2/USEPA Area 4 Site (Supplemental Phase II SOW/RFI Proposal) being submitted concurrently with this document.

11.2 Investigation of Soil and Fill Materials

As discussed in Section 4 of this document, a large number of soil samples have been collected in the East Street Area 2/USEPA 4 Site. The data generated as a result of these soil samples have been generally successful in determining the extent of fill material and the presence of hazardous constituents (particularly PCBs) at portions of the site. However, some data needs remain. Specifically, as described in Section 4.3, the extent of fill material in the scrap yard is generally well defined through the installation of borings and monitoring wells in that area. In the southwest corner of the scrap yard, however, there is a data gap in the delineation of the fill material in the scrap yard. At boring location Y-5 in that corner, fill material was detected to a depth of approximately 12 feet, while at location RF-1, located approximately 250 feet to the west, no fill material was found. To better delineate the extent of the fill material in this area, an additional boring should be installed between Y-5 and RF-1 to characterize the materials in this area.

Additionally, the Permit requires soil sampling at or near certain SWMUs to assess potential releases and to provide a general characterization of the associated area. A comparison of the information presented in Section 4 of the document and the SWMU-specific soil sampling requirements has resulted in certain SWMU-specific soil sampling data needs being identified at the following SWMUs (in addition to the Scrap Yard Area):

- Old Coal Gasification Plant Storage Tank Area;
- Building 3C Yard Former Oil/Water Separator and Building 3C Vault;
- Building 12X Emergency Overflow Tanks;
- Building 29 Transformer Oil Transfer Area;
- Building 60 Former Drum Storage Area;
- Building 60 Tank Truck Area;
- Building 12G Pyranol Unloading Station and Storage Area; and
- Building 61 Phenolic Dust Baghouse.

Proposals for soil sampling at these SWMUs are included in the Supplemental Phase II SOW/RFI Proposal.

In addition, a number of shallow soil borings should be installed adjacent to East Street to be used to collect data for a road maintenance scenario in the risk assessment/HEA. Proposals for installation of these borings are included in the Supplemental Phase II SOW/RFI Proposal.

11.3 Surficial Soils

As discussed in Section 6.4, the surficial soil sampling results to date indicate no areas of obvious concern. However, further assessment of the presence of hazardous constituents in surficial soils in grass covered areas of the site is needed, particularly for the risk assessment/HEA. To address this data need, collection and analysis of additional surficial soil samples are proposed in the Supplemental Phase II SOW/RFI Proposal.

11.4 Hydrogeologic Data Needs

11.4.1 Groundwater Quality Monitoring

As shown in Section 4, the groundwater data from the East Street Area 2/USEPA Area 4 Site indicate that, in general, there has been no significant migration of hazardous constituents from the soil/fill material into the groundwater. To verify this condition and to provide further information on groundwater quality, it would be appropriate to conduct additional groundwater monitoring at select monitoring wells on an area-wide basis. Wells to be sampled should be selected to ensure an adequate spatial coverage of areas where hazardous constituents in soils/fill and/or groundwater have been found, and to detect any potentially significant migration toward the site boundaries. The selected wells would include wells downgradient of the recharge pond, wells along the southern extent of the scrap yard adjacent to the Housatonic River, wells along the western edge of the facility adjacent to Silver Lake, where limited previous data exist, and wells where significant levels of constituents have been detected in groundwater. In addition to sampling these wells for selected hazardous constituents, seasonal water table elevations should be measured at selected wells to obtain a more complete picture of the relationship between the water table and the constituents in the soil/fill in these areas. Furthermore, additional data on background groundwater quality in the area would be useful.

In addition to this general data need, additional groundwater monitoring is needed to further assess apparent anomalies in certain wells.

Specifically, as indicated in Section 4.4.4, anomalously high levels of VOCs were detected in groundwater at well 64. Further investigation related to this matter is needed. Also, as indicated in Section 4.5.3.2, elevated concentrations of inorganic constituents were noted to be present in groundwater at well RF-3. This occurrence was noted in an unfiltered sample. Further sampling and analysis are needed to assess the presence of these constituents in the soluble phase at this location. Activities to address these data needs are presented in the Supplemental Phase II SOW/RFI Proposal.

11.4.2 LNAPL Investigations

11.4.2.1 Effectiveness of Oil Recovery

As noted earlier, GE has conducted ongoing LNAPL monitoring since February 1980, and has installed six recovery systems since that time. To assess the effectiveness and adequacy of oil recovery efforts additional evaluations should be performed on a site-wide basis. Evaluations have been performed in the riverbank areas, but the effectiveness of other recovery systems have not been assessed. It would be appropriate to perform computer modeling for this assessment.

11.4.2.2 Investigation of Localized LNAPL Occurrences

Historical monitoring of the monitoring wells at the site has indicated the presence of localized and isolated LNAPL occurrences apparently not affected by the recovery systems. Four such localized areas were again identified during the Spring 1994 monitoring event at monitoring well 14 north of East Street, at monitoring wells 13 and 14 (near Building 64), at wells 8 and 9R, and at well 50 (Blasland, Bouck & Lee, August 1994). To address the presence of oil in these areas, an evaluation should be performed to determine the need for and type of appropriate oil removal activities. Activities to address these data needs are presented in the Supplemental Phase II SOW/RFI Proposal.

11.4.3 Investigation of DNAPL Impacts at Well ES2-6

As discussed in Section 4.4, the DNAPL observed at well ES2-6 was sampled and analyzed for PCBs, volatile organics, and semi-volatile organics. Further assessment of the potential impact on groundwater associated with this DNAPL occurrence is needed. Activities to address these data needs are presented in the Supplemental Phase II SOW/RFI Proposal.

11.4.4 Monitoring Well Inventory

As discussed throughout Section 4, a number of wells have been installed as part of various investigations at the East Street Area 2/USEPA Area 4 Site. However, the existence and condition of all of the wells proposed for groundwater sampling are not known. To address this data need, a monitoring well inventory would be appropriate at any existing wells proposed for sampling to assess their condition prior to groundwater sampling. This activity is further discussed in the Supplemental Phase II SOW/RFI Proposal.

11.4.5 Other Hydrogeologic Data

To better characterize current hydrogeologic conditions at the site, it would be useful to obtain additional information on groundwater elevation, groundwater flowrate and flow patterns (including an assessment of seasonal variations), vertical groundwater gradients, and in-situ hydraulic conductivity. Activities to address these data needs are presented in the Supplemental Phase II SOW/RFI Proposal.

11.5 Additional SWMU-Specific Data Needs

As part of the investigation of individual SWMUs within the East Street Area 2/USEPA Area 4 Site, the Permit requires that GE determine, through visual or mechanical means, the integrity of several oil/water separators, pits, sumps, and inactive underground storage tanks. A total of 49 SWMUs within the East Street Area 2/USEPA 4 Site are subject to this requirement. Proposals to meet this requirement, where feasible, are included in the Supplemental Phase II SOW/RFI Proposal. As part of this effort, additional geophysical surveys are warranted to attempt to locate certain USTs (notably SWMus T-LL and T-A1), as discussed in Section 3.3.10.

11.6 Concentrations of PAHs in Ambient Air

As discussed in Section 8.3.2, PAHs were not detected during the 1991 study. However, GE believes that it would be useful to attempt to achieve a lower detection limit to quantify the concentrations of PAHs (if any) in ambient air at the site. Based on currently available information, the standard USEPA sampling and analysis methodology for PAH air samples (as was used in the 1991 effort) will not yield a lower detection limit. Toward this end, GE is currently investigating and evaluating alternative sampling and analysis methodologies that may be capable of producing PAH air monitoring results with a lower detection limit. This activity is further discussed in the Supplemental Phase II SOW/RFI Proposal.

11.7 Preferential Pathway Analysis

Based on existing information, some underground pipes within East Street Area 2/USEPA Area 4 have functioned as preferential pathways for the migration of hazardous constituents in the past. Numerous remedial activities have been conducted to address this migration. Additional evaluation is needed to determine if any other underground pipes and/or tunnels associated with the East Street Area 2/USEPA Area 4 Site are acting as preferential pathways for the transport of hazardous constituents. A proposal for such an evaluation is included in the Supplemental Phase II SOW/RFI Proposal.

11.8 Risk Assessment

Under the MCP and the Corrective Action Permit, it will be necessary, upon completion of data-gathering efforts, to evaluate the potential risks to human health and the environment associated with constituents present at this site, given the current and reasonably foreseeable uses of the site and the surrounding areas. A more detailed overview concerning this evaluation is provided in the separately bound Preliminary HEA Proposal, submitted concurrently with this document.

SECTION 12 - CONCLUSIONS AND FUTURE ACTIVITIES

12.1 Conclusions

A number of conclusions have been presented in Sections 4 through 8 of this report. Although several data gaps have been described in Section 11, it is helpful to summarize the key findings and conclusions of the East Street Area 2/USEPA Area 4 Site investigation to date. These conclusions are summarized below:

12.1.1 Oil Plume

- The oil plume has been the subject of semiannual monitoring for over ten years. During this time, the plume has changed shape somewhat, but has essentially consisted of a main oil plume and several independent "pockets" of oil. The main oil plume has remained relatively stable in general due to on-going oil recovery efforts and the hydraulic control provided by the slurry wall and the groundwater recharge pond. In addition, between 1989 and 1994, the areal extent of the main oil plume has diminished in size. Approximately 450,000 gallons of oil have been recovered in the main oil plume area since 1983.
- The isolated "pockets" of oil referenced above are located north of East Street near well 14, south of Building 64, near well 50, and in the riverbank area. These oil pockets have remained relatively stable in size and location. Additional wells have been added in these areas and, as discussed in Section 11, the oil near Building 64, well 14, and near well 50 will be the subject of further evaluation to determine the need for, and feasible methods of, recovery. The riverbank area has been extensively evaluated and a short-term measure has been

implemented by GE in an effort to accelerate the rate of oil recovery in this area.

- The main oil plume is in contact with groundwater throughout a majority of the gas plant area and a portion of the former oxbow. The concentrations and types of constituents detected in the two oil samples obtained from oil recovery caissons 64V and 64S as part of MCP activities varied. The oil in caisson 64V had higher concentrations of VOC and PAH compounds than did oil sampled from caisson 64S. Oil in caisson 64S had higher concentrations of PCBs.

12.1.2 Former Oxbow and Gas Plant Area

- Various constituents were detected in the soil/fill in the former oxbow and gas plant area.
    - Total concentrations of VOCs in soil/fill in this area were generally quite low, with the exception of a fill/tar sample from boring X-19, which was advanced in the location of the former tar separator. Where detected, VOCs were composed primarily of BTEX and chlorobenzene.
    - SVOCs were detected in soil/fill at higher concentrations than VOCs, particularly in the area of the former gas plant and those portions of the former oxbow in the vicinity of the former gas plant. The majority of SVOCs detected were PAHs, although others were detected less frequently and at lower concentrations.
    - PCBs were detected in soil/fill generally at relatively low concentrations. PCB concentrations typically decreased with depth and were generally not found in native deposits. Most borings with high PCB levels were located in the western limb of the former oxbow.

  - Inorganics, primarily metals, were also detected at some locations in the soil/fill, although, as discussed below, they do not appear to be migrating significantly to groundwater.

- Despite the presence of these constituents in the soil/fill, certain site-specific factors in this area would be expected to limit the potential for such constituents to migrate to groundwater. The water table was not observed at a majority of the boring locations north of the former oxbow, and the water table in the western limb of the oxbow was predominantly below the depth of the fill. The potential for constituents in the fill material to dissolve into and migrate with groundwater is reduced when groundwater is not in contact with the fill material. However, the water table in the eastern limb of the former oxbow was at or above the depth of fill. The elevations of groundwater in the eastern oxbow limb may be influenced by the recharge pond, which produces a localized groundwater mound. Some of the oxbow and gas plant area is covered with pavement or vegetation, which can reduce the degree of infiltration and therefore the dissolution and leaching of some constituents from soil/fill to groundwater.
- With the exception of three wells (64, ES2-6, and 54), concentrations of VOCs and SVOCs in groundwater were relatively low. Well 64 showed anomalously high concentrations of VOCs. Wells ES2-6 and 54 showed relatively high concentrations of BTEX, with well ES2-6 exhibiting relatively high levels of PAHs as well. These localized anomalies will be investigated further as discussed in Section 11.
- No PCBs, pesticides, or herbicides were detected in the groundwater in this area.

- Despite the inorganics found in the soil/fill in this area, the number and concentrations of metals detected in groundwater were low.
- The presence of DNAPL was detected at well ES2-6. Analytical results of this DNAPL indicate elevated concentrations of PAHs and no PCBs. Additional activities to determine the potential impact to groundwater associated with this DNAPL are needed as described in Section 11.

12.1.3 Scrap Yard Area

- VOC concentrations detected in soil/fill in the scrap yard area were low, with total VOC concentrations of less than 0.1 ppm detected in 27 of the 29 borings sampled. Where detected, the VOCs were composed primarily of aromatic hydrocarbon and chlorinated hydrocarbon compounds. SVOC concentrations in the soil/fill in this area were generally less than 100 ppm. The SVOCs detected consist principally of PAHs, although other compounds were detected as well. PCBs were detected in scrap yard soil/fill at generally low concentrations. The higher PCB concentrations were found primarily in the eastern and southeastern portion of the scrap yard area adjacent to the former oxbow. PCB concentrations generally decreased with depth and were relatively low in native deposits. A number of inorganics were also detected in the scrap yard soil/fill at variable concentrations, as would be expected in an area where metal was stored and recycled.
- The water table is generally below the bottom of the fill material throughout the majority of the scrap yard area. Because the groundwater is generally below the fill material, the potential for constituents in the fill material to dissolve into and migrate with groundwater is significantly reduced. The majority of the scrap yard

area is also covered with pavement, thus further reducing the potential for vertical migration of constituents during precipitation events.

- Groundwater quality data in the scrap yard area indicate that although the soil and fill material contains both organic and inorganic constituents, the majority of these constituents were not detected in groundwater samples, and those constituents that were detected in groundwater are present at considerably lower concentrations. PCBs were not detected at all in the groundwater in this area.

12.1.4 Remainder of East Street Area 2/USEPA Area 4

- Few organic or inorganic constituents were detected in soils in the remainder of the East Street Area 2/USEPA Area 4 Site.
- Groundwater analysis at nine wells in this area similarly found few constituents above detection limits, thus indicating no significant effect on groundwater in this portion of the facility.

12.1.5 Continuity and Nature of Till

- Subsurface logs from 30 borings throughout the East Street Area 2/USEPA Area 4 Site indicate that glacial till exists below fluvial deposits and fill material at depths ranging from: 0 to 10 feet below ground surface in the area north of the railroad tracks; 17.5 to 38 feet below grade adjacent to East Street; and 36 to 43 feet below grade in the area south of East Street;
- Glacial till is characterized in the 30 subsurface logs as "very dense silt", "dense sand", "silt and gravel till", and "gravel till", and by a significant increase in bulk density as determined by blow counts ("n" values > 25).
- The minimum till thickness determined from the 30 site-wide boring logs ranged from 1 to 20 feet.

- The till surface elevation map, as interpreted from the boring logs, indicates that the till surface decreases in elevation 80 feet from the northern to southern boundaries of the East Street Area 2/USEPA Area 4 Site (at a gradient of approximately four percent).
- The till surface elevation map suggests the presence of a relatively narrow north-south oriented valley that extends from the railroad tracks to the recharge pond. The feature appears to have down-cut into the till surface and may be the remnant of a pleistocene glaciofluvial stream channel.
- he presence of glacial till interpreted from the boring logs correlated stratigraphically in the geologic cross-sections, thereby indicating that the till appears to be continuous throughout the East Street Area 2/USEPA Area 4 Site.

12.1.6 Impact on Housatonic River

- The potential effects of groundwater and oil migration from the site on the Housatonic River have been assessed through sampling and Appendix IX+3 analysis of the surface water and sediments of the river upstream, adjacent to, and downstream of this site.
- As shown in Section 5, the water column data from the river indicate that possible releases from the this site in groundwater and/or oil have no significant impact on the surface water quality of the river.
- As shown in Section 5, the sediment data from the river indicate the presence of elevated levels of a few hazardous constituents at certain localized areas, notably the Lyman Street Bridge. These elevated levels may be attributable to prior releases from this site or to other sources. Otherwise, however, apart from PCBs, the sediment data do not indicate any significant overall impact of the site on constituents in the river sediments.

12.1.7 Surficial Soils and Air Quality

- As part of MCP Phase II activities, surficial soil was sampled at five locations at this site and analyzed for Appendix IX+3 constituents. The results indicate that a number of constituents, most notably PAHs and PCBs, were found at relatively low concentrations in these soils.
- An air monitoring investigation was performed as part of Phase II activities to determine if PAHs at this site, particularly in the area of the former coal gasification facilities, were susceptible to airborne migration and are contributing to ambient levels of PAHs. This monitoring was conducted in August 1991 under meteorological conditions that would be conducive to finding airborne levels of PAHs. The air samples were analyzed for 17 PAHs (many of which were detected in surficial soils in this area). The results of the monitoring showed that none of these PAHs were found above the detection limit of 0.417 ug/m^3.
- Potential airborne migration of PCBs from surficial soils or other sources in the site were assessed through the year-long Facility Air Monitoring Program. This program showed relatively low levels of PCBs in the ambient air at the site, with somewhat higher levels near Silver Lake. It identified Silver Lake as a potential source of airborne PCBs in this area.

12.2 Future Activities

Section 11 of this document has identified several data gaps concerning the presence and extent of hazardous materials at the East Street Area 2/USEPA Area 4 Site. The separately bound MCP Supplemental Phase II SOW/RFI Proposal for this site describes the field activities intended to fill those data needs. Following the MDEP's review and approval of this Interim Phase II

Report/CAS and the separately bound MCP Supplemental Phase II SOW/RFI Proposal, the activities described in the latter document will be performed. After the performance of these activities, all data will be completed, presented, and interpreted in a MCP Supplemental Phase II/RFI Report, which will be submitted for MDEP/USEPA review and approval. At the same time, a Risk Assessment Scope of Work/Supplemental HEA Proposal (which will be more detailed than the Preliminary HEA Proposal being submitted concurrently with this document) will be submitted for MDEP/USEPA review and approval. After performance of the risk assessment activities, the MCP Final Phase II Report (including the risk assessment) and the HEA Report will be submitted, together with a Media Protection Standards Proposal for this site.

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