United States et al. v. General Electric Company (D. Mass.)

Appendix E to Consent Decree

Volume IV

Annex 2 to Statement of Work for Removal Actions Outside the River

Documentation Related to Source Control Activities

(Continued)

Pittsfield/Housatonic River Site
General Electric Company
Pittsfield, Massachusetts

October 1999

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

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October 1999

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engineers & scientists

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Appendix E to Consent Decree, Volume IV
Annex 2 to Statement of Work for Removal Actions Outside the River

Index of Documents for Annex 2

GE Submittal	Date of EPA Approval Letter
Letter RE: Source Control Investigative Report, Upper Reach of Housatonic River (First ½ Mile), February 18, 1999 (follow-up to February 9, 1999 report)	March 17, 1999
Letter RE: Conceptual Containment Barrier Design for Lyman Street Site, General Electric Company, Pittsfield, MA DEP Site No. 1-0856, USEPA Area 5A, February 16, 1999	March 23, 1999
Letter RE: Conditional Approval of Supplemental Source Control Containment/Recovery Measures East Street Area 2, General Electric Company, Pittsfield, MA DEP Site No. 1-0146, USEPA Area 4, March 1, 1999	March 17, 1999
Letter RE: Newell Street Area II (DEP #1-1057; USEPA Area 5B) Proposal for DNAPL Recovery Operations [Well N2SC-11], March 10, 1999	March 17, 1999
Letter RE: Results of Supplemental Soil Sampling in Support of Source Control Activities at Lyman Street Site, DEP Site No. 1-0856, USEPA Area 5A, April 26, 1999	May 7, 1999
DNAPL Assessment, East Street Area 2 Site, April 28, 1999	June 28 1999
Source Control Investigation Addendum Report, Upper Reach Housatonic River (First ½ Mile), June 15, 1999	July 1, 1999
Proposal for Supplemental Source Control Containment/Recovery Measures - Lyman Street Site, July 1999	August 27, 1999
Verbal notification that automated DNAPL recovery system for Well #31 operational as of July 15, 1999. [No document included.]	July 22, 1999 - RE: Status of Newell Street II Source Control Activities (DEP #1-1057; USEPA Area 5B)

Letter Re: Source Control Investigative Report, Upper Reach of Housatonic River (First ½ Mile), February 18, 1999 (follow-up to February 9, 1999 report)

Corporate Environmental Programs
General Electric Company
100 Woodlawn Ave., Pittsfield, MA 01201

February 18, 1999

Mr. Bryan Olson
Mr. Dean Tagliaferro
Site Evaluation and Response Section
U.S. Environmental Protection Agency
One Congress Street
Boston, MA 02114-2023

Mr. Alan Weinberg
Bureau of Waste Site Cleanup
Department of Environmental Protection
436 Dwight Street
Springfield, MA 01103

Re: Source Control Investigation Report
Upper Reach of Housatonic River (First 1/2 Mile)

Dear Mr. Olson, Mr. Tagliaferro and Mr. Weinberg:

Last week a document entitled *Source Control Investigation Report Upper Reach of Housatonic River (First 1/2 Mile)* was transmitted to you. That document, which was prepared by HSI GeoTrans (on behalf of GE), indicated that DNAPL was present in well N2SC-07, located at the Newell Street Area II site. The document further indicated that GE would begin daily monitoring of that well and remove any DNAPL that was present.

This monitoring, which began on February 8, has not detected the presence of DNAPL in the well. The monitoring has been done utilizing an oil/water interface probe and a bailer. In addition, a peristaltic pump with downhole tubing was utilized in an attempt to remove any potential DNAPL. At this point, only silt with a trace of a sheen has been removed from the well. More than one foot of silt was removed during redevelopment of the well on February 12. Apparently, the earlier indications of DNAPL with the oil/water interface probe were due to the presence of silt at the bottom of the well. Field personnel have also indicated that although the probe previously gave an indication of a separate phase fluid in the bottom of the well, no DNAPL was actually observed on the probe tip.

In light of these additional assessment activities, I have enclosed two figures which are revisions to Figures 3-3 and 3-6 that were contained in the previously referenced report. These revisions indicate that measurable DNAPL is not present in well N2SC-07. In addition, I have enclosed the analytical data sheets from the DNAPL sample that was collected from well LSSC-07, which was installed as part of the source control investigations at the Lyman Street site.

If you have any questions on this matter, feel free to contact me at 413-494-3952.

Yours truly,

John D. Ciampa

John D. Ciampa
Remediation Project Manager

cc: S. Acree, EPA
R. Bell, Esquire, DEP
G.A. Bibler, Esquire, Goodwin, Procter & Hoar
J.R. Bieke, Esquire, Shea & Gardner
J. Bridge, HSI GeoTrans
R. Child, DEP
S.M. Cooke, Esquire, McDermott, Will & Emery
M. Nalipinski, EPA
J.M. Nuss, Blasland, Bouck & Lee
Pittsfield Conservation Commission
Pittsfield Health Department
A.T. Silfer, GE
A.J. Thomas, Esquire, GE
D. Veilleux, Roy F. Weston
J. Ziegler, DEP
Public Information Repositories
ECL I-P-IV(A)(1)

Summary of DNAPL Analyses, Lyman Street Site.

Analysis	*Location*	*Sample Name*	*Compound*	*Result*	*Qual*	*Units*
PCBs						
	LSSC-07					
		#A0260				
			Aroclor 1254	260000		mg/kg
			Total PCBs	**260000**		mg/kg
VOC						
	LSSC-07					
		#A0260				
			Carbon tetrachloride	78000		mg/kg
			Methylene chloride	3400		mg/kg
			Trichloroethene	20000		mg/kg
			Xylenes (total)	10000		mg/kg
SVOC						
	LSSC-07					
		#A0260				
			1,2,4,5-Tetrachlorobenzene	530	J	mg/kg
			1,2,4-Trichlorobenzene	30000		mg/kg
			1,2-Dichlorobenzene	370	J	mg/kg
			1,4-Dichlorobenzene	520	J	mg/kg
			2-Methylnaphthalene	150	J	mg/kg
Metals						
	LSSC-07					
		#A0260				
			Barium	3.3	B	mg/kg
			Chromium	0.52	B	mg/kg
			Copper	1.3	B	mg/kg
			Lead	7		mg/kg
			Mercury	0.74		mg/kg
			Selenium	0.23	B	mg/kg
			Silver	0.051	B	mg/kg
			Tin	2.6	B	mg/kg
			Zinc	0.96	B	mg/kg
		#A0260 DUP				
			Antimony	0.13		mg/kg
			Barium	3.8		mg/kg
			Chromium	0.55		mg/kg
			Copper	1.6		mg/kg

Summary of DNAPL Analyses, Lyman Street Site.

Analysis	*Location*	*Sample Name*	*Compound*	*Result*	*Qual*	*Units*
			Lead	7.8		mg/kg
			Mercury	0.8		mg/kg
			Silver	0.094		mg/kg
			Tin	2.8		mg/kg
			Zinc	0.96		mg/kg

Qualifier

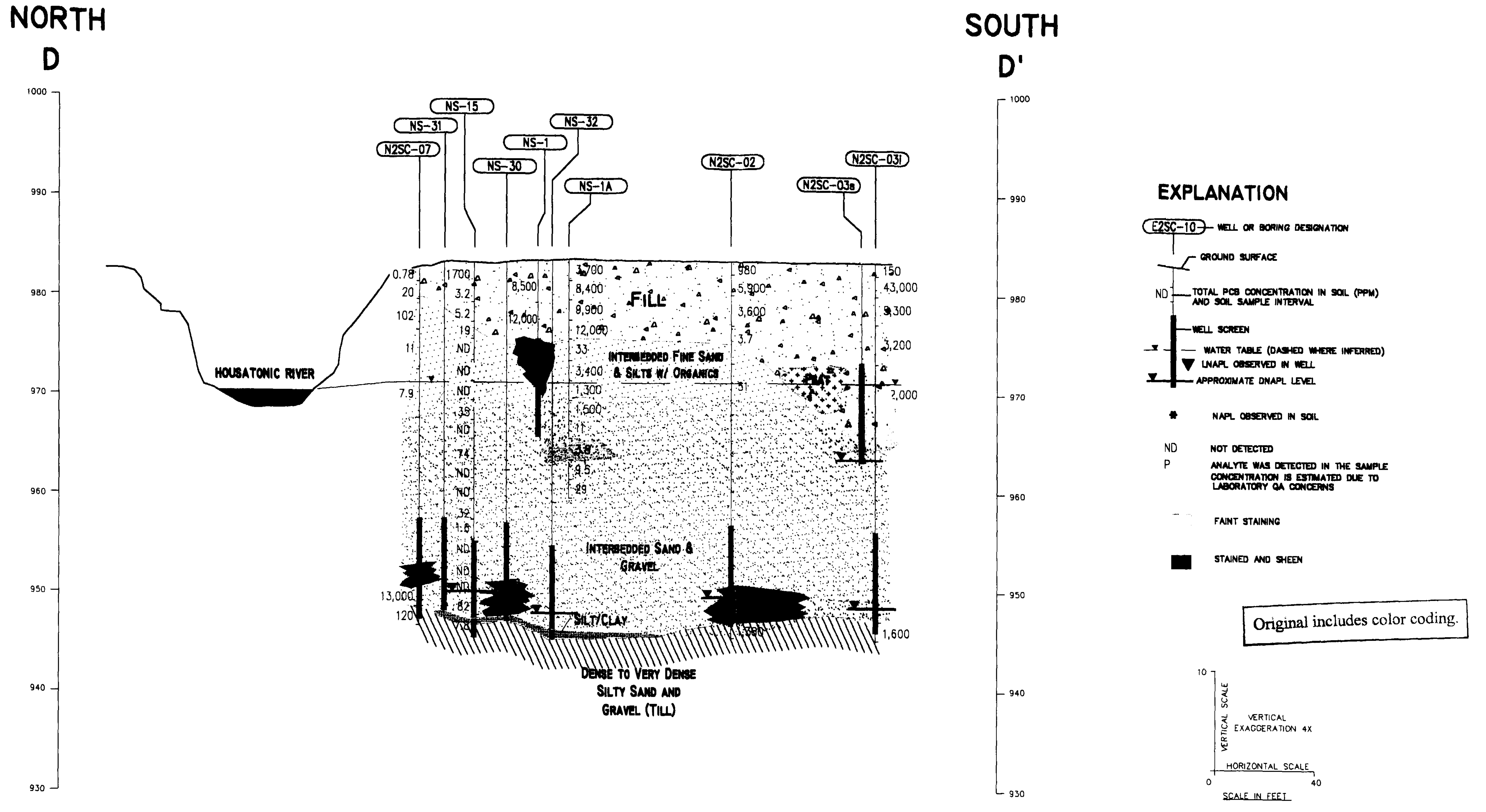
a	*Matrix spike percent recovery outside of QC limits. For Dioxins: See narrative.*
B	*For organics, compound found in method blank. For metals: Result is between MDL and RL*
D	*Compound quantified using a secondary dilution.*
E	*Result exceeds calibration range.*
J	*For organics, result is between MDL and RL.*

Summary of DNAPL Dioxins and Furans, Lyman Street Site.

Location	*Sample Name*	*Compound*	*Result*	*Qual*	*Units*
LSSC-07					
	A0260				
		1,2,3,4,6,7,8-HpCDD	0.18		ug/kg
		1,2,3,4,6,7,8-HpCDF	0.34	E	ug/kg
		1,2,3,4,7,8,9-HpCDF	0.26	E	ug/kg
		1,2,3,4,7,8-HxCDD	0.012		ug/kg
		1,2,3,4,7,8-HxCDF	0.77	E	ug/kg
		1,2,3,6,7,8-HxCDD	0.011	s	ug/kg
		1,2,3,6,7,8-HxCDF	0.31	E	ug/kg
		1,2,3,7,8,9-HxCDD	0.0098	s	ug/kg
		1,2,3,7,8,9-HxCDF	0.17		ug/kg
		1,2,3,7,8-PeCDF	0.024		ug/kg
		2,3,4,6,7,8-HxCDF	0.15		ug/kg
		2,3,4,7,8-PeCDF	0.086		ug/kg
		HpCDDs (total)	0.28		ug/kg
		HpCDFs (total)	1.1		ug/kg
		HxCDDs (total)	0.15		ug/kg
		HxCDFs (total)	2.3		ug/kg
		OCDD	1.5	E	ug/kg
		OCDF	0.66	E	ug/kg
		PeCDDs (total)	0.072	a	ug/kg
		PeCDFs (total)	0.7		ug/kg
		TCDDs (total)	0.047	a	ug/kg
		TCDFs (total)	0.26		ug/kg

Qualifier

a	*Matrix spike percent recovery outside of QC limits. For Dioxins: See narrative.*
E	*Result exceeds calibration range.*
s	*Result detected is below the lowest standard and above zero.*

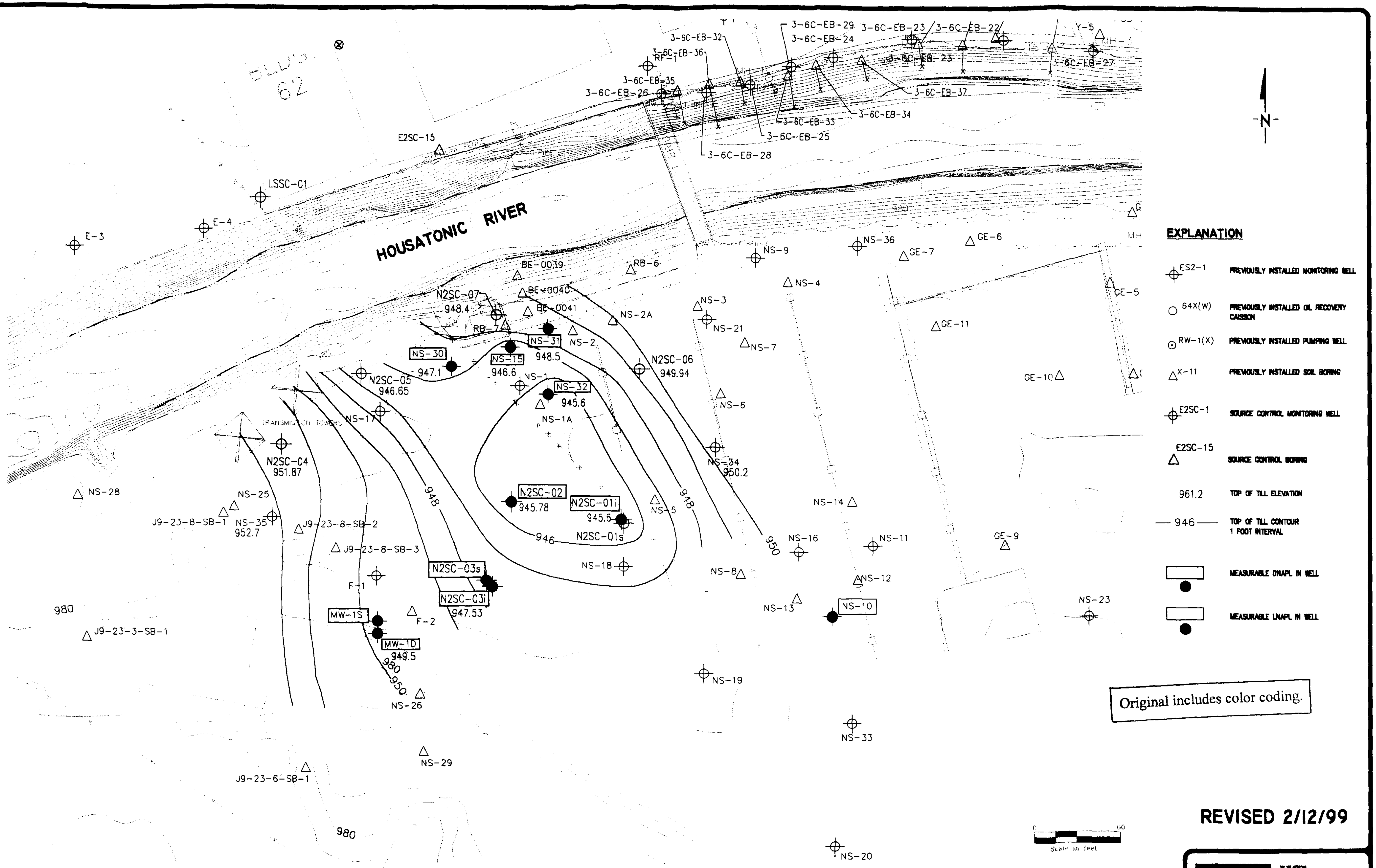


Original includes color coding.

REVISED 2/12/99

HSI GEOTRANS
A TETRA TECH COMPANY
9801-e-D.dwg

Figure 3-3 Cross-Section D-D', Newell Street Area II



Original includes color coding.

REVISED 2/12/99

HSI GEOTRANS
A TETRA TECH COMPANY
9901-newl-DNPL.dwg

Figure 3-6 Extent of DNAPL & LNAPL , Newell Street Area II

EPA Approval Letter Dated March 17, 1999 for GE's: Source Control Investigative Report, Upper Reach of Housatonic River (First ½ Mile), February 9, 1999

United States Environmental Protection Agency
Region I
One Congress Street, Suite 1100
Boston, MA 02114-2023

ENVIRONMENTAL PROGRAMS
MAR 1 1999

March 17, 1999

Mr. Andrew T. Silfer, P.E.
General Electric Company
100 Woodlawn Avenue
Pittsfield, Massachusetts 01201

RE: Conditional Approval of GE's *Source Control Investigation Report, Upper Reach of the Housatonic River (First ½ Mile)*, prepared by HSI Geotrans, dated February 9, 1999

GE submitted the above-referenced report to EPA on February 9, 1999. Based on a review of GE's submittal and on discussions with GE, EPA conditionally approves the above-referenced submittal subject to the following comments:

Requirements for additional borings/wells

<u>Newell Street</u>

GE shall install one additional intermediate depth boring/well in the area southwest of MW-1S and 1D to delineate the extent of DNAPL in this area.

If any of the proposed borings/wells collect free-phase DNAPL, then additional borings/wells to delineate the extent of DNAPL may be required.

<u>Lyman Street</u>

To assist in determining the northern extent of DNAPL, GE shall install an additional intermediate depth boring/well at a location between LS-8 and LS-28.

Well LS-43 has no cap, either protective or internal. GE shall inspect, repair (or replace if warranted) and re-monitor this well. Repair may include redevelopment of the well. GE shall also inspect and, if necessary, repair monitoring wells LS-44 and LS-45.

If wells LS-43, 44 or 45 or the borings/wells required pursuant to this investigation collect free-phase DNAPL, then additional borings/wells to delineate the extent of DNAPL may be required.

Comparison of LNAPL vs. DNAPL

GE shall provide a comparison of the LNAPL vs. the DNAPL at both the Lyman Street and Newell Street Parking Lots. This comparison shall include the chemical constituents, density, and viscosity. For the Newell Street Parking Lot, GE shall evaluate whether or not the LNAPL at NS-10 may be perched DNAPL. For the Lyman Street Parking Lot, the shallow depth of silt/till may result in a mixing of the LNAPL and DNAPL. GE shall provide a comparison of the LNAPL and DNAPL to confirm that they are separate contaminant plumes and to assist in distinguishing/delineating the plumes.

Also, EPA's Conditional Approval GE's Source Control Work Plan required the analysis of density and viscosity be performed when any samples of NAPL were collected. Please provide the results of the density and viscosity for the NAPL samples collected and include the results in the above-referenced comparison.

Incorporation of Monitoring Wells into Existing Monitoring Programs

GE shall submit a proposal to include the wells installed pursuant to source control activities to GE's existing monitoring programs.

Potential Errors and Omissions in the Report

Figures 3-2, 5-1

The elevation of the top of silt/till layer at location N2SC-03I may be incorrect. HSI/Geotrans identifies the top of silt/till at 947.53. Weston's boring logs identify the top of the silt at a depth of no greater than 946.53 ft, although the sample which confirms the presence of the silt was collected from 945.53 to 944.73 ft, below a 1-ft interval of no sample recovery. HSI/Geotrans appears to be identifying the top of the silt/till approximately one to two feet higher, as a silty sand with gravel underlying a dark-stained sand and gravel. A comparison of HSI/Geotrans and Weston boring logs show that non-recovery of samples is depicted as a data gap in Weston boring logs, while the data collected immediately above the data gap is extrapolated across the data gap in HSI/Geotrans boring logs. The HSI/Geotrans boring log appears to show that the silty sand extends continuously downward to the silt, which makes the higher elevation for the top of the silt/till seem reasonable. The Weston boring log, showing the data gap, indicates that a deeper top of silt/till is better supported by the data. The selection of the silt, rather than the silty sand, as the top of the silt/till is more consistent with the selection made at other locations at the Newell Street Area 2 site.

Figure 5-1

Top of silt/till elevations were omitted for locations 3-6C-EB-23 to -29. Addition of the top-of-till elevations at these locations would better define the topography in this area.

The top of silt/till elevation for location LSSC-01 is 952.52 (noted correctly on Figures 4-2 and 4-8) not 953.52 ft.

The 950-ft depression contour located in the vicinity of Newell Street Area 2 should extend farther northward, as the top of the silt/till elevation at location E2SC-15 is 950.3 ft.

Figure 5-2

A spot check of analytical results noted some errors. In soil boring E2SC-15, analytical data contained in the Proposal for Supplemental Source Control Containment/Recovery Measures, January 1999, does not agree with the posted total PCB results in Figure 5-2. Total PCB data for the zero to 1-ft interval bgs is not included in Table 2-4 (although Weston field notes confirm that a sample was collected from this interval, as does HSI/Geotrans Table 2-1). Further the total PCB concentration for the 1 to 6-ft interval bgs is reported as 8 mg/kg on Figure 5-2, but is actually 80 mg/kg in Table 2-4 in the same reference.

GE shall consider these comments in future submittals.

Additional Work

1. GE has proposed conducting additional investigative activities as part of their February 16, 1999 submittal titled *Conceptual Barrier Design for Lyman Street Site*. EPA is in the process of reviewing this submittal. Subsequent to the completion of the investigative activities proposed and approved in the Lyman Street submittal, EPA may require additional investigative activities including, but not limited to, the advancement of borings in the Housatonic River and the installation of intermediate depth borings/wells on the south side of the Housatonic River, opposite the Lyman Street Parking Lot.

2. EPA may require additional source control response actions subsequent to the completion of investigative activities required by this conditional approval letter. Furthermore, additional performance standards, objectives and other requirements for NAPL monitoring, containment, and/or recovery will be included in the Scope of Work for Removal Actions Outside the River, which is currently being negotiated by GE, EPA and other government agencies.

Schedule

GE shall initiate the installation of the required borings/well by March 30, 1999. Within 45 days of completing the boring/well installations, GE shall submit a report that includes the following:

- A summary of the investigative activities required by this approval letter
- A proposal for inclusion of the monitoring wells installed pursuant to source control investigative and response activities into GE's existing monitoring programs

- The evaluation of the comparison of LNAPL vs. DNAPL at the Newell and Lyman Street Parking Lots, and
- Additional proposed activities, if any

If you have any questions, please contact me at (617) 918-1282.

Sincerely,

Dean Tagliaferro

Dean Tagliaferro
On-Scene Coordinator

cc: John Ciampa, GE
Lyn Cutler, MA DEP
John Ziegler, MA DEP
John Kilborn, EPA
Steve Acree, US EPA
Dawn Veillieux, Roy F. Weston
Joel Lindsay, Roy F. Weston
John Kullberg, USACE
Margaret Meehan, EPA
Anton Giedt, NOAA
Dale Young, MA EOEA
Tom O'Brien, MA EOEA
Mayor Doyle, City of Pittsfield
Pittsfield Conservation Commission
Pittsfield City Council, c/o Tom Hickey
Site File

Letter RE: Conceptual Containment Barrier Design for Lyman Street Site, General Electric Company, Pittsfield, MA DEP Site No. 1-8-56, USEPA Area 5A, February 16, 1999

Corporate Environmental Programs
General Electric Company
100 Woodlawn Avenue, Pittsfield, MA 01201

Transmitted Via Federal Express

February 16, 1999

Bryan Olson
Dean Tagliaferro
Site Evaluation and Response Section (HBR)
U.S. Environmental Protection Agency
One Congress Street
Boston, MA 02203-2211

Alan Weinberg
Bureau of Waste Site Cleanup
Department of Environmental Protection
436 Dwight Street
Springfield, MA 01103

Re: **Conceptual Containment Barrier Design for Lyman Street Site,**
General Electric Company, Pittsfield, Massachusetts
DEP Site No. 1-0856, USEPA Area 5A

Dear Messrs. Olson, Tagliaferro, and Weinberg:

I. INTRODUCTION

The General Electric Company (GE) has recently completed supplemental investigations related to non-aqueous phase liquids (NAPLs) present at portions of the USEPA Area 5A/MCP Lyman Street Site in Pittsfield, Massachusetts. More specifically, the investigations conducted by GE between December 14, 1998 and January 29, 1999 provided further information concerning subsurface conditions in the vicinity of GE's existing NAPL recovery systems and the adjacent riverbank area. The results of these recent investigations were summarized in a document entitled *Source Control Investigation Report - Upper Reach of Housatonic River (First ½ Mile)*, dated February 9, 1999, prepared on behalf of GE by HSI GeoTrans, Inc. (Field Investigation Report). This letter builds upon the information presented in the Field Investigation Report and summarizes the activities proposed by GE to supplement the NAPL containment/recovery measures that are currently in place in this area.

The contents of this letter represents a continued follow-up to a letter from the United States Environmental Protection Agency (USEPA) to GE dated August 14, 1998. Issues posed in that letter were addressed by GE in a document entitled *Source Control Work Plan - Upper Reach of Housatonic River (First ½ Mile),* dated September 1998, prepared on behalf of GE by Blasland, Bouck & Lee, Inc. (BBL) (Work Plan), which was conditionally approved by USEPA via letter dated October 6, 1998. As indicated in that Work Plan, GE believes that its current containment/recovery measures prevent significant migration of NAPLs in the riverbank area. Although the results of the recent investigations do not alter GE's position regarding this matter, GE will proceed, in accordance with its commitment in the Work Plan, with the design and installation of supplemental NAPL containment measures in this area. Such measures will involve the design and installation of a sheetpile-based containment barrier along the riverbank.

This letter summarizes the information used to establish the preliminary and conceptual design parameters associated with the proposed containment barrier. Such information includes the results of the recently-performed field investigation activities (discussed in detail in the Field Investigation Report and summarized herein), as well as historical groundwater data available for the site. An overview of this data is provided below in Section II, while preliminary and conceptual design information regarding this proposed containment barrier is presented below in Section III.

Section IV of this report describes conceptual site restoration activities, while Section V summarizes the near-term activities to be performed by GE leading to the final design and implementation of the proposed containment barrier. Prior to the implementation of the proposed NAPL containment barrier, GE will prepare a detailed Design Report to provide additional information concerning the final configuration and design of the proposed NAPL containment barrier. Section VI presents a schedule for future activities, including final design of the barrier.

II. INVESTIGATION SUMMARY

A. Field Investigations

Most of the field investigations recently concluded in the subject area were proposed by GE in response to the USEPA's August 14, 1998 letter. The Work Plan was conditionally approved in a letter from the USEPA dated October 6, 1998. Subsequently, between December 14, 1998 and January 5, 1999, HSI/GeoTrans, Inc. (GeoTrans) advanced a total of eleven soil borings (LSSC-1 through LSSC-11), as shown on Figure 1. Following drilling, nine of the soil borings were converted into monitoring wells to gauge water table elevations and to monitor for the presence of NAPLs. Seismic refraction surveys were also conducted by Geophysical Applications, Inc. (GAI) to further assess the configuration of the till confining layer beneath the Lyman Street Parking Lot and adjacent areas.

During the performance of these field investigations, oversight of GE's activities was performed by the USEPA, through use of an oversight contractor (Roy F. Weston, Inc.). As previously stated, detailed results of the GeoTrans field investigations and the GAI seismic refraction survey were provided in the Field Investigation Report, submitted to the Agencies on February 9, 1999.

As a supplement to the initial investigation, four shallow soil borings (LSSC-12 through LSSC-15) were advanced by BBL at locations along the riverbank adjacent to the parking lot on January 29, 1999 (Figure 1). GE verbally proposed the installation of those borings to the Agencies on January 26, 1999, and approval was received prior to installation. Soil samples were collected at one-foot intervals to a depth of 6 to 8 feet below grade and submitted to Northeast Analytical, Inc. (NEA) for analysis for total petroleum hydrocarbons (TPH) by USEPA Method 418.1. The results of these analyses are presented in Table 1.

B. Historical Groundwater Data

To help provide information regarding design elevations for the proposed containment barrier, historical river levels and adjacent groundwater levels were evaluated using monitoring data dating back to 1992. Specifically, for the river levels, the data set consists of weekly monitoring results dating between January 1992 and January 1999. Weekly groundwater level measurements from riverbank well points are available from September 1992 to January 1999. Weekly monitoring data for the river and three of the nearby well points (P1, P3, and P4) are depicted on the hydrographs presented on Figure 2.

As shown on this figure, river elevations ranged from 970.14 to 976.50 feet above mean sea level, with an average level of 971.20 feet. During the 7-year monitoring period that was evaluated, four flow events occurred which produced river levels greater than 974 feet. Groundwater levels in the riverbank well points between September 1992 and January 1999 ranged from 970.35 feet to 976.43 feet and averaged about 971 feet. The groundwater levels as measured in the well points are generally slightly higher than or nearly equal to river levels. However, during several of the high-flow events when the river level was above 974 feet, the groundwater levels were lower than that of the river, indicating a landward flow direction. A groundwater level contour map representing low-water conditions is presented on Figure 3. Less frequent high-water (i.e., river level above 974 feet) conditions are presented on Figures 4 and 5. It should be noted that the high-flow river event which occurred on June 15, 1998 was not contoured because groundwater levels along the riverbank were not measured concurrently with that event.

C. Preliminary Findings

The data collected from the recent soil borings and monitoring wells, combined with data available from prior investigations for the site, have been used to further delineate the type(s) of subsurface deposits present in this area, and specifically the depth to the till confining layer. Using these data, a till elevation contour map has been developed for the subsurface area in the vicinity of the riverbank (Field Investigation Report; Figure 4-2). In addition, preliminary geologic cross sections developed in directions generally parallel to and perpendicular to the river are included as Figures 4-3, 4-4, and 4-5 of the Field Investigation Report. This information illustrates that the depth to the till layer is approximately 20 to 25 feet below ground surface in the riverbank area, which is generally consistent with previous estimates. Generally, the till surface is highest at the center of the site and slopes to the northeast and southwest. A trough has been identified in the top of the till, beginning in the north-central portion of the site and sloping to the southwest.

Based on the recent drilling and geophysical survey results, the till unit is interpreted as being continuous throughout the site, and extending to limestone bedrock at a depth of 50 to 60 feet below grade. An isolated sand lens has been identified within the till at certain locations (LS-14, LS-25, and LSSC-10), but adjacent borings have shown that this lens is localized within the till unit. Overlying the till layer are stratified sand, gravel, and silt deposits, as shown on the cross sections (descriptive boring logs and information concerning the geologic nature of the overlying materials were presented in the Field Investigation Report).

Since their installation, none of the recently installed monitoring wells has produced a measurable thickness of LNAPL. However, as shown on Figure 1, LNAPL has been periodically detected in several existing wells, which are generally located within the former oxbow of the Housatonic River (Oxbow D). The LNAPL is currently being recovered and contained by three pumping wells and an absorbent boom system which has been installed along the riverbank in this area.

Measurable accumulations of DNAPL have been detected in one newly installed well (LSSC-07) and several existing wells (see Figure 1). The DNAPL occurs at the top of the till confining layer and exists within an apparent "L-shaped" trough. Although DNAPL has been found at the top of the riverbank in several wells (RW-1, LS-4, and LS-21), it is not present in the wells or well points located closest to the river.

The primary purpose of supplemental borings LSSC-12 through LSSC-15 was to assess the potential for vertical migration of LNAPL above the average water table elevation of 971.20 feet. This was done by observing the soil cores for evidence of LNAPL staining or sheens, collecting soil samples for analysis of total petroleum hydrocarbons (TPH), and performing shake tests on soil samples. The results of this series of tests are summarized in Table 1 and on Figure 6. During installation, LNAPL staining was visually observed in two of the four riverbank soil borings (LSSC-12 and LSSC-13). These same two borings detected LNAPL residuals during shake testing. No visual observations of LNAPL staining or residuals from shake tests were shown to exist above an elevation of 974 feet. TPH values in the riverbank soil samples ranged from non-detect (in eleven samples) to 23,000 ppm. The TPH concentrations in the borings generally decreased from east to west, with maximum concentrations per boring ranging from 150 ppm in LSSC-15 to 23,000 ppm in LSSC-12. The observed soil TPH values were compared to the estimated TPH values for soil at residual saturation levels, based on physical properties of the soil and the LNAPL at the site. Typically, NAPL which is present at residual saturation levels or less for a particular soil will not be mobilized as a separate phase product (Cohen and Mercer, 1993). Estimates were made of TPH values which would represent soils at full oil saturation and residual saturation levels. The following available site or area data and typical assumptions were utilized for this analysis:

Oil Density	0.94 g/cc (average of site oil data)
Soil Dry Density	1.6 g/c (Lambe and Whitman, 1969)
Porosity	0.3 to 0.35 (Lambe and Whitman, 1969)
Residual Saturation	0.2 to 0.3 (estimates from adjacent East Street Area 2 data)
LNAPL TPH Concentration	660,000 ppm (average of site oil data)

References:
Cohen, R.M. and Mercer, J.W., 1993. *DNAPL Site Evaluation*, C.K. Smolley, Boca Raton, Florida.

Lambe, T.W. and Whitman, R.V., 1969. *Soil Mechanics*, John Wiley & Sons, New York.

Based on these inputs, the estimated TPH concentration for a soil sample fully saturated with LNAPL ranges from approximately 98,800 ppm (assuming a porosity of 0.3) to approximately 112, 500 ppm (assuming a porosity of 0.35), while the estimated TPH concentration at residual saturation ranges from a low of approximately 22,500 ppm (assuming a residual saturation level of 0.2 and a porosity of 0.3) to a high of 38,300 ppm (residual saturation of 0.3, porosity of 0.35). TPH levels near the lower range of the estimated residual saturation concentrations were observed in two of the supplemental riverbank borings, LSSC-12 and LSSC-13, at elevations between 972 and 975 feet. Groundwater was encountered in these borings at elevations of approximately 973 to 974 feet. Above 975 feet, TPH concentrations ranged from non-detect to less than 50 percent of the lower estimated residual saturation concentration. However, the results of shake tests performed on the soil samples during drilling revealed no sheens or LNAPL residuals above an elevation of 973 feet.

III. PRELIMINARY CONTAINMENT BARRIER DESIGN

Based on the results of the investigations and related evaluations described in this letter, GE proposes to supplement the ongoing LNAPL and DNAPL containment/recovery measures to include a sheetpile-based containment barrier along a portion of the riverbank. Additional information concerning the anticipated installation and related activities is provided below.

The proposed location of the NAPL containment barrier is shown on Figure 7. Information concerning the presence of NAPLs, visual evidence of soil staining and sheens, depth to groundwater, geologic characteristics of the subsurface materials, and laboratory analytical results have been considered in selecting the vertical and horizontal extent of the proposed containment barrier. In addition, the scope of future Housatonic River bank soil and sediment removal activities in this stretch of the river were also considered (i.e., the possible removal of bank soils and sediments from this area and the need to support the remaining riverbank during such activities). The horizontal extent of the proposed containment barrier has been preliminarily selected to include those soil borings and monitoring wells where separate-phase LNAPL has been detected in the vicinity of the riverbank. At many of these locations, the LNAPL appears to be present at near-residual saturation levels.

The western extent of the proposed containment barrier will extend to the Lyman Street bridge abutment. In that area, the containment barrier would include monitoring well LS-38 and recent soil boring LSSC-11. Well LS-38 appears to represent the western limit of LNAPL migration. This well has been monitored regularly since its installation in the later part of 1995. During that time period, LNAPL was only detected twice in extremely small quantities (thickness of 0.01 feet). Two well points located immediately down the bank from well LS-38 and toward the river (P6 and P7) have been monitored since the latter part of 1994 and have never indicated the presence of LNAPL. A well recently installed on the west side of the Lyman Street bridge abutment (LSSC-08) did not indicate the presence of any NAPL staining or sheens near the top of the water table. The eastern end of the proposed containment barrier will extend between well point P5 and well LS-24. LNAPL has not been detected in these wells or nearby wells LS-20, LS-22, LS-25, or RW-2. Perpendicular wing walls will extend along both sides of the proposed barrier wall. Based on these preliminary design parameters, the length of the proposed containment barrier along the riverbank is approximately 300 feet. With the addition of the wing walls, the overall length of the proposed containment barrier will be approximately 400 feet.

With respect to the vertical extent of the proposed containment barrier, it is anticipated that the sheetpiling will extend approximately 5 feet into the till layer. The top of the till layer along the riverbank area is somewhat variable, existing at elevations ranging from approximately 962 to 967 feet. Therefore, the corresponding base elevations of the barrier wall will range from about 957 to 962 feet.

Regarding the installation of the containment barrier relative to the riverbank, a location within the lower portion of the bank is anticipated. It will likely be installed with an upper elevation of 978 from its east end to approximately soil boring LSSC-13. From this point westward, the upper elevation of the wall will be 977 feet. The upper elevation of the barrier wall was conservatively selected based on the TPH data, although LNAPL sheens or staining was not observed above an elevation of 974 feet. It is anticipated that the wall will be installed approximately 2 to 5 feet from the river's edge for the majority of its length, and up to approximately 20 feet from the river's edge along its west end. This location has been selected based on several considerations, primarily including the ability to contain any NAPLs that may be present within this portion of the riverbank as well as the scope of future sediment and bank soil removal actions to be performed within this section of the river. A conceptual cross section of the proposed containment barrier is provided on Figure 8. Based on the deepest proposed bottom elevation of 957 feet, and a ground surface elevation corresponding to the proposed installation location (ranging from approximately 977 to 978 feet), the maximum necessary vertical length of sheetpiling for the containment barrier is approximately 20 to 21 feet. During preparation of the Detailed Design Report, the proposed bottom elevation of the sheetpiling will be evaluated based on consideration of the proposed excavation of any sediments and bank soils adjacent to the sheetpile wall. The vertical extent of the wall may be adjusted as needed based on the results of this geotechnical evaluation.

The type of sheetpile to be used for the proposed containment barrier will be consistent with that recently installed near GE's Building 68 area and that proposed to be installed elsewhere within the USEPA Area 4/ East Street Area 2 site (i.e., Waterloo-type sheetpile). Waterloo sheetpiling is used to create a low-permeability sheetpile wall that utilizes specially designed sheetpile joints and sealants to minimize any potential for water leakage through the sheetpile sections.

GE plans to continue operation of existing recovery wells RW-1(R), RW-2 and RW-3, which are located on the upgradient side of the proposed containment barrier. The capture zones of these recovery wells will continue to provide hydraulic control of the LNAPL and will be backed-up by the proposed barrier. Further assessment of the area hydraulics (with the addition of the proposed barrier) is ongoing. Additional details regarding the design of the proposed sheetpile installation, including performance standards, the results of hydraulic modeling, and structural design calculations, will be provided in a forthcoming submittal to the Agencies, as discussed in Part V of this letter.

IV. SITE RESTORATION

As illustrated on Figures 1 and 8, the bank along the river in the area of the proposed sheetpile wall is relatively steep. It varies in slope from approximately 1V:2.5H (i.e., 1 foot vertical to 2.5 feet horizontal) to approximately 1V:2H at the eastern and western ends of the proposed wall, while along the central portion of the proposed wall, the slope measures approximately 1.6V:1H. Due to the relative steepness of the riverbank in this area, the soil along the river side of the proposed sheetpile wall will likely become unstable in certain areas (probably not along the western end near the bridge) upon installation of the wall. As such, it will likely be necessary to remove some of the soil along the river side of the proposed wall prior to installation. Select quantities of this material are already proposed for removal as part of GE's *Removal Action Work Plan Upper ½ Mile Reach of Housatonic River* (½ - Mile Work Plan). The extent of any further bank soil removal will be presented in the Final Design Plan, discussed in Section V.

The restoration of this area will be coordinated with the restoration to be performed as part of the ½-Mile Work Plan. As part of these activities, an attempt will be made to restore the existing bank slope through the use of stone-filled gabions in the relatively vertical portions of the bank and loose stone rip-rap in the other areas. The timing of the restoration activities related to the ½-Mile Work Plan may require an interim restoration of the Lyman Street riverbank, which will involve the temporary placement of erosion control measure (e.g., silt fencing geotextile) along the base of the sheetpile wall.

V. NEAR-TERM ACTIVITIES

Concurrent with Agency review and comment concerning the contents of this letter, GE will perform detailed design-related activities for the containment barrier. The results of these design activities will be presented in a Detailed Design Report. Included in that report will be proposed performance standards and detailed design calculations, including final sheetpile layout and structural calculations, the results of the hydraulic modeling, and other potential implementation-related issues.

Additionally, as noted above in Section IV, as part of the detailed containment barrier installation, it may be necessary to propose the removal of additional riverbank soil (along the river side of the sheetpile wall) which is not currently proposed for removal as part of GE's ½-Mile Work Plan. In order to evaluate the potential presence of NAPL residuals in this material, GE proposes the collection of additional bank soil samples and analysis of this material (beyond that already performed by USEPA). Specifically, GE proposes sampling at eight bank locations along the edge of the proposed sheetpile (see Figure 7). A number of these locations correspond to areas previously sampled by the USEPA and GE (SLO170, SLO229, SLO182, SLO232, SLO235, and LS-Soil). Samples will be collected utilizing a direct push sampling probe. It is anticipated that samples will be collected to a depth of 8 feet below grade, depending upon visual observation (e.g., staining, sheens) and sampling limitations. Soil samples from depths below the depths previously sampled by the USEPA will be analyzed in 1-foot increments for PCBs and TPH. At locations not previously sampled, analysis of PCBs and TPH will be performed in 1-foot increments from the surface.

GE also proposes to install an additional monitoring well on the west side of the Lyman Street bridge, near existing well LSSC-08. Although well LSSC-08 did not indicate the presence of LNAPL within soil samples at that location, the well screen does not intercept the top of the water table. Therefore, another well will be constructed at this location (as illustrated on Figure 7) with a well screen between the elevations of approximately 967 to 977 feet.

No additional sediment sampling is proposed since GE recently proposed in the ½-Mile Work Plan to remove the sediment along this portion of the river to depths of 1 to 2.5 feet.

VI. SUMMARY AND SCHEDULE

Upon approval of this conceptual design plan for the Lyman Street containment barrier by the USEPA, GE will install the proposed monitoring well, conduct the supplemental bank soil sampling and analysis activities described herein and will submit the results of these activities. Included with this submission will be a detailed design of the proposed containment barrier. That report will be submitted within approximately six weeks from Agency approval of this proposal. That document will also propose a schedule for sheetpile installation.

We look forward to receiving your comments regarding this letter, and specifically any comments related to the proposed NAPL containment barrier.

Yours truly,

John D Ciampa/

John D. Ciampa
Remediation Project Manager
U:\PLH99\17191543.WPD

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State Representative D. Bosley
Mayor G.S. Doyle
State Representative C.J. Hodgkins
State Representative S.P. Kelly
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Pittsfield Health Department*
Pittsfield Conservation Commission*
Housatonic River Initiative
Public Information Repositories ECL I-P-IV(A)(1)* & (2)*

(* with tables and figures)

TABLE 1

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

LYMAN STREET PARKING LOT / USEPA AREA 5A

RIVERBANK SUBSURFACE SOIL AND LNAPL SAMPLING SUMMARY - JANUARY 1999

SAMPLE LOCATION	SAMPLE DATE	SAMPLE TYPE	SAMPLE DEPTH (feet below grade)	SAMPLE ELEVATION (feet above MSL)	SAMPLE PID READING (instrument units)	STAINING OBSERVED	SHAKE TEST	TPH (ppm)
LSSC-12	1\29\99	Soil	0-1'	979-980	2.3	No	No	140
LSSC-12	1\29\99	Soil	1-2'	978-979	3.9	No	No	ND
LSSC-12	1\29\99	Soil	2-3'	977-978	11.4	No	No	1,400
LSSC-12	1\29\99	Soil	3-4'	976-977	2.8	No	No	5,900
LSSC-12	1\29\99	Soil	4-5'	975-976	2.5	No	No	9,300
LSSC-12	1\29\99	Soil	5-6'	974-975	2.0	No	No	23,000
LSSC-12	1\29\99	Soil	6-7'	973-974	2.4	Yes	No	22,000
LSSC-12	1\29\99	Soil	7-8'	972-973	5.0	Yes	Yes	13,000
LSSC-12	1\29\99	Soil	7-8' (Duplicate)	972-973	5.0	Yes	Yes	12,000
LSSC-13	1\29\99	Soil	0-1'	979-980	0.6	No	No	140
LSSC-13	1\29\99	Soil	1-2'	978-979	0.8	No	No	ND
LSSC-13	1\29\99	Soil	2-3'	977-978	1.1	No	No	140
LSSC-13	1\29\99	Soil	3-4'	976-977	1.2	No	No	ND
LSSC-13	1\29\99	Soil	4-5'	975-976	1.2	No	No	ND
LSSC-13	1\29\99	Soil	5-6'	974-975	1.3	No	No	ND
LSSC-13	1\29\99	Soil	6-7'	973-974	1.4	No	No	4,500
LSSC-13	1\29\99	Soil	7-8'	972-973	5.5	Yes	Sheen	21,000
LSSC-14	1\29\99	Soil	0-1'	979-980	0.6	No	No	180
LSSC-14	1\29\99	Soil	1-2'	978-979	1.1	No	No	ND
LSSC-14	1\29\99	Soil	2-3'	977-978	0.8	No	No	ND
LSSC-14	1\29\99	Soil	3-4'	976-977	0.7	No	No	920
LSSC-14	1\29\99	Soil	4-5'	975-976	0.6	No	No	1,200
LSSC-14	1\29\99	Soil	5-6'	974-975	0.6	No	No	2,900
LSSC-15	1\29\99	Soil	0-1'	979-980	0.1	No	No	120
LSSC-15	1\29\99	Soil	1-2'	978-979	0.2	No	No	ND
LSSC-15	1\29\99	Soil	2-3'	977-978	0.1	No	No	ND
LSSC-15	1\29\99	Soil	3-4'	976-977	0.2	No	No	ND
LSSC-15	1\29\99	Soil	3-4' (Duplicate)	976-977	0.2	No	No	ND
LSSC-15	1\29\99	Soil	4-5'	975-976	0.1	No	No	140
LSSC-15	1\29\99	Soil	5-6'	974-975	0.0	No	No	130
LSSC-15	1\29\99	Soil	6-7'	973-974	0.4	No	No	150
LSSC-15	1\29\99	Soil	7-8'	972-973	0.4	No	No	110
RW-1R	1\29\99	LNAPL	N/A	N/A	N/A	N/A	N/A	680,000
RW-3	1/29/99	LNAPL	N/A	N/A	N/A	N/A	N/A	640,000

Notes:

1. Samples were collected by Blasland, Bouck & Lee, Inc. and screened with a photoionization detector (PID) in the field.
2. Water shake tests were performed on all samples to evaluate the potential presence of LNAPL residuals.
   "No" indicates that no LNAPL residuals were observed.
   "Yes" indicates that LNAPL residuals were observed.
   "Sheen" indicates that a slight sheen formed on the water surface during the test.
3. Total Petroleum Hydrocarbon (TPH) analyses were conducted utilizing USEPA Method 418.1 by Northeast Analytical, Inc.
4. ppm: Dry weight parts per million.
5. ND: Not detected (detection limit of 100 ppm).
6. N/A: Not applicable.
7. LNAPL: Light Non-Aqueous Phase Liquid.

LEGEND:

- —— ″ —— EXISTING INDEX ELEVATION CONTOUR
- ———— EXISTING INTERMEDIATE ELEVATION CONTOUR
- ○ DECIDUOUS TREE
- * CONIFEROUS TREE
- • MANHOLE
- ——×—— CHAIN LINK FENCE
- ∘ POLE (NON-UTILITY)
- ⋄ POLE (OVERHEAD UTILITY)
- ▨ APPROXIMATE DELINEATION OF FORMER OXBOWS
- ⊕ LS-32 LNAPL OBSERVED (FROM 1998/1999 INVESTIGATIONS)
- ● DNAPL OBSERVED (FROM 1998/1999 INVESTIGATIONS)
- ⊕ ES2-1 EXISTING MONITORING WELL
- ⊙ RW-1(X) EXISTING PUMPING WELL
- △ X-11 EXISTING SOIL BORING
- LOCATION OF CROSS-SECTION N-N'

NOTES:

1. MAPPING IS BEST AVAILABLE INFORMATION AS OF 12/10/98 BASED ON MAPPING PROVIDED BY LOCKWOOD MAPPING, INC. PREPARED FROM 1990 AERIAL PHOTOGRAPHY; DATA PROVIDED BY GENERAL ELECTRIC; AND BLASLAND AND BOUCK ENGINEERS, PC. CONSTRUCTION PLANS. RIVERBANK AND RIVER BED TOPOGRAPHIC INFORMATION PROVIDED BY BBL FROM OCTOBER 12-23, 1998 FIELD SURVEY.
2. COORDINATE GRID BASED ON 1927 STATE PLANE COORDINATES.
3. ELEVATION DATUM REFERENCED TO NGVD 1929.
4. CONTOUR INTERVAL IN THE RIVER AND ON RIVERBANK = 1 FOOT CONTOUR. INTERVAL OUTSIDE RIVERBANK AREA = 2 FEET.
5. ALL SAMPLING LOCATIONS ARE APPROXIMATE.
6. NAPL = NON-AQUEOUS PHASE LIQUID.
   LNAPL = LIGHT NON-AQUEOUS PHASE LIQUID.
   DNAPL = DENSE NON-AQUEOUS PHASE LIQUID.

Original includes color coding.

0 40 80
GRAPHIC SCALE

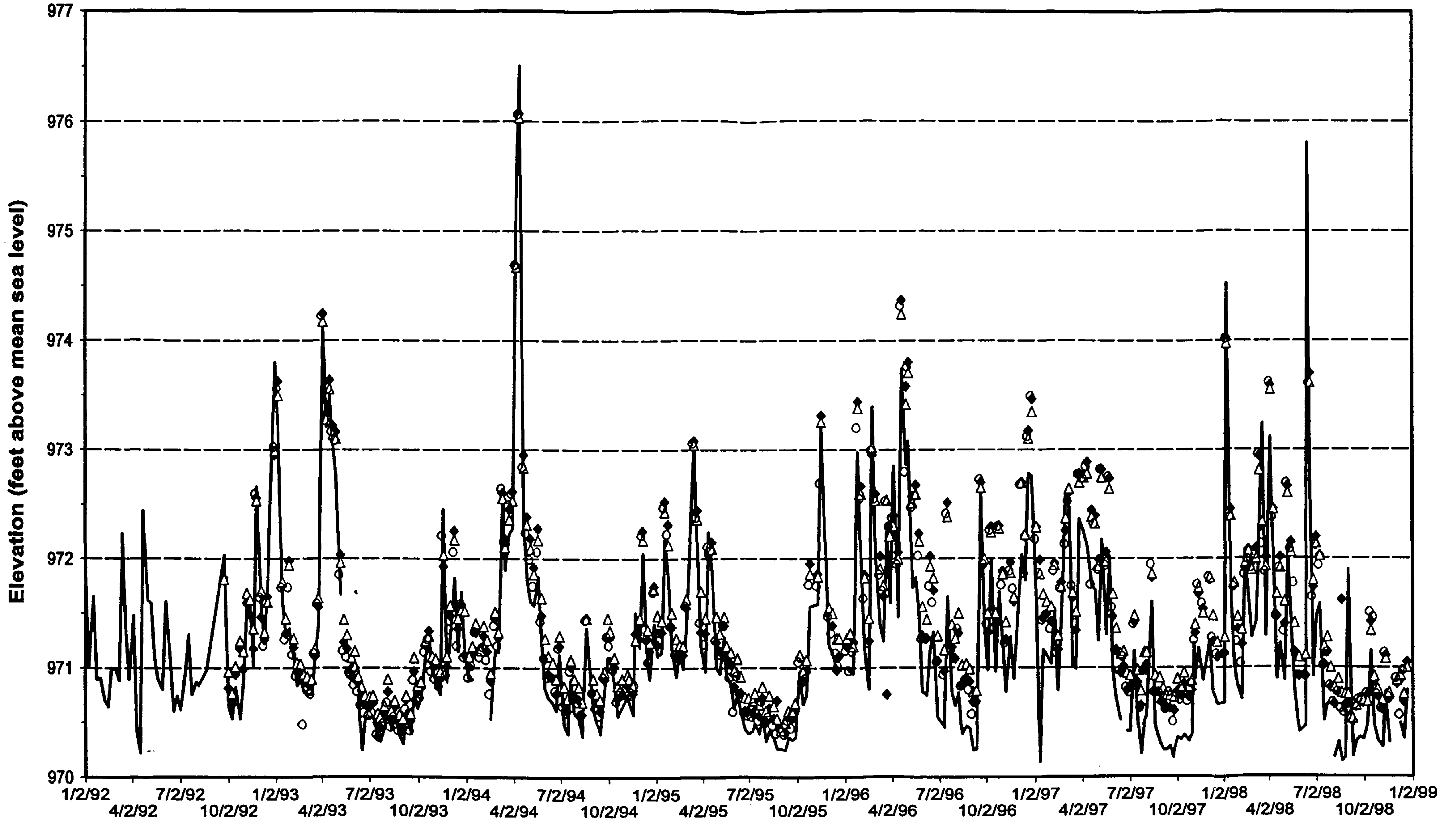
GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
LYMAN STREET PARKING LOT
SOURCE CONTROL INVESTIGATION

SITE PLAN

BBL BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
1

X: 20140X1A,20140X1B
L: ON=*, OFF=*REF*
P: B01-D. B01-D2B
2/16/99 SYR-54-RLP RJM AK
20140005/DHOLLAND/20140B02.DWG



NOTES:
1. Data compiled by Golder associates.
2. River elevation data was not collected on the following dates:
May 13-June 3, 1993; January 20 - February 10, 1994; June 19, 1997; July 30, 1998; and December 30, 1998.

LEGEND

◆ P-1 △ P-3 ○ P-4 — RIVER ELEVATION

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

LYMAN STREET PARKING LOT/
USEPA AREA 5A RIVERBANK
AREA HYDROGRAPHS

BBL BLASLAND, BOUCK & LEE, INC.
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FIGURE
2

2/99 SYR-D54-DJH
20140005/20140g06.cdr

LEGEND:

- 980 — EXISTING INDEX ELEVATION CONTOUR
- EXISTING INTERMEDIATE ELEVATION CONTOUR
- DECIDUOUS TREE
- ✳ CONIFEROUS TREE
- ⊗ MANHOLE
- —x— CHAIN LINK FENCE
- ○ POLE (NON-UTILITY)
- POLE (OVERHEAD UTILITY)
- APPROXIMATE DELINEATION OF FORMER OXBOWS
- ⌖ ES2-1 EXISTING MONITORING WELL
- ⊙ RW-3 EXISTING PUMPING WELL
- GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)

NOTES:

1. MAPPING IS BEST AVAILABLE INFORMATION AS OF 12/10/98 BASED ON MAPPING PROVIDED BY LOCKWOOD MAPPING, INC. PREPARED FROM 1990 AERIAL PHOTOGRAPHY; DATA PROVIDED BY GENERAL ELECTRIC; AND BLASLAND AND BOUCK ENGINEERS, P.C. CONSTRUCTION PLANS. RIVERBANK AND RIVER BED TOPOGRAPHIC INFORMATION PROVIDED BY BBL FROM OCTOBER 12-23, 1998 FIELD SURVEY.
2. COORDINATE GRID BASED ON 1927 STATE PLANE COORDINATES.
3. ELEVATION DATUM REFERENCED TO NGVD 1929.
4. ALL SAMPLING LOCATIONS ARE APPROXIMATE.
5. SOME GROUNDWATER CONTOURS AROUND RECOVERY WELLS NOT SHOWN FOR CLARITY.

0 20' 40'
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
LYMAN STREET PARKING LOT
SOURCE CONTROL INVESTIGATION

GROUNDWATER ELEVATION CONTOUR MAP OCTOBER 1, 1998

BBL BLASLAND, BOUCK & LEE, INC.
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FIGURE
3

X: 20140X1A,20140X1B
L: ON=*, OFF=*REF*
P: B01-D, B01-D2B
02/16/99 SYR-54-RLP RJM AK
20140005/DHOLLAND/20140B10.DWG

LEGEND:

— 986 —	EXISTING INDEX ELEVATION CONTOUR
——	EXISTING INTERMEDIATE ELEVATION CONTOUR
○	DECIDUOUS TREE
✳	CONIFEROUS TREE
⊚	MANHOLE
—x—x—	CHAIN LINK FENCE
○	POLE (NON-UTILITY)
⊸	POLE (OVERHEAD UTILITY)
▨	APPROXIMATE DELINEATION OF FORMER OXBOWS
⊕ ES2-1	EXISTING MONITORING WELL
⊙ RW-1	EXISTING PUMPING WELL
━━	GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)

NOTES:

1. MAPPING IS BEST AVAILABLE INFORMATION AS OF 12/10/98 BASED ON MAPPING PROVIDED BY LOCKWOOD MAPPING, INC. PREPARED FROM 1990 AERIAL PHOTOGRAPHY; DATA PROVIDED BY GENERAL ELECTRIC; AND BLASLAND AND BOUCK ENGINEERS, PC. CONSTRUCTION PLANS. RIVERBANK AND RIVER BED TOPOGRAPHIC INFORMATION PROVIDED BY BBL FROM OCTOBER 12-23, 1998 FIELD SURVEY.
2. COORDINATE GRID BASED ON 1927 STATE PLANE COORDINATES.
3. ELEVATION DATUM REFERENCED TO NGVD 1929.
4. ALL SAMPLING LOCATIONS ARE APPROXIMATE.
5. SOME GROUNDWATER CONTOURS AROUND RECOVERY WELLS NOT SHOWN FOR CLARITY.

0 20' 40'
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
LYMAN STREET PARKING LOT
SOURCE CONTROL INVESTIGATION

GROUNDWATER ELEVATION CONTOUR MAP
APRIL 13-14, 1994

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FIGURE
4

X: 20140X1A,20140X1B
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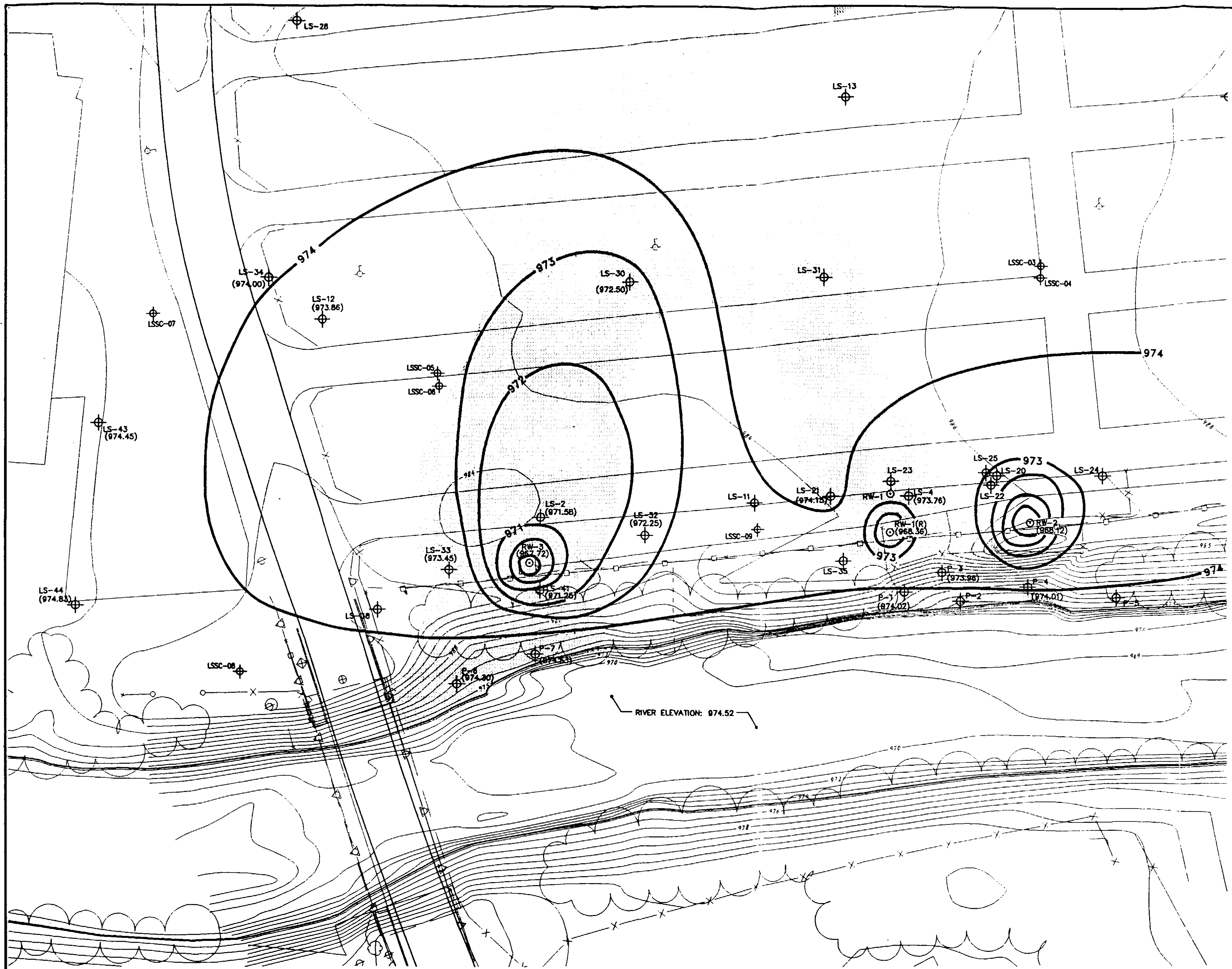
20140005/DHOLLAND/20140B09.DWG



LEGEND:

—— 980 ——	EXISTING INDEX ELEVATION CONTOUR
———	EXISTING INTERMEDIATE ELEVATION CONTOUR
○	DECIDUOUS TREE
✳	CONIFEROUS TREE
⊗	MANHOLE
—x—x—	CHAIN LINK FENCE
○	POLE (NON-UTILITY)
-○-	POLE (OVERHEAD UTILITY)
░	APPROXIMATE DELINEATION OF FORMER OXBOWS
⌖ ES2-1	EXISTING MONITORING WELL
⊙ RW-3	EXISTING PUMPING WELL
━━━	GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)

NOTES:

1. MAPPING IS BEST AVAILABLE INFORMATION AS OF 12/10/98 BASED ON MAPPING PROVIDED BY LOCKWOOD MAPPING, INC. PREPARED FROM 1990 AERIAL PHOTOGRAPHY; DATA PROVIDED BY GENERAL ELECTRIC; AND BLASLAND AND BOUCK ENGINEERS, PC. CONSTRUCTION PLANS. RIVERBANK AND RIVER BED TOPOGRAPHIC INFORMATION PROVIDED BY BBL FROM OCTOBER 12-23, 1998 FIELD SURVEY.
2. COORDINATE GRID BASED ON 1927 STATE PLANE COORDINATES.
3. ELEVATION DATUM REFERENCED TO NGVD 1929.
4. ALL SAMPLING LOCATIONS ARE APPROXIMATE.
5. SOME GROUNDWATER CONTOURS AROUND RECOVERY WELLS NOT SHOWN FOR CLARITY.

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
LYMAN STREET PARKING LOT
SOURCE CONTROL INVESTIGATION

GROUNDWATER ELEVATION CONTOUR MAP
JANUARY 7-8, 1998

BBL BLASLAND, BOUCK & LEE, INC.
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FIGURE
5

X: 20140X1A,20140X1B
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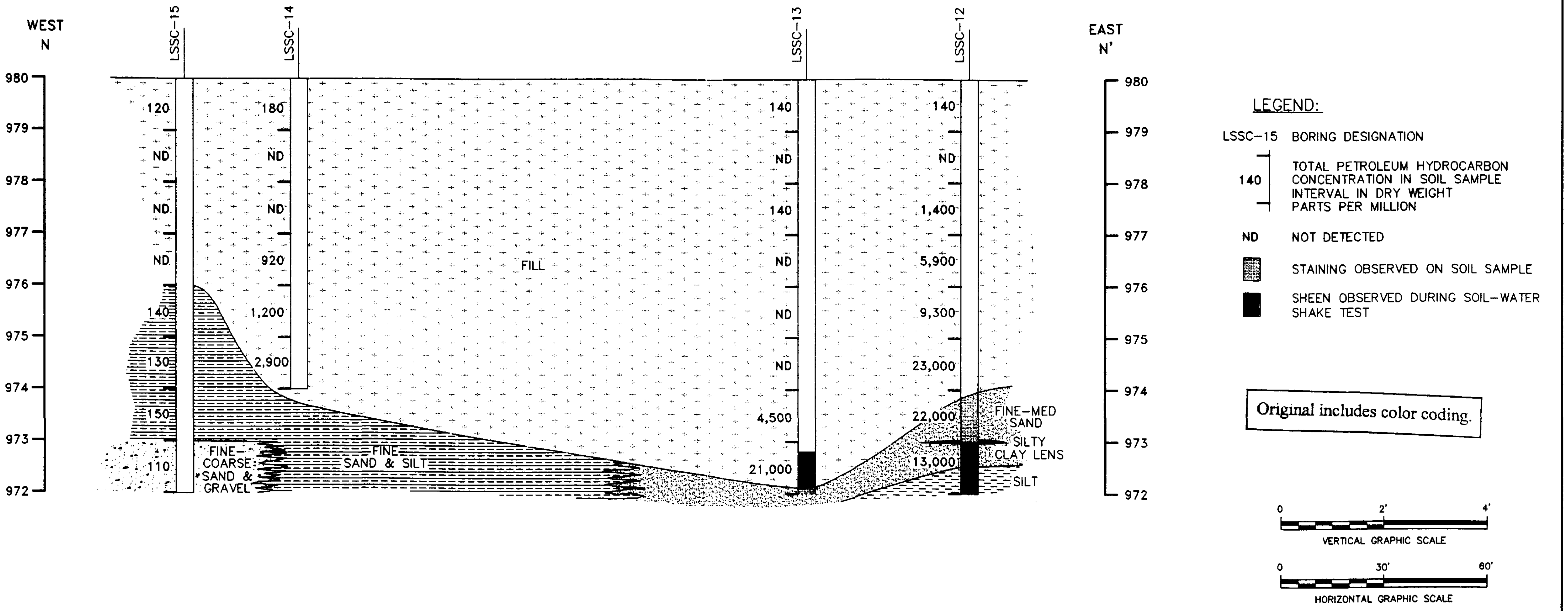
20140005/DHOLLAND/20140B05.DWG



Original includes color coding.

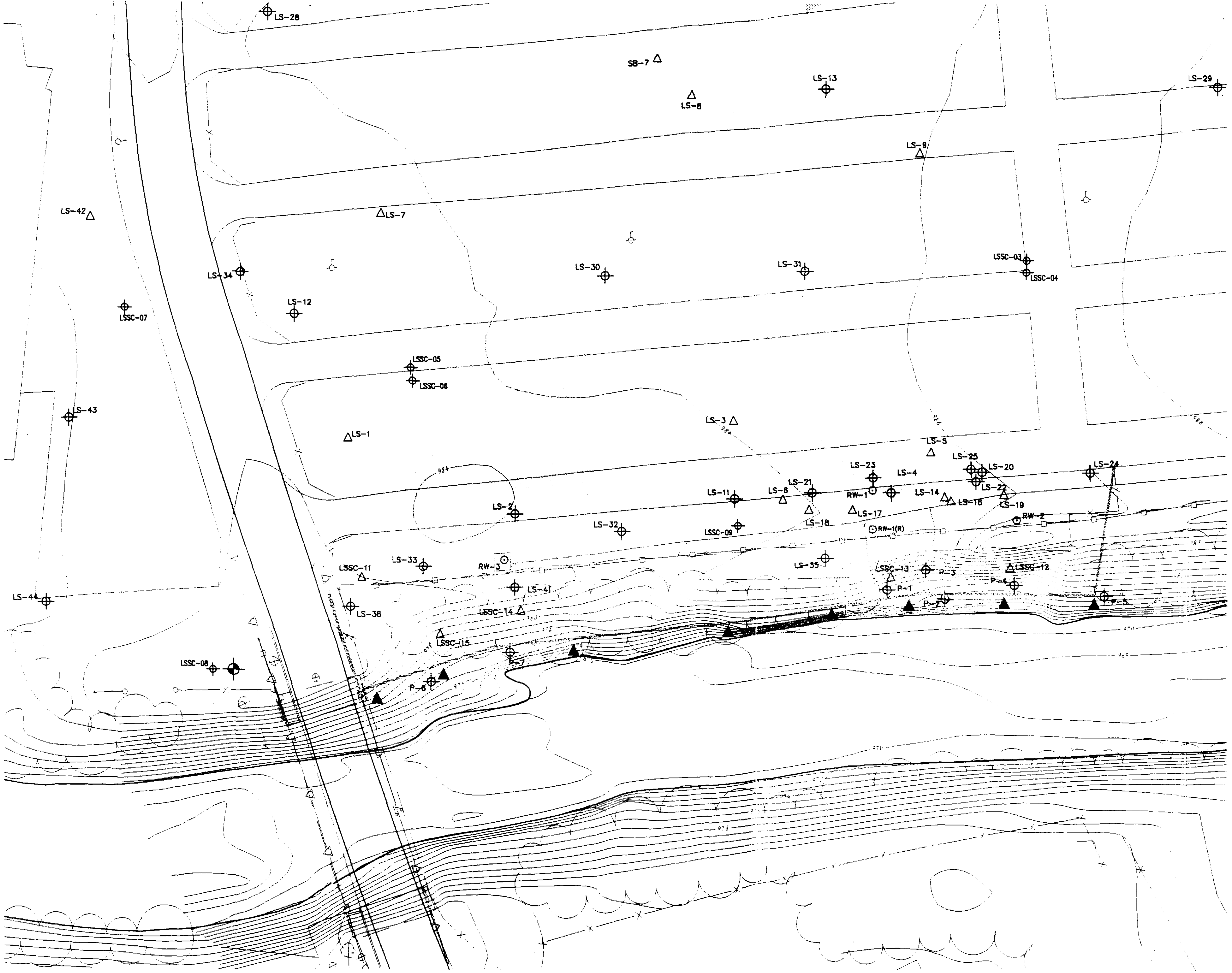
GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
LYMAN STREET PARKING LOT
SOURCE CONTROL INVESTIGATION

CROSS SECTION N-N'

BBL BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
6

L: ON=*, OFF=*REF
P: STD/PCP-BL
2/15/99 SYR-54-RCA
20140005\20140V06.DWG



LEGEND:

- PROPOSED CONTAINMENT BARRIER
- ▲ PROPOSED RIVER BANK SOIL BORING
- ⊕ PROPOSED MONITORING WELL
- EXISTING INDEX ELEVATION CONTOUR
- EXISTING INTERMEDIATE ELEVATION CONTOUR
- DECIDUOUS TREE
- CONIFEROUS TREE
- MANHOLE
- CHAIN LINK FENCE
- POLE (NON-UTILITY)
- POLE (OVERHEAD UTILITY)
- APPROXIMATE DELINEATION OF FORMER OXBOWS
- ⊕ ES2-1 EXISTING MONITORING WELL
- ⊙ RW-3 EXISTING PUMPING WELL
- △LS-1 EXISTING SOIL BORING

Original includes color coding.

NOTES:

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2. COORDINATE GRID BASED ON 1927 STATE PLANE COORDINATES.
3. ELEVATION DATUM REFERENCED TO NGVD 1929.
4. ALL SAMPLING LOCATIONS ARE APPROXIMATE.

0 20' 40'
GRAPHIC SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
LYMAN STREET PARKING LOT
SOURCE CONTROL INVESTIGATION

PROPOSED CONTAINMENT BARRIER AND SUPPLEMENTAL SAMPLING LOCATIONS

BBL BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
7

X: 20140X1A,20140X1B
L: ON=*, OFF=*REF*
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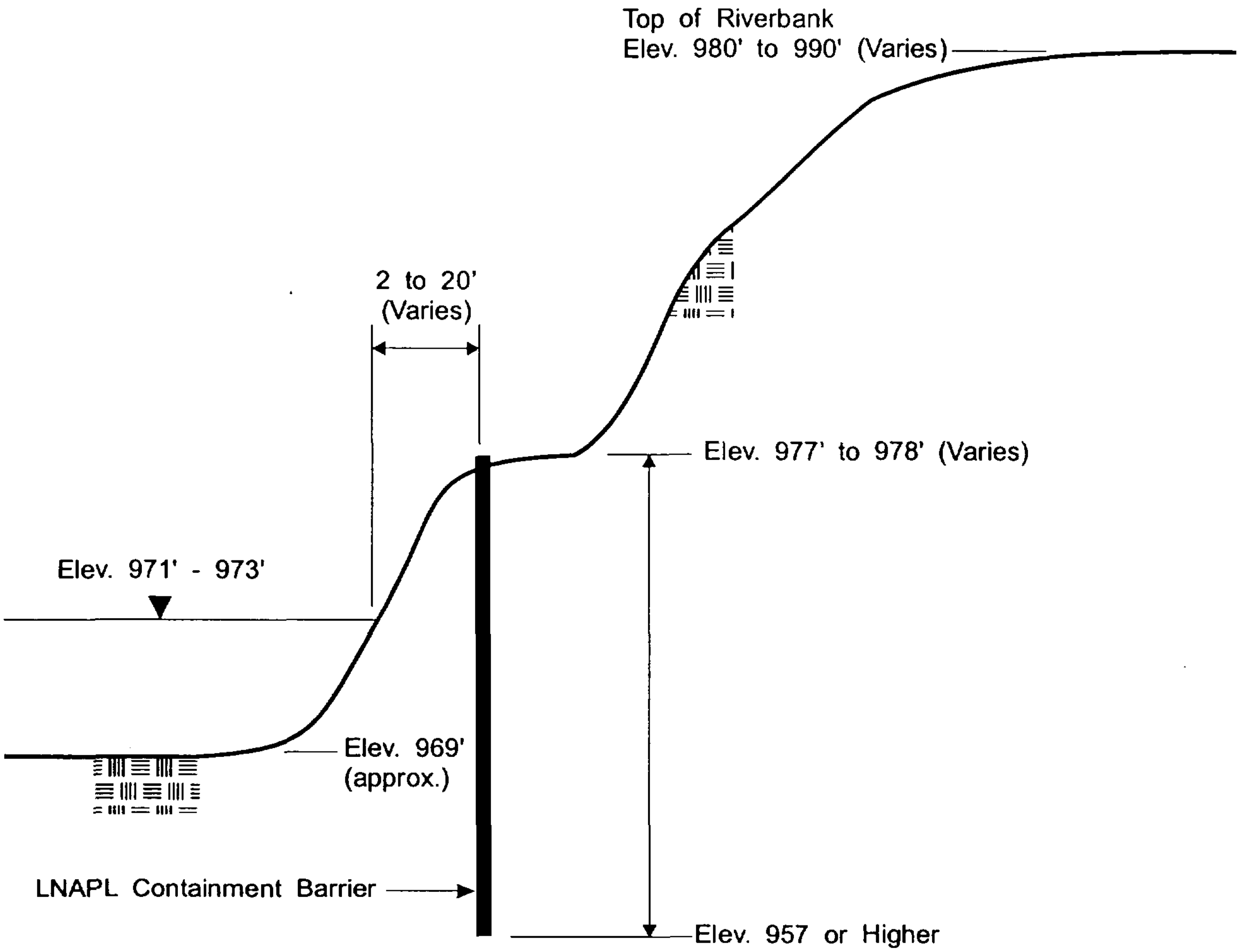

NOT-TO-SCALE

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
LYMAN STREET PARKING LOT
SOURCE CONTROL INVESTIGATIONS

CONTAINMENT BARRIER - CONCEPTUAL CROSS-SECTION

BBL BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
8

02/98 SYR-D54-DJH
20140005/20140g09.cdr

EPA Approval Letter Dated March 23, 1999 for GE's: Letter RE: Conceptual Containment Barrier Design for Lyman Street Site, General Electric Company, Pittsfield, MA DEP Site No. 1-8-56, USEPA Area 5A, February 16, 1999

United States Environmental Protection Agency
Region I
One Congress Street, Suite 1100
Boston, MA 02114-2023

March 23, 1999

Mr. Andrew T. Silfer, P.E.
General Electric Company
100 Woodlawn Avenue
Pittsfield, Massachusetts 01201

RE: Conditional Approval of GE's February 16, 1999 Submittal Titled *Conceptual Barrier Design for Lyman Street Site*

GE submitted the above-referenced report to EPA on February 16, 1999. On March 22, 1999, representatives of GE and EPA met to discuss the submittal. Based on a review of the submittal and on the discussions held during the March 22, 1999 meeting, EPA conditionally approves the above-referenced submittal subject to the following:

Technical Comments on Proposed Sheetpile Design

1. Based on the current information, EPA concurs with the lateral extent of the proposed sheetpiling and with the upper elevation of the sheetpiling being set at 977 to 978 feet above mean sea level. This determination may change based on the results of the sampling proposed by GE, as modified below, and additional information supplied by GE in the Detailed Barrier Design (e.g., the groundwater modeling).

2. The depth of embedment, the distance from the riverbank, and the lateral extent of the sheetpiling cannot be finalized until the additional investigative activities proposed by GE in Section V. of the submittal have been completed and the maximum depth of sediment excavation required pursuant to the *½-Mile Removal Action Work Plan* have been finalized.

Depth of Embedment

With regard to the depth of embedment of the proposed sheetpiling, EPA concurs that the sheetpile shall be installed into the till. The final depth of embedment shall be sufficient to support the required excavation of adjacent bank soils and sediments.

Distance Between the Proposed Sheetpiling and the Riverbank

Similarly, the distance of the sheetpiling from the riverbank cannot be finalized until the lateral and vertical extent of excavation of riverbank soils has been finalized. GE is required to excavate bank soils located between the sheetpiling and the river in areas where potentially mobile NAPL is present. If potentially mobile NAPL is present at the western edge of the proposed sheetpiling, GE may be required to excavate bank soils from the river's edge to the sheetpiling. Therefore, GE shall evaluate the appropriateness of installing the sheetpile closer to the Housatonic River.

Lateral Extent of Sheetpiling

The proposed lateral extent of the sheetpiling appears sufficient to prevent the migration of NAPL into the Housatonic River. The information collected as part of the additional investigative activities proposed by GE in Section V. shall be evaluated prior to finalizing the lateral extent of the proposed sheetpiling.

1. GE shall install a monitoring well screened at the water table approximately 15 feet east of the upstream edge of the proposed sheetpiling. This well, and well proposed to be installed near LSSC-8 shall be monitored to ensure that NAPL is not migrating beyond the sheetpile and into the Housatonic River.

2. GE shall provide an equivalent level of detail with regard to supporting calculations. groundwater modeling, and technical specifications as was provided in GE submittals for the final containment barrier design at East Street Area 2.

3. The sheetpile is proposed to extend five feet into the till. To support adjacent bank soil and sediment excavation, the sheetpile may need to be driven deeper into the till. Therefore, GE shall ensure that the final design addresses potential buckling of the sheetpile during installation.

Near Term Activities/Additional Sampling

1. GE shall survey the vertical and horizontal location of the sampling points.
2. GE shall collect soil samples beginning at a depth of two feet below ground surface for the bank soil unless the water table is within the top two feet. If the water table is encountered in the top two feet, GE shall collect samples beginning at the water table.
3. GE shall collect samples as close to the river's edge as possible, with the objective being to collect samples down to elevation 965.
4. GE shall analyze all samples, regardless of the visual observation of the samples (e.g., staining, sheens), for PCBs and TPHs.
5. GE shall perform a shake test for NAPL on all samples.
6. An additional objective of the sampling shall be to determine if DNAPL is present at the top of silt/till at the river/riverbank interface.
8. GE shall add two additional sample locations, one between P-2 and P-4 and one approximately 30 feet east of P-5. Also, GE shall relocate two of the samples as shown on a revised Figure 7 (see attached).

Additional Work

If GE's proposed sampling, as modified in this approval letter, indicate the extent of NAPL is not fully characterized along this bank, then EPA may require additional investigative activities.

Schedule

GE shall install the proposed monitoring well adjacent to LSSC-8, conduct the supplemental bank soil sampling and provide a report summarizing the results of the additional sampling to EPA for approval by April 26, 1999. This report shall include a sample location map, the sample depth, the sample elevation in feet above mean sea level, visual observations of the sample (including soil classifications), results of the shake test, and a summary of the PCB and TPH results. In the April 26, 1999 submittal, GE shall propose a due date for the detailed design of the containment barrier.

If you have any questions, please contact me at (617) 918-1282

Sincerely,

Dean Tagliaferro

Dean Tagliaferro
On-Scene Coordinator

cc: John Ciampa, GE
Lyn Cutler, MA DEP
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Joel Lindsay, Roy F. Weston
John Kullberg, USACE
Margaret Meehan, EPA
Anton Giedt, NOAA
Dale Young, MA EOEA
Tom O'Brien, MA EOEA
Mayor Doyle, City of Pittsfield
Pittsfield Conservation Commission
Pittsfield City Council, c/o Tom Hickey
Site File

Letter RE: Conditional Approval of Supplemental Source Control Containment/Recovery Measures East Street Area 2, General Electric Company, Pittsfield, MA DEP Site No. 1-0146, USEPA Area 4,

March 1, 1999

Corporate Environmental Programs
General Electric Company
100 Woodlawn Avenue, Pittsfield, MA 01201

Transmitted Via Federal Express

March 1, 1999

Bryan Olson
Dean Tagliaferro
Site Evaluation and Response Section (HBR)
U.S. Environmental Protection Agency
One Congress Street
Boston, MA 02203-2211

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Department of Environmental Protection
436 Dwight Street
Springfield, MA 01103

Re: **Conditional Approval of Supplemental Source Control Containment/Recovery Measures East Street Area 2, General Electric Company, Pittsfield, Massachusetts DEP Site No. 1-0146, USEPA Area 4**

Dear Messrs. Olson, Tagliaferro, and Weinberg:

I. INTRODUCTION

The General Electric Company (GE) has received the United States Environmental Protection Agency's (USEPA's) February 11, 1999 conditional approval letter concerning GE's *Proposal for Supplemental Source Control Containment/Recovery Measures* (Supplemental Source Control Proposal, Blasland, Bouck & Lee, Inc, January 1999). In that letter, the USEPA provided several comments, questions and requests for additional information concerning the January 1999 proposal. This letter provides GE's responses to those items in a format that is generally consistent with the topics identified in the USEPA's conditional approval letter. Where necessary, additional, more detailed information is provided as attachments to this letter.

II. PERFORMANCE STANDARDS AND REVISED MONITORING PROCEDURES

In its February 11, 1999 conditional approval letter, the USEPA requested that GE propose Performance Standards and revised monitoring procedures pertaining to the proposed containment/recovery measures. The USEPA stated that the Performance Standards for the proposed containment barrier should fulfill the objectives of achieving no discharge of LNAPL or residual LNAPL to the Housatonic River, no sheens on the River, no bank seeps, and no measurable LNAPL in the perimeter monitoring wells located outside the proposed sheetpiling. The USEPA also stated that the revised monitoring procedures to determine compliance with the Performance Standards should include a number of specified procedures.

In response to the USEPA's letter, GE proposes the Performance Standards listed below for the containment barrier to achieve the objectives identified by the USEPA. It should be noted that, although the objectives specified by the USEPA were not specifically identified as Performance Standards in the Supplemental

Source Control Proposal, they were considered as design criteria for the proposed containment barrier. The Performance Standards proposed by GE for the sheetpile barrier are as follows (with the activities designed to achieve each standard presented in parentheses):

1. Prevention, to the extent practical, of detectable discharges of LNAPL to the Housatonic River in the area of the proposed containment barrier (to be accomplished by the continued operation of the ongoing active LNAPL recovery systems and the installation of supplemental control measures -- i.e., a sheetpile containment barrier);

2. Prevention, to the extent practical, of bank seeps, as well as sheens to the Housatonic River in this area resulting from either bank seeps or residual LNAPL in soils/sediments located on the riverside of the proposed containment barrier (to be accomplished through the removal of soils/sediments along the river's edge that may contain historic residual LNAPL); and

3. Prevention of any measurable LNAPL migration around the ends of the containment barrier (to be accomplished by the continued operation of the ongoing active LNAPL recovery systems and the installation of additional perimeter monitoring wells).

GE proposes the following measurement and monitoring activities to demonstrate that the proposed Performance Standards listed above have been achieved:

1. Install two monitoring wells at the east and west ends of the proposed containment barrier, respectively, to detect any potential LNAPL migration around the ends of the barrier (refer to Figure 1);

2. Conduct weekly monitoring activities at the two wells proposed above to collect water level information and assess whether any LNAPL is present;

3. Conduct weekly visual inspections of the Housatonic River in the area of the sheetpile, as well as the bank area located between the sheetpile and Housatonic River, to assess the potential presence of bank seeps or sheens on the Housatonic River; and

4. Incorporate the monitoring activities in Items 2 and 3 above, as well as monitoring of relevant source control investigation monitoring wells, into the comprehensive monitoring program described in Section 3.4 of the Supplemental Source Control Proposal. This monitoring plan will begin following installation of the proposed monitoring wells and sheetpile barrier. However, the Performance

Standards will not become effective until after completion of the activities outlined in the *Removal Action Work Plan - Upper ½-Mile Reach of the Housatonic River* (½-Mile Removal Action Work Plan). This groundwater monitoring will be incorporated into the ongoing riverbank monitoring program, which includes wells 53, 54, 64X-N, 64X-S, 64X-W, RW-1 (X), RW-2 (X), PZ-1S, PZ-2S, PZ-4S, PZ-5S, PZ-6S, RB-1, WP-1 through WP-6, and WP-13. If any of these wells are damaged/destroyed by the work activities in this area, they will be replaced. Additionally, GE proposes to add weekly monitoring for potential LNAPL at wells E2SC-13, 14, and 16, which were recently installed as part of the source control investigation.

As noted above, the Performance Standards will not become effective until the proposed riverbank/sediment excavations outlined in the ½-Mile Removal Action Work Plan have been completed. If, after that time, the Performance Standards are not met, GE will propose corrective measures and implement such measures upon USEPA approval.

III. DESCRIPTION OF SUPPLEMENTAL LNAPL CONTROL MEASURES

In its February 11, 1999 conditional approval letter, the USEPA approved the proposed containment barrier subject to several conditions, and requested clarification of several calculations used in designing the proposed sheetpile. Additionally, USEPA requested clarification of the maximum excavation depth of bank soils located between the sheetpile and river. GE's responses to these requests are presented below.

Since the Supplemental Source Control Proposal was provided to the USEPA, GE has further evaluated the technical design of the proposed containment barrier and has conducted additional soil and sediment investigations in the vicinity of the proposed barrier. Based on these activities, the following information is provided:

1) The analytical data collected during the additional bank soil and near-bank sediment sampling efforts recently conducted (as proposed in GE's January 29, 1999 *Proposal for Further Investigation Pursuant to Supplemental Source Control Containment/Recovery Measures*) indicate that excavation of bank soils to a maximum depth corresponding to elevation 967.5 feet will likely achieve the Performance Standards presented above in Section II. These investigations included the installation of eight riverbank soil borings along the area between the river and the proposed containment barrier. Samples were collected in 1-foot intervals to depths of 7 to 8 feet below the surface. These samples were submitted for laboratory analysis of PCBs and Total Petroleum Hydrocarbons (TPH). Additionally, field screening tests were performed consisting of soil screening with a photoionization detector (PID),

shake testing, and visual observations. Select samples were also submitted to the laboratory for analysis using the Toxicity Characteristic Leaching Procedure (TCLP), to support disposal decisions for soil which may need to be removed along the base of the bank prior to sheetpile installation. The locations of these borings are illustrated on Figure 2. The results of the analyses are presented collectively in Tables 1 and 2 and on Figure 3. Additionally, sediment sampling was performed at locations adjacent to these boring locations (plus one additional location). These samples were collected from depths ranging up to 4 feet. However, at the majority of the locations, samples could not be collected below a depth of 1 foot because of sampling refusal. These samples were screened in the field and submitted for laboratory analysis as described above for the riverbank soil samples (except for TCLP analysis). The results of these analyses are also presented in Table 1, and the locations are illustrated on Figure 2.

The results of these supplemental investigations indicate that the concentrations of PCBs and TPH in riverbank soils are generally highest in the elevation range associated with the typical groundwater table (971 to 972 feet). PCBs and TPH concentrations below 967.5 feet are at low concentrations or non-detectable. Field screening evaluation by shake testing and visual observation of the soil samples from these borings produced inconclusive results. In many instances, the visual observations and shake tests do not correlate well with the TPH and PCB analytical results. Furthermore, staining/sheens were indicated on a number of soil cores along the eastern section of the proposed containment barrier (i.e., sample locations SL0028, SL0404, and SL0007) in areas where bank seeps or separate phase LNAPL have not been observed. Some of the sheens and staining in this area may be associated with coal gas manufacturing by-products, since cinders have been observed along the riverbank and in borings located in this area. Polycyclic aromatic hydrocarbons (PAHs) have also been detected in previously collected soil samples in this vicinity (e.g., boring E2SC-16 and riverbank soil sample SL0009-T05).

Based primarily on the PCB and TPH analytical results, it appears that a maximum excavation depth to an elevation 967.5 feet may be warranted for the majority of the bank adjacent to the riverside of the proposed containment barrier. However, in the area of sediment sample SL0404, excavation to a depth of 2.5 feet is proposed in the ½-Mile Removal Action Work Plan. The recent sediment sampling at this location indicates that the river bed surface topography to be at an elevation of 969.3 feet. Removal of 2.5 feet of sediment in this area would require excavation to an elevation of approximately 966.5 feet.

As explained below in the responses to the other USEPA technical questions, excavation to these elevations (966.5 feet in the area of sample location SL0404 and 967.5 for the remaining areas) can be completed and would be supported by the proposed sheetpile wall. If site conditions arise that cause the current design of the sheetpile to be less than sufficient to allow excavation, GE will augment the design (through tiebacks, bracing or other controls) to ensure that excavation activities may take place to the necessary depths. The actual limits and depths of excavation of bank soils and sediments in this area will be evaluated and presented in the next phase of design-documentation related to the ½-Mile Removal Action Work Plan.

2) The containment barrier design calculations submitted in the Supplemental Source Control Proposal have been reviewed and revised considering the USEPA comments regarding the interface friction between the silty sand and the sheet piling. The results of this review/revision are presented below in summary form, and the revised calculations are included in Attachment 1.

After reviewing the EPA's comments, our technical consultant, Blasland, Bouck & Lee, Inc. (BBL), believes that an average N value of 10, corresponding to an angle of internal friction (ϕ) of 30°, is a conservative value for design since the results of the Standard Penetration Test (SPT) for fine sands below the water table may, in general, not be representative of the actual material. According to Peck, Hanson and Thornburn (1974)[1]:

> "By far the most common error in connection with the standard penetration test in sand or silt occurs, however, when drilling is being done below the water table. If the water level in the drill hole is allowed to drop below groundwater level, as may easily occur, for instance, when the drill rods are removed rapidly, an upward hydraulic gradient is created in the sand beneath the drill hole. Consequently, the sand may become quick and its relative density may be greatly reduced. The N-value will accordingly be much lower than that corresponding to the relative density of the undisturbed sand."

In the opinion of our technical consultant, BBL, the lower N values for boring E2SC-031 (referenced by USEPA) reflect this phenomenon and are not considered to be representative of the actual in situ conditions. Since this effect tends to be less for medium to coarse sands, the N values for the other borings were not affected as much. Therefore, based on this information and the results in other borings, BBL considers a friction angle of 30° to be a conservative strength estimate for the material.

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[1] Peck, R. B., W. E. Hanson, and T. H. Thornburn (1974) *Foundation Engineering*. John Wiley & Sons, Inc. New York, New York pp. 514.

The USEPA also expressed a concern about the higher N values in boring E2SC-03I. The elevation where the higher N-values were encountered are at, or above, the elevation at which driving will commence. If shallow debris is encountered that could cause damage to the sheetpile, it will have to be removed as part of pre-driving operations.

3) The containment barrier design calculations have been re-evaluated to consider the other USEPA comments, the recently collected bank soil/sediment data, removal depths proposed in the ½ -Mile Removal Action Work Plan, and changes in horizontal placement of the containment barrier to allow for a 1:1 slope as part of final restoration activities. The revised calculations are presented in Attachment 1. Figure 1 illustrates the revised layout of the proposed containment barrier, and a discussion of the 1:1 slope evaluation is presented in Section VI.

As a result of the re-evaluation of the design calculations, it has been determined that the previous design depth for the bottom of the containment barrier (i.e., 20 feet) should generally be extended 5 feet (for an overall depth of 25) to provide a reasonable degree of safety. Additionally, in a limited area adjacent to the proposed 2.5 foot removal area near sediment sample location SL0404, the sheetpile should extend 3 feet deeper (to a depth of 28 feet). The factor of safety for the permanent condition, i.e., after the sheeting is installed and the ½ -Mile Removal Action activities are completed, is greater than 2.0. For the temporary condition, i.e., when sediments/banksoils are excavated to maximum depths corresponding to elevations of 966.5 to 967.5 feet, the factor of safety is at least 1.25. Figure 4 illustrates a revised containment barrier profile.

IV. EROSION CONTROL MEASURES

As part of its February 11, 1999 conditional approval letter, the USEPA requested the implementation of various erosion control measures in the vicinity of the proposed sheetpile containment barrier. These measures will be performed during installation of the sheetpile barrier and will continue until the area is fully restored upon completion of the ½-Mile Removal Action activities.

Consistent with the USEPA's comments, GE proposes that erosion control matting, geotextiles, and/or straw mulch be used as appropriate to temporarily protect disturbed soils from erosion. GE will install erosion control matting and/or geotextile on exposed soils at the toe of the bank to be able to withstand river flow velocities of at least 10 feet/sec. The existing absorbent booms along the riverbank will also be extended and maintained. GE will inspect the erosion control measures and booms every working day during construction and weekly during the interim period between completion of the sheetpile containment barrier and completion of the work outlined in the ½-Mile Removal Action Work Plan.

V. SHEETPILE TOP PROTECTION

As part of its February 11, 1999 conditional approval letter, the USEPA requested protection of the sheetpile joints until they are grouted to prevent introduction of debris into the joints. GE concurs with this comment, and will implement measures to protect the joints such as installation of end caps or utilization of high strength tape sealants.

VI. SITE RESTORATION

As part of its February 11, 1999 conditional approval letter, the USEPA had several comments concerning site restoration activities. Specifically, these comments can be summarized as follows:

1) USEPA requested consideration by GE of the installation of a "heavy-duty woven geotextile or geogrid" beneath the proposed riprap.

2) USEPA requested the addition of two notes on Sheet 4 in Appendix D (summarized as):

> "The top of the sheetpile wall will be covered with riprap at the completion of the work."
>
> "The riprap toe protection will be well graded, composed of angular stones and will be smooth and uniform in appearance. Oversize stones will be rejected, as well as riprap which contains an objectionable amount of fines."

3) USEPA requested the inclusion into the ½ -Mile Removal Action Work Plan of mitigation measures for the permanent loss of bank habitat and stream cover resulting from the proposed bank soil removal.

GE responds to these three items as follows:

1) During the site restoration, GE will implement the USEPA suggestion concerning the installation of either a heavy-duty woven geotextile or geogrid beneath the riprap.

2) GE will incorporate notes to Sheet 4 similar to those suggested by USEPA. A revised Sheet 4 is presented in Attachment 2.

3) Section 9.2 of the ½-Mile Removal Action Work Plan includes mitigation measures pertaining to restoration of areas where bank excavations will occur. The riprap backfill planned as part of the proposed sheetpile containment barrier will not result in significant loss of bank or river bed habitats. Riprap will be utilized in an approximate 5- to 6-foot wide strip along the toe of the bank. It will be placed on a slope extending from approximately the top of the sheeting to the edge of the river. The work planned in this area will result only in a temporary absence of bank habitat. GE will evaluate the need for additional restoration activities along this narrow rip-rap strip in the final ½-Mile Removal Action Work Plan.

In addition to responding to the USEPA's above-listed comments relating to site restoration, and as mentioned in Section III above, GE's technical consultant, BBL, has evaluated restoration conditions associated with a 1:1 slope along the riverside of the proposed sheetpile wall. Specifically, the evaluation was conducted to ascertain: 1) the location of the sheetpile wall necessary to result in an approximate 1:1 slope between the top of the wall (i.e., elevation of 977 feet) and the edge of the Housatonic River (i.e., assumed at an average elevation of 972 feet); and 2) the potential change in flood storage volume resulting from the proposed activities, incorporating the re-alignment of the sheetpile to achieve a 1:1 slope.

Figure 1 depicts the proposed re-alignment of the sheetpile wall necessary to fulfill the criteria in Item 1 in the preceding paragraph. This re-alignment was generated by assuming that bank soil removal could extend horizontally to the edge of the river. Placement of a 1:1 slope will require a width of 5.0 feet between the sheetpiling and the river edge to avoid encroachment on the river channel. This guideline results in the sheetpiling re-alignment shown on Figure 1. Note that, in certain areas, the sheetpile top elevation 977 feet is now below existing grade (generally near upstream wing wall). Hence, the height of the sheetpile top in these areas will be adjusted to allow for the re-alignment on Figure 1.

Figures 5 and 6 present two illustrative cross sections of the proposed sheetpile and bank restoration. Figure 1 also depicts these cross section locations along the sheetpile. The cross sections represent approximate typical sections for calculating changes of flood storage capacity (discussed below) due to the removal of bank soil associated with sheetpile installation and restoration of the lower portion of the bank with rip-rap at a 1:1 slope.

Several assumptions have been made in assessing the changes in flood storage capacity due to this project: 1) both existing soil and riprap backfill were assumed to have similar porosities; 2) permeability differences between soil and riprap were ignored; 3) riprap will constitute the entire fill volume (i.e., a triangular solid with a length of 388 feet, height of 5.0 feet, and base of 5.0 feet); and 4) the assessment of the change in flood storage capacity ignores changes that may result from work in the first ½ -mile of the Housatonic River stream bed.

If it is assumed that the porosities and permeabilities of the existing soil and riprap backfill are both similar and inconsequential, assessing the change in flood storage capacity is reduced to a comparison of material present prior to, and following, removal and restoration operations.

The volume of the existing soil located between the sheetpile wall and the river is estimated at 116 cy. The volume of the riprap backfill is 205 cy. The resultant change in flood storage capacity is a loss of approximately 89 cy.

Figures 5 and 6 depict two cross sections typical of the changes in grade at locations along the proposed sheetpile wall. Changes in flood storage per total volume, per foot of elevation, are also presented in tabulated format for each cross section.

Preliminary flood storage capacity calculations related to site restoration at the Building 68 Area located just downstream, indicates a reserve volume of flood storage capacity from that project which is generally of the same order of magnitude needed for the 1:1 slope re-alignment for the proposed sheetpile wall. The results of the preliminary Building 68 Area flood storage capacity calculations were presented in the Notice of Intent for General Electric Company, Newell Street Parking Lot Pump Station, dated December 17, 1998 (Newell Street NOI). In that document, it was indicated that a reserve flood capacity of 74 cy existed as a result of the Building 68 Area activities. It was further explained that approximately 19 cy of the 74 cy were needed to compensate for the Newell Street Parking Lot Pump Station. This would result in a net reserve capacity of approximately 55 cy. However, the preliminary calculations performed for the Building 68 Area were based on estimates made utilizing riverbank topography which was only partially surveyed. Final survey data has been recently obtained which indicates that the actual reserve flood storage capacity will be greater than the preliminary calculation of 74 cy. BBL is currently in the process of incorporating this new data and revising the calculations. When the sheetpile wall is installed, GE will provide a final evaluation of the resulting change in flood storage capacity. If the increase of material along the sheetpile barrier cannot be offset by the reserve capacity from the Building 68 Area, GE will propose a means to offset this increase.

In addition to these analyses, we are including as Attachment 3 an evaluation of the potential impacts of the proposed project on areas subject to the Massachusetts Wetlands Protection Act (310 CMR 10.00), together with a description of the proposed temporary mitigation (e.g., erosion control) measures and permanent site restoration measures designed to mitigate or minimize such impacts. Although approval from the Pittsfield Conservation Commission is not necessary to implement this project (since the project is an onsite removal action under the Comprehensive Environmental Response, Compensation, and Liability Act), this Attachment is provided to address the substantive requirements of the Massachusetts Wetlands Protection Act.

VII. FURTHER EVALUATION OF DNAPL

As part of its February 11, 1999 conditional approval letter, the USEPA requested that GE conduct additional DNAPL characterization activities south of the Housatonic River in the vicinity of the proposed containment barrier. Specifically, the USEPA suggested the drilling of three soil borings (rather than the proposed single boring) along the southern bank to evaluate the potential presence of DNAPL and determine the top of till elevation.

In response, GE proposes to install three soil borings along the south bank of the Housatonic River at the locations shown on Figure 1. These borings will be installed and sampled in a manner consistent with the previous source control investigation borings installed at the East Street Area 2 site. These borings have been located in a potential "trough" area in the till surface as indicated by the geophysical data presented in the Source Control Report.

The USEPA also requested in the conditional approval letter that GE include in the forthcoming *DNAPL Recovery Evaluation and Report* performance standards and measurement methods concerning DNAPL in the East Street Area 2 site. GE will do so, and anticipates submission of that report within approximately six weeks of completing the three new borings at the Hibbard Playground. (It should be noted that GE has not yet received access from the City of Pittsfield to install these borings.)

VIII. WEST HEADWALL

As part of its February 11, 1999 conditional approval letter, the USEPA presented several comments concerning the proposed configuration of the sheetpile wall in the vicinity of the west headwall as presented on Sheet 5 of Appendix D of the Supplemental Source Control Proposal. In general, these comments relate to the integration of the sheetpile wall with the headwall without resulting in permanently exposed sheetpiles along this portion of the river.

In response to these comments, the alignment of the sheetpile wall in the vicinity of the west headwall has been modified to address the USEPA's comments. The modified connection details are shown on Figure 1 and in Attachment 4. Specifically, the sheetpile wall alignment has been changed such that it will extend out flush with the front face of the west headwall, with the use of "L" sections on either side of the headwall. To accomplish this, longer sheets will be used in this area so that the driving hammer will not be obstructed by the existing headwall. The sheets will then be cut flush with the top of the headwall once they have been driven to the desired depth. A new concrete headwall will be constructed on the face of the sheetpile such that the sheetpile will not be exposed. Geotextile and riprap will be placed at the excavated toe of the bank slope as a measure of erosion protection until such time that final excavation and restoration activities are conducted as part of the ½-Mile Removal Action Work Plan activities.

IX. FURTHER INVESTIGATIONS PURSUANT TO SUPPLEMENTAL SOURCE CONTROL CONTAINMENT/RECOVERY MEASURES

The USEPA's February 11, 1999 conditional approval letter presented several conditions to be applied to the work proposed by GE in a letter dated January 29, 1999. GE's January 29, 1999 letter proposed additional bank soil and sediment sampling activities in the area of the sheetpile wall at East Street Area 2 in order to obtain additional descriptive and analytical data of the riverbank and near-bank soils and sediments.

The USEPA's conditions are summarized as follows:

1) GE will survey each sampling location in the horizontal and vertical planes;

2) GE will collect samples from each location to the limits of the approved sampling equipment (i.e. refusal);

3) All samples collected will be analyzed for PCBs and TPH;

4) Shake tests will be performed on all samples;

5) Efforts will be made to collect bank samples to elevation 967;

6) Sampling intervals for bank locations will begin at the water table or at two feet below grade, whichever horizon is encountered first; and

7) Samples will be analyzed within 5 days of receipt by the laboratory.

GE conducted these sampling efforts on February 8, 9 and 10, 1999 (with USEPA Contractor oversight) in accordance with the conditions listed above. The data obtained during this sampling effort have been used to support discussions presented in Section III above, as further summarized in Tables 1 and 2 and on Figure 3. It should be noted (as indicated above in Section III) that sediment sampling refusal occurred at a depth of 1 foot at the majority of the sampling locations.

X. REVISED SCHEDULE

In their conditional approval letter, the USEPA requested a revised construction schedule. This schedule is presented in Figure 7, GE will contact USEPA shortly to discuss the timing of the proposed sheetpile installation relative to implementation of the work activities proposed in the ½-Mile Removal Action Work Plan.

If you have any questions on this information, feel free to contact me at (413) 494-3952.

Yours truly,

John D Ciampa (ple)

John D. Ciampa
Remediation Project Manager
U:\PLH99\20591543.WPD

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Mayor G.S. Doyle
State Representative C.J. Hodgkins
State Representative S.P. Kelly
State Representative P.J. Larkin
State Senator A.F. Nuciforo
A. Thomas, GE*
J. Gardner, GE
J. Magee, GE
A. Silfer, GE*
J. Nuss, P.E., LSP, BBL*
Pittsfield Health Department*
Pittsfield Conservation Commission*
Housatonic River Initiative
Public Information Repositories ECL I-P-IV(A)(1)* & (2)

(* with tables, figures, and attachments)

Tables

TABLE 1

GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS
SOURCE CONTROL MEASURES FOR EAST STREET AREA 2 / USEPA AREA 4

SUMMARY OF SEDIMENT AND RIVERBANK SOIL DATA - FEBRUARY 1999

Sample Identification	Depth	Elevation Interval (Feet AMSL)	Date Collected	Analytical Results (ppm)		Field Observations/Testing		
				Total PCBs	TPH	PID Reading (Instrument Units)	Stain / Sheen Observed on Soil Core	Shake Test Results
Riverbank Soil								
SL0007-BNK(0-1')	0-1'	974.7 - 973.7	02/10/99	N/A	N/A	8.3	no	negative
SL0007-BNK(1-2')	1-2'	973.7 - 972.7	02/10/99	N/A	N/A	10.2	no	negative
SL0007-BNK(2-3')	2-3'	972.7 - 971.7	02/10/99	26.6	450	40.2	yes	trace oily residue
SL0007-BNK(3-4')	3-4'	971.7 - 970.7	02/10/99	0.301	240	23.7	yes	trace oily residue
SL0007-BNK(4-5')	4-5'	970.7 - 969.7	02/10/99	ND (0.057)	600	35.5	yes	oily residue
SL0007-BNK(5-6')	5-6'	969.7 - 968.7	02/10/99	ND (0.064)	560	41.5	yes	oily residue
SL0007-BNK(6-7')	6-7'	968.7 - 967.7	02/10/99	ND (0.062)	700	35.7	yes	oily residue, trace sheen
SL0007-BNK(7-8')	7-8'	967.7 - 966.7	02/10/99	0.118	260	21.3	yes	trace oily residue
SL0404-BNK(0-1')	0-1'	976.6 - 975.6	02/10/99	N/A	N/A	4.3	no	negative
SL0404-BNK(1-2')	1-2'	975.6 - 974.6	02/10/99	N/A	N/A	7.6	no	negative
SL0404-BNK(2-3')	2-3'	974.6 - 973.6	02/10/99	3.51	ND (100)	4.6	no	negative
SL0404-BNK(3-4')	3-4'	973.6 - 972.6	02/10/99	20	140	5.6	no	negative
SL0404-BNK(4-5')	4-5'	972.6 - 971.6	02/10/99	187	730	12.5	yes (4.8-5.0' only)	trace oily residue
SL0404-BNK(5-6')	5-6'	971.6 - 970.6	02/10/99	725	2,900	18.3	yes	sheen
SL0404-BNK(6-7')	6-7'	970.6 - 969.6	02/10/99	84.6	4,100	27.3	yes	sheen
SL0404-BNK(7-8')	7-8'	969.6 - 968.6	02/10/99	57.7	610	29.8	yes (7-7.8' only)	oily residue
SL0028-BNK(0-1')	0-1'	973.5 - 972.5	02/10/99	N/A	N/A	9.7	no	negative
SL0028-BNK(1-2')	1-2'	972.5 - 971.5	02/10/99	1.59 [4.91]	ND(120) [ND(100)]	8.1	no	negative
SL0028-BNK(2-3')	2-3'	971.5 - 970.5	02/10/99	5.61	180	7.3	no	trace oil
SL0028-BNK(3-4')	3-4'	970.5 - 969.5	02/10/99	23.5	2,000	28.6	no	oily residue
SL0028-BNK(4-5')	4-5'	969.5 - 968.5	02/10/99	7.82	1,600	41.2	yes	oily residue
SL0028-BNK(5-6')	5-6'	968.5 - 967.5	02/10/99	59.2	1,800	81.7	yes	oily residue
SL0028-BNK(6-7')	6-7'	967.5 - 966.5	02/10/99	4.26	100	25	yes (6-6.5' only)	trace oil
SL0028-BNK(7-8')	7-8'	966.5 - 965.5	02/10/99	0.401	ND (100)	17	no	negative
SL0401-BNK(0-1')	0-1'	974.9 - 973.9	02/08/99	1.91	ND (110)	3.7	no	negative
SL0401-BNK(1-2')	1-2'	973.9 - 972.9	02/09/99	37.4	2,700	9.2	no	negative
SL0401-BNK(2-3')	2-3'	972.9 - 971.9	02/09/99	94.6	4,200	17.6	no	negative
SL0401-BNK(3-4')	3-4'	971.9 - 970.9	02/09/99	21.8	1,600	24	no	oily residue
SL0401-BNK(4-5')	4-5'	970.9 - 969.9	02/09/99	39.9 [13.1]	3,100 [970]	34.7	yes	oily residue
SL0401-BNK(5-6')	5-6'	969.9 - 968.9	02/09/99	20	910	27	yes	sheen
SL0401-BNK(6-7')	6-7'	968.9 - 967.9	02/09/99	1.19	ND (100)	19.7	yes	oily residue
SL0401-BNK(7-8')	7-8'	967.9 - 966.9	02/09/99	0.392	ND (100)	11.2	no	negative

See notes on page 3.

TABLE 1

GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS
SOURCE CONTROL MEASURES FOR EAST STREET AREA 2 / USEPA AREA 4

SUMMARY OF SEDIMENT AND RIVERBANK SOIL DATA - FEBRUARY 1999

Sample Identification	Depth	Elevation Interval (Feet AMSL)	Date Collected	Analytical Results (ppm)		Field Observations/Testing		
				Total PCBs	TPH	PID Reading (Instrument Units)	Stain / Sheen Observed on Soil Core	Shake Test Results
Riverbank Soil (cont.)								
SL0041-BNK(0-1')	0-1'	973.2 - 972.2	02/09/99	N/A	N/A	24.7	no	negative
SL0041-BNK(1-2')	1-2'	972.2 - 971.2	02/09/99	477	46,000	38.0	yes	negative
SL0041-BNK(2-3')	2-3'	971.2 - 970.2	02/09/99	53.5	5,700	31.8	yes	oily residue
SL0041-BNK(3-4')	3-4'	970.2 - 969.2	02/09/99	157	3,100	30.4	yes	sheen
SL0041-BNK(4-5')	4-5'	969.2 - 968.2	02/09/99	16.1	430	29.9	yes	oily residue
SL0041-BNK(5-6')	5-6'	968.2 - 967.2	02/09/99	0.773	ND (100)	18.6	yes	oily residue
SL0041-BNK(6-7')	6-7'	967.2 - 966.2	02/09/99	0.272	ND (100)	10.7	yes	oily residue
SL0041-BNK(7-8')	7-8'	966.2 - 965.2	02/09/99	ND (0.052)	ND (100)	8.5	yes (7-7.8' only)	trace sheen
SL0398-BNK(0-1')	0-1'	974.9 - 973.9	02/09/99	N/A	N/A	6.9	no	negative
SL0398-BNK(1-2')	1-2'	973.9 - 972.9	02/09/99	N/A	N/A	4.6	no	negative
SL0398-BNK(2-3')	2-3'	972.9 - 971.9	02/09/99	386	4,300	4.0	no	negative
SL0398-BNK(3-4')	3-4'	971.9 - 970.9	02/09/99	88.3	3,400	32.0	yes	trace oily residue
SL0398-BNK(4-5')	4-5'	970.9 - 969.9	02/09/99	20.9	1,800	38.7	yes	trace sheen
SL0398-BNK(5-6')	5-6'	969.9 - 968.9	02/09/99	12.5	900	36.3	yes	trace sheen
SL0398-BNK(6-7')	6-7'	968.9 - 967.9	02/09/99	2.06	170	22.4	yes (6-6.5' only)	trace oily residue
SL0398-BNK(7-8')	7-8'	967.9 - 966.9	02/09/99	0.715	ND (100)	9.7	no	negative
SL0031-BNK(0-1')	0-1'	973.1 - 972.1	02/09/99	N/A	N/A	6.5	no	negative
SL0031-BNK(1-2')	1-2'	972.1 - 971.1	02/09/99	N/A	N/A	8.0	no	negative
SL0031-BNK(2-3')	2-3'	971.1 - 970.1	02/09/99	189	8,900	31.0	yes (2-2.5' only)	negative
SL0031-BNK(3-4')	3-4'	970.1 - 969.1	02/09/99	8.72	580	27.7	no	trace oily residue
SL0031-BNK(4-5')	4-5'	969.1 - 968.1	02/09/99	0.199	ND (100)	14.0	no	negative
SL0031-BNK(5-6')	5-6'	968.1 - 967.1	02/09/99	0.145	ND (100)	9.9	no	negative
SL0031-BNK(6-7')	6-7'	967.1 - 966.1	02/09/99	0.171	ND (100)	9.0	no	trace sheen
SL0031-BNK(7-8')	7-8'	966.1 - 965.1	02/09/99	0.064	ND (100)	8.2	no	negative
SL0395-BNK(0-1')	0-1'	975.8 - 974.8	02/09/99	N/A	N/A	11.8	no	negative
SL0395-BNK(1-2')	1-2'	974.8 - 973.8	02/09/99	N/A	N/A	6.2	no	negative
SL0395-BNK(2-3')	2-3'	973.8 - 972.8	02/09/99	8	130	6.2	no	negative
SL0395-BNK(3-4')	3-4'	972.8 - 971.8	02/09/99	599	47,000	18.7	no	negative
SL0395-BNK(4-5')	4-5'	971.8 - 970.8	02/09/99	232	19,000	32.3	yes (4.9-5.0' only)	negative
SL0395-BNK(5-6')	5-6'	970.8 - 969.8	02/09/99	19.5 [21.4]	1,200 [1,600]	21.9	yes (5.0-5.1' only)	trace oil
SL0395-BNK(6-7')	6-7'	969.8 - 968.8	02/09/99	2.15	200	20.1	no	negative
SL0395-BNK(7-8')	7-8'	968.8 - 967.8	02/09/99	2.96	230	17.8	no	negative

See notes on page 3.

TABLE 1

GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS
SOURCE CONTROL MEASURES FOR EAST STREET AREA 2 / USEPA AREA 4

SUMMARY OF SEDIMENT AND RIVERBANK SOIL DATA - FEBRUARY 1999

Sample Identification	Depth	Elevation Interval (Feet AMSL)	Date Collected	Analytical Results (ppm)		Field Observations/Testing		
				Total PCBs	TPH	PID Reading (Instrument Units)	Stain / Sheen Observed on Soil Core	Shake Test Results
River Sediment								
SL0007-SED(0-1')	0-1'	971.1 - 970.1	02/08/99	51.1	800	14.4	yes	negative
SL0404-SED(0-1')	0-1'	969.3 - 968.3	02/08/99	42.8	280	17.2	yes	trace sheen
SL0404-SED(1-2')	1-2'	968.3 - 967.3	02/08/99	52.8	450	42.6	yes	sheen
SL0028-SED(0-1')	0-1'	971.8 - 970.8	02/08/99	3.12	160	10.5	no	negative
SL0401-SED(0-1')	0-1'	970.9 - 969.9	02/08/99	165	11,000	25.5	yes	trace sheen
SL0398-SED(0-1')	0-1'	970.8 - 969.8	02/08/99	30.1	1,800	20.0	yes	sheen
SL0031-SED(0-1')	0-1'	971.0 - 970.0	02/08/99	46.2 [49.6]	2,300 [2,200]	33.3	no	negative
SL0395-SED(0-1')	0-1'	971.0 - 970.0	02/08/99	8.51	460	25.6	no	negative
SL0395-SED(1-2')	1-2'	970.0 - 969.0	02/08/99	ND (0.056)	ND (100)	17.7	no	negative
SL0395-SED(2-3')	2-3'	969.0 - 968.0	02/08/99	0.091	ND (100)	17.1	no	negative
SL0395-SED(3-4')	3-4'	968.0 - 967.0	02/08/99	ND (0.058)	ND (100)	16.8	no	negative
SL0041-SED(0-1')	0-1'	971.3 - 970.3	02/08/99	58.7	2,700	28.3	yes	trace sheen
SL0044-SED(0-1')	0-1'	971.1 - 970.1	02/08/99	ND (0.056)	ND (100)	12.6	no	negative

Notes:

1. Samples were collected and field tested by Blasland, Bouck & Lee, Inc.
   Field analyses consisted of photoionization detector (PID) screening, shake testing, and sample description.
2. Water shake tests were performed on all samples.
3. Samples submitted to Northeast Analytical, Inc., for analysis of PCBs by EPA Method 8082 and Total Petroleum Hydrocarbons (TPH) by EPA Method 418.1.
4. ppm: dry weight parts per million.
5. Duplicate sample results shown in brackets [ ].
6. ND: not detected (Practical Quantitation Limit shown in parantheses).
7. N/A: not analyzed.
8. Feet AMSL: Feet above mean sea level.

TABLE 2

GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS
SOURCE CONTROL MEASURES FOR EAST STREET AREA 2 / USEPA AREA 4

SUMMARY OF RIVERBANK SOIL TCLP DATA - FEBRUARY 1999

Sample I.D.:	SL0007-BNK(1-2')	SL0028-BNK(0-1')	SL0041-BNK(0-1')	SL0395-BNK(1-2')
Date:	02/10/99	02/10/99	02/09/99	02/09/99
Depth:	1-2'	0-1'	0-1'	1-2'
Elevation:	973.7 - 972.7	973.5 - 972.5	973.2 - 972.2	974.8 - 973.8
VOLATILES				
Chlorobenzene	ND (0.005)	ND (0.005)	0.0133	ND (0.005)
SEMI-VOLATILES	None Detected			
PESTICIDES	None Detected			
HERBICIDES	None Detected			
METALS				
Barium	0.78	0.64	0.69	0.34
Lead	0.18	ND (0.18)	ND (0.18)	ND (0.18)

Notes:

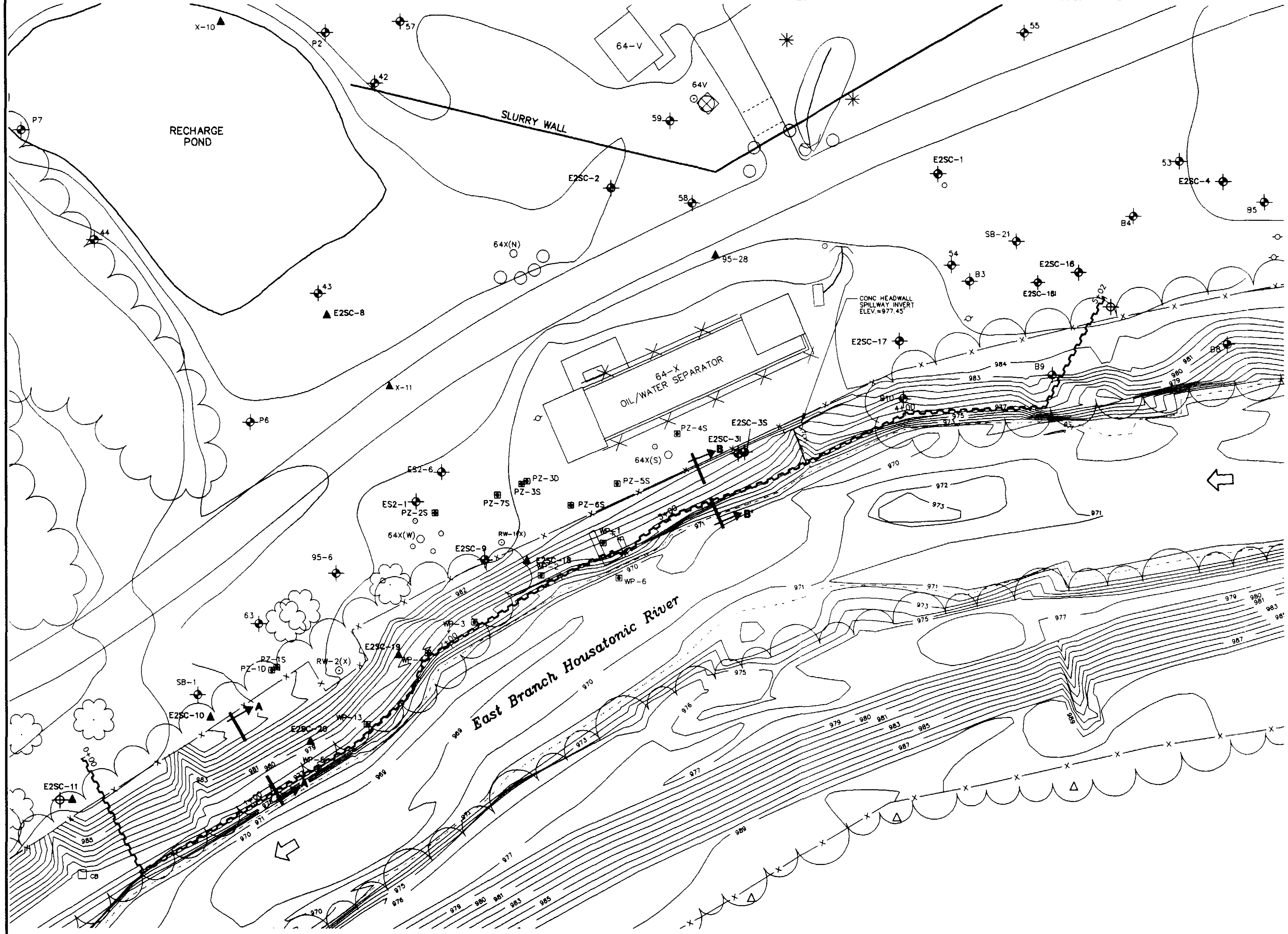
1. Samples were collected by Blasland, Bouck & Lee, Inc.
2. Samples were submitted to Northeast Analytical, Inc., for analyses by the following EPA Methods:

VOLATILES:	EPA Method 8260B-TCLP
SEMI-VOLATILES:	EPA Method 8270C - TCLP
PESTICIDES:	EPA Method 8081
HERBICIDES:	EPA Method 8151A
METALS:	EPA Method 6010B (7471A for mercury)

3. Results are presented in parts per million (ppm). Only constituents detected in at least one sample are presented.
4. ND: not detected (Practical Quantitation Limit shown in parantheses, when applicable).
5. Elevations presented in feet above mean sea level.

Figures

Original includes color coding.



LEGEND:

———	EXISTING INDEX ELEVATION CONTOUR
—980—	EXISTING INTERMEDIATE ELEVATION CONTOUR
– — –	TYPICAL WATER LINE
	DECIDUOUS TREE
✳	CONIFEROUS TREE
⊗	MANHOLE
—x—x—	CHAIN LINK FENCE
○	POLE (NON-UTILITY)
-○-	POLE (OVERHEAD UTILITY)
ES2-1 ⊕	PREVIOUSLY INSTALLED MONITORING WELL
64X(W) ○	PREVIOUSLY INSTALLED OIL RECOVERY CAISSON
RW-1(X) ⊙	PREVIOUSLY INSTALLED PUMPING WELL
X-11 ▲	PREVIOUSLY INSTALLED SOIL BORING
PZ-4S ⊠	PREVIOUSLY INSTALLED PIEZOMETER
E2SC-1 ⊕	1998 MONITORING WELLS
E2SC-8 ▲	1998 SOIL BORINGS
〰〰	LOCATION OF REVISED PROPOSED CONTAINMENT BARRIER
⊕	PROPOSED MONITORING WELL
△	PROPOSED SOIL BORING
A ↑ A' ↑	APPROXIMATE CROSS SECTION LOCATION

NOTES:

1. BASE MAP PROVIDED BY LOCKWOOD MAPPING, INC. PREPARED FROM 1990 AERIAL PHOTOGRAPHY. RIVERBANK AND RIVER BED TOPOGRAPHIC INFORMATION PROVIDED BY BBL FROM OCTOBER 12-23, 1998 FIELD SURVEY.
2. COORDINATE GRID BASED ON 1927 STATE PLANE COORDINATES.
3. ELEVATION DATUM REFERENCED TO NGVD 1929.
4. CONTOUR INTERVAL IN THE RIVER AND ON RIVERBANK = 1 FOOT CONTOUR. INTERVAL OUTSIDE RIVERBANK AREA = 2 FEET.
5. ALL MONITORING WELL, BORING, PUMPING WELL, CAISSON, FENCE, MANHOLE, AND TREE LOCATIONS ARE APPROXIMATE.
6. PROFILE OF SHEETPILE WALL ALIGNMENT, INCLUDING SHEETPIPE LENGTHS AND CUTOFF ELEVATIONS, SHOWN ON DRAWING 4.

20' 0 20' 40'
SCALE (FEET)

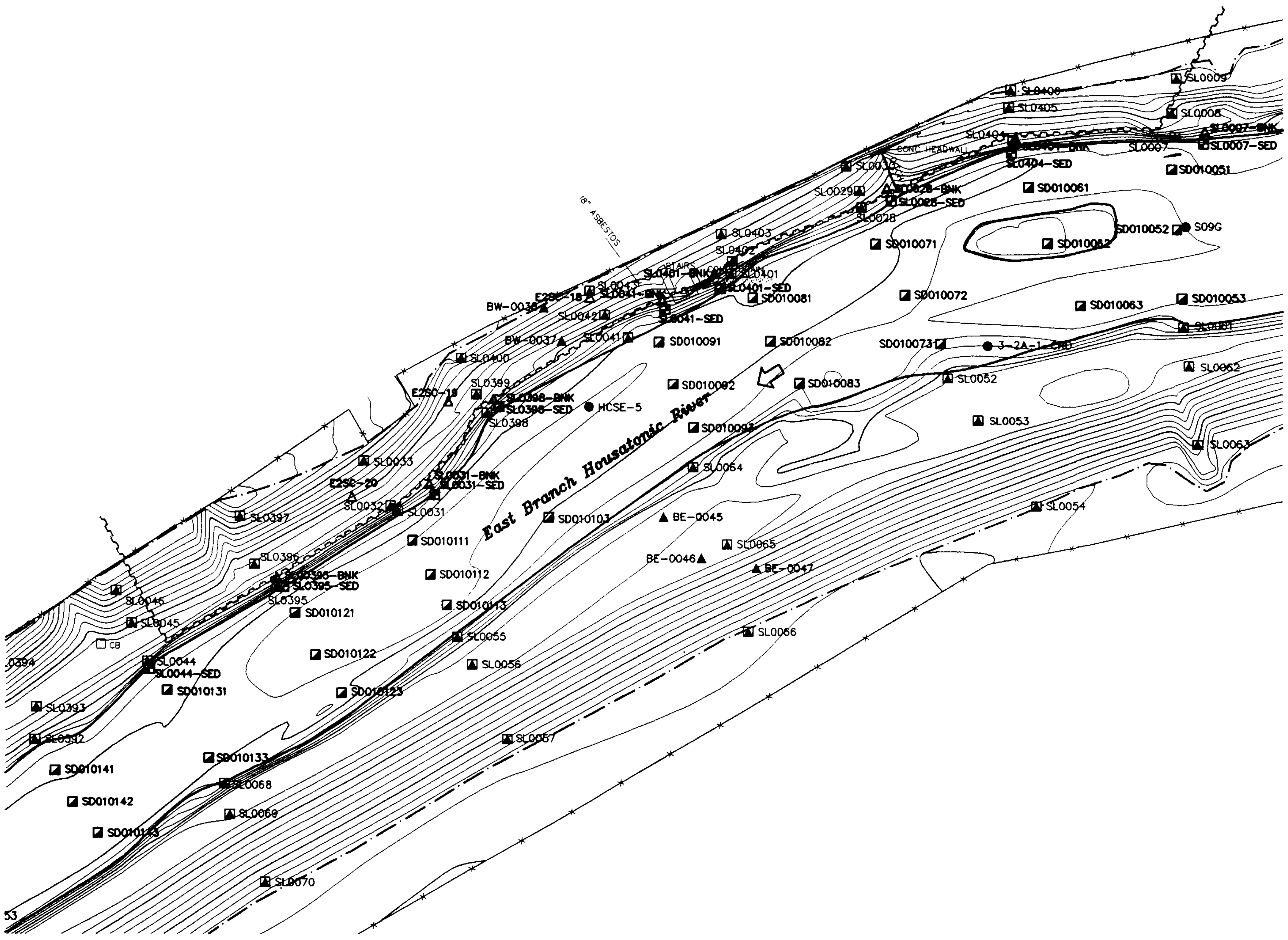
GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
EAST STREET AREA 2 SUPPLEMENTAL
SOURCE CONTROL MEASURES

CONTAINMENT BARRIER PLAN

BBL BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
1

X 20140X03, 20140X05
L: ON=*; OFF=*REF
P: STD/PCP-DL
3/1/99 SYR-54-RJM GMS AK
20140005\20140818.DWG



LEGEND:

- ▲ SUPPLEMENTAL BANK SAMPLE LOCATION 2/99
- ◘ SUPPLEMENTAL SEDIMENT SAMPLE LOCATION 2/99
- ◪ EPA SEDIMENT SAMPLE LOCATION
- ● OTHER SEDIMENT SAMPLE LOCATION
- ▣ EPA BANK SAMPLE LOCATION
- ▲ OTHER BANK SAMPLE LOCATION
- △ 1998 TPH SOIL BORING LOCATION
- ~~~~ LOCATION OF REVISED PROPOSED CONTAINMENT BARRIER

Original includes color coding.

NOTES:

1. BASE MAP PROVIDED BY LOCKWOOD MAPPING, INC. PREPARED FROM 1990 AERIAL PHOTOGRAPHY. RIVERBANK AND RIVER BED TOPOGRAPHIC INFORMATION PROVIDED BY BBL FROM OCTOBER 12-23, 1998 FIELD SURVEY.
2. COORDINATE GRID BASED ON 1927 STATE PLANE COORDINATES.
3. ELEVATION DATUM REFERENCED TO NGVD 1929.
4. CONTOUR INTERVAL IN THE RIVER AND ON RIVERBANK = 1 FOOT CONTOUR. INTERVAL OUTSIDE RIVERBANK AREA = 2 FEET.
5. ALL MONITORING WELL, BORING, PUMPING WELL, CAISSON, FENCE, MANHOLE, AND TREE LOCATIONS ARE APPROXIMATE.
6. PROFILE OF SHEETPILE WALL ALIGNMENT, INCLUDING SHEETPIPE LENGTHS AND CUTOFF ELEVATIONS, SHOWN ON DRAWING 4.

0 40' 80'
GRAPHIC SCALE

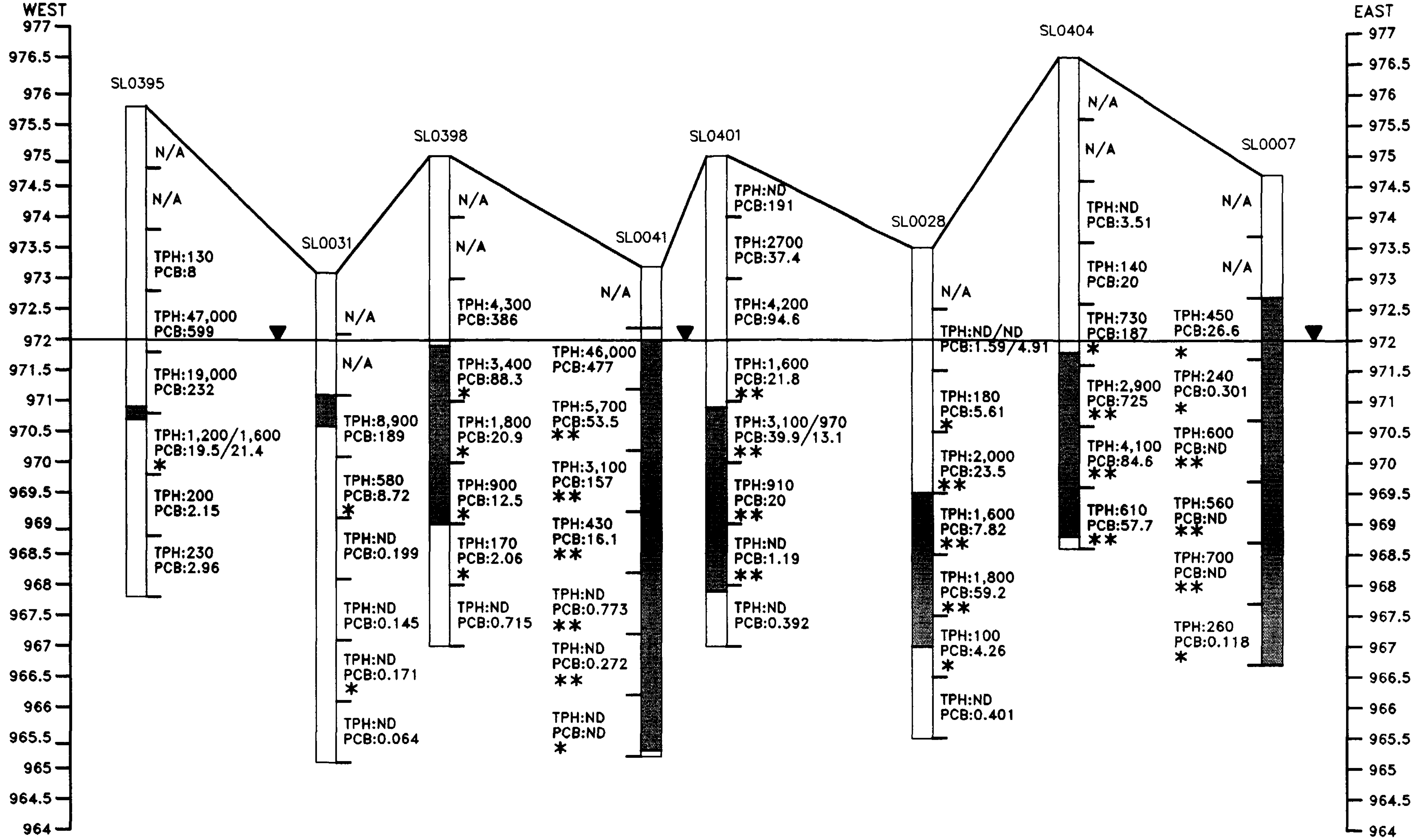
GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
EAST STREET AREA 2 SUPPLEMENTAL
SOURCE CONTROL MEASURES

SUPPLEMENTAL SAMPLING LOCATIONS - FEBRUARY 1999

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

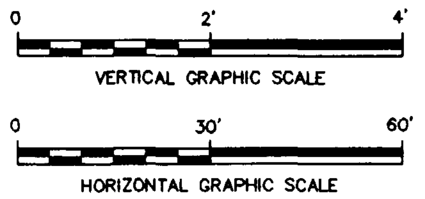
FIGURE
2

X: NONE
L: ON =* OFF=*REF*,SURV*
P: STD-PCP/BL
02/25/99 SYR-54-NES AK
20140008/20140B19.DWG



LEGEND:

SL0007	BORING DESIGNATION
TPH:ND PCB:ND	SOIL SAMPLE INTERVAL: TOTAL PETROLEUM HYDROCARBON (TPH) AND TOTAL POLYCHLORINATED BIPHENYL (PCB) CONCENTRATIONS IN DRY WEIGHT PARTS PER MILLION
ND	NOT DETECTED
ND/ND	DUPLICATE SAMPLE RESULTS
N/A	NOT ANALYZED
▨	STAINING/SHEEN OBSERVED ON SOIL CORE
*	TRACE OIL/SHEEN OBSERVED DURING SOIL-WATER SHAKE TEST
**	OIL RESIDUE/SHEEN OBSERVED DURING SOIL-WATER SHAKE TEST
▼	APPROXIMATE WATER TABLE ELEVATION DURING SAMPLING EFFORT: 972 FEET AMSL



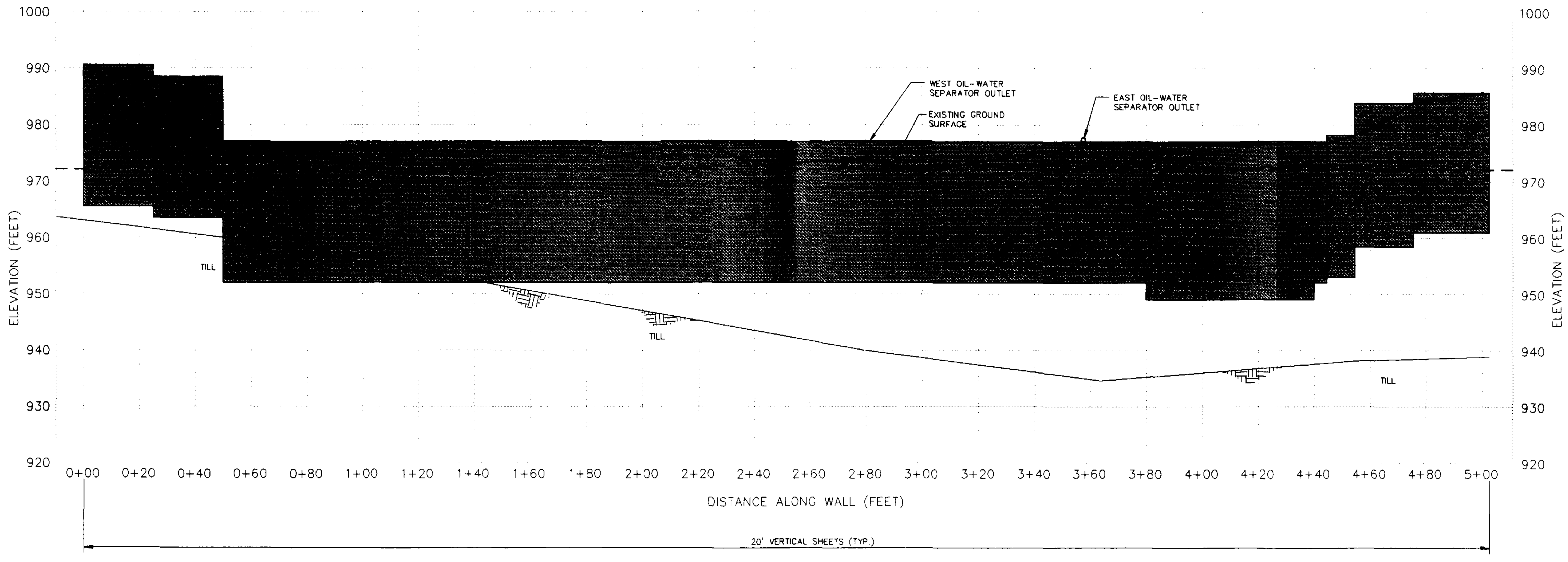
L: ON=*; OFF=*REF
P: STD/PCP-BL
2/25/99 SYR-54-RJM AK
20140032\20140V01.DWG

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
EAST STREET AREA 2 SUPPLEMENTAL
SOURCE CONTROL MEASURES

GENERALIZED CROSS-SECTIONAL SUMMARY OF RIVERBANK SOIL DATA-FEBRUARY 1999

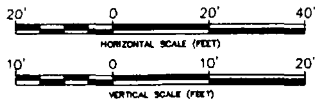
BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE
3



LEGEND:

CP10	SHEET PILE ALIGNMENT CONTROL POINT
— — ▼	TYPICAL RIVER SURFACE WATER ELEVATION
▨	VERTICAL EXTENT OF PROPOSED CONTAINMENT BARRIER



NOTE:

1. TOP OF TILL TAKEN FROM SECTION A-A' OF FIGURE 3 IN SOURCE CONTROL PROPOSAL.
2. ALL THE DIMENSIONS AND ELEVATIONS ARE APPROXIMATE. FIELD CONDITIONS MAY VARY.
3. CUTOFF SHEETING AT APPROXIMATELY GROUND SURFACE AT STATIONS 0+00 TO 0+50 AND STATIONS 4+30 TO 4+85.

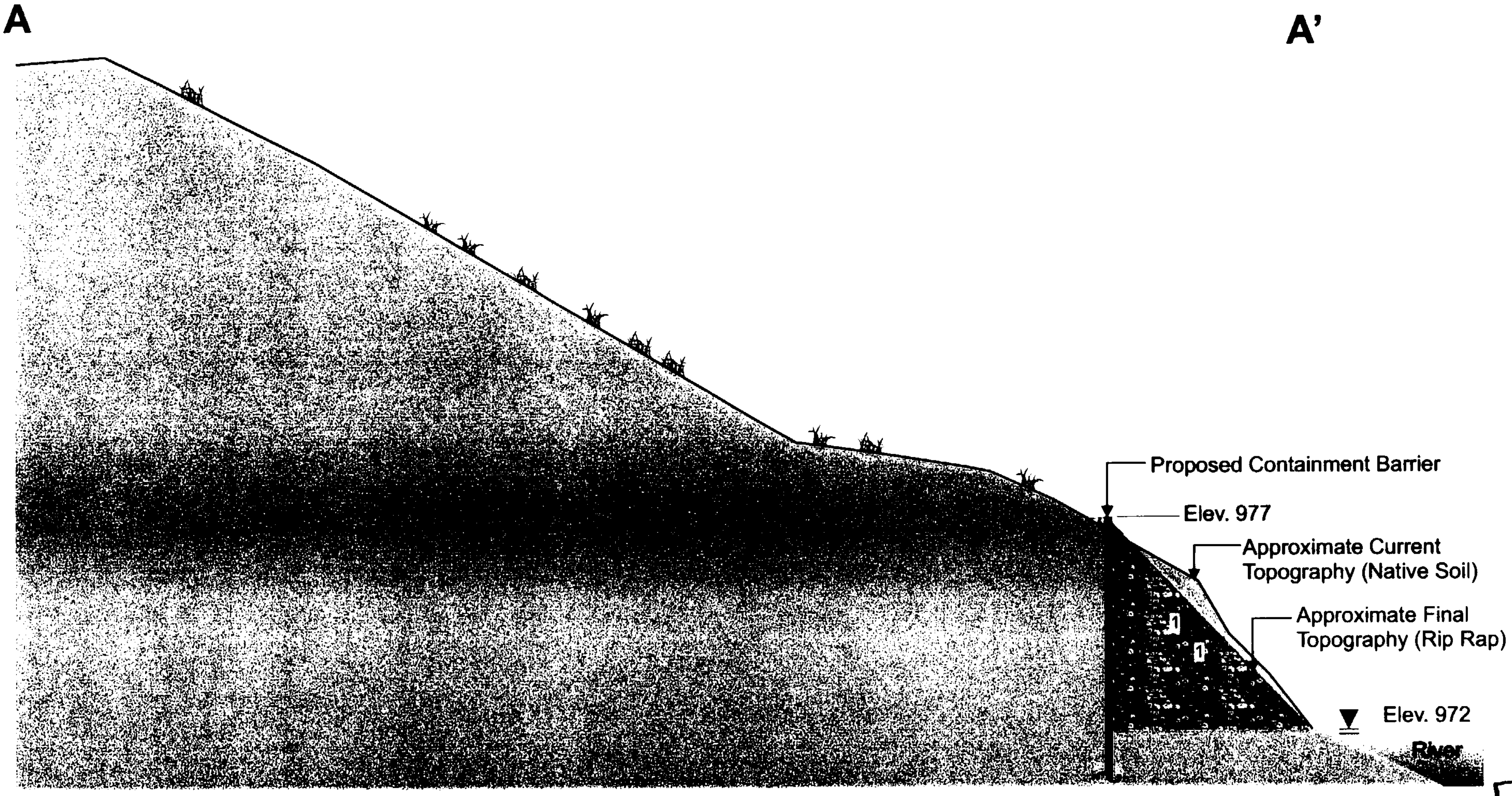
L: ON=*, OFF=REF
P: STD-PCP/DL
3/1/99 SYR-54-AK GMS AK
20140005/20140V05.DWG

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
EAST STREET AREA 2 SUPPLEMENTAL
SOURCE CONTROL MEASURES

CONTAINMENT
BARRIER PROFILE

BBL BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
4



Approximate Scale 1" = 4'

Approximate Changes in Flood Storage at A- A'

	ELEVATION INTERVAL				
	972 - 973	**973 - 974**	**974 - 975**	**975 - 976**	**976 - 977**
Current Flood Storage/ Total Volume (sf)	1.66 4.73	1.33 3.8	0.97 2.77	0.74 2.11	0.20 0.58
Final Flood Storage/ Total Volume (sf)	1.59 4.53	1.24 3.53	0.85 2.42	0.50 1.43	0.27 0.78
Change Flood Storage	0.13	0.18	0.23	0.44	-0.13
Total Change in Flood Storage at A-A'	+0.85 (sf), +0.09 (sy) (Addition of Void Space Available at Section)				

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
EAST STREET AREA 2
SUPPLEMENTAL SOURCE CONTROL MEASURES

CONCEPTUAL CROSS-SECTION A-A'

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FIGURE
5

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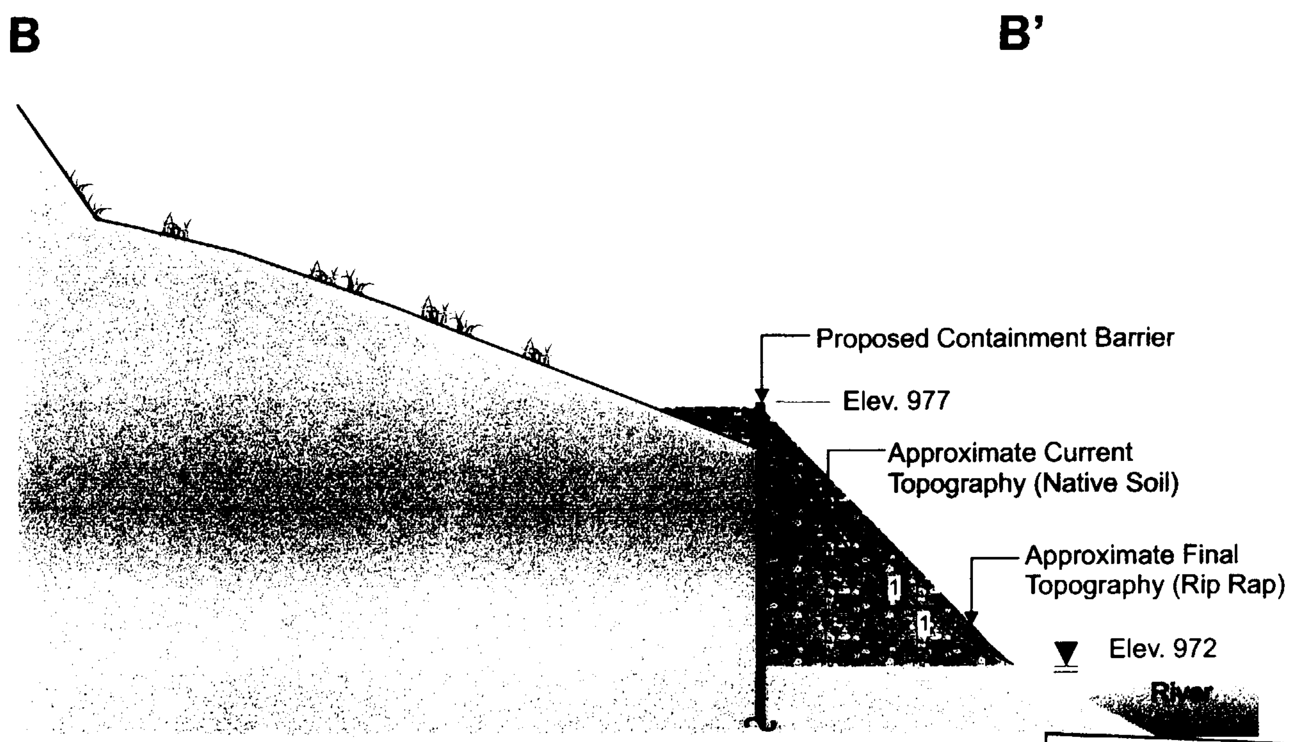

Original includes color coding.

Approximate Changes in Flood Storage at B- B'

	ELEVATION INTERVAL				
	972 - 973	**973 - 974**	**974 - 975**	**975 - 976**	**976 - 977**
Current Flood Storage/ Total Volume (sf)	1.39 / 3.97	0.89 / 2.54	0.50 / 1.43	0.20 / 0.58	0.04 / 0.12
Final Flood Storage/ Total Volume (sf)	1.61 / 4.59	1.16 / 3.32	0.76 / 2.17	0.38 / 1.08	0.58 / 1.66
Change Flood Storage	-0.40	-0.51	-0.48	-0.33	-1.00
Total Change in Flood Storage at B-B'	-2.72 (sf), - 0.30 (sy) (Loss of Void Space Available at Section)				

Approximate Scale 1" = 4'

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EAST STREET AREA 2
SUPPLEMENTAL SOURCE CONTROL MEASURES

CONCEPTUAL CROSS-SECTION B-B'

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FIGURE
6

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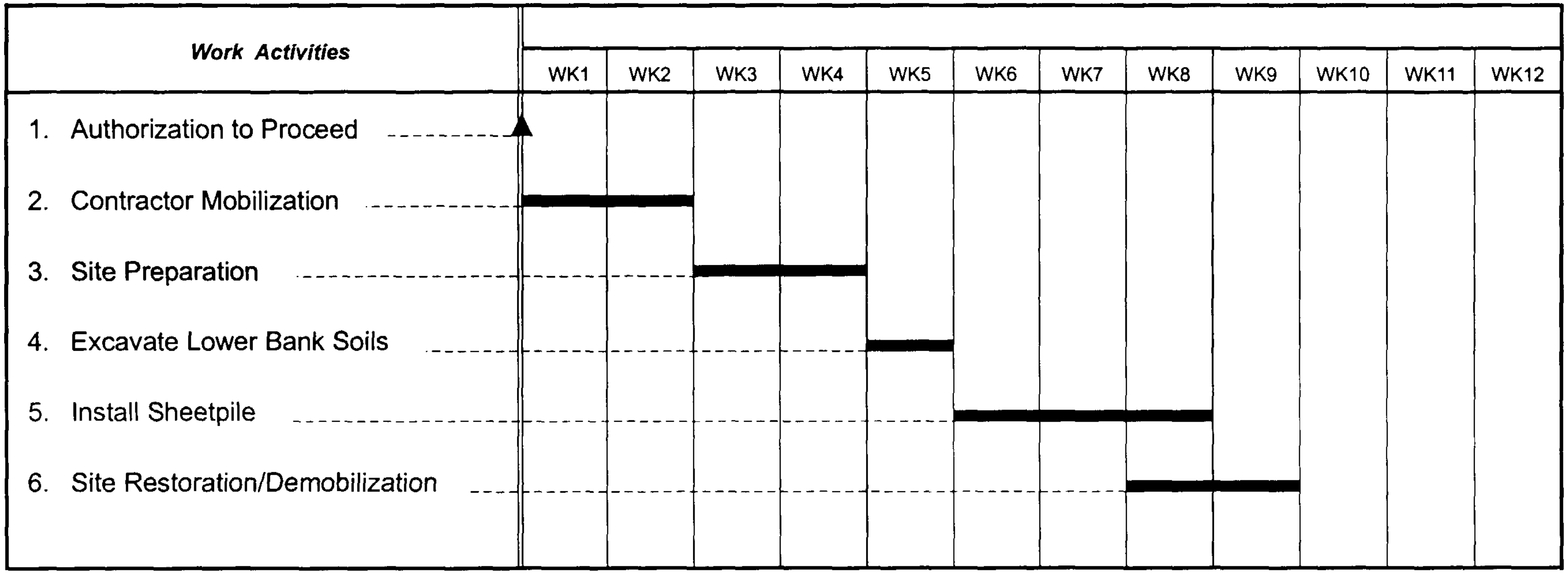

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
EAST STREET AREA 2
SUPPLEMENTAL PARKING LOT SOURCE CONTROL MEASURES

REVISED IMPLEMENTATION SCHEDULE - EAST STREET AREA 2 LNAPL CONTAINMENT BARRIER

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FIGURE 7

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20140005/20140J05.cdr

Attachment 1

Revised Design Calculations for Proposed Containment Barrier

CLIENT GE SUBJECT Sheetpile Design Calculations Prepared By LHK Date: 2/24/99
Reviewed By RDD Date 2/25/99
PROJECT East Street Area 2 Source Control Containment Barrier Temporary Case

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TASK:

To calculate the required embedment depth, maximum moment, and section modulus for a sheetpile wall supporting a slope of 2H:1V with soil excavated temporarily to 967.5 feet in front of the wall. The elevation of the top of the wall is 977 feet.

REFERENCES:

1. NAVFAC DM-7, March 1971.

2. Das, B. M. (1990) Principles of Foundation Engineering, 2nd Edition, PWS-Kent Publishing Company.

ASSUMPTIONS:

Soil unit weight = γ = 125 pcf
Buoyant soil unit weight = γ' = 62.6 pcf
Exposed height of sheetpile = 9.5 feet

CALCULATIONS:

The following calculation method is outlined in Ref. 2 (Sheets 13 through 20).

(1) Determine net pressure diagram:

(a) Calculate K_a and K_p
Using Table 1 from Ref. 1 (Sheet 21), wall friction angle $\delta = 14°$,

For K_p, $\phi = 30°$, $\beta = 0°$, $\delta = -14°$

Using Figure 6 on Sheet 22, for $\beta/\phi = 0°/30° = 0$, and $\delta/\phi = -14°/30° = -0.47$,

$K_p = R(K_p \text{ for } \delta/\phi = -1) = [(7/10)(0.746 - 0.686) + 0.686]\text{x}(6.5) = 0.728 \text{ x } 6.5 = 4.73$

$K_p = 4.73$

For K_a, $\phi = 30°$, $\beta = \tan^{-1}(1/2) = 26.6°$, $\delta = 14°$,

Since Figure 6 does not provide values for $\delta \neq \phi$, use general equation on Sheet 23 instead (with $\theta = 0$).

$$
\begin{aligned}
K_a &= \cos^2\phi \,/\, \{ \cos\delta[\,1 + ((\,\sin(\phi+\delta)\sin(\phi-\beta)/(\cos\delta\cos(-\beta)))^{0.5}]^2\} \\
&= \cos^2(30)/\,\{\cos(14)[\,1 + ((\,\sin(30+14)\sin(30\text{-}26.6)/(\cos(14)\cos(-26.6)))^{0.5}]^2\} \\
&= 0.75/\,\{\,0.9703[\,1 + (0.6947 \text{ x } 0.0591/(0.9703 \text{ x } 0.8942))^{0.5}]^2\}
\end{aligned}
$$

$K_a = 0.52$

(b) Calculate pressures and forces acting on wall.

All of the following calculations are based on the information provided on Sheets 6 and 13 through 20.

(i) Calculate active pressure on wall at EL 967.5 ft:

$p_1 = \gamma L_1 K_a = p_2$

$\underline{p_1 = 617.5 \text{ psf}}$

(ii) Determine location of zero net pressure as distance below excavation elevation (967.5 ft):

$$L_3 = \frac{p_2}{\gamma'(K_p - K_a)}$$

$\underline{L_3 = 2.34 \text{ ft}}$

(iii) Calculate magnitude and location of active force acting on wall, P.

$P = 0.5p_1L_1 + 0.5p_1L_3$

$\underline{P = 3656 \text{ lb}}$

$\sum M_E$ to determine location:

$Pz_1 = 1/2p_1L_1(L_3 + L_1/3) + 1/2p_1L_3(2/3L_3)$

$\underline{z_1 = 4.73 \text{ ft}}$

(iv) Formulate equations for pressures acting at the bottom of the sheetpile wall:

$p_3 = L_4(K_p - K_a)\gamma'$ (1)
$p_4 = \gamma L_1 K_p + \gamma' L_3(K_p - K_a) + \gamma' L_4(K_p - K_a) = p_5 + \gamma' L_4(K_p - K_a)$ (2)
where $p_5 = \gamma L_1 K_p + \gamma' L_3(K_p - K_a)$

$\underline{p_5 = 6234 \text{ psf}}$

(c) Satisfy principles of statics.

$\sum F_H = 0$
$P - 0.5p_3L_4 + 0.5(p_3 + p_4)L_5 = 0$ (3)

Solving Eq. 3 for L_5:

$$L_5 = \frac{p_3 L_4 - 2P}{p_3 + p_4} \tag{4}$$

$\sum M_B = 0$

$$P(L_4+z_1)-(1/2)L_4p_3(L_4/3)+(1/2)L_5(p_3+p_4)(L_5/3) = 0 \tag{5}$$

Combining Eqs. 1, 2, 4, and 5 and simplifying yields:

$$L_4^4+A_1L_4^3-A_2L_4^2-A_3L_4-A_4 = 0 \tag{6}$$

where

$$A_1 = \frac{p_5}{\gamma'(K_p-K_a)} \qquad A_2 = \frac{8P}{\gamma'(K_p-K_a)}$$

$$A_3 = \frac{6P[2z_1\gamma'(K_p-K_a)+p_5]}{(\gamma')^2(K_p-K_a)^2} \qquad A_4 = \frac{P(6z_1p_5+4P)}{(\gamma')^2(K_p-K_a)^2}$$

$A_1 = 23.65$; $A_2 = 110.98$; $A_3 = 2756$; $A_4 = 10082$

By trial and error:

L_4	Equation	
12	2466	
11.5	-2997	
11.8	188	OK

L_4=11.8 ft

Using Eqs. 1, 2, and 4 :

p_3 = 3110 psf
p_4 = 9343 psf

L_5 =2.4 ft

(d) Determine required embedment depth.

$D = L_3 + L_4$
$D = 2.34+11.8=14.14$ ft

Increase D by 10 percent (F.S.=1.25 for temporary construction condition) → **D = 15.6 ft**

(2) Calculate the maximum bending moment.

(a) Determine location of maximum moment as distance from Point E (see Sheets 6 and 13 through 20 for clarification):

$$z'=\sqrt{\frac{2P}{(K_p-K_a)\gamma'}}$$

z' = 5.27 ft

(b) Calculate maximum bending moment:

$M_{max} = P(z_1+z')-[0.5\gamma'(z')^2(K_p-K_a)](1/3)z'$

M_{max} = 30127 lb-ft/ft

M_{max} = 361,525 lb-in/ft

(3) Calculate required section modulus:

$$S=\frac{M_{\max}}{f_b}$$

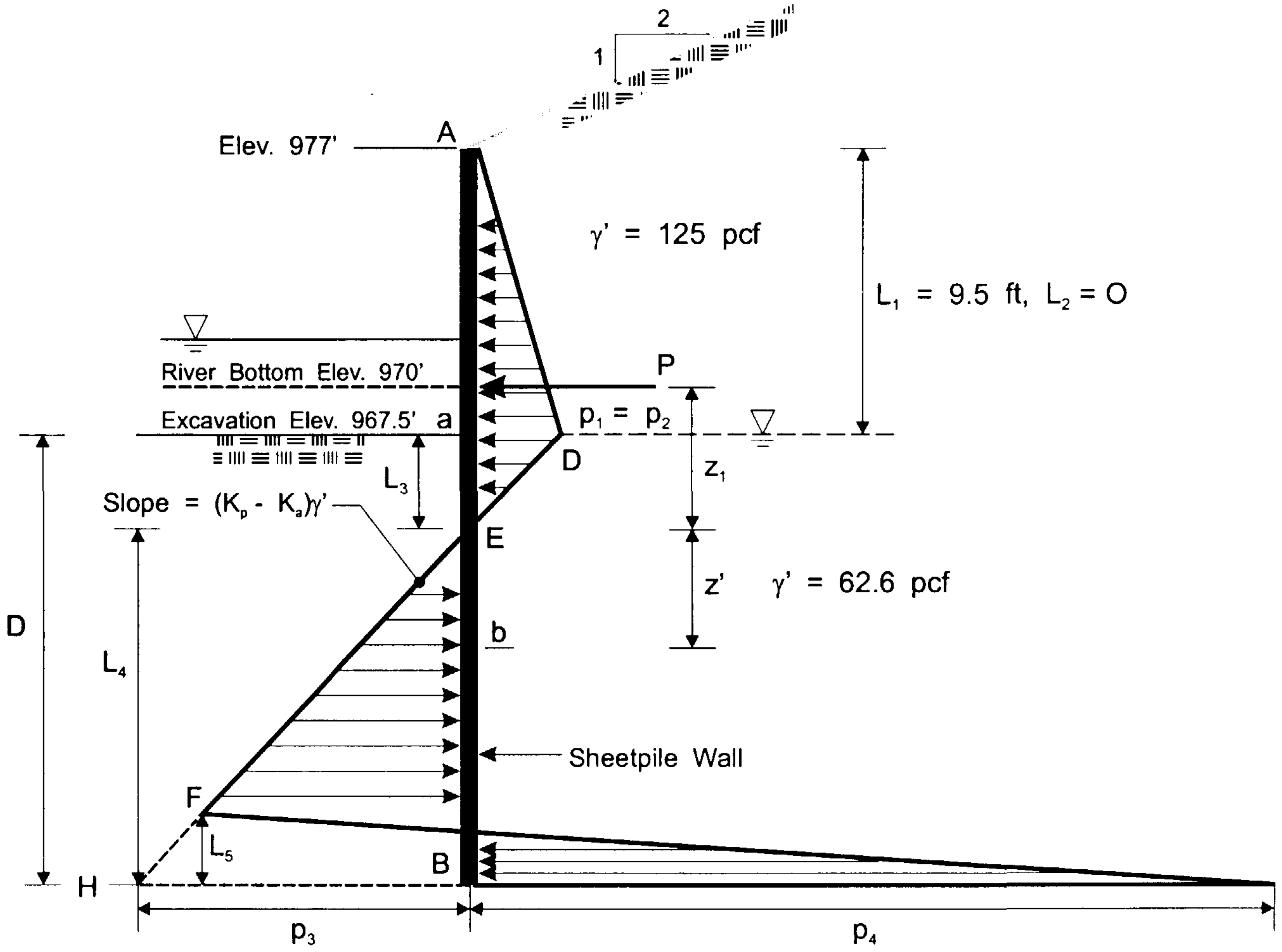
where f_b = 25 ksi for allowable stress on σ_y = 36 ksi steel.

S=14.5 in^3

The section modulus, S, is less than 15.9 in^3 for WZ-75, therefore OK.

CONCLUSIONS

For an exposed wall height of 9.5 feet with a 2H:1V slope of soil above sheetpile, the required embedment depth is 15.6 feet for a factor of safety of 1.25 under temporary construction conditions. Rounded to the nearest foot, a 25-foot long sheetpile is required. The section modulus of a WZ-75 sheetpile is acceptable.



NET PRESSURE DIAGRAM - TEMPORARY CASE

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20140005/20140g11.cdr

CLIENT GE SUBJECT Sheetpile Design Calculations Prepared By LHK Date: 2/24/99
Reviewed By RDD Date 2/25/99
PROJECT East Street Area 2 Source Control Containment Barrier Long Term Case

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TASK:

To calculate the required embedment depth, maximum moment, and required section modulus for a sheetpile wall supporting a slope of 2H:1V. The elevation of the top of the wall is 977 feet and the river bottom elevation adjacent to the wall is about 970 feet. The presence of rip-rap or other materials against the wall above the river bottom is ignored to be conservative.

REFERENCES:

1. NAVFAC DM-7, March 1971.
2. Das, B. M. (1990) Principles of Foundation Engineering, 2nd Edition, PWS-Kent Publishing Company.

ASSUMPTIONS:

Soil unit weight = γ = 125 pcf
Buoyant soil unit weight = γ' = 62.6 pcf
Exposed height of sheetpile = 7.0 feet

CALCULATIONS:

The following calculation method is outlined in Ref. 2 (Sheets 13 through 20).

(1) Determine net pressure diagram:

(a) Calculate K_a and K_p
Using Table 1 from Ref. 1 (Sheet 21), wall friction angle δ= 14°,

For K_p , $\phi = 30°$, $\beta = 0°$, $\delta = -14°$

Using Figure 6 on Sheet 22, for $\beta/\phi = 0°/30° = 0$, and $\delta/\phi = -14°/30° = -0.47$,

$K_p = R(K_p \text{ for } \delta/\phi = -1) = [(7/10)(0.746 - 0.686) + 0.686]x(6.5) = 0.728 \times 6.5 = 4.73$

$K_p = 4.73$

For K_a , $\phi = 30°$, $\beta = \tan^{-1}(1/2) = 26.6°$, $\delta = 14°$,

Since Figure 6 does not provide values for $\delta \neq \phi$, use general equation on Sheet 23 instead (with $\theta = 0$).

$K_a = \cos^2\phi \,/\, \{ \cos\delta[1 + ((\sin(\phi + \delta) \sin(\phi - \beta)/ (\cos\delta \cos(-\beta)))^{0.5}]^2\}$
$= \cos^2(30)/ \{ \cos(14)[1 + ((\sin(30 + 14) \sin(30-26.6)/ (\cos(14) \cos(-26.6)))^{0.5}]^2\}$
$= 0.75/ \{ 0.9703[1 + (0.6947 \times 0.0591/ (0.9703 \times 0.8942))^{0.5}]^2\}$
$K_a = 0.52$

(b) Calculate pressures and forces acting on wall.

All of the following calculations are based on the information provided on Sheets 12 and 13 through 20.

(i) Calculate active pressure on wall at EL 970 ft:

$p_1 = \gamma L_1 K_a = p_2$

$\underline{\mathbf{p_1 = 455\ psf}}$

(ii) Determine location of zero net pressure as distance below river bottom elevation (970 ft):

$$L_3 = \frac{p_2}{\gamma'(K_p - K_a)}$$

$\underline{\mathbf{L_3 = 1.73\ ft}}$

(iii) Calculate magnitude and location of active force acting on wall, P.

$P = 0.5p_1L_1 + 0.5p_1L_3$

$\underline{\mathbf{P = 1986\ lb}}$

$\sum M_E$ to determine location:

$Pz_1 = 1/2p_1L_1(L_3 + L_1/3) + 1/2p_1L_3(2/3L_3)$

$\underline{\mathbf{z_1 = 3.49\ ft}}$

(iv) Formulate equations for pressures acting at the bottom of the sheetpile wall:

$p_3 = L_4(K_p - K_a)\gamma'$ (1)
$p_4 = \gamma L_1 K_p + \gamma' L_3(K_p - K_a) + \gamma' L_4(K_p - K_a) = p_5 + \gamma' L_4(K_p - K_a)$ (2)
where $p_5 = \gamma L_1 K_p + \gamma' L_3(K_p - K_a)$

$\underline{\mathbf{p_5 = 4595\ psf}}$

(c) Satisfy principles of statics.

$\sum F_H = 0$
$P - 0.5p_3L_4 + 0.5(p_3 + p_4)L_5 = 0$ (3)

Solving Eq. 3 for L_5:

$$L_5 = \frac{p_3 L_4 - 2P}{p_3 + p_4} \qquad (4)$$

$\sum M_B = 0$

$P(L_4+z_1)-(1/2)L_4p_3(L_4/3)+(1/2)L_5(p_3+p_4)(L_5/3)=0$ (5)

Combining Eqs. 1, 2, 4, and 5 and simplifying yields:

$L_4^4+A_1L_4^3-A_2L_4^2-A_3L_4-A_4 = 0$ (6)

where

$$A_1 = \frac{p_5}{\gamma'(K_p - K_a)} \qquad A_2 = \frac{8P}{\gamma'(K_p - K_a)}$$

$$A_3 = \frac{6P[2z_1\gamma'(K_p - K_a) + p_5]}{(\gamma')^2(K_p - K_a)^2} \qquad A_4 = \frac{P(6z_1p_5 + 4P)}{(\gamma')^2(K_p - K_a)^2}$$

$A_1 = 17.44$; $A_2 = 60.29$; $A_3 = 1104$; $A_4 = 2978$

By trial and error:

L_4	Equation	
9	1477	
8.5	-787	
8.7	67	OK

L_4 = 8.7 ft

Using Eqs. 1, 2, and 4 :

$\underline{p_3 = 2293 \text{ psf}}$
$\underline{p_4 = 6888 \text{ psf}}$

$\underline{L_5 = 1.74 \text{ ft}}$

(d) Determine required embedment depth.

$D = L_3 + L_4$
$D = 1.73 + 8.7 = 10.4$ ft

Increase D by 20 percent (F.S. = 1.50 for long term case) → **$\underline{D = 12.5 \text{ ft}}$**

(2) Calculate the maximum bending moment.
(a) Determine location of maximum moment as distance from Point E (see Sheets 12 and 13 through 20 for clarification):

$$z' = \sqrt{\frac{2P}{(K_p - K_a)\gamma'}}$$

$\underline{z' = 3.88 \text{ ft}}$

(b) Calculate maximum bending moment:

$M_{max} = P(z_1 + z') - [0.5\gamma'(z')^2(K_p - K_a)](1/3)z'$

$M_{max} = 12071$ lb-ft/ft

$\underline{M_{max} = 144{,}854 \text{ lb-in/ft}}$

(3) Calculate required section modulus:

$$S = \frac{M_{\max}}{f_b}$$

where $f_b = 25$ ksi for allowable stress on $\sigma_y = 36$ ksi steel.

$\underline{S = 5.79 \text{ in}^3}$

CLIENT GE SUBJECT Sheetpile Design Calculations Prepared By LHK Date: 2/24/99
Reviewed By RDD Date 2/25/99
PROJECT East Street Area 2 Source Control Containment Barrier Long Term Case

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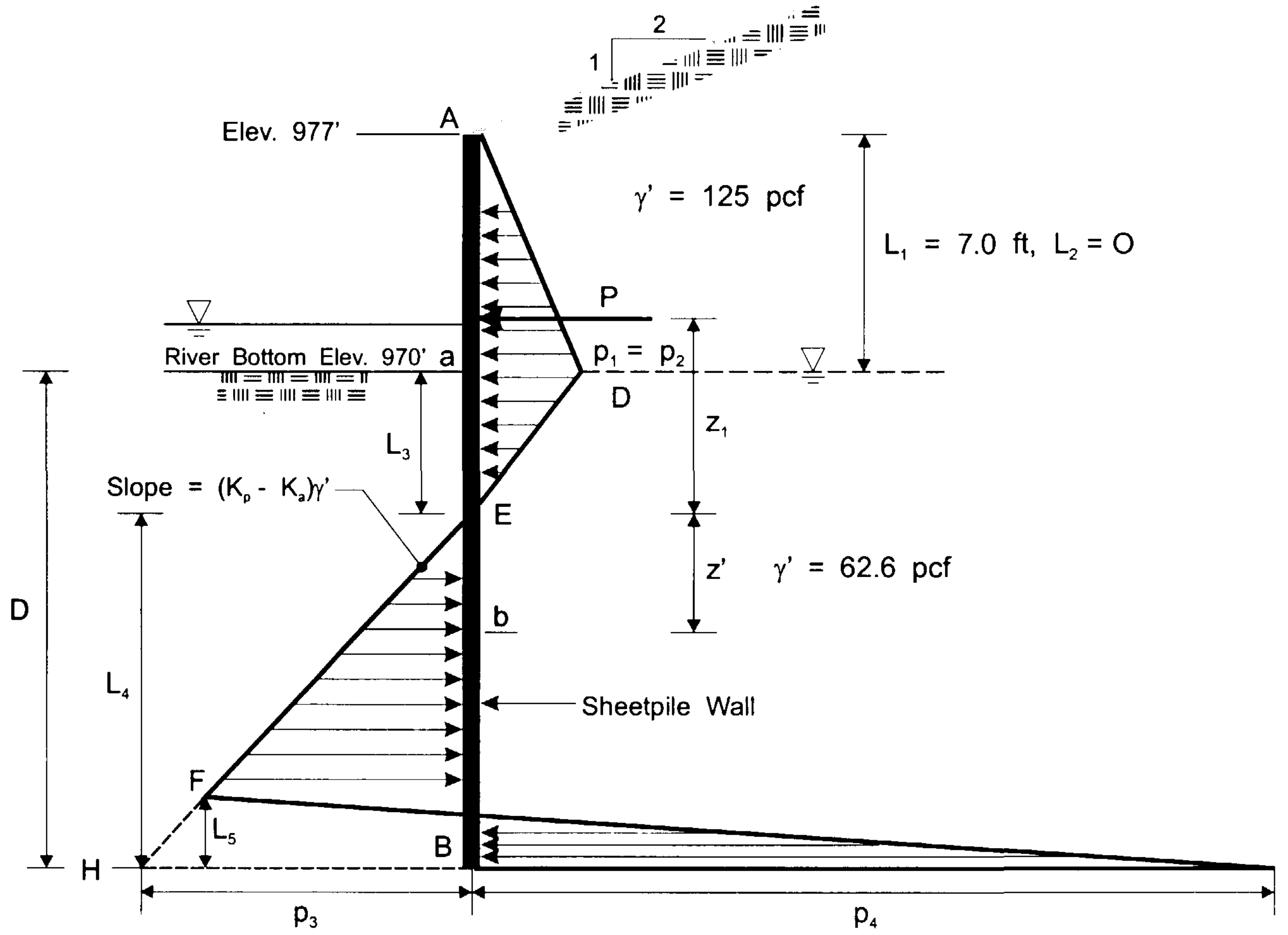
The section modulus, S, is less than 15.9 in^3 for WZ-75, therefore OK.

CONCLUSIONS

For exposed wall height of 7 feet with a 2H:1V slope of soil above sheetpile, the required embedment depth is 12.5 feet for a factor of safety of 1.50 under long term conditions. Therefore, the embedment depth of 18 feet from the 25-foot long sheetpile calculated for the temporary case provides a factor of safety above 2.0. The section modulus of a WZ-75 sheetpile is acceptable.



NET PRESSURE DIAGRAM - LONG TERM CASE

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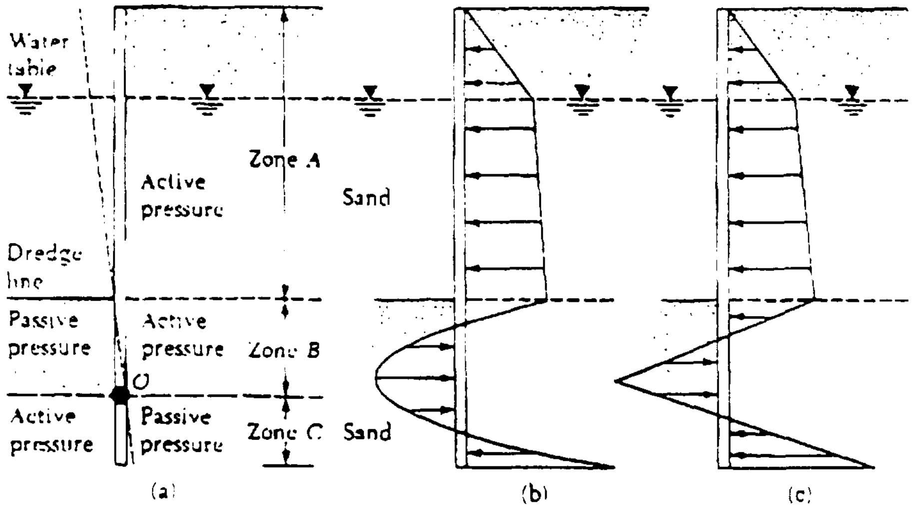

Figure 6.6 Cantilever sheet pile penetrating sand

The following sections (Sections 6.3 through 6.6) present the mathematical formulation of the analysis of cantilever sheet pile walls. Note that, in some waterfront structures, the water level may fluctuate as the result of tidal effects. Care should be taken in determining the water level that will affect the net pressure diagram.

6.3 Cantilever Sheet Piling Penetrating Sandy Soils

To develop the relationships for the proper depth of embedment of sheet piles driven into a granular soil, we refer to Figure 6.7a. The soil retained by the sheet piling above the dredge line is also sand. The water table is located at a depth of L_1 below the top of the wall. Let the angle of friction of the sand be ϕ. The intensity of the active pressure at a depth $z = L_1$ can be given as

$$p_1 = \gamma L_1 K_a \tag{6.1}$$

where K_a = Rankine active pressure coefficient = $\tan^2 (45 - \phi/2)$
γ = unit weight of soil above the water table

Similarly, the active pressure at a depth of $z = L_1 + L_2$ (that is, at the level of the dredge line) is equal to

$$p_2 = (\gamma L_1 + \gamma' L_2)K_a \tag{6.2}$$

where γ' = effective unit weight of soil = $\gamma_{sat} - \gamma_w$

Note that, at the level of the dredge line, the hydrostatic pressures from both sides of the wall are of the same magnitude and cancel each other.

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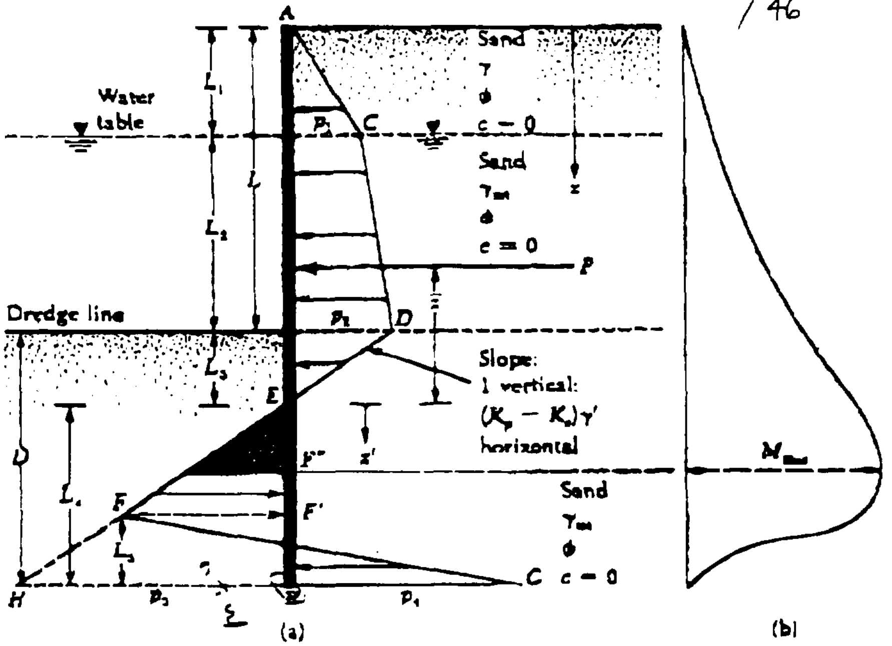

Figure 6.7 Cantilever sheet pile penetrating sand: (a) variation of net pressure diagram. (b) variation of moment

In order to determine the net lateral pressure below the dredge line up to the point of rotation O, as shown in Figure 6.6a, one has to consider the passive pressure acting from the left side (water side) toward the right side (land side) and also the active pressure acting from the right side toward the left side of the wall. For such cases, ignoring the hydrostatic pressure from both sides of the wall, the active pressure at a depth z can be given as

$$p_a = [\gamma L_1 + \gamma' L_2 + \gamma'(z - L_1 - L_2)]K_a \tag{6.3}$$

Also, the passive pressure at that depth z is equal to

$$p_p = \gamma'(z - L_1 - L_2)K_p \tag{6.4}$$

where K_p = Rankine passive pressure coefficient = $\tan^2(45 + \phi/2)$

Hence, combining Eqs. (6.3) and (6.4), the net lateral pressure can be obtained as

$$\begin{aligned} p = p_a - p_p &= (\gamma L_1 + \gamma' L_2)K_a - \gamma'(z - L_1 - L_2)(K_p - K_a) \\ &= p_2 - \gamma'(z - L)(K_p - K_a) \end{aligned} \tag{6.5}$$

where $L = L_1 + L_2$

The net pressure, p, becomes equal to zero at a depth L_3 below the dredge line; or

$$p_2 - \gamma'(z - L)(K_p - K_a) = 0$$

or

$$(z - L) = L_3 = \frac{p_2}{\gamma'(K_p - K_a)} \tag{6.6}$$

From the preceding equation, it is apparent that the slope of the net pressure distribution line DEF is 1 vertical to $(K_p - K_a)\gamma'$ horizontal. So, in the pressure diagram

$$\overline{HB} = p_3 = L_4(K_p - K_a)\gamma' \tag{6.7}$$

At the bottom of the sheet pile, passive pressure (p_p) acts from the right toward the left side, and active pressure acts from the left toward the right side of the sheet pile. So, at $z = L + D$

$$p_p = (\gamma L_1 + \gamma' L_2 + \gamma' D)K_p \tag{6.8}$$

At the same depth

$$p_a = \gamma' D K_a \tag{6.9}$$

Hence, the net lateral pressure at the bottom of the sheet pile is equal to

$$\begin{aligned} p_p - p_a = p_4 &= (\gamma L_1 + \gamma' L_2)K_p + \gamma' D(K_p - K_a) \\ &= (\gamma L_1 + \gamma' L_2)K_p + \gamma' L_3(K_p - K_a) + \gamma' L_4(K_p - K_a) \\ &= p_5 + \gamma' L_4(K_p - K_a) \end{aligned} \tag{6.10}$$

where $p_5 = (\gamma L_1 + \gamma' L_2)K_p - \gamma' L_3(K_p - K_a)$ (6.11)

$D = L_3 + L_4$ (6.12)

For the stability of the wall, the principles of statics can now be applied; or

$$\sum \text{horizontal forces per unit length of wall} = 0$$

and

$$\sum \text{moment of the forces per unit length of wall about point } B = 0$$

For summation of the horizontal forces,

area of the pressure diagram $ACDE$ − area of $EFHB$ + area of $FHBG = 0$

or

$$P - \tfrac{1}{2}p_3 L_4 + \tfrac{1}{2}L_5(p_3 + p_4) = 0 \tag{6.13}$$

where P = area of the pressure diagram $ACDE$

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Summing the moment of all the forces about point B

$$P(L_4 + \bar{z}) - \left(\frac{1}{2} L_4 p_3\right)\left(\frac{L_4}{3}\right) + \frac{1}{2} L_5(p_3 + p_4)\left(\frac{L_5}{3}\right) = 0 \tag{6.14}$$

From Eq. (6.13)

$$L_5 = \frac{p_3 L_4 - 2P}{p_3 + p_4} \tag{6.15}$$

Combining Eqs. (6.7), (6.10), (6.14), and (6.15) and simplifying them further, one obtains the following fourth-degree equation in terms of L_4.

$$\boxed{L_4^4 + A_1 L_4^3 - A_2 L_4^2 - A_3 L_4 - A_4 = 0} \tag{6.16}$$

where

$$A_1 = \frac{p_5}{\gamma'(K_p - K_a)} \tag{6.17}$$

$$A_2 = \frac{8P}{\gamma'(K_p - K_a)} \tag{6.18}$$

$$A_3 = \frac{6P[2\bar{z}\gamma'(K_p - K_a) + p_5]}{\gamma'^2(K_p - K_a)^2} \tag{6.19}$$

$$A_4 = \frac{P(6\bar{z}p_5 + 4P)}{\gamma'^2(K_p - K_a)^2} \tag{6.20}$$

Step-by-Step Procedure for Obtaining the Pressure Diagram

Based on the preceding theory, the step-by-step procedure for obtaining the pressure diagram for a cantilever sheet pile wall penetrating a granular soil is as follows:

1. Calculate K_a and K_p.
2. Calculate p_1 [Eq. (6.1)] and p_2 [Eq. (6.2)]. *Note:* L_1 and L_2 will be given.
3. Calculate L_3 [Eq. (6.6)].
4. Calculate P.
5. Calculate $\bar{z}$ (that is, the center of pressure for the area $ACDE$) by taking the moment about E.
6. Calculate p_5 [Eq. (6.11)].
7. Calculate A_1, A_2, A_3, and A_4 [Eqs. (6.17) to (6.20)].
8. Solve Eq. (6.16) by trial and error to determine L_4.
9. Calculate p_4 [Eq. (6.10)].

10. Calculate p_3 [Eq. (6.7)].
11. Obtain L_5 from Eq. (6.15).
12. Now the pressure distribution diagram as shown in Figure 6.7a can easily be drawn.
13. Obtain the theoretical depth [Eq. (6.12)] of penetration as $L_3 + L_4$. The actual depth of penetration is increased by about 20–30%.

Note: Some designers prefer to use a factor of safety on the passive earth pressure coefficient at the beginning. In that case, in Step 1

$$K_{p(\text{design})} = \frac{K_p}{FS}$$

where FS = factor of safety (usually between 1.5 to 2)

For this type of analysis, follow Steps 1 through 12 with the value of $K_a = \tan^2(45 - \phi/2)$ and $K_{p(\text{design})}$ (instead of K_p). The actual depth of penetration can now be determined by adding L_3, obtained from Step 3, and L_4, obtained from Step 8.

Calculation of Maximum Bending Moment

The nature of variation of the moment diagram for a cantilever sheet pile wall is shown in Figure 6.7b. The maximum moment will occur between the points E and F'. To obtain the maximum moment (M_{max}) per unit length of the wall, one must determine the point of zero shear. Adopting a new axis z' (with origin at point E) for zero shear

$$P = \tfrac{1}{2}(z')^2(K_p - K_a)\gamma'$$

or

$$z' = \sqrt{\frac{2P}{(K_p - K_a)\gamma'}} \tag{6.21}$$

Once the point of zero shear force is determined (point F'' in Figure 6.7a), the magnitude of the maximum moment can be obtained as

$$\boxed{M_{max} = P(\bar{z} + z') - [\tfrac{1}{2}\gamma' z'^2(K_p - K_a)](\tfrac{1}{3})z'} \tag{6.22}$$

The sizing of the necessary profile of the sheet piling is then made according to the allowable flexural stress of the sheet pile material, or

$$\boxed{S = \frac{M_{max}}{\sigma_{all}}} \tag{6.23}$$

where S = section modulus of the sheet pile required per unit length of the structure

σ_{all} = allowable flexural stress of the sheet pile

Example 6.1

Refer to Figure 6.7. For a cantilever sheet pile wall penetrating a granular soil, given: $L_1 = 2$ m, $L_2 = 3$ m. The granular soil has the following properties:

$\phi = 32°$

$c = 0$

$\gamma = 15.9 \text{ kN/m}^3$

$\gamma_{sat} = 19.33 \text{ kN/m}^3$

Make the necessary calculations to determine the theoretical and actual depth of penetration. Also determine the miminum size of sheet pile (section modulus) necessary.

Solution

The step-by-step procedure given in Section 6.3 will be followed here.

Step 1

$$K_a = \tan^2\left(45 - \frac{\phi}{2}\right) = \tan^2\left(45 - \frac{32}{2}\right) = 0.307$$

$$K_p = \tan^2\left(45 + \frac{\phi}{2}\right) = 3.25$$

Step 2

$$p_1 = \gamma L_1 K_a = (15.9)(2)(0.307) = 9.763 \text{ kN/m}^2$$

$$p_2 = (\gamma L_1 + \gamma' L_2)K_a = [(15.9)(2) + (19.33 - 9.81)3]0.307$$
$$= 18.53 \text{ kN/m}^2$$

Step 3

$$L_3 = \frac{p_2}{\gamma'(K_p - K_a)} = \frac{18.53}{(19.33 - 9.81)(3.25 - 0.307)} = 0.66 \text{ m}$$

Step 4

$$P = \tfrac{1}{2}p_1L_1 + p_1L_2 + \tfrac{1}{2}(p_2 - p_1)L_2 + \tfrac{1}{2}p_2L_3$$
$$= \tfrac{1}{2}(9.763)(2) + (9.763)(3) + \tfrac{1}{2}(18.53 - 9.763)3 + \tfrac{1}{2}(18.53)(0.66)$$
$$= 9.763 + 29.289 + 13.151 + 6.115 = 58.32 \text{ kN/m}$$

Step 5. Taking the moment about E

$$\bar{z} = \frac{1}{58.32}\left[9.763\left(0.66 + 3 + \frac{2}{3}\right) + 29.289\left(0.66 + \frac{3}{2}\right) + 13.151\left(0.66 + \frac{3}{3}\right) + 6.115\left(0.66 \times \frac{2}{3}\right)\right] = 2.23 \text{ m}$$

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Step 6

$$
\begin{aligned}
p_5 &= (\gamma L_1 + \gamma' L_2)K_p + \gamma' L_3(K_p - K_a) \\
&= [(15.9)(2) + (19.33 - 9.81)3]3.25 + (19.33 - 9.81)(0.66)(3.25 - 0.307) \\
&= 196.17 + 18.49 = 214.66 \text{ kN/m}^2
\end{aligned}
$$

Step 7

$$A_1 = \frac{p_5}{\gamma'(K_p - K_a)} = \frac{214.66}{(9.52)(2.943)} = 7.66$$

$$A_2 = \frac{8P}{\gamma'(K_p - K_a)} = \frac{(8)(58.32)}{(9.52)(2.943)} = 16.65$$

$$
\begin{aligned}
A_3 &= \frac{6P[2\bar{z}\gamma'(K_p - K_a) + p_5]}{\gamma'^2(K_p - K_a)^2} \\
&= \frac{(6)(58.32)[(2)(2.23)(9.52)(2.943) + 214.66]}{(9.52)^2(2.943)^2} = 151.93
\end{aligned}
$$

$$
\begin{aligned}
A_4 &= \frac{P(6\bar{z}p_5 + 4P)}{\gamma'^2(K_p - K_a)^2} \\
&= \frac{58.32[(6)(2.23)(214.66) + (4)(58.32)]}{(9.52)^2(2.943)^2} = 230.72
\end{aligned}
$$

Step 8. From Eq. (6.16)

$$L_4^4 + 7.66L_4^3 - 16.65L_4^2 - 151.39L_4 - 230.72 = 0$$

The following table shows the solution of the preceding equation by trial and error.

Assumed L_4 (m)	Left side of Eq. (6.16)
4	−356.44
5	+178.58
4.8	+36.96

So, $L_4 \approx 4.8$ m

Step 9

$$
\begin{aligned}
p_4 &= p_5 + \gamma' L_4(K_p - K_a) \\
&= 214.66 + (9.52)(4.8)(2.943) = 349.14 \text{ kN/m}^2
\end{aligned}
$$

Step 10

$$p_3 = \gamma'(K_p - K_a)L_4 = (9.52)(2.943)(4.8) = 134.48 \text{ kN/m}^2$$

Step 11

$$L_5 = \frac{p_3 L_4 - 2P}{p_3 + p_4} = \frac{(134.48)(4.8) - 2(58.32)}{134.48 + 349.14} = 1.09 \text{ m}$$

Step 12. The net pressure distribution diagram can now be drawn, as shown in Figure 6.7a.

Step 13. The actual depth of penetration = $1.3(L_3 + L_4) = 1.3(0.66 + 4.8) = 7.1$ m. The theoretical depth of penetration = 0.66 + 4.8 = 5.46 m.

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Size of Sheet Piling

Using Eq. (6.21)

$$z' = \sqrt{\frac{2P}{\gamma'(K_p - K_a)}} = \sqrt{\frac{(2)(58.32)}{9.52(2.943)}} = 2.04 \text{ m}$$

From Eq. (6.22)

$$M_{max} = P(\bar{z} + z') - \left[\frac{1}{2}\gamma' z'^2 (K_p - K_a)\right]\left(\frac{z'}{3}\right)$$

$$= (58.32)(2.23 + 2.04) - \frac{1}{2}(9.52)(2.04)^2(2.943)\left(\frac{2.04}{3}\right)$$

$$= 249.03 - 39.64 = 209.39 \text{ kN-m}$$

The required section modulus of the sheet pile

$$S = \frac{M_{max}}{\sigma_{all}}$$

With $\sigma_{all} = 172.5 \text{ MN/m}^2$

$$S = \frac{209.39 \text{ kN-m}}{172.5 \times 10^3 \text{ kN/m}^2} = 1.214 \times 10^{-3} \text{ m}^3\text{/m of wall}$$

6.4 Special Cases for Cantilever Wall (Penetrating a Sandy Soil)

Following are two special cases of the mathematical formulation shown in Section 6.3.

Case 1: Sheet Pile Wall with the Absence of Water Table

In the absence of the water table, the net pressure diagram on the cantilever sheet pile wall will be as shown in Figure 6.8, which is a modified version of Figure 6.7. For this figure

$$p_2 = \gamma L K_a \tag{6.24}$$

$$p_3 = L_4(K_p - K_a)\gamma \tag{6.25}$$

$$p_4 = p_3 + \gamma L_4(K_p - K_a) \tag{6.26}$$

$$p_5 = \gamma L K_p + \gamma L_3(K_p - K_a) \tag{6.27}$$

$$L_3 = \frac{p_2}{\gamma(K_p - K_a)} = \frac{LK_a}{(K_p - K_a)} \tag{6.28}$$

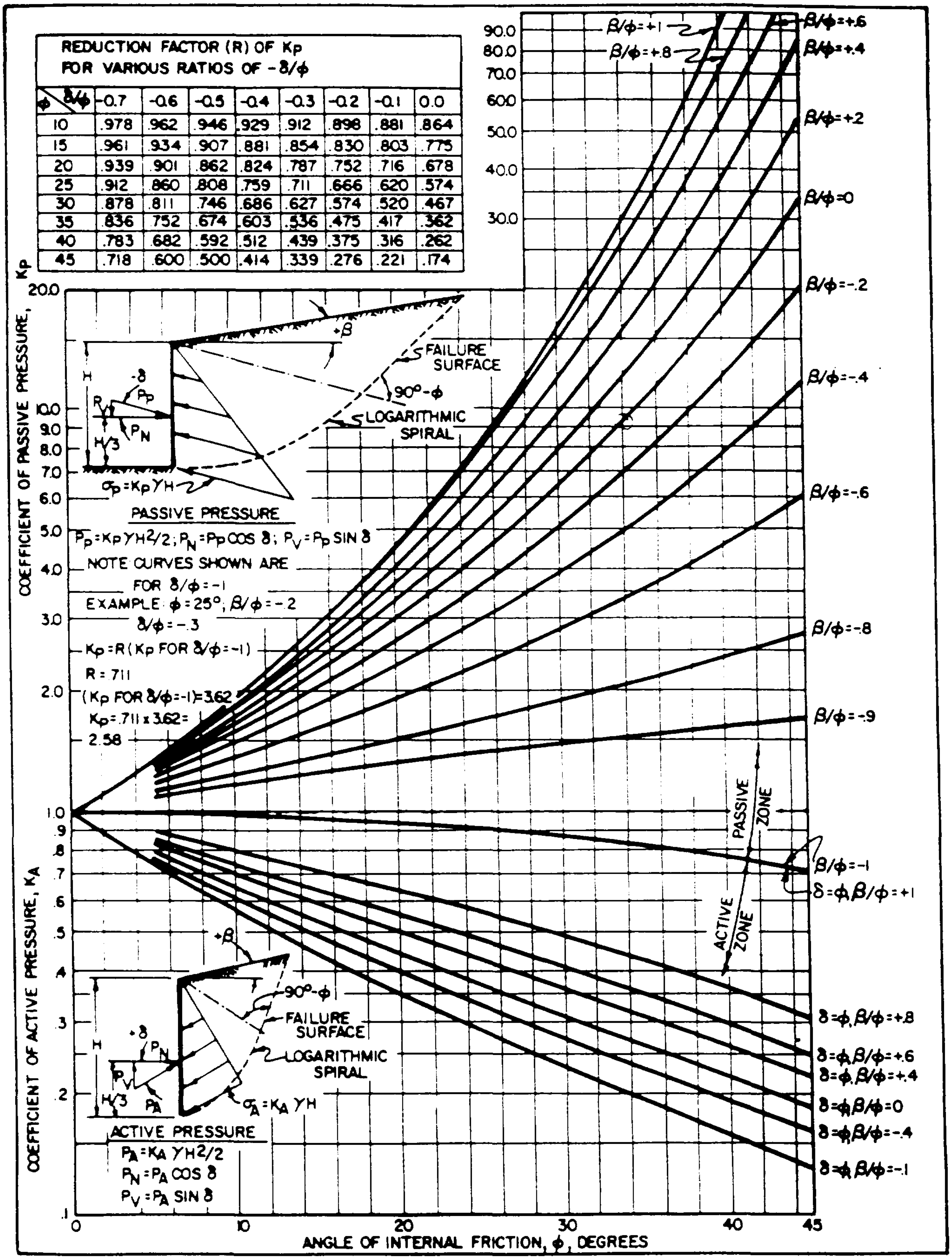
$$P = \tfrac{1}{2}p_2 L + \tfrac{1}{2}p_2 L_3 \tag{6.29}$$

$$\bar{z} = L_3 + \frac{L}{3} = \frac{LK_a}{K_p - K_a} + \frac{L}{3} = \frac{L(2K_a + K_p)}{3(K_p - K_a)} \tag{6.30}$$

TABLE 1
Ultimate Friction Factors and Adhesion for Dissimilar Materials

Interface Materials	Friction factor, tan δ	Friction angle, δ degrees
Mass concrete on the following foundation materials:		
Clean sound rock..................................	0.70	35
Clean gravel, gravel-sand mixtures, coarse sand...	0.55 to 0.60	29 to 31
Clean fine to medium sand, silty medium to coarse sand, silty or clayey gravel....................	0.45 to 0.55	24 to 29
Clean fine sand, silty or clayey fine to medium sand..	0.35 to 0.45	19 to 24
Fine sandy silt, nonplastic silt..................	0.30 to 0.35	17 to 19
Very stiff and hard residual or preconsolidated clay..	0.40 to 0.50	22 to 26
Medium stiff and stiff clay and silty clay........	0.30 to 0.35	17 to 19
(Masonry on foundation materials has same friction factors.)		
Steel sheet piles against the following soils:		
Clean gravel, gravel-sand mixtures, well-graded rock fill with spalls...........................	0.40	22
Clean sand, silty sand-gravel mixture, single size hard rock fill.................................	0.30	17
Silty sand, gravel or sand mixed with silt or clay	0.25	14
Fine sandy silt, nonplastic silt..................	0.20	11
Formed concrete or concrete sheet piling against the following soils:		
Clean gravel, gravel-sand mixture, well-graded rock fill with spalls...........................	0.40 to 0.50	22 to 26
Clean sand, silty sand-gravel mixture, single size hard rock fill.................................	0.30 to 0.40	17 to 22
Silty sand, gravel or sand mixed with silt or clay	0.30	17
Fine sandy silt, nonplastic silt..................	0.25	14
Various structural materials:		
Masonry on masonry, igneous and metamorphic rocks:		
Dressed soft rock on dressed soft rock..........	0.70	35
Dressed hard rock on dressed soft rock..........	0.65	33
Dressed hard rock on dressed hard rock..........	0.55	29
Masonry on wood (cross grain).....................	0.50	26
Steel on steel at sheet pile interlocks...........	0.30	17

Interface Materials (Cohesion)	Adhesion C_a (psf)
Very soft cohesive soil (0 - 250 psf)	0 - 250
Soft cohesive soil (250 - 500 psf)	250 - 500
Medium stiff cohesive soil (500 - 1000 psf)	500 - 750
Stiff cohesive soil (1000 - 2000 psf)	750 - 950
Very stiff cohesive soil (2000 - 4000 psf)	950 - 1,300



φ \ δ/φ	-0.7	-0.6	-0.5	-0.4	-0.3	-0.2	-0.1	0.0
10	.978	.962	.946	.929	.912	.898	.881	.864
15	.961	.934	.907	.881	.854	.830	.803	.775
20	.939	.901	.862	.824	.787	.752	.716	.678
25	.912	.860	.808	.759	.711	.666	.620	.574
30	.878	.811	.746	.686	.627	.574	.520	.467
35	.836	.752	.674	.603	.536	.475	.417	.362
40	.783	.682	.592	.512	.439	.375	.316	.262
45	.718	.600	.500	.414	.339	.276	.221	.174

FIGURE 6
Active and Passive Coefficients with Wall Friction
(Sloping Backfill)

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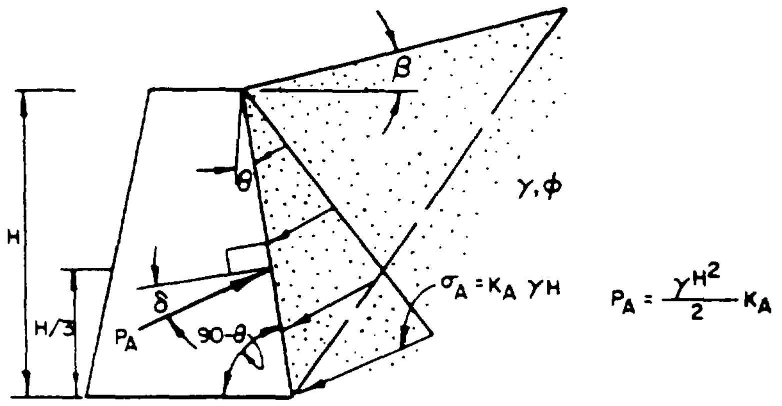
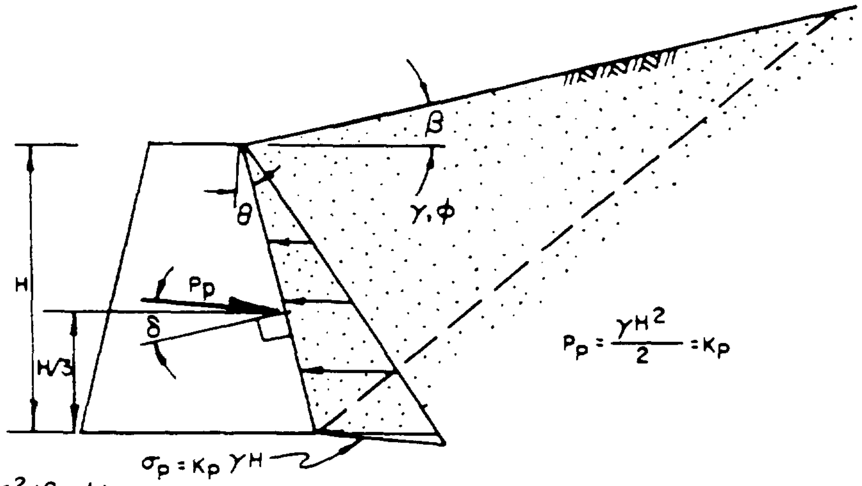


$$K_A = \frac{\cos^2(\phi-\theta)}{\cos^2\theta \cos(\theta+\delta)\left[1+\sqrt{\frac{\sin(\phi+\delta)\sin(\phi-\beta)}{\cos(\theta+\delta)\cos(\theta-\beta)}}\right]^2}$$



$$K_p = \frac{\cos^2(\theta+\phi)}{\cos^2\theta \cos(\theta-\delta)\left[1-\sqrt{\frac{\sin(\phi+\delta)\sin(\phi+\beta)}{\cos(\theta-\delta)\cos(\theta-\beta)}}\right]^2}$$

K_p VALUES ARE SATISFACTORY FOR $\delta \leq \phi/3$ BUT ARE UNCONSERVATIVE FOR $\delta > \phi/3$ AND THEREFORE SHOULD NOT BE USED.

FIGURE 8
Coefficients K_A and K_p for Walls with Sloping Wall and Friction, and Sloping Backfill

CLIENT GE SUBJECT Grout Cracking Evaluation Prepared By LHK Date: 2/24/99
Reviewed By RDD Date 2/25/99
PROJECT East Street Area 2 Source Control Containment Barrier Temporary Case

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TASK:

To perform a bending deflection and grout cracking evaluation for a sheetpile wall supporting a slope of 2H:1V with 9.5 feet of sheetpile wall exposed (temporary case).

REFERENCES:

1. Manual of Steel Construction - Load and Resistant Factor Design (1986). First Edition. American Institute of Steel Construction.

METHODOLOGY:

The following procedure was used to evaluate the potential of grout cracking:

(1) Calculate the deflection of the sheetpile wall at the bottom of the exposed sheetpile.

(2) Calculate total equivalent load on the grout core to match the deflection of the sheetpile wall.

(3) Determine maximum moment in the grout core.

(4) Calculate tensile stress in the grout and compare it to the allowable tensile stress.

CALCULATIONS:

Assumptions:

Sheetpile:
Modulus of elasticity = E = 30,000,000 psi
Moment of inertia = I = 64.8 in^4 (Sheet 30 for a WZ-75 sheetpile wall)
Exposed height of sheetpile = L_1 = 9.5 ft = 114 in

1.5" Diameter Grout Core:
Modulus of elasticity = E = 4,560,000 psi (see Sheet 31 for calculation)
Allowable tensile stress = σ_t' = 740 psi (see Sheet 31 calculation)
Moment of inertia = I_x = 19.9 in^4 (see Sheet 31 for calculation)
Section modulus = S = 4.87 in^3 (see Sheet 32 for calculation)

Soil Properties:
Soil unit weight = γ = 125 pcf = 0.072 pci
Buoyant soil unit weight = γ' = 62.5 pcf = 0.036 pci (Note: 62.5 pcf is used as a simplification since it is the average value of the buoyant weight of the soil (62.6 pcf) and the unit weight of water (62.4 pcf), and it is within the required accuracy.)

From Sheet 1:
K_a = 0.52; K_p = 4.73

(1) Calculate the deflection of the sheetpile wall at the bottom of the exposed sheetpile (Point a).

Point b is the location of zero net shear, which was determined on Sheet 4. Therefore, based on Sheet 6:

$D_1 = L_3 + z' = 2.34 \text{ ft} + 5.27 \text{ ft}$

$\underline{D_1 = 7.6 \text{ ft} = 91.3 \text{ in}}$

$\underline{L = L_1 + D_1 = 17.1 \text{ ft} = 205.3 \text{ in}}$

Using the deflection formula for a Cantilever Beam - Load Increasing Uniformly to Fixed End in Ref. 1 (Sheet 34), the loading geometry shown on Sheet 35, and the modulus and moment of inertia for the sheetpile:

$$\Delta x_a = \frac{W_1}{60EIL^2}(L_1^5 - 5L^4 L_1 + 4L^5) - \frac{W_2}{60EID_1^2}(4D_1^5)$$

where $W_1 = 0.5K_a\gamma L^2$ and $W_2 = 0.5(K_p+K_a)\gamma' D_1^2$

$\underline{\Delta x_a = 0.054 \text{ in}}$

(2) Calculate total equivalent load on the grout core to match the deflection of the sheetpile wall.

The deflection formula for a Cantilever Beam - Uniformly Distributed Load in Ref. 1 (Sheet 34), with the Δx_a calculated in Step 2, and the modulus and moment of inertia of the grout is used to calculate the equivalent load on the grout core. The length of this beam is assumed to be D_1 which provides a conservative overestimate of the loading condition (see Sheet 35 for loading geometry).

$$w = \frac{\Delta x_a 24EI}{3D_1^4}$$

$\underline{w = 0.56 \text{ lb/in}}$

(3) Determine maximum moment in the grout core.

Using the maximum moment formula for a Cantilever Beam - Uniformly Distributed Load in Ref. 1 (Sheet 34):

$$M_{\max} = \frac{wD_1^2}{2}$$

$\underline{M_{\max} = 2{,}351.4 \text{ lb-in}}$

CLIENT GE SUBJECT Grout Cracking Evaluation Prepared By LHK Date: 2/24/99
Reviewed By RDD Date 2/25/99
PROJECT East Street Area 2 Source Control Containment Barrier Temporary Case

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(4) Calculate tensile stress in the grout and compare it to the allowable tensile stress.

$$\sigma_t' = \frac{M_{\max}}{S}$$

σ_t' = 482.8 psi

483 psi (calculated) < 740 psi (allowable) OK

CONCLUSIONS

Based on the above calculations, it was determined that the stress in the grout is significantly less than the the allowable tensile stress (483 psi < 740 psi) under a worst case loading condition; therefore, grout cracking is unlikely.

BBL
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engineers & scientists

CALCULATION SHEET

PROJECT NO. 20140

CLIENT GE SUBJECT Grout Cracking Evaluation Prepared By LHK Date: 2/24/99
Reviewed By RDD Date 2/25/99
PROJECT East Street Area 2 Source Control Containment Barrier Long Term Case

TASK:

To perform a bending deflection and grout cracking evaluation for a sheetpile wall supporting a slope of 2H:1V with 7 feet of sheetpile wall exposed (long term case).

REFERENCES:

1. Manual of Steel Construction - Load and Resistant Factor Design (1986). First Edition. American Institute of Steel Construction.

METHODOLOGY:

The following procedure was used to evaluate the potential of grout cracking:

(1) Calculate the deflection of the sheetpile wall at the bottom of the exposed sheetpile.

(2) Calculate total equivalent load on the grout to match the deflection of the sheetpile wall.

(3) Determine maximum moment in the grout core.

(4) Calculate tensile stress in the grout and compare it to the allowable tensile stress.

CALCULATIONS:

Assumptions:

Sheetpile:	Modulus of elasticity = E = 30,000,000 psi Moment of inertia = 64.8 in^4 (Sheet 30 for a WZ-75 sheetpile wall) Exposed height of sheetpile = L_1 = 7 ft = 84 in
1.5" Diameter Grout Core:	Modulus of elasticity = E = 4,560,000 psi (see Sheet 31 for calculation) Allowable tensile stress = σ_t' = 740 psi (see Sheet 31 for calculation) Moment of inertia = I_x = 19.9 in^4 (see Sheet 31 for calculation) Section modulus = S = 4.87 in^3 (see Sheet 32 for calculation)
Soil Properties:	Soil unit weight = γ = 125 pcf = 0.072 pci Buoyant soil unit weight = γ' = 62.5 pcf = 0.036 pci (Note: 62.5 pcf is used as a simplification since it is the average value of the buoyant weight of the soil (62.6 pcf) and the unit weight of water (62.4 pcf), and it is within the required accuracy.)
From Sheet 1:	K_a=0.52; K_p=4.73

(1) Calculate the deflection of the sheetpile wall at the bottom of the exposed sheetpile (Point a).

Point b is the location of zero net shear, which was determined on Sheet 10. Therefore, based on Sheet 12:

$D_1 = L_3 + z' = 1.73\ \text{ft} + 3.88\ \text{ft}$

$D_1 = 5.6\ \text{ft} = 67.2\ \text{in}$

$L = L_1 + D_1 = 12.6\ \text{ft} = 151.2\ \text{in}$

Using the deflection formula for a Cantilever Beam - Load Increasing Uniformly to Fixed End in Ref. 1 (Sheet 34), the loading geometry shown on Sheet 35, and the modulus and moment of inertia for the sheetpile:

$$\Delta x_A = \frac{W_1}{60EIL^2}(L_1^5 - 5L^4L_1 + 4L^5) - \frac{W_2}{60EID_1^2}(4D_1^5)$$

iere $W_1 = 0.5K_a\gamma L^2$ and $W_2 = 0.5(K_p+K_a)\gamma D_1^2$

$\Delta x_a = 0.012\ \text{in}$

(2) Calculate total equivalent load on the grout core to match the deflection of the sheetpile wall.

The deflection formula for a Cantilever Beam - Uniformly Distributed Load in Ref. 1 (Sheet 34), with the Δx_a calculated in Step 2, and the modulus and moment of inertia of the grout, is used to calculate the equivalent load on the grout core. The length of this beam is assumed to be D_1, which provides a conservative overestimate of the loading condition (see Sheet 35 for loading geometry).

$$w = \frac{\Delta x_a 24EI}{3D_1^4}$$

$w = 0.43\ \text{lb/in}$

(3) Determine maximum moment in the grout core.

Using the maximum moment formula for a Cantilever Beam - Uniformly Distributed Load in Ref. 1 (Sheet 34):

$$M_{\max} = \frac{wD_1^2}{2}$$

$M_{\max} = 970.9\ \text{lb-in}$

(4) Calculate tensile stress in the grout and compare it to the allowable tensile stress.

$$\sigma_t' = \frac{M_{\max}}{S}$$

σ_t' = 199.4 psi

199 psi (calculated) < 740 psi (allowable) OK

CONCLUSIONS

Based on the above calculations, it was determined that the stress in the grout is significantly less than the the allowable (199 psi < 740 psi) under a worst case loading condition; therefore, grout cracking is unlikely.

WATERLOO BARRIER™

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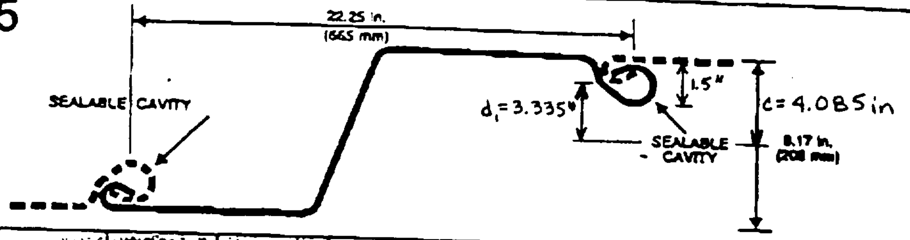
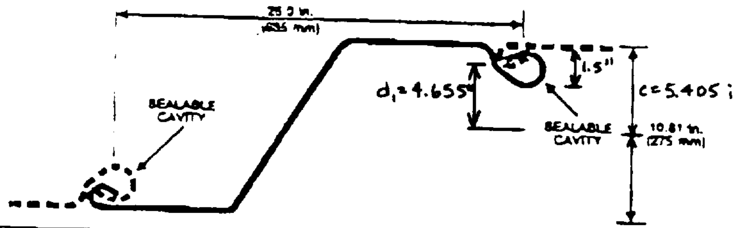
IS AVAILABLE IN TWO DESIGNS. THE MEDIUM WALL WZ75 AND THE HEAVY WALL WEZ95

WZ75



SECTION	THICKNESS in (mm)	HEIGHT in (mm)	NOMINAL WIDTH in (mm)	SECTION AREA in² (cm²)	WEIGHT lbs/lin. ft (kg/lin.m)	WEIGHT lbs/ft² (kg/m²)	MOMENT OF INERTIA [illegible]	RADIUS OF GYRATION [illegible]	SECTION MODULUS [illegible]
WZ75	.295 (7.50)	8.17 (208)	22.25 (565)	10.5 (67.5)	35.8 (53.0)	19.2 (93.7)	64.8 (8870)	3.29 (86.1)	16.9 (860)

WEZ95



SECTION	THICKNESS in (mm)	HEIGHT in (mm)	NOMINAL WIDTH in (mm)	SECTION AREA in² (cm²)	WEIGHT [illegible]	WEIGHT [illegible]	MOMENT OF INERTIA [illegible] (cm⁴/wall m)	RADIUS OF GYRATION [illegible]	SECTION MODULUS [illegible] (cm³/wall m)
WEZ95	.375 (9.50)	10.81 (275)	25.0 (635)	14.9 (96.2)	50.5 (75.2)	24.3 (119)	134 (18300)	4.33 (110)	24.9 (1340)

SPECIFICATIONS:

RAW MATERIAL:	ASTM A572 GR50 CSA G40.21 GR 350W
MANUFACTURING:	ASTM A6 CSA G40.20
COATINGS:	1) GALVANIZED ASTM A123, CSA G164 2) COAL TAR EPOXY SSPC-16 3) FUSION BONDED EPOXY RESIN, MFG'S SPEC.
ACCESSORIES:	BENDS CAN BE SUPPLIED TO ANY ANGLE. 'T' SECTIONS AND OTHER WELDED FABRICATIONS ARE AVAILABLE.

TASK:

To determine the allowable tensile stress, the elastic modulus, moment of inertia, and section modulus of the grout core.

REFERENCES:

1. Merritt, F. S., M.K. Loftin, and J.T. Ricketts. (1996) Standard Handbook for Civil Engineers. Fourth Edition. McGraw- Hill Companies, Inc. New York, NY.

CALCULATIONS:

Allowable Tensile Stress

The tensile stress of the grout is usually between 7 to 10 percent of its compressive strength. Using 8.5 percent:

$$\sigma_t' = (0.085)\, f_c'$$

where f_c' = specified compressive strength at 28 days= 60 MPa (8,700 psi) from Sheet 33.

σ_t' = 740 psi

Modulus of Elasticity

Using Ref. 1 the modulus of elasticity of the grout, E, is calculated as follows:

$$E = w^{1.5}(33)\sqrt{f_c'}$$

where w = unit weight of the grout = 130 pcf.

E = 4,560,000 psi

Moment of Inertia

Using the parallel axis theorem (Ref. 1), the moment of inertia about the parallel axis, I_x, is calculated as follows:

$$I_x = I + A d_1^2$$

where I = moment of inertia about centroidal axis for a circle; A = cross-sectional area; d_1 = distance between centroidal and parallel axes (see Sheet 30 for a WZ-75 sheetpile wall).

$$I_x = \frac{\pi d^4}{64} + \frac{\pi d^2}{4}(d_1^2)$$

where d = diameter of the grout core.

I_x = 19.9 in^4

Section Modulus

The section modulus, S, is calculated as follows:

$$S = \frac{I_x}{c}$$

where c = distance from the outermost fiber of the grout core to the neutral axis of the sheetpile wall (see Sheet 30 for a WZ-75 sheetpile wall).

S = 4.87 in^3

CONCLUSIONS

The allowable tensile strength of the grout core is 740 psi, the elastic modulus is 4,560,000 psi, the moment of inertia is 19.9 in^4, and the section modulus is 4.87 in^3.

MIXING PROPERTIES:

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DESCRIPTION	REQUIREMENTS
SEALANT PACKAGING:	30 kg Bags
MINIMUM WATER VOLUME (per bag):	6.25 L
MAXIMUM WATER VOLUME (per bag):	9.25 L
MIXER TYPE:	Colloidal
MINIMUM MIXING TIME:	2.5 (min.)
MAXIMUM POT LIFE:	180 (min.)

CURING AND SET TIMES:

The initial gel time of the sealant varies from 1.5 to 2.0 hours @ 20°C.
Initial set time of the sealant varies from 1 to 2 days after placement.
Ultimate strength is reached at approximately 28 days.

COMPRESSIVE TESTING	STRENGTH
1 DAY:	15 Mpa
3 DAYS:	38 Mpa
7 DAYS:	50 Mpa
28 DAYS:	60 Mpa

PERMEABILITY TESING:

Permeability testing was completed by Davroc Tesing Laboratories Inc. to confirm a bulk hydraulic conductivity of 3.19×10^{-15} m/s

YIELD:

Each 30 kg (66 lb) bag of WBS 301 sealant produces 0.01 cubic metres of grout.

SAFETY PRECAUTIONS:

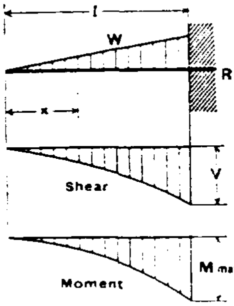
Waterloo Barrier® Grout - WBS 301 - contains Portland Cement, Fly Ash, Silica Fume and other admixtures. Normal safety wear, such as rubber gloves, dust masks and safety glasses that are used to handle conventional cement based products should be worn. Material Safety Data Sheets available on request.

34/46

BEAM DIAGRAMS AND FORMULAS
For various static loading conditions

For meaning of symbols, see page 3-127

18. CANTILEVER BEAM—LOAD INCREASING UNIFORMLY TO FIXED END



Total Equiv. Uniform Load . . . . . $= \frac{8}{3}W$

R = V . . . . $= W$

V_x . . . . $= W\frac{x^2}{l^2}$

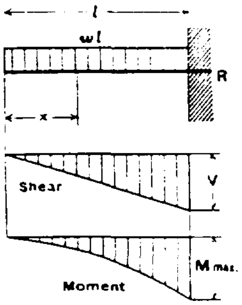
M max. (at fixed end) . . . . . . $= \frac{Wl}{3}$

M_x . . . . $= \frac{Wx^3}{3l^2}$

Δmax. (at free end) . . . . . . $= \frac{Wl^3}{15EI}$

Δx . . . . $= \frac{W}{60EIl^2}(x^5 - 5l^4x - 4l^5)$

19. CANTILEVER BEAM—UNIFORMLY DISTRIBUTED LOAD



Total Equiv. Uniform Load . . . . . $= 4wl$

R = V . . . . $= wl$

V_x . . . . $= wx$

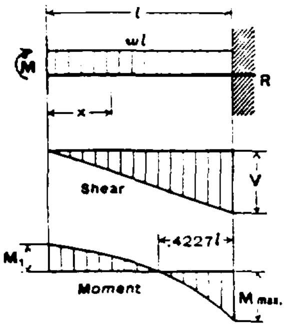
M max. (at fixed end) . . . . . . $= \frac{wl^2}{2}$

M_x . . . . $= \frac{wx^2}{2}$

Δmax. (at free end) . . . . . . $= \frac{wl^4}{8EI}$

Δx . . . . $= \frac{w}{24EI}(x^4 - 4l^3x + 3l^4)$

20. BEAM FIXED AT ONE END, FREE TO DEFLECT VERTICALLY BUT NOT ROTATE AT OTHER—UNIFORMLY DISTRIBUTED LOAD



Total Equiv. Uniform Load . . . . . $= \frac{8}{3}wl$

R = V . . . . $= wl$

V_x . . . . $= wx$

M max. (at fixed end) . . . . . . $= \frac{wl^2}{3}$

M_1 (at deflected end) . . . . . $= \frac{wl^2}{6}$

M_x . . . . $= \frac{w}{6}(l^2 - 3x^2)$

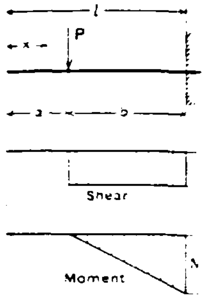
Δmax. (at deflected end) . . . . . $= \frac{wl^4}{24EI}$

Δx . . . . $= \frac{w(l^2 - x^2)^2}{24EI}$

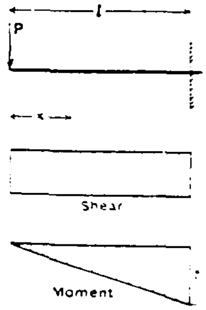
BE

Fo

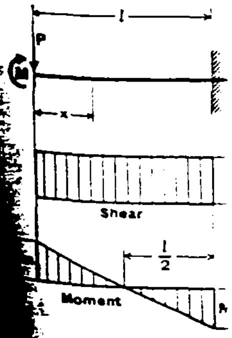
21. CANTILEVE

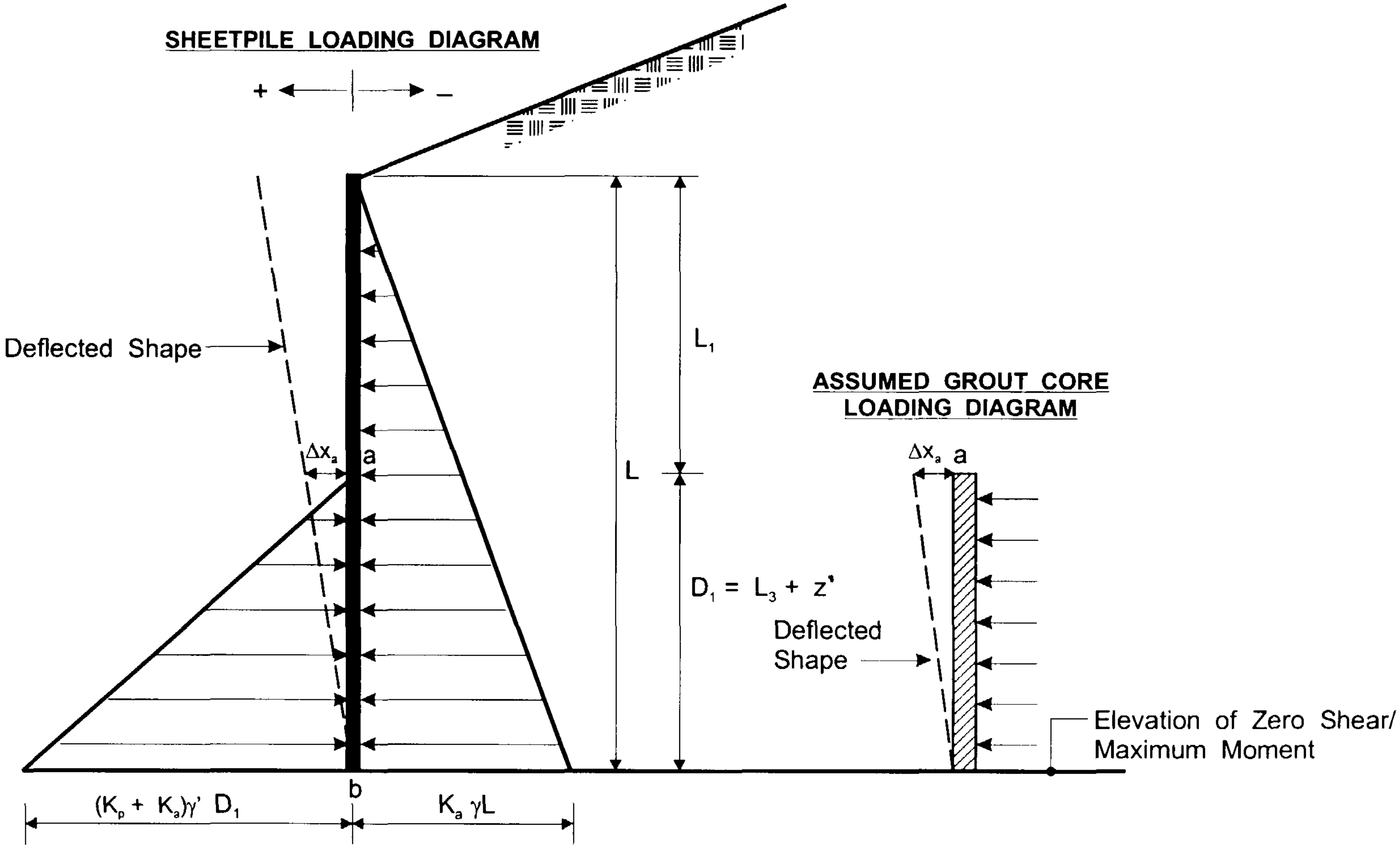


22. CANTILEVE



23. BEAM FIXE
NOT ROTATE





LOADING DIAGRAM

02/99 SYR-D54-DJH
20140005/20140g13.cdr

CLIENT GE SUBJECT Additional Sheetpile Design Calculations Prepared By LHK Date: 2/24/99
Reviewed By RDD Date 2/25/99
PROJECT East Street Area 2 Source Control Containment Barrier Temporary Case

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TASK:

To calculate the required embedment depth, maximum moment, and section modulus for a sheetpile wall supporting a slope of 2H:1V with soil excavated temporarily to 966.5 feet in front of the wall. The elevation of the top of the wall is 977 feet.

REFERENCES:

1. NAVFAC DM-7, March 1971.
2. Das, B. M. (1990) Principles of Foundation Engineering, 2nd Edition, PWS-Kent Publishing Company.

ASSUMPTIONS:

Soil unit weight = γ = 125 pcf
Buoyant soil unit weight = γ' = 62.6 pcf
Exposed height of sheetpile = 10.5 feet

ALCULATIONS:

The following calculation method is outlined in Ref. 2 (Sheets 13 through 20).

(1) Determine net pressure diagram:

(a) Calculate K_a and K_p
Using Table 1 from Ref. 1 (Sheet 21), wall friction angle $\delta = 14°$,

For K_p, $\phi = 30°$, $\beta = 0°$, $\delta = -14°$

Using Figure 6 on Sheet 22, for $\beta/\phi = 0°/30° = 0$, and $\delta/\phi = -14°/30° = -0.47$,

$K_p = R(K_p \text{ for } \delta/\phi = -1) = [(7/10)(0.746 - 0.686) + 0.686]x(6.5) = 0.728 \times 6.5 = 4.73$

$K_p = 4.73$

For K_a, $\phi = 30°$, $\beta = \tan^{-1}(1/2) = 26.6°$, $\delta = 14°$,

Since Figure 6 does not provide values for $\delta \neq \phi$, use general equation on Sheet 23 instead (with $\theta = 0$).

$$K_a = \cos^2\phi \,/\, \{ \cos\delta[\,1 + ((\sin(\phi+\delta)\sin(\phi-\beta)/(\cos\delta\cos(-\beta)))^{0.5}]^2\}$$
$$= \cos^2(30)/\,\{\cos(14)[\,1 + ((\sin(30+14)\sin(30-26.6)/(\cos(14)\cos(-26.6)))^{0.5}]^2\}$$
$$= 0.75/\,\{0.9703[\,1 + (0.6947 \times 0.0591/(0.9703 \times 0.8942))^{0.5}]^2\}$$

$K_a = 0.52$

(b) Calculate pressures and forces acting on wall.

All of the following calculations are based on the information provided on Sheets 41 and 13 through 20.

(i) Calculate active pressure on wall at EL 966.5 ft:

$p_1 = \gamma L_1 K_a = p_2$

$p_1 = 682.5$ psf

(ii) Determine location of zero net pressure as distance below excavation elevation (966.5 ft):

$$L_3 = \frac{p_2}{\gamma'(K_p - K_a)}$$

$L_3 = 2.59$ ft

(iii) Calculate magnitude and location of active force acting on wall, P.

$P = 0.5p_1L_1 + 0.5p_1L_3$

$P = 4467$ lb

$\sum M_E$ to determine location:

$Pz_1 = 1/2p_1L_1(L_3 + L_1/3) + 1/2p_1L_3(2/3L_3)$

$z_1 = 5.23$ ft

(iv) Formulate equations for pressures acting at the bottom of the sheetpile wall:

$p_3 = L_4(K_p - K_a)\gamma'$ (1)
$p_4 = \gamma L_1K_p + \gamma' L_3(K_p - K_a) + \gamma' L_4(K_p - K_a) = p_5 + \gamma' L_4(K_p - K_a)$ (2)
where $p_5 = \gamma L_1K_p + \gamma' L_3(K_p - K_a)$

$p_5 = 6891$ psf

(c) Satisfy principles of statics.

$\sum F_H = 0$
$P - 0.5p_3L_4 + 0.5(p_3 + p_4)L_5 = 0$ (3)

Solving Eq. 3 for L_5:

$$L_5 = \frac{p_3 L_4 - 2P}{p_3 + p_4} \qquad (4)$$

$\sum M_B = 0$

$$P(L_4+z_1)-(1/2)L_4p_3(L_4/3)+(1/2)L_5(p_3+p_4)(L_5/3) = 0 \qquad (5)$$

Combining Eqs. 1, 2, 4, and 5 and simplifying yields:

$$L_4^4+A_1L_4^3-A_2L_4^2-A_3L_4-A_4 = 0 \qquad (6)$$

where

$$A_1 = \frac{p_5}{\gamma'(K_p-K_a)} \qquad A_2 = \frac{8P}{\gamma'(K_p-K_a)}$$

$$A_3 = \frac{6P[2z_1\gamma'(K_p-K_a)+p_5]}{(\gamma')^2(K_p-K_a)^2} \qquad A_4 = \frac{P(6z_1p_5+4P)}{(\gamma')^2(K_p-K_a)^2}$$

$A_1 = 26.15$; $A_2 = 135.60$; $A_3 = 3723$; $A_4 = 15056$

By trial and error:

L_4	Equation	
12.9	-1824	
13.1	1136	
13.0	-363	**OK**

L_4=13.0 ft

Using Eqs. 1, 2, and 4 :

p_3 = 3426 psf
p_4 = 10,317 psf

L_5 = 2.59 ft

(d) Determine required embedment depth.

$D = L_3+L_4$
$D = 2.59 + 13.0 = 15.59$ ft

Increase D by 10 percent (F.S.=1.25 for temporary construction condition) → **D = 17.1 ft**

(2) Calculate the maximum bending moment.
(a) Determine location of maximum moment as distance from Point E (see Sheets 41 and 13 through 20 for clarification):

$$z' = \sqrt{\frac{2P}{(K_p - K_a)\gamma'}}$$

z' = 5.82 ft

(b) Calculate maximum bending moment:

$M_{max} = P(z_1+z') - [0.5\gamma'(z')^2(K_p-K_a)](1/3)z'$

$M_{max} = 40{,}701$ lb-ft/ft

M_{max} = 488,415 lb-in/ft

(3) Calculate required section modulus:

$$S = \frac{M_{max}}{f_b}$$

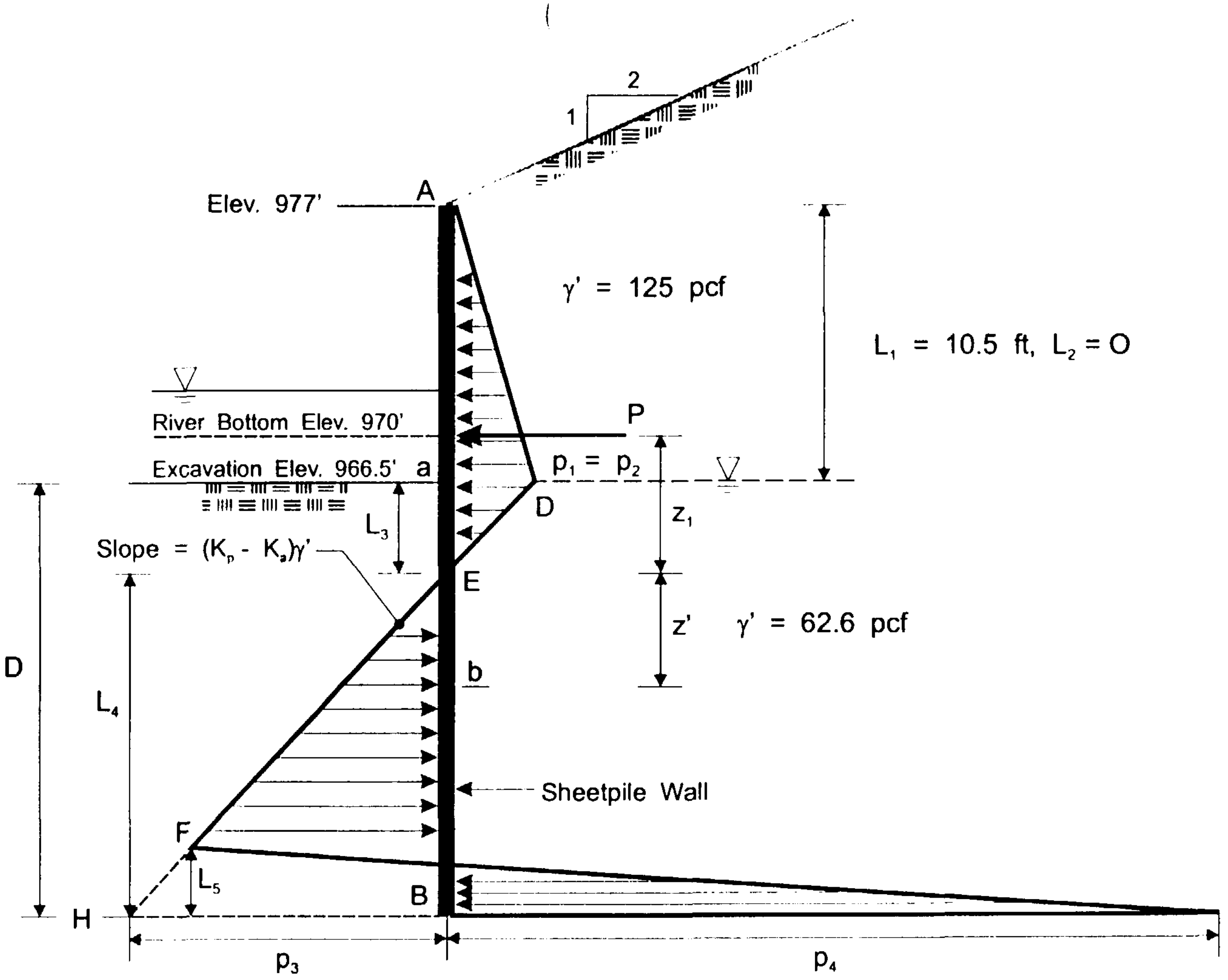
where $f_b = 25$ ksi for allowable stress on $\sigma_y = 36$ ksi steel.

S=19.5 in^3

The section modulus, S, is greater than 15.9 in^3 for WZ-75, therefore a thicker sheetpile is required. A WEZ-95 with a section modulus of 24.9 in^3 is acceptable.

CONCLUSIONS

For an exposed wall height of 10.5 feet with a 2H:1V slope of soil above sheetpile, the required embedment depth is 17.1 feet for a factor of safety of 1.25 under temporary construction conditions. Rounded to the nearest foot, a 28-foot long sheetpile is required. The section modulus of a WEZ-95 sheetpile is acceptable.



NET PRESSURE DIAGRAM - TEMPORARY CASE

02/99 SYR-D54-DJH
20140005/20140g14.cdr

CLIENT GE SUBJECT Grout Cracking Evaluation Prepared By LHK Date: 2/24/99
Reviewed By RDD Date 2/25/99
PROJECT East Street Area 2 Source Control Containment Barrier Temporary Case

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TASK:

To perform a bending deflection and grout cracking evaluation for a sheetpile wall supporting a slope of 2H:1V with 10.5 feet of sheetpile wall exposed (temporary case).

REFERENCES:

1. Manual of Steel Construction - Load and Resistant Factor Design (1986). First Edition. American Institute of Steel Construction.

METHODOLOGY:

The following procedure was used to evaluate the potential of grout cracking:

(1) Calculate the deflection of the sheetpile wall at the bottom of the exposed sheetpile.

(2) Calculate total equivalent load on the grout core to match the deflection of the sheetpile wall.

(3) Determine maximum moment in the grout core.

(4) Calculate tensile stress in the grout and compare it to the allowable tensile stress.

CALCULATIONS:

Assumptions:

Sheetpile:	Modulus of elasticity = E = 30,000,000 psi Moment of inertia = I = 134 in^4 (Sheet 30 for a WEZ-95 sheetpile wall) Exposed height of sheetpile = L_1 = 10.5 ft = 126 in
1.5" Diameter Grout Core:	Modulus of elasticity = E = 4,560,000 psi (see Sheet 45 for calculation) Allowable tensile stress = σ_t' = 740 psi (see Sheet 45 calculation) Moment of inertia = I_x = 38.5 in^4 (see Sheet 45 for calculation) Section modulus = S = 7.13 in^3 (see Sheet 46 for calculation)
Soil Properties:	Soil unit weight = γ = 125 pcf = 0.072 pci Buoyant soil unit weight = γ' = 62.5 pcf = 0.036 pci (Note: 62.5 pcf is used as a simplification since it is the average value of the buoyant weight of the soil (62.6 pcf) and the unit weight of water (62.4 pcf), and it is within the required accuracy.)
From Sheet 1:	K_a = 0.52; K_p = 4.73

(1) Calculate the deflection of the sheetpile wall at the bottom of the exposed sheetpile (Point a).

Point b is the location of zero net shear, which was determined on Sheet 39. Therefore, based on Sheet 41:

$D_1 = L_3 + z' = 2.59\text{ ft} + 5.82\text{ ft}$

$\underline{D_1 = 8.4\text{ ft} = 100.9\text{ in}}$

$\underline{L = L_1 + D_1 = 18.9\text{ ft} = 226.8\text{ in}}$

Using the deflection formula for a Cantilever Beam - Load Increasing Uniformly to Fixed End in Ref. 1 (Sheet 34), the loading geometry shown on Sheet 35, and the modulus and moment of inertia for the sheetpile:

$$\Delta x_a = \frac{W_1}{60EIL^2}(L_1^5 - 5L^4L_1 + 4L^5) - \frac{W_2}{60EID_1^2}(4D_1^5)$$

where $W_1 = 0.5K_a\gamma L^2$ and $W_2 = 0.5(K_p+K_a)\gamma' D_1^2$

$\underline{\Delta x_a = 0.043\text{ in}}$

(2) Calculate total equivalent load on the grout core to match the deflection of the sheetpile wall.

The deflection formula for a Cantilever Beam - Uniformly Distributed Load in Ref. 1 (Sheet 34), with the Δx_a calculated in Step 2, and the modulus and moment of inertia of the grout is used to calculate the equivalent load on the grout core. The length of this beam is assumed to be D_1 which provides a conservative overestimate of the loading condition (see Sheet 35 for loading geometry).

$$w = \frac{\Delta x_a 24EI}{3D_1^4}$$

$\underline{w = 0.58\text{ lb/in}}$

(3) Determine maximum moment in the grout core.

Using the maximum moment formula for a Cantilever Beam - Uniformly Distributed Load in Ref. 1 (Sheet 34):

$$M_{\max} = \frac{wD_1^2}{2}$$

$\underline{M_{\max} = 2{,}952.4\text{ lb-in}}$

(4) Calculate tensile stress in the grout and compare it to the allowable tensile stress.

$$\sigma_t' = \frac{M_{\max}}{S}$$

$\underline{\sigma_t' = 414.1 \text{ psi}}$

414.1 psi (calculated) < 740 psi (allowable) OK

CONCLUSIONS

Based on the above calculations, it was determined that the stress in the grout is significantly less than the the allowable tensile stress (414 psi < 740 psi) under a worst case loading condition; therefore, grout cracking is unlikely.

TASK:

To determine the allowable tensile stress, the elastic modulus, moment of inertia, and section modulus of the grout core.

REFERENCES:

1. Merritt, F. S., M.K. Loftin, and J.T. Ricketts. (1996) Standard Handbook for Civil Engineers. Fourth Edition. McGraw- Hill Companies, Inc. New York, NY.

CALCULATIONS:

Allowable Tensile Stress

The tensile stress of the grout is usually between 7 to 10 percent of its compressive strength. Using 8.5 percent:

$$\sigma_t' = (0.085)\, f_c'$$

where f_c' = specified compressive strength at 28 days= 60 MPa (8,700 psi) from Sheet 33.

$$\underline{\sigma_t' = 740 \text{ psi}}$$

Modulus of Elasticity

Using Ref. 1 the modulus of elasticity of the grout, E, is calculated as follows:

$$E = w^{1.5}(33)\sqrt{f_c'}$$

where w = unit weight of the grout = 130 pcf.

$$\underline{E = 4{,}560{,}000 \text{ psi}}$$

Moment of Inertia

Using the parallel axis theorem (Ref. 1), the moment of inertia about the parallel axis, I_x, is calculated as follows:

$$I_x = I + Ad_1^2$$

where I = moment of inertia about centroidal axis for a circle; A = cross-sectional area; d_1 = distance between centroidal and parallel axes (see Sheet 30 for a WEZ-95 sheetpile wall).

$$I_x = \frac{\pi d^4}{64} + \frac{\pi d^2}{4}(d_1^2)$$

where d = diameter of the grout core.

$I_x = 38.5\ in^4$

Section Modulus

The section modulus, S, is calculated as follows:

$$S = \frac{I_x}{c}$$

where c = distance from the outermost fiber of the grout core to the neutral axis of the sheetpile wall (see Sheet 30 for a WEZ-95 sheetpile wall).

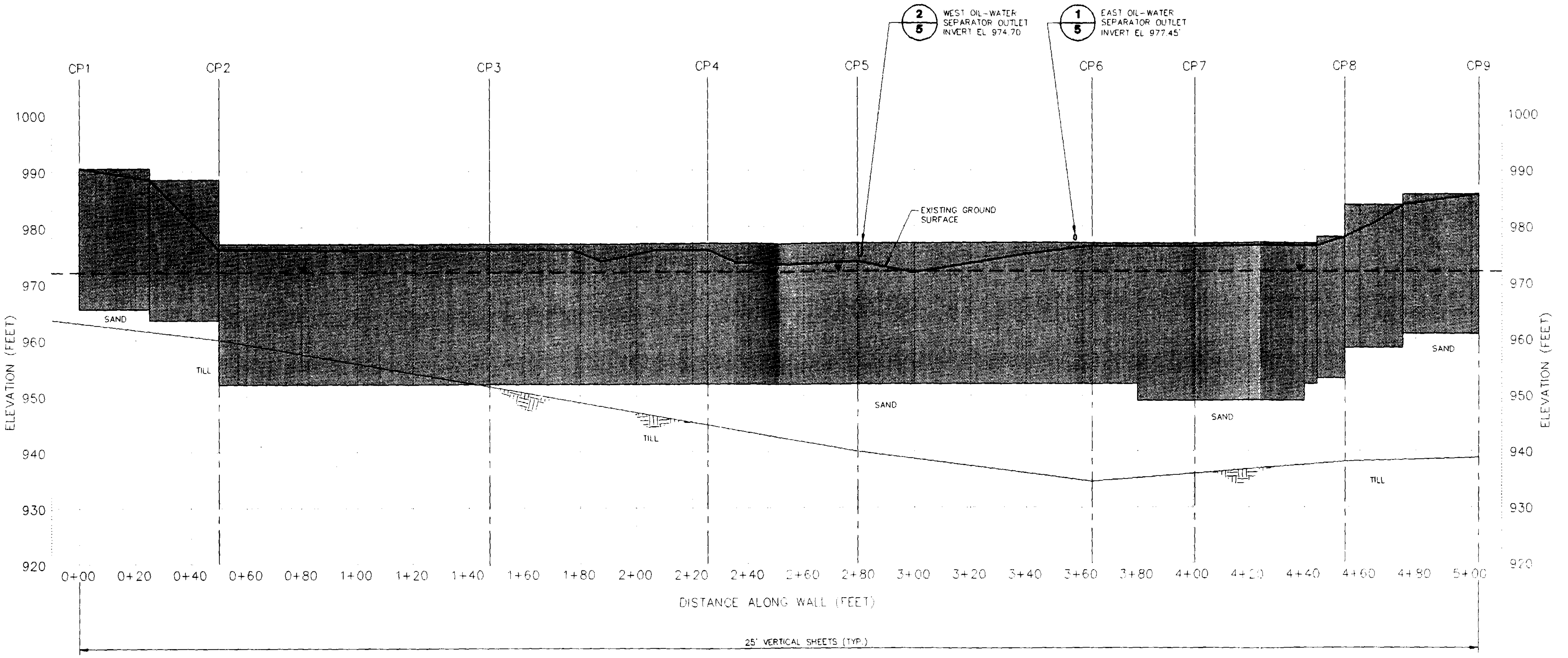
$S = 7.13\ in^3$

CONCLUSIONS

The allowable tensile strength of the grout core is 740 psi, the elastic modulus is 4,560,000 psi, the moment of inertia is 38.5 in^4, and the section modulus is 7.13 in^3.

Attachment 2

Revised Sheet 4 of Appendix D of the Supplemental Source Control Proposal



LEGEND:

CP10	SHEET PILE ALIGNMENT CONTROL POINT
— — ▼	TYPICAL RIVER SURFACE WATER ELEVATION
▨	DEPTH OF THE SHEET PILE

NOTE:

1. TOP OF TILL AND GROUND WATER TABLE ARE PROJECTED FROM SECTION A-A' OF FIGURE 3 IN SOURCE CONTROL PROPOSAL.
2. CONTROL POINT COORDINATES SHOWN ON DRAWING 2.
3. INSTALL STEEL SHEET PILE AND JOINT SEALANT IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS
4. ALL THE DIMENSIONS AND ELEVATIONS ARE APPROXIMATE. FIELD CONDITIONS MAY VARY.
5. CUTOFF SHEETING AT APPROXIMATELY GROUND SURFACE BETWEEN CP1 TO CP2 AND CP8 TO CP9.
6. THE TOP OF THE SHEET PILE WALL SHALL BE COVERED WITH RIPRAP AT THE COMPLETION OF WORK.
7. RIPRAP TOE PROTECTION SHALL BE WELL GRADED, COMPOSED OF ANGULAR STONE, AND BE SMOOTH AND UNIFORM IN APPEARANCE UPON COMPLETION.

L: ON=*, OFF=REF
P: STD-PCP/DL
3/1/99 SYR-54-RCA GMS AK
20140005/20140V04.DWG

10' 0 10' 20'
VERTICAL SCALE (FEET)
20' 0 20' 40'
HORIZONTAL SCALE (FEET)

No.	Date	Revisions	Init

Project Mgr. JMN
Designed by RDD
Drawn by RCA
Checked by RDD
Prof. Eng.
PE License

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

GENERAL ELECTRIC COMPANY • PITTSFIELD, MASSACHUSETTS
EAST STREET AREA 2 SUPPLEMENTAL SOURCE CONTROL CONTAINMENT

CONTAINMENT BARRIER PROFILE

CONTRACT DRAWINGS

File Number
201.40.005

Date
JANUARY 1999

Blasland, Bouck & Lee, Inc
Corporate Headquarters
6723 Towpath Road
Syracuse, NY 13214
315-446-9120

4

Attachment 3

Evaluation of Impacts and Mitigation/Restoration Measures for Area Subject to Massachusetts Wetlands Protection Act (3109 CMR 10.00)

Site Location

The location of this proposal activity is designated as USEPA Area 4/MCP East Street Area 2 in the "Proposal for Supplemental Source Control Containment/Recovery Measures" prepared by BBL, Inc. in January, 1999. The area for the proposed work is near a water-oil separator (identified as Building 64x) owned by the General Electric Company. The work will occur along the bank of the Housatonic River in the vicinity of Newell Street and East Street. Presently, the site is secured with gates and fencing.

Proposed Project

As part of the ongoing activities identified in the sources control work plans, the General Electric Company is proposing to implement supplemental containment measures. The activities subject to the Massachusetts Wetlands Protection Act (310 CMR 10.00) are outlined below with associated mitigating measures.

The proposed project will include installing sheet piling approximately five feet from the edge of the lower bank of the Housatonic River. The sheet piling shall extend 25 feet in depth and shall generally have an upper elevation of 977 feet (slightly higher in certain areas). Erosion control silt fence shall be installed at water's edge, between the proposed sheet piling and the water edge. This silt fence shall prevent any soil from entering the river during the installation of the sheet piling. An existing containment boom adjacent to the work area will be extended to include the entire length of the proposed sheetpile wall. In addition, a silt curtain will be installed in the river along the entire length of the work area, prior to beginning the work activities. In order to install the sheetpile, the majority of the trees on the bank of the river will need to be cleared. The trees which occur along the proposed alignment of sheetpiling will be removed, including the roots. Other trees in the work area will be cut to ground level to facilitate use of a crane and excavator to place the sheets and remove some soil form the toe of the riverbank. The roots of these trees will not be removed at this time. In addition, the fence along the top of the bank will be relocated for access by equipment.

Areas Subject to Work Under the Jurisdiction of the Wetlands Protection Act

The proposed work is along the bank of the Housatonic River. In this area, a major portion of the riverbank has a shelf below the upper bank of the river. This shelf is essentially the boundary of a bordering vegetated wetland associated with the river. (See enclosed wetland report). Therefore, the following areas are identified as resource areas as delineated by White Engineering, Inc. on February 19, 1999.

Land Under Waterway: The only work being performed within the river is the installation of the silt curtain and extension of the existing absorbent boom system. These are temporary devices. This resource area extends from the edge of the bank under the river water for the entire 400 feet of proposed work area. There will be no impact to this portion of the resource area from the sheetpile installation.

Bordering Vegetated Wetland: A strip of bordering vegetated wetland (BVW) exists along the lower shelf of the riverbank. See attachments for vegetation analysis. The sheet piling and silt fence will be installed within this BVW. The area will also be cleared of tress in order to accommodate installation crews. Trees will be cut flush with the ground and roots will be removed along the proposed alignment of the sheetpile. Roots will not be removed from those trees which occur outside the alignment of the proposed barrier wall. Additionally, some soil may be excavated from the lower portion of the riverbank to prevent possible sloughing into the river during sheetpile installation. Precautions to minimize erosion into the river include the silt fence and silt curtain. The proposed work will disturb less than 5,000 SF of BVW. Temporary restoration will include the installation of geotextiles to stabilize the bank since this area will be subject to further disturbance during GE's implementation of its proposed removal project for the upper ½ mile of the river. Final bank restoration will occur as part of that project.

Bank: The bank of the river is the first observable break in slope which is essentially where the BVW ends. There is a visible break in slope below the elevation of the top of bank, which occurs approximately along the existing fence line. This activity will involve approximately 400 linear feet. The majority of the existing trees will be removed from this portion of bank. Temporary restoration will include the installation of geotextiles, rolled erosion control products or mulch, to stabilize the bank. This area will be subject to further disturbance during GE's implementation of its proposed removal project for the upper ½ mile of the river and final bank restoration will occur as part of that project.

Bordering Land Subject to Flooding: This site is entirely within the 100-year floodplain of the Housatonic River according to the FEMA maps. The land subject to the 100-year flood begins at the border of the BVW and extends up the slope for approximately 600 feet. The potential effect of the project on flood storage capacity is discussed in Section VI of the forgoing letter from General Electric to USEPA and the Massachusetts Department of Environmental Protection.

Riverfront Area: The installation of erosion controls, sheet piling and clearing of vegetation will occur within the 100 ft. inner riparian zone to the Housatonic River. Incidental work and storage of equipment and materials will occur within the 100-ft. outer riparian zone to the river although no disturbance is proposed in this area. Less than 10% of either zone will be disturbed.

Wetland Reconnaissance Report
Riverbank Area Adjacent to General Electric Building 64X
USEPA AREA 4/ MCP East Street Area 2
Pittsfield, MA

The above mentioned area was reviewed for wetlands boundaries on February 19, 1999 by Shannon Lombardi of White Engineering, Inc. The resource area was delineated based on vegetation alone using the methods described in "Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act, A Handbook", March 1995 by MA Department of Environmental Protection. The property abuts the Housatonic River which has a bordering vegetated wetland (BVW) approximately 5 feet wide. The wetland boundary was flagged with orange and white-stripped survey flags numbered WF-1, start through WF-10, end. Vegetation and topography were adequate to determine the wetland boundary.

The area consists of the riverine system including land under waterway, bank, bordering vegetated wetland, floodplain, upland and riverfront area. The land under waterway associated with the Housatonic River extends to the bottom of the bank. The associated bank is dominated by Red-Osier Dogwood (*Cornus stolonifera*) shrubs. A bordering vegetated wetland averaging 5 feet wide along the 400 feet stretch of river is dominated by American Elm (*Almus americana*), Eastern Cottonwood (*Populus deltoides*), Silver Maple (*Acer saccharinum*), and Red-Osier Dogwood (*Cornus stolonifera*). At the top of the bank the land creates a "shelf" several feet wide along most of the 400 foot stretch of river then changes to an upward direction forming the upper bank until leveling off to the open lot. From the edge of the bordering vegetated wetland the 100-year floodplain extends well into the upland. The entire bank of the river is part of the 100-foot inner riparian zone of the riverfront area. At the time of my visit there was no visible groundcover on the bank.

Wetland Indicator Categories:

OBL (Obligate Wetland): Occurs almost always (>99%) in wetlands
FACW (Facultative Wetland): Usually occurs in wetlands (67%-99%) but occasionally found in upland environments
FAC (Facultative): Equally likely to occur in wetland or uplands (34%-66%)
FACU (Facultative Upland): Usually occurs in uplands (67%-99%), but occasionally found in wetland environments
UPL (Obligate Upland): Occurs almost always (>99%) in uplands under natural conditions in this region. May occur in wetlands in other regions of the country.

The following resource areas present at the site are subject to the Massachusetts Wetlands Protection Act; land under waterway (Housatonic River), bank of the Housatonic River, bordering vegetated wetland adjacent to the bank, 100 ft. buffer zone from the bordering vegetated wetland, floodplain extending from the BVW boundary into the upland and 200 ft riparian zone from the Housatonic River bank under the Rivers Protection Act. This site is not included in an area of estimated wildlife habitat by the Natural Heritage and Endangered Species Program. The 400-foot stretch of riverbank is significantly less than the 10% allowable disturbance under the Wetlands Protection Act for wildlife habitat protection.

Shannon D Lombardi

Shannon D. Lombardi
Environmental Analyst
White Engineering, Inc.

DEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant: General Electric Co. Prepared by: S Lombardi, White Engineering, Inc. Project location: EAst st/Newell st. DEP File #:

Check all that apply:

☒ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only

☐ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II

☐ Method other than dominance test used (attach additional information)

Section I. Vegetation

Observation Plot Number: A Transect Number: 2 Date of Delineation: 2/19/99

A. Sample Layer and Plant Species (by common/scientific name)	B. Percent Cover (or basal area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Trees				
Northern Red oak (Quercus rubra)	10%	10.2%	no	FACU-
American Elm (alnus americana)	6%	6.1%	no	FACW-
Eastern Cottonwood (Populus deltoides)	60%	61.2%	yes	FAC*
Norway maple (Acer platanoides)	8%	8.2%	no	UPL
Gray Birch (Betula populifolia)	6%	6.1%	no	FAC
Paper Birch (Betula papyrifera)	8%	8.2%	no	FACU
Shrubs/saplings				
Common Buckthorn (Rhamnus carthartica)	10%	18.9%	no	UPL
Red-osier Dogwood (Cornus stolonifera)	35%	66%	yes	FACW+*
Norway maple (Acer platanoides)	8%	15.1%	no	UPL
Climbing vines				
Bittersweet (celastrus scandens)	60%	100%	yes	FACU-

* Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus *Sphagnum*; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.

Vegetation conclusion:

Number of dominant wetland indicator plants: 2 Number of dominant non-wetland indicator plants: 1

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? [✓ yes] no

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent.

MA DEP; 3/95

DEP Bordering Vegetated Wetland (310 CMR 10.55) Delineation Field Data Form

Applicant: General Electric Co Prepared by: S. Lombardi White engineering, Inc. Project location: EAST ST/Newell St. DEP File #:

Check all that apply:

☒ Vegetation alone presumed adequate to delineate BVW boundary: fill out Section I only

☐ Vegetation and other indicators of hydrology used to delineate BVW boundary: fill out Sections I and II

☐ Method other than dominance test used (attach additional information)

Section I. Vegetation

Observation Plot Number: A Transect Number: 1 Date of Delineation: 2/19/99

A. Sample Layer and Plant Species (by common/scientific name)	B. Percent Cover (or basal area)	C. Percent Dominance	D. Dominant Plant (yes or no)	E. Wetland Indicator Category*
Trees				
Eastern cottonwood (Populus deltoides)	50%	47.5%	yes	FAC*
Norway maple (Acer platanoides)	30%	28.6%	yes	UPL
Silver maple (Acer saccharinum)	25%	23.8%	no	FACW
Shrub/Sapling				
Common Buckthorn (Rhamnus cathartica)	8%	11.4%	no	UPL
American Elm (Ulnus americana)	12%	17.1%	no	FACW-
Silver maple (Acer saccharinum)	10%	14.3%	no	FACW
Red maple (Acer rubrum)	25%	35.7%	yes	FAC*
Red-osier Dogwood (Cornus stolonifera)	15%	21.4%	yes	FACW*
Climbing Vines				
American Bittersweet (Celastrus scandens)	80%	100%	yes	FACU-

* Use an asterisk to mark wetland indicator plants: plant species listed in the Wetlands Protection Act (MGL c.131, s.40); plants in the genus *Sphagnum*; plants listed as FAC, FAC+, FACW-, FACW, FACW+, or OBL; or plants with physiological or morphological adaptations. If any plants are identified as wetland indicator plants due to physiological or morphological adaptations, describe the adaptation next to the asterisk.

Vegetation conclusion:

Number of dominant wetland indicator plants: 3 Number of dominant non-wetland indicator plants: 0

Is the number of dominant wetland plants equal to or greater than the number of dominant non-wetland plants? [✓ yes] no

If vegetation alone is presumed adequate to delineate the BVW boundary, submit this form with the Request for Determination of Applicability or Notice of Intent.

MA DEP: 3/95

Riverbank Adjacent to General Electric Company Building 64X
USEPA Area A/ MCP East Street Area 2
General Electric Company Property

Species List

As observed February 19, 1999

Sta 0+50

Trees (# of species >5" dia)	Scientific Name	Wetland Indicator Category
Eastern Cottonwood (3)	*Populus deltoides*	FAC
Norway Maple (5)	*Acer platanoides*	UPL
Silver Maple (5)	*Acer saccharimum*	FACW

Shrubs	Scientific Name	Wetland Indicator Category
Common Buckthorn	*Rhamnus cathartica*	UPL
American Elm	*Ulmus americana*	FACW-
Silver Maple	*Acer saccharimum*	FACW
American Bittersweet	*Celastrus scandens*	FACU-

Sta 50+100

Trees (# of species >5" dia)	Scientific Name	Wetland Indicator Category
None		

Shrubs	Scientific Name	Wetland Indicator Category
Red-Osier Dogwood	*Cornus stolonifera*	FACW+
Smooth Sumac	*Rhus glabra*	FAC
American Bittersweet	*Celastrus scandens*	FACU-

Sta 100+150

Trees (# of species >5" dia)	Scientific Name	Wetland Indicator Category
None		

Shrubs	Scientific Name	Wetland Indicator Category
Red Maple	*Acer rubrum*	FAC
Red-Osier Dogwood	*Cornus stolonifera*	FACW+

Sta 150+200

No vegetation visible at this time

Sta 200+250

Trees (# of species >5" dia)	Scientific Name	Wetland Indicator Category
Northern Red Oak(1)	*Quercas rubra*	FACU-
American Elm (1)	*Ulmus americana*	FACW-
Eastern Cottonwood (5)	*Populus deltoides*	FAC

(Sta 200+250 cont.)

Shrubs	Scientific Name	Wetland Indicator Category
Common Buckthorn	*Rhamnus cathartica*	UPL
Red-Osier Dogwood	*Cornus stolonifera*	FACW+
Norway Maple	*Acer platanoides*	UPL

Sta 250+300

Trees (# of species >5" dia)	Scientific Name	Wetland Indicator Category
Eastern Cottonwood (4)	*Populus deltoides*	FAC
Norway Maple(1)	*Acer platanoides*	UPL

Shrubs	Scientific Name	Wetland Indicator Category
None		

Sta 300+350

Trees (# of species >5" dia)	Scientific Name	Wetland Indicator Category
Northern Red Oak(2)	*Quercas rubra*	FACU-
Eastern Cottonwood (2)	*Populus deltoides*	FAC

Shrubs	Scientific Name	Wetland Indicator Category
Red-Osier Dogwood	*Cornus stolonifera*	FACW+

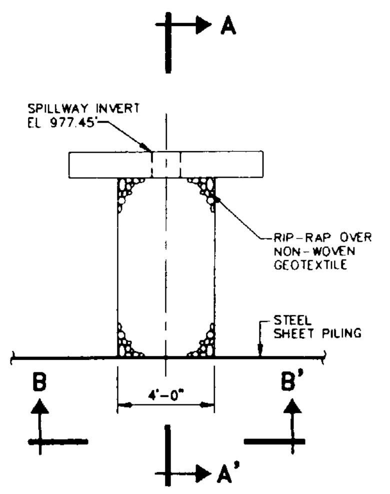
Sta 350+400

Trees (# of species >5" dia)	Scientific Name	Wetland Indicator Category
Eastern Cottonwood (6)	*Populus deltoides*	FAC
Gray Birch(1)	*Betula populifolia*	FAC
Paper birch (1)	*Betula papyrifera*	FACU

Shrubs	Scientific Name	Wetland Indicator Category
None		

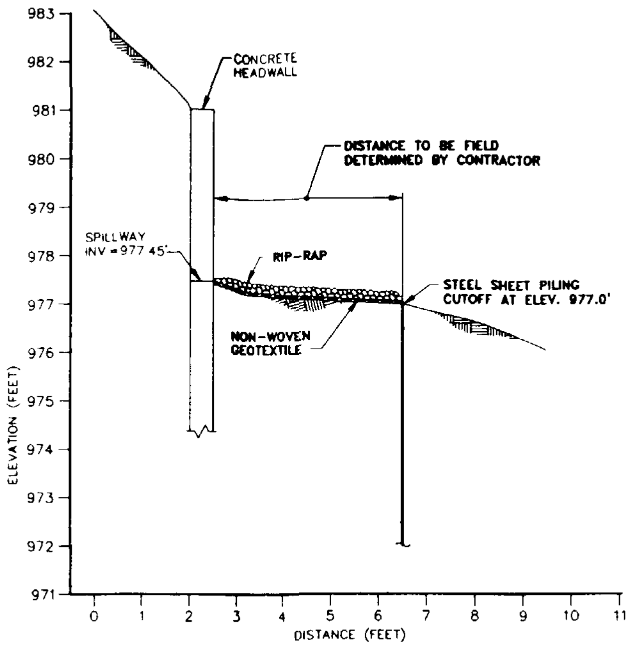
Attachment 4

Revised Sheet 5 of the Supplemental Source Control Proposal



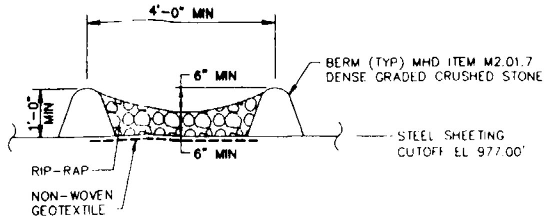
EAST HEADWALL PLAN ①

NOT TO SCALE



SECTION A-A' ①

SCALE: 1"=2'-0"



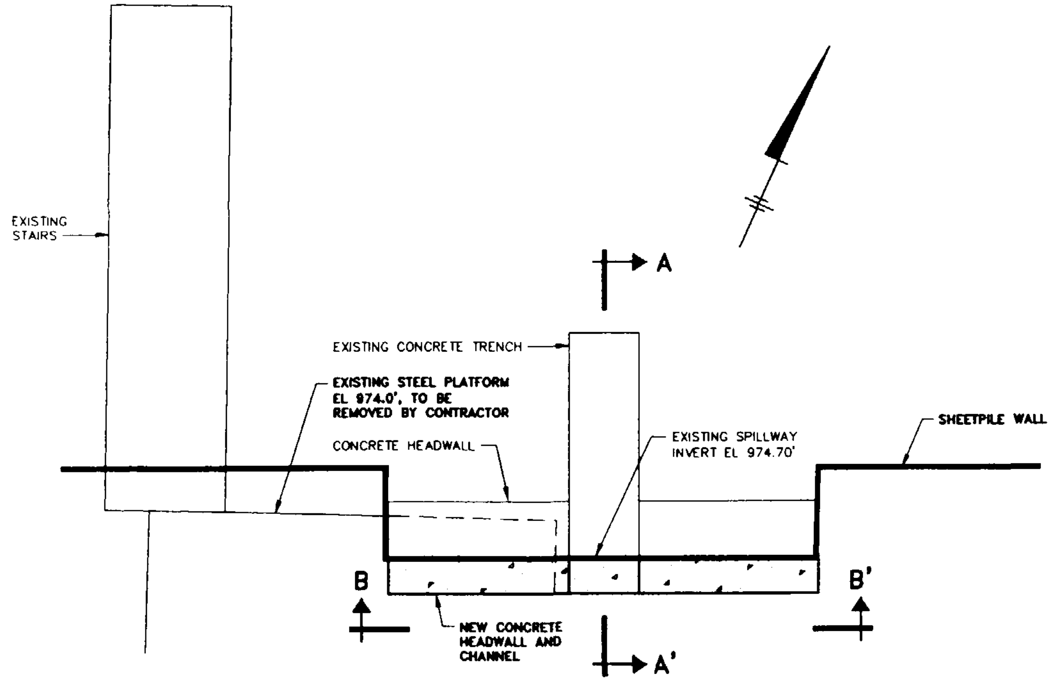
NOTES:

1. RIP-RAP SHALL CONSIST OF HARD, DURABLE ANGULAR ROCK WITH STONE SIZES OF 10 TO 50 LBS OR INTERLOCKING PRECAST CONCRETE BLOCKS.

2. CONTRACTOR MAY USE PRECAST CONCRETE GUTTER SECTIONS PROVIDED SOILS BELOW ENDS ARE ADEQUATELY PROTECTED AGAINST EROSION.

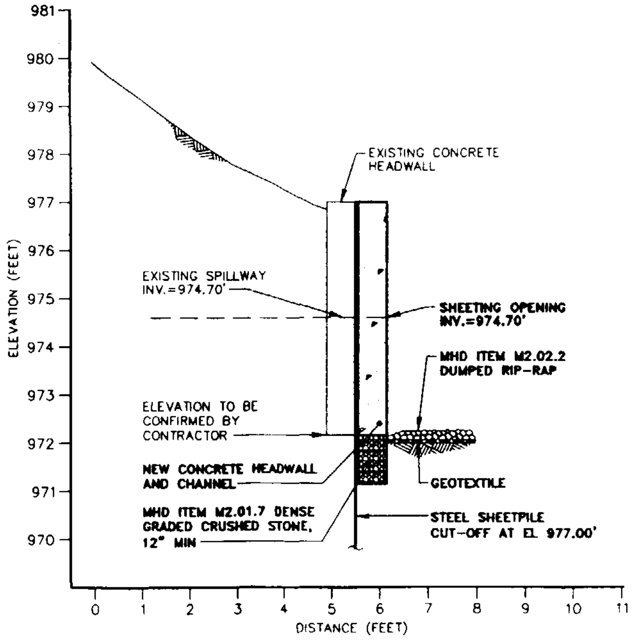
SECTION B-B" ①

NOT TO SCALE



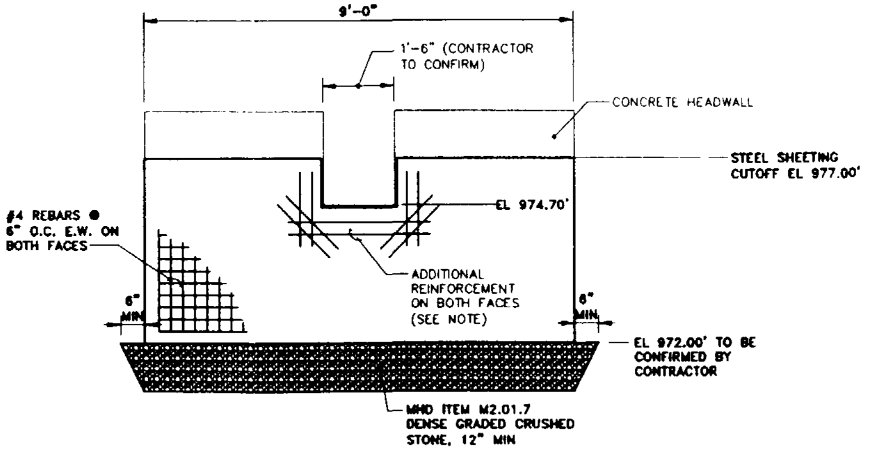
WEST HEADWALL PLAN ②

NOT TO SCALE



SECTION A-A' ②

SCALE: 1"=2'-0"



NOTES:

1. REBAR MAT TO BE ATTACHED TO STEEL LUGS WELDED TO SHEETPILING @ 1' O.C.
2. MINIMUM 3" COVER FOR REBAR.
3. PROVIDE ADDITIONAL REINFORCEMENT OF #4 BARS AS SHOWN. THE BARS WILL BE PLACED ABOUT 2" FROM THE CONCRETE FACE. THE REINFORCEMENT WILL BE EXTENDED A MINIMUM OF 12" BEYOND THE OPENING.

SECTION B-B' ②

NOT TO SCALE

FOR BID ONLY
NOT FOR CONSTRUCTION

L: ON=*; OFF=*REF
P: STD-PCP/DL D2BL
2/25/99 SYR-54-RCA GMS AK
20140005\20140809.DWG

GRAPHIC SCALE

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No.	Date	Revisions	Init

Project Mgr. JMN
Designed by RDD
Drawn by RCA/GMS
Checked by RDD
Prof. Eng.
PE License

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

GENERAL ELECTRIC COMPANY• PITTSFIELD, MASSACHUSETTS
EAST STREET AREA 2 SUPPLEMENTAL SOURCE CONTROL MEASURES

DETAILS

CONTRACT DRAWINGS

File Number
201.40.005

Date
FEBRUARY 1999

Blasland, Bouck & Lee, Inc.
Corporate Headquarters
6723 Towpath Road
Syracuse, NY 13214
315-446-9120

5

EPA Approval Letter Dated March 17, 1999 for GE's: Letter RE: Conditional Approval of Supplemental Source Control Containment/Recovery Measures East Street Area 2, General Electric Company, Pittsfield, MA DEP Site No. 1-0146, USEPA Area 4, March 1, 1999

United States Environmental Protection Agency
Region I
One Congress Street, Suite 1100
Boston, MA 02114-2023

ENVIRONMENTAL PROGRAMS
MAR 1 [illegible] 1999

March 17, 1999

Mr. Andrew T. Silfer, P.E.
General Electric Company
100 Woodlawn Avenue
Pittsfield, Massachusetts 01201

RE: GE's March 1, 1999 submittal titled *Conditional Approval of Supplemental Source Control Containment/Recovery Measures East Street Area 2, General Electric Company, Pittsfield, Massachusetts*

EPA reviewed the above-referenced submittal and approves the submittal subject to the following conditions:

Performance Standards and Revised Monitoring Procedures

The proposed performance standards are modified as follows:

1. Prevention of discharges of LNAPL to the Housatonic River and/or river sediments in the area of the proposed containment barrier.
2. Prevention of bank seeps, as well as sheens to the Housatonic River in this area resulting from either bank seeps or residual LNAPL in soils/sediments located on the river side of the proposed containment barrier or from failure of the containment barrier.
3. Prevention of any measurable LNAPL migration around the ends of the containment barrier.

The 3rd sentence of Bullet 4 of the section discussing measurement and monitoring activities shall be revised as follows:

"However, Performance Standards #1 and #2 will not become effective until after the completion of activities outlined in the *Removal Action Work Plan - Upper ½-Mile Reach of the Housatonic River* (½-Mile Removal Action Work Plan). Performance Standard #3 will become effective upon completion of the sheetpile installation."

The subsequent paragraph shall be revised as follows:

"As noted above, Performance Standards #1 and #2 will not become effective until after the completion of activities outlined in the *Removal Action Work Plan - Upper ½-Mile Reach of the Housatonic River* (½-Mile Removal Action Work Plan). Performance Standard #3 will become effective upon completion of the sheetpile installation. If, after the effective date, the performance standards are not met, GE shall propose corrective measures and implement corrective measures upon USEPA approval."

Semi-Annual Reports

GE shall continue to submit semi-annual reports to EPA for approval. The reports are currently titled, *Occurrence of Oil at East Street Area 2/USEPA Area 4.* The semi-annual reports shall be modified to include a comparison of the monitoring results to the performance standards, documentation of any exceedances of the performance standards, an assessment of the containment and NAPL recovery operations, and proposals for any additions and/or modifications to the containment, recovery, and/or monitoring procedures.

Figure 1. Containment Barrier Plan

Relocate the proposed monitoring well on the upstream end of the proposed containment barrier fifteen feet to the east.

Page 6, 3rd paragraph and Figure 4. Containment Barrier Profile (and/or other contract drawings/specifications)

Include the following as notes on Figure 4 and other appropriate contract drawings/ specifications:

1. The elevation of the top of sheetpile from control location CP2 to station 4+42 (approximately) shall be 977 feet above mean sea level.

2. The minimum depth of embedment of the sheetpiling from control location CP2 to station 3+80 and from station 4+40 to CP8 shall be 952 feet above mean sea level. (Note to GE. This requires a slightly deeper embedment and length of sheetpiling from approximately 4+42 to CP8).

3. The minimum depth of embedment of the sheetpiling from station 3+80 to 4+40 shall be 949 feet above mean sea level.

Geotechnical

GE did not fully address EPA's concerns regarding the potential for localized hard driving conditions along the sheetpile alignment. EPA believes the potential is real due to the low Section Moduli (15.9 and 24.9 in^3/ft) and hence the light duty structural integrity of the selected Waterloo WZ75 and WEZ95 sections. These sections may therefore only be able to withstand limited driving stresses before buckling under hard driving conditions. For comparison purposes, conventional heavy duty sheetpiling sections are available with section modulus values as high as 60 in^3/ft. GE shall monitor the sheetpile installation to ensure that buckling does not occur. If buckling is observed, the GE shall take corrective action such as welding steel plates to the flanges of Z shaped sheeting to stiffen these sections.

West Headwall

GE shall take measures to eliminate or minimize groundwater seepage at the concrete spillway/sheetpile interface where the sheetpile is cut to elevation 974.70. This may include the use of sealant, gasket or other mechanism.

In subsequent submittals for the ½-Mile Removal Action, GE shall account for the scour induced by the proposed west headwall protrusion into the river. This shall be factored into the design of the toe protection, armored cap, or other restoration proposed in the vicinity of the west headwall. The design shall be consistent with EM 1110-2-1601, Hydraulic Design of Flood Control Channels.

Schedule

For the purpose of establishing a start date, GE shall issue the authorization-to-proceed to their construction contractor on April 19, 1999. Therefore, according to GE's proposed schedule, the completion date for the installation for the sheetpile is June 11, 1999 and the completion date for the project is June 18, 1999. Prior to April 19, 1999, GE may order materials (including the sheetpiling) necessary to complete the project on schedule.

Additional performance standards, objectives and other requirements for the containment/recovery systems will be included in the Scope of Work for Removal Actions Outside the River, which is currently being negotiated by GE, EPA, and other government agencies.

If you have any questions, please contact me at (617) 918-1282.

Sincerely,

Dean Tagliaferro
On-Scene Coordinator

cc: John Ciampa, GE
Lyn Cutler, MA DEP
John Ziegler, MA DEP
John Kilborn, EPA
Steve Acree, US EPA
Dawn Veillieux, Roy F. Weston
Joel Lindsay, Roy F. Weston
John Kullberg, USACE
Margaret Meehan, EPA
Anton Giedt, NOAA
Dale Young, MA EOEA
Tom O'Brien, MA EOEA
Mayor Doyle, City of Pittsfield
Pittsfield Conservation Commission
Pittsfield City Council, c/o Tom Hickey
Site File

Letter RE: Newell Street Area II (DEP #1-1057; USEPA Area 5B) Proposal for DNAPL Recovery Operations [Well N2SC-11], March 10, 1999

GE Corporate Environmental Programs
General Electric Company
100 Woodlawn Avenue, Pittsfield, MA 01201

Transmitted Via Facsimile and FedEx

March 10, 1999

Mr. Alan Weinberg
Bureau of Waste Site Cleanup
Department of Environmental Protection
436 Dwight Street
Springfield, MA 01103

Mr. Dean Tagliaferro
Mr. Bryan Olson
Office Site Remediation and Restoration
U.S. Environmental Protection Agency
One Congress Street
Boston, MA 02203-2211

Re: Newell Street Area II (DEP #1-1057; USEPA Area 5B)
Proposal for DNAPL Recovery Operations

Dear Mr. Weinberg, Mr. Olson and Mr. Tagliaferro:

Enclosed please find the General Electric Company's (GE's) proposal for dense nonaqueous phase liquid (DNAPL) recovery operations at the Newell Street Area II/USEPA Area 5B Site in Pittsfield, Massachusetts. This proposal presents a design for an automated DNAPL collection system for well N2SC-1I.

Upon approval of the proposed DNAPL recovery system, GE will start procurement of all necessary materials and implement the proposed activities once these materials are received.

Please call if you have any questions or comments.

Sincerely,

John D. Ciampa

John D. Ciampa
Remedial Project Manager
F:\USERS\JLL\03891813.WPD

JJL/jll

Enclosures

cc: J. Cutler, DEP*
R. Bell, DEP*
M. Holland, DEP
A. Kurpaska, DEP*
R. Child, DEP*
J. Kilborne, EPA
M. Nalipinski, EPA*
State Representative D. Bosley
Mayor G. Doyle
State Representative C. Hodgkins
State Representative S. Kelly
State Representative P. Larkin
State Senator A. Nuciforo
Pittsfield Conservation Commission*
Commissioner of Health, Pittsfield*
Housatonic River Initiative
Public Information Repositories ECL I-P-IV(A)(1) & (2)*
J. Bieke, Esq., Shea & Gardner*
S. Cooke, McDermott & Emery*
G. Bibler, Esq., Goodwin, Procter & Hoar*
A. Thomas, Esq., GE*
J. Magee, GE
M. Gravelding, BBL*
B. Charest, Northeast Utilities*

* enclosures

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS

PROPOSAL FOR DNAPL RECOVERY OPERATIONS FOR WELL N2SC-1I - NEWELL STREET AREA II

I. INTRODUCTION

On December 18, 1998, an initial pump test was performed in well N2SC-1I at the Newell Street Area II/USEPA Area 5B Site (the Site) in Pittsfield, Massachusetts. Based on the results of this initial test, it appeared that an automated dense non-aqueous phase liquid (DNAPL) recovery system might be warranted for this well, since it recovered significantly more DNAPL than the surrounding wells and is located in a depression of the till confining layer. On January 8, 1999, the General Electric Company (GE) submitted a letter to the United States Department of Environmental Protection (USEPA) and the Massachusetts Department of Environmental Protection (MDEP) (collectively referred to as the Agencies) regarding the results of the initial DNAPL pump test. This letter included a proposal to pump DNAPL from well N2SC-1I for approximately one hour per weekday over a two-week time frame and to perform an additional one-day pump test to further evaluate the potential recovery volumes in this area. Subsequently, between January 15 and February 1, 1999, GE in conjunction with Blasland, Bouck & Lee, Inc. (BBL) performed the DNAPL recovery tests. The results of these tests were presented in a document entitled *Source Control Investigation Report Upper Reach of Housatonic River (First ½ Mile)* (HSI Geotrans, February 1999).

Based on the DNAPL recovery test results, installation of an automated DNAPL collection system was proposed for well N2SC-1I. This proposed automated DNAPL collection system is in addition to the USEPA-approved automated DNAPL collection system for wells NS-15, NS-30, and NS-32 (which became operational on March 1, 1999). A description of the additional proposed system is provided in Section II; regulatory requirements are discussed in Section III; and the tentative implementation schedule is discussed in Section IV.

II. DESCRIPTION OF DNAPL COLLECTION SYSTEM

As discussed above, GE intends to install an automated DNAPL collection system in well N2SC-1I. This section provides a general description of the proposed system. Figure 1 provides a site plan and Figures 2 through 5 provide additional details and system specifications.

A pneumatic DNAPL recovery pump will be installed in well N2SC-1I. The pump will discharge via double wall containment piping into four 1,000-gallon steel tanks located within a portable box trailer enclosure. The box trailer will be located within the GE parking lot, adjacent to well N2SC-1I. The piping run from the well to the trailer will be insulated and heat traced to prevent freezing during winter operations. Additionally, the piping will be sloped to allow drainage back to the well when the pump is not in operation. The operation of the pump will be controlled by a timer located adjacent to the well head that can be adjusted, as appropriate, to optimize DNAPL recovery. The air compressor installed for the existing in-place automated system for wells NS-15, NS-30, and NS-32 will supply the air for the pneumatic recovery pump in well N2SC-1I. Additionally, all piping materials, the pump, floats, etc. that will be in contact with the DNAPL have been selected based on appropriate materials compatibility considerations.

Four steel tanks will be installed in an existing box trailer that currently contains heat and lighting. Ventilation will be added to the trailer prior to initiating DNAPL collection activities. The trailer will be modified to include a steel-diked secondary containment area for each set of two tanks. Each containment area will be able to hold 110 percent of the total volume of two tanks (i.e., 2,200 gallons). The steel tanks will additionally contain overfill protection, level controls, and an ultrasonic level transmitter. A backup high level float will also be installed for redundant protection. To properly ventilate the steel tanks, vent lines will be connected from each tank to one 55-gallon carbon vessel located within the trailer and then vented 12 feet above grade.

The DNAPL storage trailer is mobile and will be set-up on cribbing on the GE-owned Newell Street parking lot. It is expected that a self-powered vacuum disposal vehicle will be utilized to periodically pump-out the DNAPL from the steel tanks and transport it for appropriate off-site disposal. As a preventative measure, a drip-pan to be stored in the box trailer will be placed below the valves during the time when the storage tanks are being emptied. In order to comply with Toxic Substances Control Act (TSCA) regulations, pump-out activities will occur every 30 days or less. A stand-by unloading pump will also be installed in the trailer in the event that self-powered vacuum disposal vehicles are not available. This pump will allow the storage tanks to be emptied into conventional tank trucks for off-site disposal.

III. REGULATORY REQUIREMENTS

Based on correspondence with the USEPA, this source control project is being performed as an onsite removal action under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA); therefore, a Notice of Intent (NOI) is not required to be submitted to the Pittsfield Conservation Commission (PCC). However, this proposal has been prepared to meet substantive requirements of the Massachusetts Wetlands Protection Act.

The above-mentioned proposed work will be performed within the 100-foot buffer zone and river front area of the Housatonic River. Based on an evaluation of the site in November 1998, by White Engineering, wetland vegetation is confined to the lower portion of the river bank. The box trailer will be located approximately 100 feet from the top of the southerly bank of the River. There shall be no impacts on the River, vegetation, or soil as the work proposed is within the paved portion of Newell Street parking lot. In addition, portions of the work (the compressed air and electrical connection to the existing DNAPL collection system) are also within the inner and outer riparian zones under protection by the Rivers Protection Act. However, there will be minimal temporary disturbances to this area due to the fact that the site has been used previously as a paved parking lot. The existing DNAPL system was previously permitted by the PCC with respect to the Massachusetts Wetlands Protection Act.

The proposed project area is also within the 100-year floodplain of the River. Approximately 0.135 cubic yards (cy) of flood storage, in the form of pipe stands, piping, and electrical enclosures, will be affected in this area (see Table 1). The mobile box trailer enclosure is designed to be removed (after the tanks have been emptied) in the event of a potential flood. Therefore, the trailer will not impact floodplain compensation. Flood storage compensation for this project (due to pipe stands, piping, electrical enclosures) is being provided by removal of 117 linear feet of existing guardrails and support post located in the parking lot (see Figure 1). A total of 0.167 cy is available, from removal of the guardrail and support posts (see Table 1).

IV. ANTICIPATED SCHEDULE

Upon receipt of Agency approval of the proposed DNAPL collection system, GE will order the necessary materials and implement the proposed activities once these materials are received. The estimated time for procurement and delivery of equipment is 6 to 8 weeks and the estimated installation time is 4 weeks. This schedule may be subject to modification, if necessary, to accommodate possible constraints associated with material procurement, inclement weather, and obtaining access permission from the Western Massachusetts Electric Company (since the well N2SC-1I is on their property). In the meantime, GE will continue to perform previously approved daily monitoring and DNAPL recovery, for wells N2SC-1I, N2SC-2, N2SC-3S, and N2SC-3I until the automated recovery system is operational. Once automated recovery in well N2SC-1I is initiated, GE will monitor nearby wells N2SC-2, N2SC-3S, and N2SC-3I to see if DNAPL levels are influenced by the pumping activities. If they are not, GE will evaluate the necessity of extending automated recovery operations to these wells.

TABLE NO. 1

COMPENSATORY STORAGE - NEWELL STREET PARKING LOT

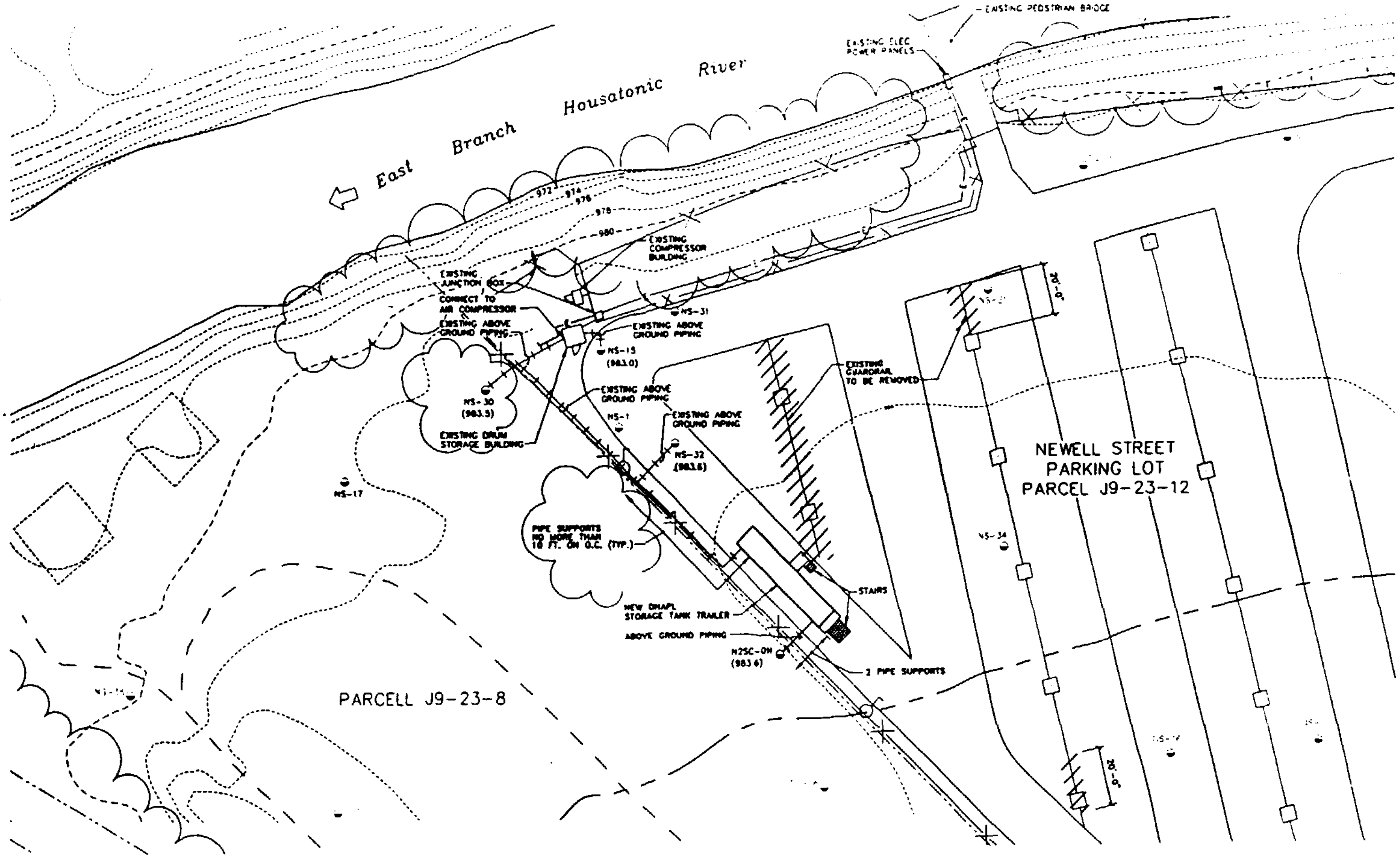
New Items - Well Head & Piping

Fill Volumes (Cubic Yards)					
Elevation Range (Ft.)		Pipe Stands	Control Box	Misc.	Total
983-984		0.003		0.002	0.005
984-985		0.003		0.002	0.005
985-986		0.003		0.002	0.005
986-987		0.003	0.05	0.002	0.055
987-988		0.003	0.05	0.002	0.055
988-989		0.003		0.002	0.005
989-990		0.003		0.002	0.005
		0.021	0.1	0.014	0.135

Removal of Existing Guard Rail

Cut Volumes (Cubic Yards)					
Elevation Range (Ft.)		Guard Rail	Post		Total
983-984		-0.021	-0.021		-0.042
984-985		-0.104	-0.021		-0.125
985-986					
986-987					
987-988					
988-989					
989-990					
		-0.125	-0.042		-0.167

Total Volume of Fill = .135 CY
Total Volume of Cut = -.167 CY
Surplus Compensatory Volume = 0.032



SITE PLAN

SCALE: 1"=20'

LEGEND

NS-32 ◒ (983.6) MONITORING WELL (GRADE ELEVATION IDENTIFIED IN PARENTHESES)

—— E —— ELECTRIC SUPPLY

—— - - —— 100 - FOOT BUFFER ZONE

NOTES:

1. THE BASE MAP FEATURES PRESENTED ON THIS FIGURE WERE PHOTOGRAMMETRICALLY MAPPED FROM APRIL 1990 AERIAL PHOTOGRAPHS.
2. MONITORING WELL LOCATIONS HAVE BEEN SURVEYED TO KNOWN PHYSICAL FEATURES BY BLASLAND, BOUCK & LEE, INC. AND HILL ENGINEERS, ARCHITECTS, PLANNERS, INC. WELL LOCATIONS SHOWN ON THIS MAPPING ARE APPROXIMATE. HOWEVER SURVEY DATA ARE AVAILABLE TO IDENTIFY PRECISE SAMPLING LOCATIONS.
3. LIMITS OF BUILDINGS, PROPERTY BOUNDARIES, AND ROADS ARE APPROXIMATE.
4. THE 100 YEAR FLOODPLAIN ELEVATION IS 990 FEET PER THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA).

GENERAL NOTE:

ALL SCALES ARE REDUCED FROM INDICATED TO APPROXIMATELY HALF SIZE

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Graphic Scale
1"=20' 20' 0 20' 40'

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engineers & scientists

GENERAL ELECTRIC COMPANY • PITTSFIELD, MASSACHUSETTS
NEWELL STREET AREA II/USEPA AREA 5B PARCEL J9-23-12

SITE PLAN

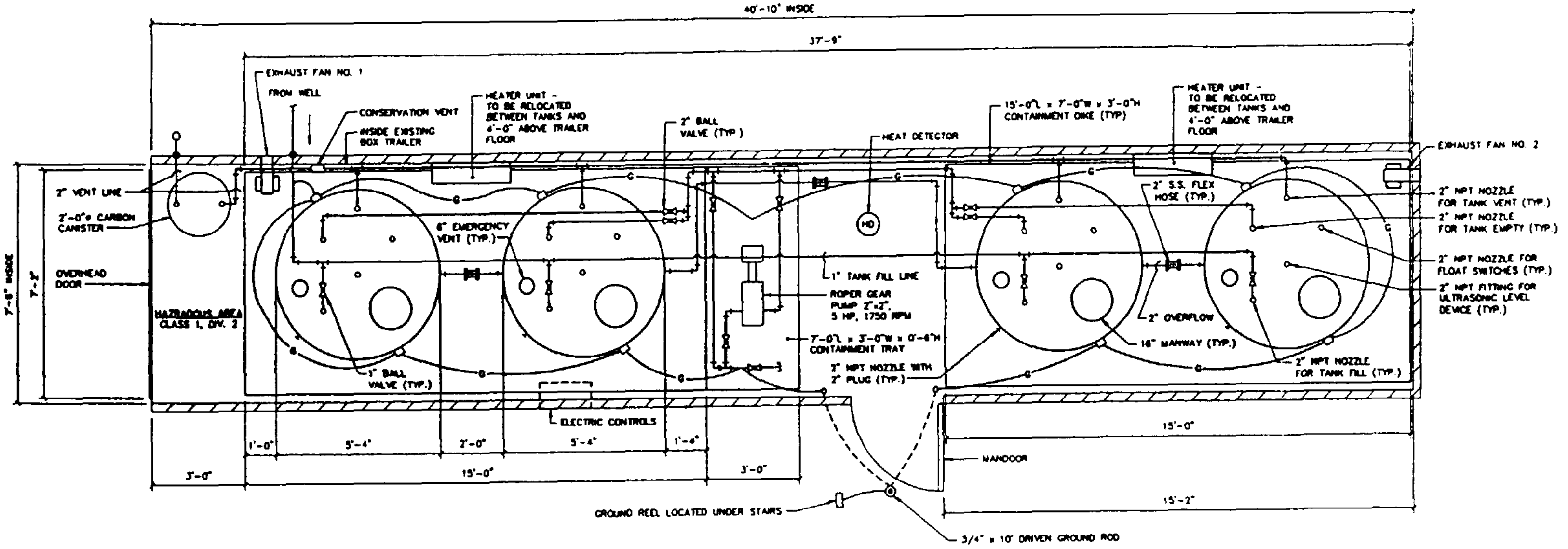
GENERAL

File Number
201 40 XXF

Date
MARCH 1999

Blasland, Bouck & Lee, Inc
Corporate Headquarters
6723 Towpath Road
Syracuse, NY 13214
315-446-9120

1



DNAPL STORAGE TANK TRAILER

SCALE: 1/2"=1'-0"

GENERAL NOTE:
ALL SCALES ARE REDUCED FROM INDICATED TO APPROXIMATELY HALF SIZE.

L: ON=*, OFF=REF
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20140005/20140083.DWG

Graphic Scale
1/2"=1'-0" 2' 0 2' 4'

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DNAPL STORAGE TANK TRAILER

GENERAL

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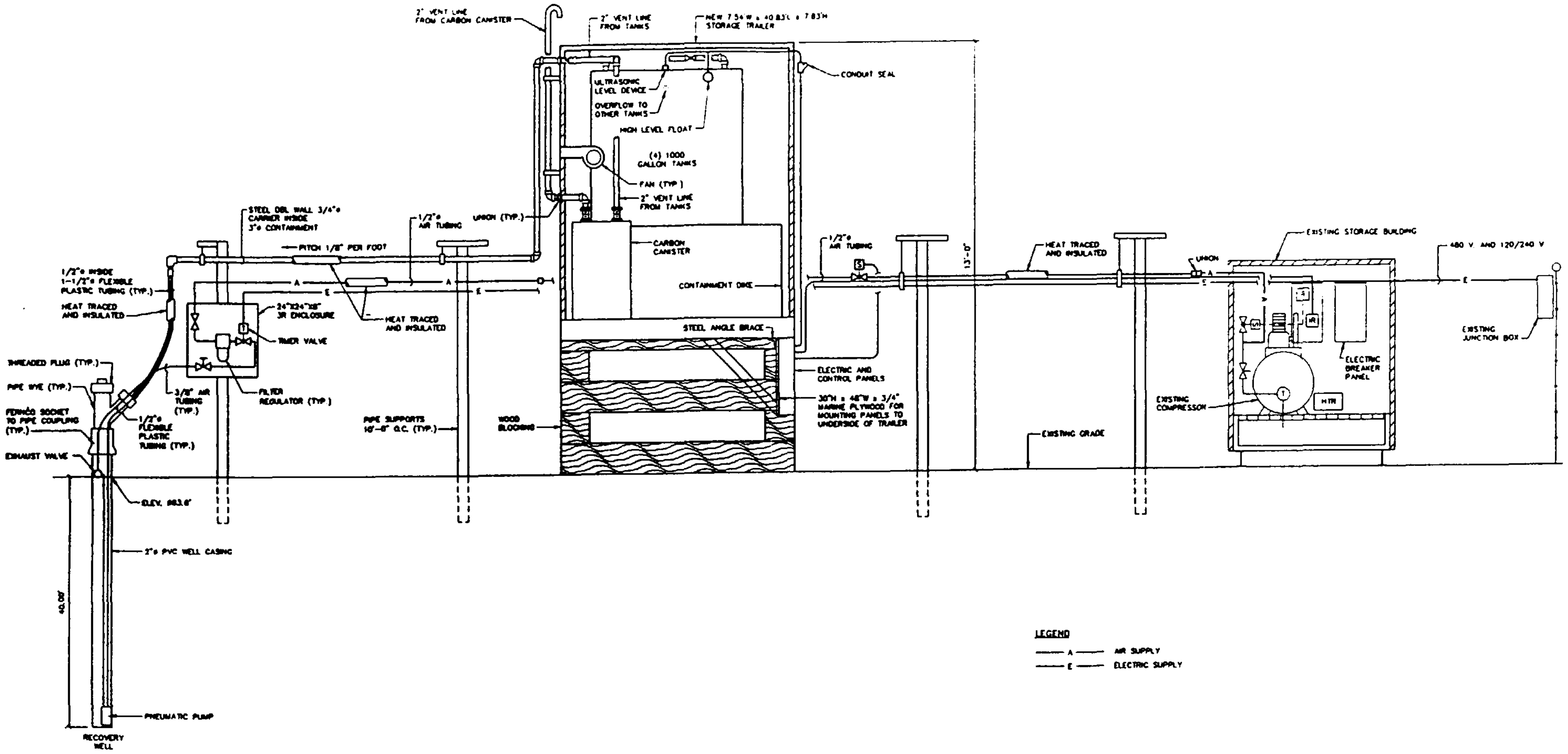

DNAPL RECOVERY SYSTEM SCHEMATIC

NOT TO SCALE

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Graphic Scale

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NEWELL STREET AREA II/USEPA AREA 5B PARCEL J9-23-12

DNAPL RECOVERY SYSTEM

GENERAL

File Number
201.40.XXF

Date
MARCH 1999

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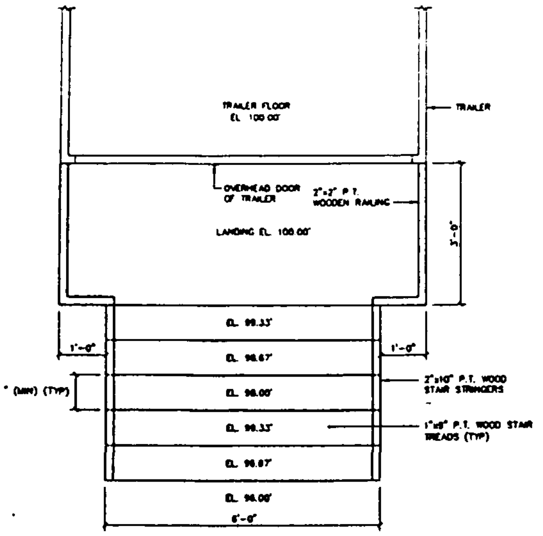
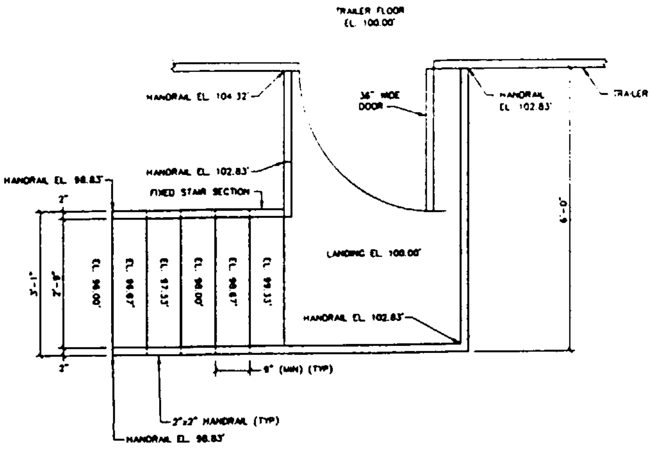
Syracuse, NY 13214
315-446-9120

3



OVERHEAD DOOR LANDING AND STAIRS

SCALE: 3/4"=1'-0"

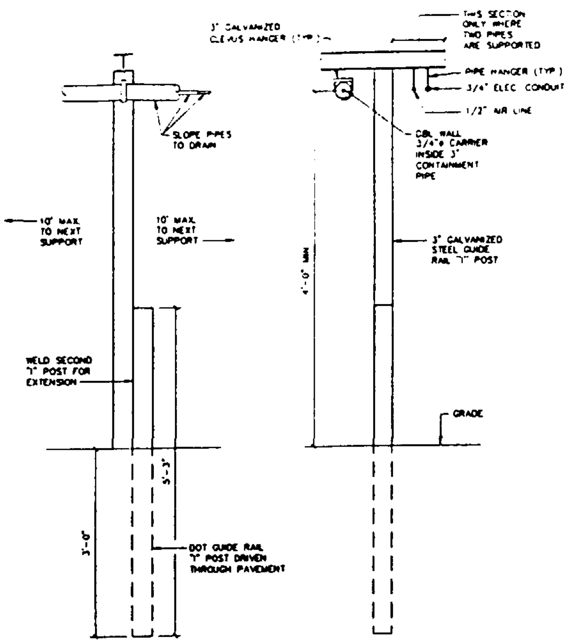


NOTE:

ALL WOOD MEMBERS TO BE PRESSURE TREATED LUMBER. ALL HARDWARE TO BE GALVANIZED UNLESS OTHERWISE NOTED.

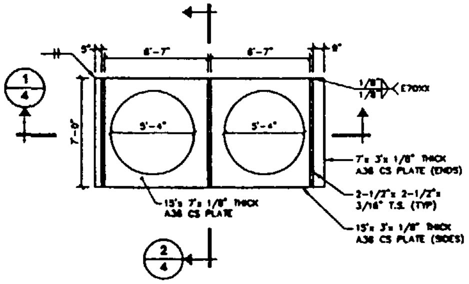
STAIR PLAN

SCALE: 3/4"=1'-0"



PIPE SUPPORT DETAIL

NOT TO SCALE

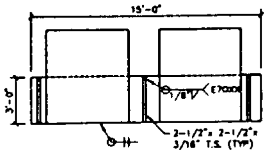


NOTES:

1. ALL WELD DESIGNATIONS ARE TYPICAL.
2. THE 7' x 3' x 6" HIGH CONTAINMENT TRAY SHALL BE OF SIMILAR MATERIAL AND CONSTRUCTION EXCEPT NO TUBULAR STEEL SHALL BE USED.

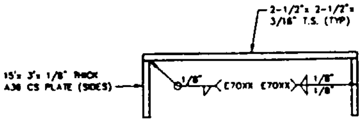
CONTAINMENT DIKE PLAN

SCALE: 1/4"=1'-0"



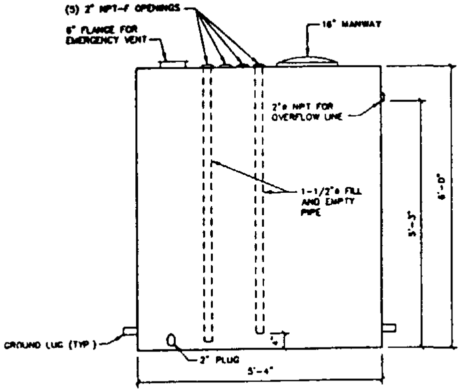
SECTION $\frac{1}{4}$

SCALE: 1/4"=1'-0"



SECTION $\frac{2}{4}$

SCALE: 1/2"=1'-0"

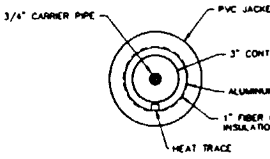


NOTE:

SEE PLAN ON SHEET 2 FOR LOCATION OF OPENINGS.

STORAGE TANK DETAIL

SCALE: 3/4"=1'-0"



PIPE SECTION

NOT TO SCALE

GENERAL NOTE:

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20140000/20140C04 DWG

1/4"=1'-0" 4' 0 4' 8'
1/2"=1'-0" 2' 0 2' 4'
3/4"=1'-0" 2' 1' 0 1' 2'

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NEWELL STREET AREA II/USEPA AREA 5B PARCEL J9-23-12

MISCELLANEOUS DETAILS

GENERAL

File Number
201 40 XXF

Date
MARCH 1999

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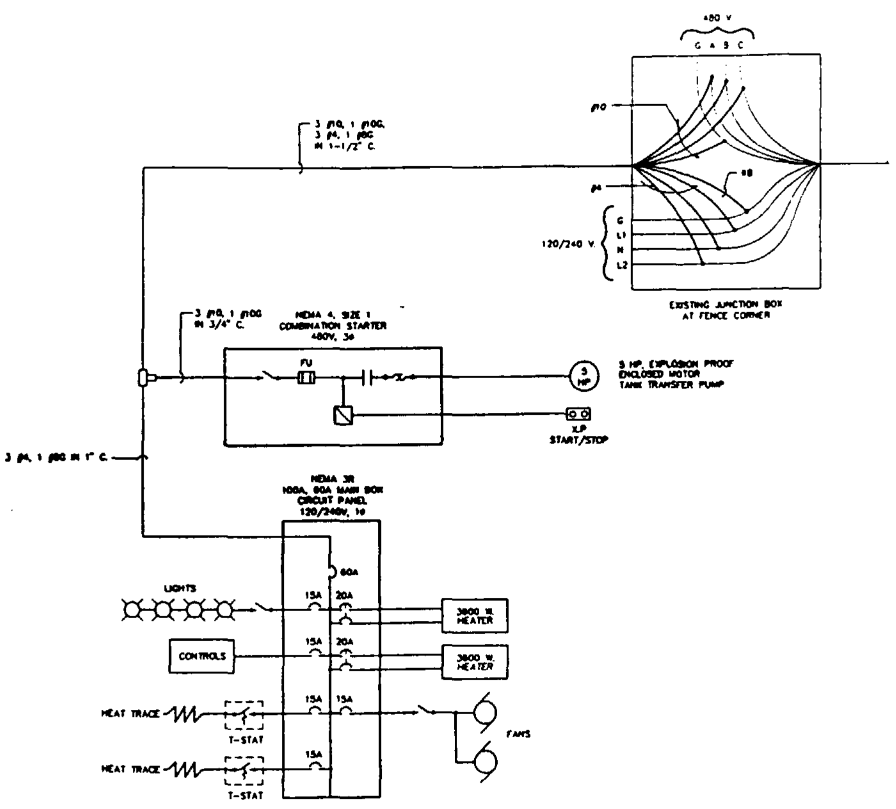
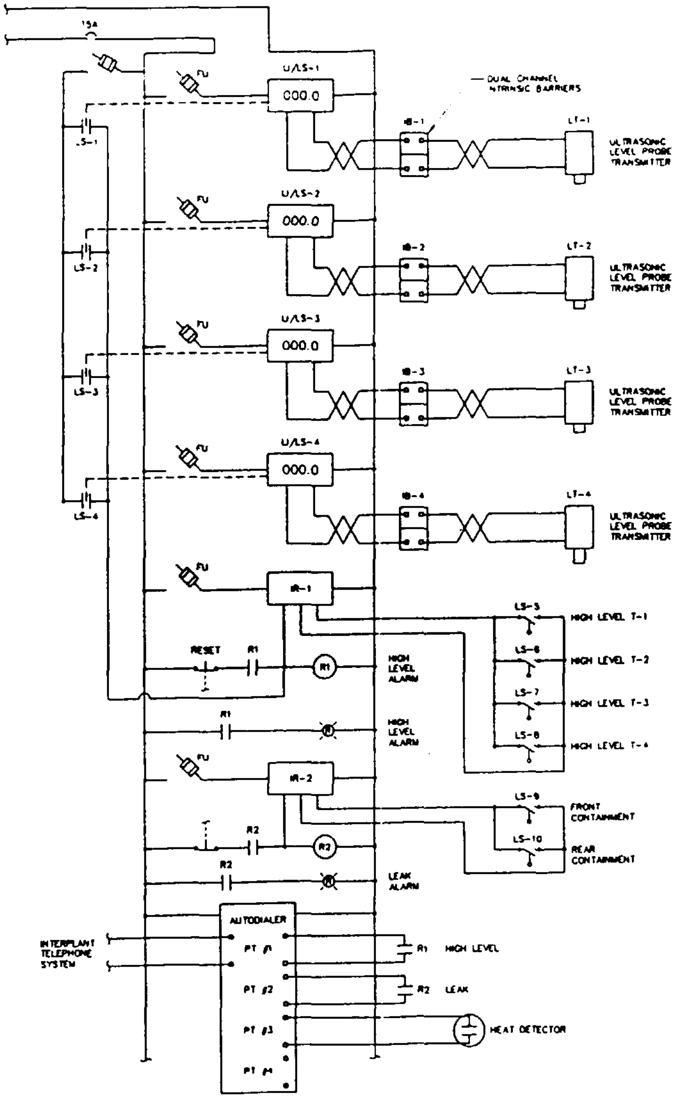
Corporate Headquarters
6723 Towpath Road
Syracuse, NY 13214
315-446-9120

4



ELECTRICAL ONE-LINE DIAGRAM

NOT TO SCALE



CONTROL DIAGRAM

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Graphic Scale

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NEWELL STREET AREA II/USEPA AREA 5B PARCEL J9-23-12

ELECTRICAL DIAGRAMS

ELECTRICAL

File Number
20140.XXF

Date
MARCH 1999

Blasland, Bouck & Lee, Inc.
Corporate Headquarters
6723 Towpath Road
Syracuse, NY 13214
315-446-9120

5

GENERAL SPECIFICATIONS:

1. RECOVERY PUMP: PNEUMATIC DNAPL PUMP AS MANUFACTURED BY QED ENVIRONMENTAL SYSTEMS, INC
   - A. ONE (1) PUMP PART # UP1301 FOR 2" DIAMETER WELLS
     ONE (1) MINI PULSE PUMP CYCLE TIMER, PART # MPS360, 120 VOLTS, WITH FILTER REGULATOR
     ONE (1) 2" DIAMETER WELL EXHAUST VALVES, PART # L353
   - B. TUBING: 60 FT NYLON, PART # L417, 1/2" O.D. LIQUID, 3/8" O.D. AIR
     TUBING: 60 FT. UV-BLACK NYLON, PART # 35097, 1/2" O.D.
     TUBING: 60 FT. 3/8" NYLON AIR, PART # 35716
     TUBING FITTINGS: MISC. FITTINGS PACKAGE, PART # PP-CUSTOM
2. PIPING:
   - A. DOUBLE-WALL PRODUCT PIPE: CARBON STEEL PIPING, SCHEDULE 40 SEAMLESS, ASTM B31.1, 3/4" CARRIER PIPE WITH 3" CONTAINMENT PIPE. WELDED JOINTS.
   - B. FLEXIBLE PRODUCT TUBING: 1/2" INSIDE, NALGENE 880 KYNAR BY THE NALGE COMPANY. 1-1/2" OUTSIDE, NALGENE 689 POLYPROPYLENE COPOLYMER TUBING.
   - C. AIR TUBING: 1/2" GALVANIZED STEEL, THREADED PIPING. USE TEFLON TAPE ON JOINTS.
3. ONE (1) TIMER AND REGULATOR ENCLOSURE: HOFFMAN STEEL ENCLOSURE, 24"X24"X8", CATALOG # A-24R248HCR. PADLOCK HASP, CONTINUOUS HINGE.
4. TANK TRANSFER PUMP: ROPER MODEL 2AM 32. SELF-PRIMING GEAR PUMP WITH INTERNAL BYPASS VALVE, 3 HP, 1750 RPM, SPARK RESISTANT CONSTRUCTION AND EXPLOSION PROOF MOTOR, 38 GPM @ 40 PSI.
5. TANKS: FOUR (4) SYRACUSE TANK 1,000 GALLON (NOMINAL) CARBON STEEL TANKS. 64"DIAMETER X 72" HIGH, FLAT BOTTOM AND TOP WITH 18" DIAMETER MANWAY. 2" NPT SIDE DRAIN NOZZLE WITH PLUG.
   FOUR (4) 2" NPT NOZZLES AS NOTED AT TOP OF TANK, AND ONE (1) EACH 1-1/2" INTERNAL FILL AND TANK EMPTY PIPES. TANK THICKNESS SHALL BE MINIMUM OF 10 GAUGE. TANK SHALL BE U.L. LISTED.
6. INSULATION - 3" CONTAINMENT: 1" THICK FIBERGLASS WITH PVC JACKET.
   - 1/2" AIR: USE 3/4" URETHANE FOAM.
7. EYE/FACE WASH: SPEAKMAN GRAVITYFLO, HIGH EFFICIENCY SPRAY HEADS W/ CONTOURED RUBBER EYE PROTECTION, SPRAY HEADS PULL OUT TO QUICKLY RELEASE FLOW OF WATER, AVERAGES .75 GPM OVER A 20 MINUTE TIME PERIOD. MOLDED OF BRIGHT, DURABLE, HIGH DENSITY PLASTIC FOR HIGH VISIBILITY. EXCEEDS ANSI Z358.1-1990 AND MEETS ANSI A117.1-1986, BARRIER-FREE DESIGN FOR HANDICAPPED USE. PROVIDE EYE SOLUTION WITH BACTERIA AND ALGAE INHIBITORS.
8. CONTAINMENT PANS: MINIMUM OF 1/4" THICK STEEL PLATES SHALL CONFORM TO ASTM A36, ALL FIELD CONNECTONS SHALL BE WELDED AND GROUNDED SMOOTH. ALL WELDS SHALL CONFORM TO AWS AND AISC SPECIFICATIONS.
   CONTAINMENT SHALL BE LEAK TESTED BY FILLING WITH WATER AND OBSERVING FOR LEAKS FOR A PERIOD OF TWO HOURS. ANY LEAKS SHALL BE REPAIRED AND CONTAINMENT RETESTED. REPEAT TEST UNTIL THERE ARE NO LEAKS OBSERVED.
9. CARBON: CARBTROL MODEL G-1, VAPOR PHASE CARBON CANISTER CONTAINING 200 LBS. OF GRANULAR ACTIVATED CARBON, DESIGN MAX. FLOW RATE AT 100 SCFM @ 10" W.C.
10. VENTING:
    - A. ONE (1) CONSERVATION VENT: PROTECTO SEAL MODEL C-18542. END-OF-LINE CONSERVATION BREATHER VENT WITH PIPE-AWAY CONSTRUCTION, DUCTILE IRON HOUSING WITH STAINLESS STEEL PALLETS AND TEFLON PALLET DIAPHRAGM.
    - B. FOUR (4) EMERGENCY VENTS: PROTECTO SEAL MODEL C-7808H. EMERGENCY VENT FOR PRESSURE RELIEF WITH STAINLESS STEEL CONSTRUCTION AND TEFLON PALLET DIAPHRAGM.

ELECTRICAL SPECIFICATIONS:

1. AREA INSIDE OF TRAILER SHALL BE CONSIDERED AN EXPLOSIVE HAZARDOUS AREA, CLASS I DIVISION II. WELL SHALL BE CONSIDERED A CLASS I, DIVISION I AREA.
2. SAFETY SWITCH: GENERAL ELECTRIC FUSED SAFETY DISCONNECT SWITCHES NEMA 3R, HEAVY DUTY TYPE TH
3. CIRCUIT PANEL: GENERAL ELECTRIC POWERMARK PLUS, 3R, 60 AMP MAIN BREAKER, 12 BRANCH CIRCUIT, 10K AMP RMS SHORT CIRCUIT. THREE (3) 20AMP/2P BREAKERS, FIVE (6) 15AMP/1P BREAKERS.
4. FLOATS: GEMS PART # LS1800 SLIDING MAGNETIC SWITCH, TEFLON FLOAT WITH STAINLESS STEEL STEM.
   - A. FOUR (4) TANK FLOATS: 1-1/2" DIAMETER, 1/4" NPT THREADED STEM. FURNISH WITH 2" MALE BRASS THREADED PLUG.
   - B. TWO (2) SUMP FLOATS: 1-1/4" DIAMETER, 1/4" NPT THREADED STEM.
5. INTRINSIC RELAY: GEMS SAFE-PAK, SOLID STATE INTRINSIC SAFE RELAY, UL LISTED, FM APPROVED FOR USE IN CLASS I, DIVISION I AREAS.
6. RELAYS: ICE CUBE, PLUG-IN TYPE WITH SOCKET, DPDT, 120 VAC, 5 AMP RATED CONTACTS.
7. CONDUIT: RIGID GALVANIZED STEEL CONDUIT, 3/4" DIAMETER. THREADED COUPLINGS FOR OUTDOOR USE, THREADED CAST FITTINGS AND DEVICE/JUNCTION BOXES.
8. RETRACTABLE GROUNDING WIRE: AMETEK ROTA-REEL SPRING LOADED REWIND, HOLDS 20 FT. OF 3/32" CARBON STEEL CABLE W/ END ALLIGATOR CLIP.
9. GROUND WIRE: No. 6, BARE, STRANDED COPPER, COMPRESSION LUGS FOR BOLTED CONNECTION TO EQUIPMENT OR DEVICES.
10. SOLENOID VALVE: ONE (1) ASCO GENERAL SERVICE, SERIES 8210. BRASS BODY, 120 VAC CONTINUOUS DUTY COIL, NORMALLY CLOSED, 1/2" NPT PROCESS CONNECTIONS, OPERATION RATED AT 150 PSI AIR WITH 0 PSI DIFFERENTIAL, NEMA 4 ENCLOSURE.
11. ULTRASONIC LEVEL PROBE: FOUR (4) MILLTRONICS, "THE PROBE" TWO WIRE TRANSMITTER, INTRINSICALLY SAFE, 2" NPT MOUNTING.
12. DIGITAL METER: FOUR (4) PRECISION DIGITAL, MODEL PD690-3-14, 4-1/2" DIGIT DISPLAY, 120 VAC POWERED, 2 PROGRAMMABLE ALARM RELAYS, 24 VDC LOOP POWER SUPPLY, MAXIMUM LOOP RESISTANCE OF 1200 OHMS.
13. HEAT DETECTOR: ONE (1) SIMPLEX, SERIES 2098-9430, MODEL 1256-1. EXPLOSION PROOF, RATE-OF-RISE AND FIXED TEMPERATURE DETECTOR, 136F FIXED, FURNISH WITH X-P BASE, ONE NORMALLY OPEN CONTACT.
14. COMBINATION STARTER: GENERAL ELECTRIC SERIES CR, FUSIBLE, 30AMP, SIZE 2, NON-REVERSING COMBINATION MAGNETIC STARTER, DISCONNECT TYPE, 480 VAC, 3 PHASE, NEMA 4 AND UL LISTED.
15. HEAT TRACE: THERMON TYPE FD. FM RATED CLASS I DIVISION 2, 5 WATTS PER FOOT, 120 VAC, ET-7 END CAPS, TBX-4LC CONNECTORS AS NEEDED.
16. HEAT TRACE CONTROLS: TWO THERMON N-7G-040 THERMOSTATS.
17. AUTO DIALER: ONE (1) RACO VERBATIM MODULAR SERIES VSS. FOUR CONTACT INPUTS, 120 VAC POWER, VOICE RECORDED MESSAGE, BATTERY PACK MEMORY.
18. EXHAUST FANS:
    - A. TWO (2) UTILITIES SUPPLY MODEL LAB 71420. 560 CFM @ 0.0375" S.P., 1140 RPM, HP, 115 VAC, SINGLE PHASE, EXPLOSION PROOF CONSTRUCTION. SUPPORT FAN FROM INSIDE WALL OF TRAILER. TERMINATE DUCTWORK AT WALL DISCHARGE GRILLE, GRAINGER MODEL 5C522, FANTECH MODEL HG-8. PROVIDE FLEX DUCT CONNECTION AT FAN DISCHARGE.
19. CONTROL PANEL: HOFFMAN CAT. NO. C-SD30248LG. ENCLOSURE FOR CONTROLS AND AUTODIALER SHALL BE 30"H x 24"W x 8"D, NEMA 4.
20. INTRINSIC BARRIER: FOUR (4) GEMS DUAL CHANNEL ZENER BARRIERS PART NO. 54808, U.L. LISTED, FM APPROVED FOR USE IN CLASS I, DIV. I AREAS.

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Graphic Scale

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NEWELL STREET AREA II/USEPA AREA 5B PARCEL J9-23-12

SPECIFICATIONS

GENERAL

File Number
201.40.XXF

Date
MARCH 1999

Blasland, Bouck & Lee, Inc
Corporate Headquarters
6723 Towpath Road
Syracuse, NY 13214
315-446-9120

6

EPA Approval Letter Dated March 17, 1999 for GE's: Letter RE: Newell Street Area II (DEP #1-1057; USEPA Area 5B) Proposal for DNAPL Recovery Operations [Well N2SC-11], March 10, 1999

United States Environmental Protection Agency
Region I
One Congress Street, Suite 1100
Boston, MA 02114-2023

ENVIRONMENTAL PROGRAMS
MAR 1 1999

March 17, 1999

Mr. Andrew T. Silfer, P.E.
General Electric Company
100 Woodlawn Avenue
Pittsfield, Massachusetts 01201

RE: GE's March 10, 1999 submittal titled *Newell Street II (DEP #1-1057; USEPA Area 5B) Proposal for DNAPL Recovery Operations*

EPA reviewed the above-referenced submittal and approves the submittal subject to the following conditions:

1. GE shall inspect, maintain, and monitor the proposed automated DNAPL recovery system.
2. GE shall periodically evaluate the DNAPL recovery system and adjust operating parameters to optimize DNPAL recovery.
3. GE shall have the proposed automated DNAPL recovery system for well N2SC-1I operating properly no later than June 8, 1999.
4. GE shall evaluate extending the automated recovery system to wells N2SC-2, N2SC-3S, and N2SC-3I, as described on page 3 of the submittal, within six months of the on-line date for the proposed automated DNAPL recovery system for well N2SC-1I.
5. Every six months, GE shall submit to EPA for approval, a report summarizing and evaluating all of the NAPL monitoring and recovery systems at the Newell Street II Site. The evaluation shall include proposed modifications, if any, to the NAPL recovery systems necessary to optimize NAPL removal. The initial report shall be submitted within six months of the on-line date for the proposed automated DNAPL recovery system for well N2SC-1I.
6. EPA may require additional response actions subsequent to the completion of investigative activities proposed by GE in their February 9, 1999 *Source Control Investigative Report, Upper Reach of Housatonic River (First ½-Mile)*, by HSI Geotrans and/or subsequent to evaluations of the existing and proposed automated DNAPL recovery systems.

Additional performance standards, objectives and other requirements for NAPL removal at the Newell Street II Site will be included in the Scope of Work for Removal Actions Outside the River, which is currently being negotiated by GE, EPA and other government agencies.

If you have any questions, please contact me at (617) 918-1282.

Sincerely,

Dean Tagliaferro

Dean Tagliaferro
On-Scene Coordinator

cc: John Ciampa, GE
Lyn Cutler, MA DEP
John Ziegler, MA DEP
Tony Kurpaska, MA DEP
John Kilborn, EPA
Steve Acree, US EPA
Dawn Veillieux, Roy F. Weston
Joel Lindsay, Roy F. Weston
John Kullberg, USACE
Margaret Meehan, EPA
Anton Giedt, NOAA
Dale Young, MA EOEA
Tom O'Brien, MA EOEA
Mayor Doyle, City of Pittsfield
Pittsfield Conservation Commission
Pittsfield City Council, c/o Tom Hickey
Site File

Letter RE: Results of Supplemental Soil Sampling in Support of Source Control Activities at Lyman Street Site, DEP Site No. 1-0856, USEPA Area 5A, April 26, 1999

Corporate Environmental Programs
General Electric Company
100 Woodlawn Avenue, Pittsfield, MA 01201

April 26, 1999

Bryan Olson
Dean Tagliaferro
Site Evaluation and Response Section (HBR)
U.S. Environmental Protection Agency
One Congress Street
Boston, MA 02203-2211

Alan Weinberg
Bureau of Waste Site Cleanup
Department of Environmental Protection
436 Dwight Street
Springfield, MA 01103

Re: Results of Supplemental Soil Sampling in Support of Source Control Activities at Lyman Street Site, General Electric Company, Pittsfield, Massachusetts DEP Site No. 1-0856, USEPA Area 5A

Dear Messrs. Olson, Tagliaferro, and Weinberg:

I. INTRODUCTION

The General Electric Company (GE) has recently completed supplemental investigations in portions of the USEPA Area 5A/MCP Lyman Street Site in Pittsfield, Massachusetts. More specifically, the investigations conducted by GE between March 29 and April 2, 1999 provided further information concerning subsurface conditions in the vicinity of GE's existing NAPL recovery systems and the adjacent riverbank area. The contents of this letter represent a follow-up to the design and installation of a proposed sheetpile-based containment barrier along the riverbank, as outlined in GE's *Conceptual Containment Barrier Design for Lyman Street Site*, dated February 16, 1999 (Conceptual Design Proposal). In that document, GE proposed supplemental sampling to further support the conceptual design and related riverbank soil removal activities.

These supplemental investigations were conditionally approved by EPA in a letter dated March 23, 1999. This letter summarizes the results of those investigations. An overview of the resulting data is provided below in Section II.

Prior to the installation of the proposed NAPL containment barrier presented in GE's Conceptual Design Proposal, GE will prepare a detailed Design Report to provide additional information concerning the final configuration and design of the proposed containment barrier. Section III presents a schedule for future activities, including final design of the barrier and submittal of the detailed Design Report.

II. INVESTIGATION SUMMARY

A. Field Investigations

Between April 1 and 5, 1999, GE collected and analyzed soil samples from ten bank locations (LSSC-20 through LSSC-25 and LSSC-27 through LSSC-30) along the edge of the proposed sheetpile (see Figure 1). A number of these locations correspond to areas previously sampled by the USEPA or GE (SLO170, SLO229, SLO182, SLO232, SLO235, and LS-SOIL). Samples were collected utilizing direct push sampling techniques to a depth of at least 10 feet below grade, depending upon visual observations and sampling limitations. Soil samples adjacent to and below the depths previously sampled were analyzed in 1-foot increments for total petroleum hydrocarbons (TPH) and polychlorinated biphenyls (PCBs). At locations not previously sampled, analyses of TPH and PCBs were performed in 1-foot increments from the ground surface. A total of 108 analytical samples (including 6 duplicate samples) were collected.

During the performance of these field investigations, oversight of GE's activities was performed by the USEPA, through use of an oversight contractor (Roy F. Weston, Inc.). All soil samples were submitted to CT&E Environmental Services, Inc. (CT&E) for analysis for TPH by USEPA Method 418.1 and PCBs by USEPA Method 8082. The results of these analyses are summarized in Table 1 and on Figure 2 and are discussed below.

In addition to the riverbank soil investigations, two additional wells (LSSC-8S and LSSC-18) were installed by HSI GeoTrans, Inc., on March 29, 1999 along the western and eastern edges, respectively, of the proposed containment barrier. The purpose of these wells was to confirm the lateral limits of LNAPL relative to the proposed barrier. Five soil samples were collected from boring LSSC-18 and submitted to CT&E for analysis for PCBs by USEPA Method 8020. The results of these analyses are summarized in Table 2 and are discussed below. Since installation, the wells have been monitored on a weekly basis and no LNAPL has been detected.

B. Preliminary Findings

The primary purpose of supplemental borings LSSC-20 through LSSC-25 and LSSC-27 through LSSC-30 was to assess the potential presence of LNAPL residuals along the riverbank on the river side of the proposed containment barrier. This was done by observing the soil cores for evidence of LNAPL staining or sheens, collecting soil samples for analysis of TPH and PCBs, and performing shake tests on soil samples. The results of this series of tests are summarized in Table 1 and on Figure 2. During installation, LNAPL staining was visually observed in four of the ten riverbank soil borings (LSSC-21, LSSC-23, LSSC-28, and LSSC-29). Two of these borings (LSSC-21 and LSSC-23) and one other boring (LSSC-22) exhibited LNAPL residuals during shake testing. Each of these borings are located in the eastern limb of the former oxbow located in this area, as shown on Figure 1. No visual observations of LNAPL staining or residuals from shake tests were shown to exist below an elevation of 966 feet.

TPH values in the riverbank soil samples ranged from non-detect (in 45 of 108 samples) to 58,100 ppm. The highest TPH levels were observed in soil borings LSSC-21 and LSSC-23 at elevations between 970 and 973 feet. Groundwater was encountered at an elevation of approximately 973 feet. PCB values in the riverbank soil samples ranged from non-detect (in 9 of 108 samples) to 5,600 ppm. Similar to the TPH results, higher PCB concentrations were detected in borings along the eastern limb of the former oxbow (LSSC-21 and LSSC-23) at elevations near the top of the water table (970 to 973 feet). PCB concentrations of up to 5,200 ppm were also detected in boring LSSC-27, located near the Lyman Street bridge. In this boring, the highest PCB levels were detected at elevations above the water table (977 to 979 feet) and do not appear to be associated with LNAPL, since staining or sheens were not observed in the soil cores. Furthermore, the TPH values in this interval were significantly less than those observed along the eastern limb of the former oxbow, where staining and sheens were observed.

Well LSSC-8S was installed to a depth of 15 feet below grade and screened from an elevation of 978.64 feet to 968.64 feet. No indications of the presence of LNAPL were noted during the installation and subsequent weekly monitoring of this well. No samples were collected from this boring, as the area had been previously sampled by adjacent boring LSSC-8I. Well LSC-18 was installed to a depth of 19 feet below grade and screened from an elevation of 978.66 feet to 968.66 feet. No indications of the presence of LNAPL were noted during the installation and subsequent weekly monitoring of this well. Soil samples were submitted for PCB analysis from the 0- to 1-foot, 1- to 3-foot, 3- to 6-foot, 6- to 10-foot, and 10- to 15-foot depth intervals. Total PCB concentrations ranged from 0.14 ppm to 0.73 ppm, as shown in Table 2. The boring/well construction logs for wells LSSC-8S, LSSC-8I , and LSSC-18 are provided as an attachment to this letter.

III. SUMMARY AND SCHEDULE

From March 29 to April 5, 1999, ten soil borings were recently advanced along the riverbank adjacent to the Lyman Street Site, and two shallow monitoring wells were installed near the edges of the proposed containment barrier. A total of 108 soil samples were collected from the riverbank borings, examined for evidence of LNAPL residuals, and analyzed for TPH and PCBs. TPH concentrations in the riverbank soil samples ranged from non-detect to 58,100 ppm, while PCB values ranged from non-detect to 5,600 ppm. PCB concentrations ranged between 0.14 ppm and 0.73 ppm in five soil samples collected and analyzed from monitoring well boring LSSC-18. No indications of the presence of NAPL were noted during the installation and subsequent monitoring of wells LSSC-8S and LSSC-18.

Data from this supplemental investigation will be incorporated into the proposed containment barrier design parameters, and the results of these design activities will be presented in a Detailed Design Report. Included in that report will be a detailed design of the proposed containment barrier, including final sheetpile layout, performance standards, detailed design and structural calculations, the results of the hydraulic modeling, and other potential implementation-related issues. That report will be submitted within approximately 60 days of the date of this letter.

Yours truly,

John D Ciampa

John D. Ciampa
Remediation Project Manager
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Pittsfield Conservation Commission* ✓
Housatonic River Initiative ✓
Public Information Repositories ECL I-P-IV(A)(1) & (2)*

(* with tables and figures)

_E 1

GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

SOURCE CONTROL MEASURES FOR LYMAN STREET SITE

SUMMARY OF RIVERBANK SOIL DATA - APRIL 1999

Sample Location	Sample Date	Sample Depth	Sample Elevation (Feet AMSL)	Field Observations/Testing			Analytical Results (ppm)	
				Sample PID Reading (Instrument Units)	Staining Observed on Soil Core	Shake Test Results	Total PCBs	TPH
LSSC-20	04/02/99	0-1'	974.05 - 973.05	0.0	No	No	N/A	N/A
LSSC-20	04/02/99	1-2'	973.05 - 972.05	0.0	No	No	N/A	N/A
LSSC-20	04/02/99	2-3'	972.05 - 971.05	N/A	No	N/A	77	391
LSSC-20	04/02/99	3-4'	971.05 - 970.05	0.0	No	No	0.58	ND(55.1)
LSSC-20	04/02/99	4-5'	970.05 - 969.05	N/A	No	Trace Sheen	0.41	ND(60)
LSSC-20	04/02/99	5-6'	969.05 - 968.05	N/A	No	N/A	0.11	ND(54.9)
LSSC-20	04/02/99	6-7'	968.05 - 967.05	N/A	No	N/A	0.25	ND(58.2)
LSSC-20	04/02/99	7-8'	967.05 - 966.05	N/A	No	N/A	0.15	ND(54.2)
LSSC-20	04/02/99	8-9'	966.05 - 965.05	N/A	No	N/A	1.5	ND(47.1)
LSSC-20	04/02/99	9-10'	965.05 - 964.05	N/A	No	N/A	N/A	N/A
LSSC-21	04/05/99	0-1'	974.48 - 973.48	16.9	No	No	15	74.0 [ND (40)]
LSSC-21	04/05/99	1-2'	973.48 - 972.48	16.9	No	No	140	263 [46,000]
LSSC-21	04/05/99	2-3'	972.48 - 971.48	15.8	No	No	5,600	23,500
LSSC-21	04/05/99	3-4'	971.48 - 970.48	39.0	Yes (begins at 3.2')	Yes	5,600 [47]	58,100
LSSC-21	04/05/99	4-5'	970.48 - 969.48	21.8	Yes	No	30	337
LSSC-21	04/05/99	5-6'	969.48 - 968.48	28.6	Yes	Yes	39	723
LSSC-21	04/05/99	6-7'	968.48 - 967.48	25.3	Yes	Trace Sheen	8.3	93.3 [ND (46.6)]
LSSC-21	04/05/99	7-8'	967.48 - 966.48	16.1	Yes	No	3.4	50.6
LSSC-21	04/05/99	8-9'	966.48 - 965.48	17.3	No	No	2.9	65.6
LSSC-21	04/05/99	9-10'	965.48 - 964.48	17.4	No	No	5.9 [1.8]	58.1
LSSC-22	04/01/99	0-1'	974.43 - 973.43	N/A	No	N/A	2.3	47 [76]
LSSC-22	04/01/99	1-2'	973.43 - 972.43	3.8	No	No	2.5	45
LSSC-22	04/01/99	2-3'	972.43 - 971.43	N/A	No	N/A	180 [160]	120
LSSC-22	04/01/99	3-4'	971.43 - 970.43	18.3	No	Yes	150	1,900
LSSC-22	04/01/99	4-5'	970.43 - 969.43	81.2	Yes	Yes	180	6,200
LSSC-22	04/01/99	5-6'	969.43 - 968.43	31.8	Yes	Yes	40	3,500
LSSC-22	04/01/99	6-7'	968.43 - 967.43	9.3	Yes	No	0.31	ND (40)
LSSC-22	04/01/99	7-8'	967.43 - 966.43	5.2	Yes (ends at 7.6')	No	0.15	ND (40)
LSSC-22	04/01/99	8-9'	966.43 - 965.43	7.4	No	No	1.2	ND (40)
LSSC-22	04/01/99	9-10'	965.43 - 964.43	6.4	No	No	0.028 J	ND (40)

See notes on page 4.

TABLE (Continued)

GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

SOURCE CONTROL MEASURES FOR LYMAN STREET SITE

SUMMARY OF RIVERBANK SOIL DATA - APRIL 1999

Sample Location	Sample Date	Sample Depth	Sample Elevation (Feet AMSL)	Field Observations/Testing			Analytical Results (ppm)	
				Sample PID Reading (Instrument Units)	Staining Observed on Soil Core	Shake Test Results	Total PCBs	TPH
LSSC-23	04/05/99	0-1'	973.14 - 972.14	N/A	No	N/A	24	88.6
LSSC-23	04/05/99	1-2'	972.14 - 971.14	19.3	No	No	800	9,620
LSSC-23	04/05/99	2-3'	971.14 - 970.14	18.7	Yes (begins at 2.5')	Yes	5,200	48,800
LSSC-23	04/05/99	3-4'	970.14 - 969.14	23.6	Yes	Yes	39	1,000
LSSC-23	04/05/99	4-5'	969.14 - 968.14	17.4	Yes	Trace Sheen	28	772
LSSC-23	04/05/99	5-6'	968.14 - 967.14	N/A	Yes	N/A	1.4	ND (46.6)
LSSC-23	04/05/99	6-7'	967.14 - 966.14	17.5	Yes	No	0.24	ND (45.6)
LSSC-23	04/05/99	7-8'	966.14 - 965.14	17.6	No	No	0.36	ND (49.9)
LSSC-23	04/05/99	8-9'	965.14 - 964.14	15.6	No	No	0.22	ND (44.5)
LSSC-23	04/05/99	9-10'	964.14 - 963.14	15.8	No	No	N/A	N/A
LSSC-24	04/05/99	0-1'	973.35 - 972.35	3.3	No	No	3.2 [0.77]	102
LSSC-24	04/05/99	1-2'	972.35 - 971.35	3.8	No	No	44	392 [ND (55.3)]
LSSC-24	04/05/99	2-3'	971.35 - 970.35	3.4	No	No	37	2,920
LSSC-24	04/05/99	3-4'	970.35 - 969.35	18.5	No	No	0.78	ND (55.1)
LSSC-24	04/05/99	4-5'	969.35 - 968.35	6.1	No	No	0.12	ND (63.8)
LSSC-24	04/05/99	5-6'	968.35 - 967.35	8.7	No	No	ND (0.043)	ND (52.2)
LSSC-24	04/05/99	6-7'	967.35 - 966.35	3.5	No	No	ND (0.038)	ND (46.3)
LSSC-24	04/05/99	7-8'	966.35 - 965.35	N/A	No	No	0.96	ND (42.6)
LSSC-24	04/05/99	8-9'	965.35 - 964.35	3.7	No	No	0.6	ND (50.8)
LSSC-24	04/05/99	9-10'	964.35 - 963.35	3.8	No	No	N/A	N/A
LSSC-25	04/01/99	0-1'	974.01 - 973.01	N/A	No	N/A	2.0	51
LSSC-25	04/01/99	1-2'	973.01 - 972.01	N/A	No	N/A	19	60
LSSC-25	04/01/99	2-3'	972.01 - 971.01	1.6	No	No	0.22	ND (40)
LSSC-25	04/01/99	3-4'	971.01 - 970.01	2.7	No	No	ND (0.042)	ND (40)
LSSC-25	04/01/99	4-5'	970.01 - 969.01	2.4	No	No	ND (0.045)	ND (40)
LSSC-25	04/01/99	5-6'	969.01 - 968.01	N/A	No	N/A	0.067	ND (40)
LSSC-25	04/01/99	6-7'	968.01 - 967.01	2.5	No	No	0.046	ND (40)
LSSC-25	04/01/99	7-8'	967.01 - 966.01	2.9	No	No	ND (0.034)	ND (40)
LSSC-25	04/01/99	8-9'	966.01 - 965.01	3.6	No	No	0.031 J	ND (40)
LSSC-25	04/01/99	9-10'	965.01 - 964.01	3.2	No	No	ND (0.04)	ND (40)

See notes on page 4.

TABLE continued)

GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

SOURCE CONTROL MEASURES FOR LYMAN STREET SITE

SUMMARY OF RIVERBANK SOIL DATA - APRIL 1999

Sample Location	Sample Date	Sample Depth	Sample Elevation (Feet AMSL)	Field Observations/Testing			Analytical Results (ppm)	
				Sample PID Reading (Instrument Units)	Staining Observed on Soil Core	Shake Test Results	Total PCBs	TPH
LSSC-27	04/01/99	0-1'	980.97 - 979.97	7.0	No	No	700	202
LSSC-27	04/01/99	1-2'	979.97 - 978.97	1.8	No	No	18	65
LSSC-27	04/01/99	2-3'	978.97 - 977.97	1.8	No	No	1,200	654
LSSC-27	04/01/99	3-4'	977.97 - 976.97	1.9	No	No	5,200	1,960
LSSC-27	04/01/99	4-5'	976.97 - 975.97	1.8	No	No	6.2	138
LSSC-27	04/01/99	5-6'	975.97 - 974.97	N/A	No	N/A	3.6	94.8
LSSC-27	04/01/99	6-7'	974.97 - 973.97	1.5	No	No	11	148
LSSC-27	04/01/99	7-8'	973.97 - 972.97	N/A	No	N/A	9.9	196
LSSC-27	04/01/99	8-9'	972.97 - 971.97	1.6	No	No	6.6	152
LSSC-27	04/01/99	9-10'	971.97 - 970.97	N/A	No	N/A	3.0	96.1
LSSC-27	04/01/99	10-11'	970.97 - 969.97	1.8	No	No	1.2	65.4
LSSC-27	04/01/99	11-12'	969.97 - 968.97	2.8	No	No	1.7	144
LSSC-27	04/01/99	12-13'	968.97 - 967.97	N/A	No	N/A	1.3	80.2
LSSC-27	04/01/99	13-14'	967.97 - 966.97	8.1	No	Trace Sheen	0.67	51.1
LSSC-27	04/01/99	14-15'	966.97 - 965.97	22.9	No	Trace Sheen	1.1	98
LSSC-27	04/01/99	15-16'	965.97 - 964.97	2.7	No	No	0.019 J	ND (44.9)
LSSC-27	04/01/99	16-17'	964.97 - 963.97	2.0	No	No	0.022 J	ND (47.8)
LSSC-27	04/01/99	17-18'	963.97 - 962.97	2.1	No	No	ND (0.037)	ND (45.2)
LSSC-28	04/01/99	0-1'	977.81 - 976.81	N/A	No	N/A	N/A	N/A
LSSC-28	04/01/99	1-2'	976.81 - 975.81	N/A	No	N/A	N/A	N/A
LSSC-28	04/01/99	2-3'	975.81 - 974.81	N/A	No	N/A	25	323
LSSC-28	04/01/99	3-4'	974.81 - 973.81	2.5	No	No	14	229
LSSC-28	04/01/99	4-5'	973.81 - 972.81	N/A	No	N/A	12	128
LSSC-28	04/01/99	5-6'	972.81 - 971.81	2.5	No	No	5.0	222
LSSC-28	04/01/99	6-7'	971.81 - 970.81	N/A	No	N/A	35 [31]	636
LSSC-28	04/01/99	7-8'	970.81 - 969.81	46.8	Yes	Yes	33	7,560
LSSC-28	04/01/99	8-9'	969.81 - 968.81	34.1	Yes	Trace Sheen	20	4,080
LSSC-28	04/01/99	9-10'	968.81 - 967.81	23.1	Yes	Trace Sheen	2.8	100
LSSC-28	04/01/99	10-11'	967.81 - 966.81	30.3	Yes (ends at 10.5')	No	0.47	339
LSSC-28	04/01/99	11-12'	966.81 - 965.81	26.0	No	Trace Sheen	ND (0.05)	63.4
LSSC-28	04/01/99	12-13'	965.81 - 964.81	N/A	No	N/A	1.9	265 [140]
LSSC-28	04/01/99	13-14'	964.81 - 963.81	9.5	No	No	0.14	ND (44.6)
LSSC-28	04/01/99	14-15'	963.81 - 962.81	4.1	No	No	ND (0.044)	ND (44.7)
LSSC-28	04/01/99	15-16'	962.81 - 961.81	N/A	No	N/A	N/A	N/A

See notes on page 4.

TAB. (Continued)

GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

SOURCE CONTROL MEASURES FOR LYMAN STREET SITE

SUMMARY OF RIVERBANK SOIL DATA - APRIL 1999

Sample Location	Sample Date	Sample Depth	Sample Elevation (Feet AMSL)	Field Observations/Testing			Analytical Results (ppm)	
				Sample PID Reading (Instrument Units)	Staining Observed on Soil Core	Shake Test Results	Total PCBs	TPH
LSSC-29	04/05/99	0-1'	973.00 - 972.00	3.2	No	No	N/A	N/A
LSSC-29	04/05/99	1-2'	972.00 - 971.00	3.5	No	No	N/A	N/A
LSSC-29	04/05/99	2-3'	971.00 - 970.00	N/A	No	No	120	783
LSSC-29	04/05/99	3-4'	970.00 - 969.00	N/A	No	No	6.2	45.5
LSSC-29	04/05/99	4-5'	969.00 - 968.00	15.5	Yes	No	7.0	1,800
LSSC-29	04/05/99	5-6'	968.00 - 967.00	7.3	Yes	No	0.53	60.3
LSSC-29	04/05/99	6-7'	967.00 - 966.00	5.6	No	No	0.12	ND (44.7)
LSSC-29	04/05/99	7-8'	966.00 - 965.00	4.2	No	No	0.064	ND (44.8)
LSSC-29	04/05/99	8-9'	965.00 - 964.00	3.2	No	No	0.041	ND (45.3)
LSSC-29	04/05/99	9-10'	964.00 - 963.00	3.5	No	No	N/A	N/A
LSSC-30	04/02/99	0-1'	973.32 - 972.32	N/A	No	N/A	11	ND (59)
LSSC-30	04/02/99	1-2'	972.32 - 971.32	N/A	No	N/A	54	89.6
LSSC-30	04/02/99	2-3'	971.32 - 970.32	N/A	No	N/A	6.6	252
LSSC-30	04/02/99	3-4'	970.32 - 969.32	N/A	No	N/A	3.8	84
LSSC-30	04/02/99	4-5'	969.32 - 968.32	N/A	No	N/A	3.8 [1.6]	67.8
LSSC-30	04/02/99	5-6'	968.32 - 967.32	N/A	No	N/A	0.18	ND (46.1)
LSSC-30	04/02/99	6-7'	967.32 - 966.32	11.7	No	No	0.083	ND (45.3)
LSSC-30	04/02/99	7-8'	966.32 - 965.32	10.3	No	No	0.19	ND (44.4)
LSSC-30	04/02/99	8-9'	965.32 - 964.32	9.4	No	No	0.45	ND (45.0)
LSSC-30	04/02/99	9-10'	964.32 - 963.32	N/A	No	N/A	N/A	N/A

Notes:

1. Samples were collected and screened in the field with a photoionization detector (PID) by Blasland, Bouck & Lee, Inc. (BBL).
2. Water shake tests were performed by BBL on all samples to evaluate the potential presence of LNAPL residuals.
   "No" indicates that no LNAPL residuals were observed.
   "Yes" indicates that LNAPL residuals were observed, or a moderate to strong sheen formed on the water surface during the test.
   "Trace Sheen" indicates that a slight sheen formed on the water surface during the test.
3. Samples were submitted to CT & E Environmental Services, Inc., for analysis of PCBs by EPA Method 8082 and Total Petroleum Hydrocarbons (TPH) by EPA Method 418.
4. ppm: Dry weight parts per million.
5. Duplicate sample results are shown in brackets [ ].
6. ND: Not detected (Practical Quantitation Limit shown in parantheses).
7. N/A: Not analyzed - sample not submitted to laboratory or insufficient volume for field analyses.
8. J: Indicates an estimated value less than the Practical Quantitation Limit.
9. Feet AMSL: Feet above mean sea level.
10. The boring designation of LSSC-26 was not utilized.
11. LNAPL: Light Non-Aqueous Phase Liquid

TABLE 2

GENERAL ELECTRIC COMPANY - PITTSFIELD, MASSACHUSETTS

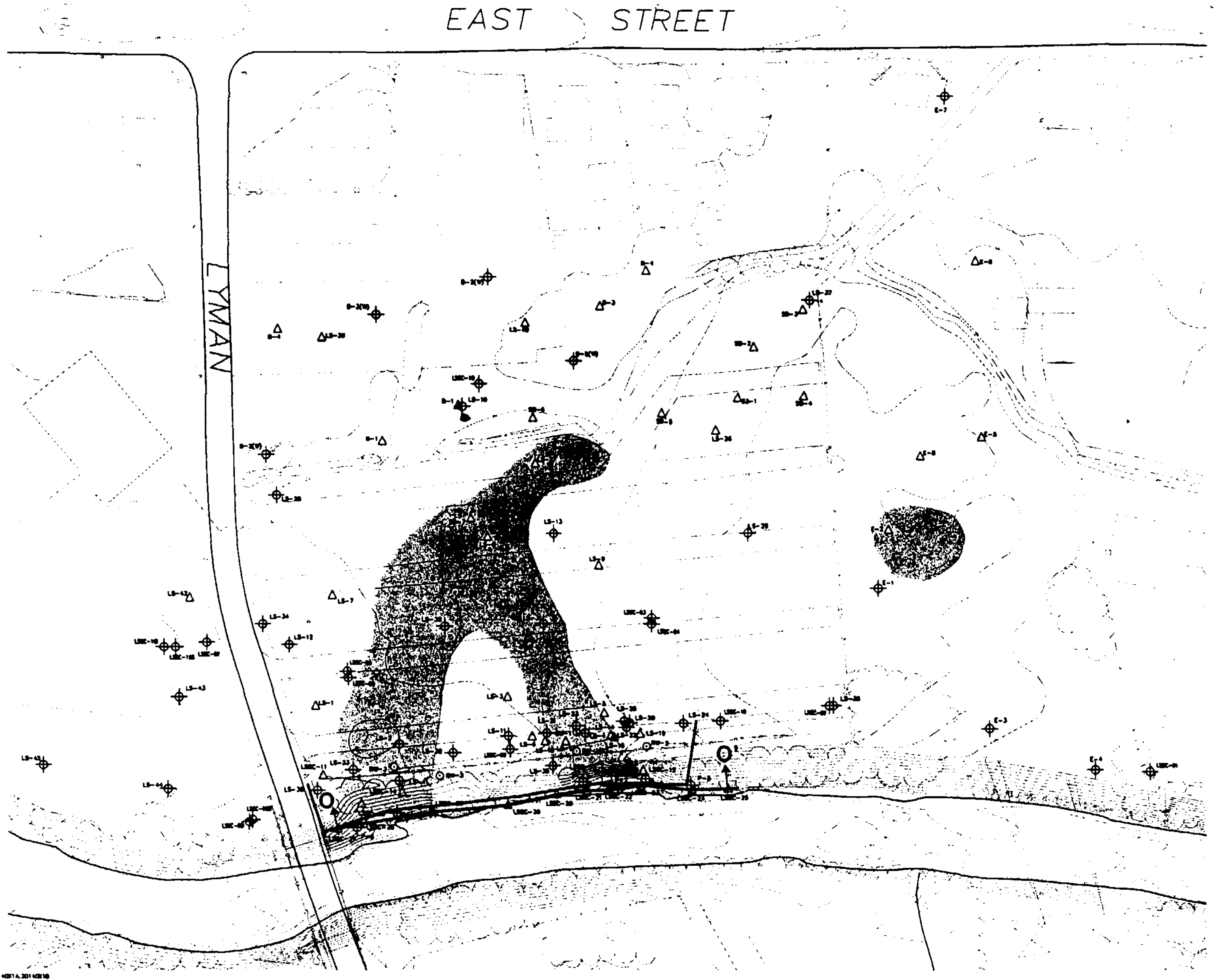
SOURCE CONTROL MEASURES FOR LYMAN STREET SITE

SUMMARY OF SOIL DATA - MARCH 1999

Sample Location	Sample Date	Sample Depth	Sample Elevation (Feet AMSL)	Analytical Results Total PCBs (ppm)
LSSC-18	03/29/99	0 - 1'	987.66 - 986.66	0.24
LSSC-18	03/29/99	1 - 3'	986.66 - 984.66	0.73
LSSC-18	03/29/99	3 - 6'	984.66 - 981.66	0.53
LSSC-18	03/29/99	6 - 10'	981.66 - 977.66	0.14
LSSC-18	03/29/99	10 - 15'	977.66 - 972.66	0.20

Notes:

1. Samples were collected by HSI GeoTrans, Inc.
2. Samples were submitted to CT & E Environmental Services, Inc., for analysis of PCBs by EPA Method 8082.
3. ppm: Dry weight parts per million.
4. Feet AMSL: Feet above mean sea level.



LEGEND:

— - —	EXISTING INDEX ELEVATION CONTOUR
———	EXISTING INTERMEDIATE ELEVATION CONTOUR
○	DECIDUOUS TREE
●	CONIFEROUS TREE
•	MANHOLE
———	CHAIN LINK FENCE
•	POLE (NON-UTILITY)
•	POLE (OVERHEAD UTILITY)
▨	APPROXIMATE DELINEATION OF FORMER OXBOWS
⌖	EXISTING MONITORING WELL
●	EXISTING PUMPING WELL
△	EXISTING SOIL BORING
↑—↑	LOCATION OF CROSS-SECTION O-O'
━━━	PROPOSED CONTAINMENT BARRIER

NOTES:

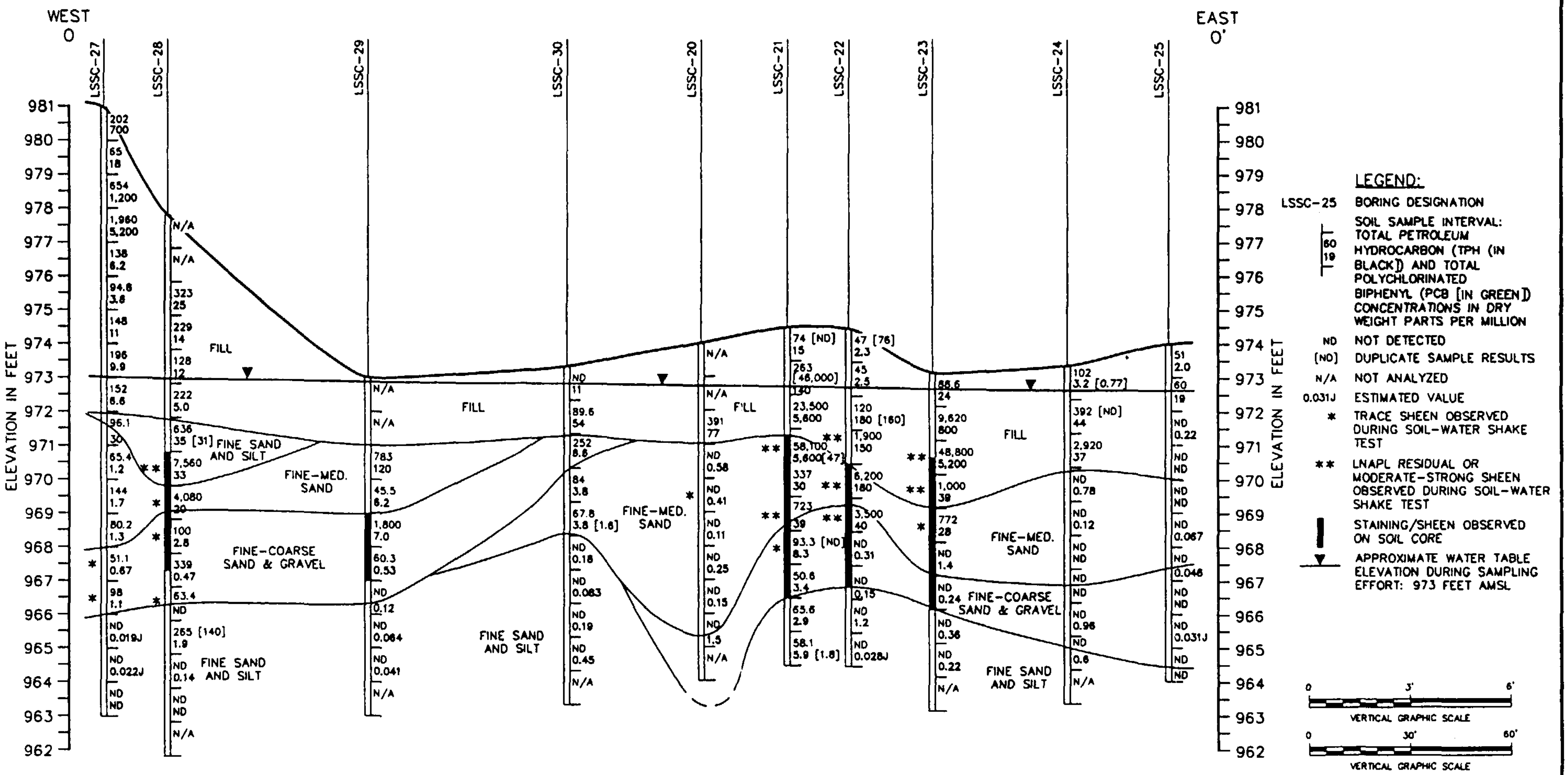
1. MAPPING IS BEST AVAILABLE INFORMATION AS OF 12/10/98 BASED ON MAPPING PROVIDED BY LOCKWOOD MAPPING, INC. PREPARED FROM 1990 AERIAL PHOTOGRAPHY; DATA PROVIDED BY GENERAL ELECTRIC; AND BLASLAND AND BOUCK ENGINEERS, P.C. CONSTRUCTION PLANS. RIVERBANK AND RIVER BED TOPOGRAPHIC INFORMATION PROVIDED BY BBL FROM OCTOBER 12-23, 1998 FIELD SURVEY.
2. COORDINATE GRID BASED ON 1927 STATE PLANE COORDINATES.
3. ELEVATION DATUM REFERENCED TO NGVD 1929.
4. CONTOUR INTERVAL IN THE RIVER AND ON RIVERBANK = 1 FOOT CONTOUR. INTERVAL OUTSIDE RIVERBANK AREA = 2 FEET.
5. ALL SAMPLING LOCATIONS ARE APPROXIMATE.
6. NAPL = NON-AQUEOUS PHASE LIQUID.
LNAPL = LIGHT NON-AQUEOUS PHASE LIQUID.
DNAPL = DENSE NON-AQUEOUS PHASE LIQUID.

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
LYMAN STREET SITE
SOURCE CONTROL INVESTIGATION

SITE PLAN

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
1



LEGEND:

LSSC-25 BORING DESIGNATION

60 / 19 SOIL SAMPLE INTERVAL: TOTAL PETROLEUM HYDROCARBON (TPH (IN BLACK)) AND TOTAL POLYCHLORINATED BIPHENYL (PCB (IN GREEN)) CONCENTRATIONS IN DRY WEIGHT PARTS PER MILLION

ND NOT DETECTED

[ND] DUPLICATE SAMPLE RESULTS

N/A NOT ANALYZED

0.031J ESTIMATED VALUE

* TRACE SHEEN OBSERVED DURING SOIL-WATER SHAKE TEST

** LNAPL RESIDUAL OR MODERATE-STRONG SHEEN OBSERVED DURING SOIL-WATER SHAKE TEST

▮ STAINING/SHEEN OBSERVED ON SOIL CORE

▼ APPROXIMATE WATER TABLE ELEVATION DURING SAMPLING EFFORT: 973 FEET AMSL

GENERAL ELECTRIC COMPANY
PITTSFIELD, MASSACHUSETTS
LYMAN STREET SITE
SOURCE CONTROL INVESTIGATION

CROSS SECTION O-O'

BBL BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
2

L: ON=*, OFF=REF*
P: STD-PCP/BL
4/26/99 SYR-54 RCA
20182001/20182V01.DWG

HSI GEOTRANS
A TETRA TECH COMPANY

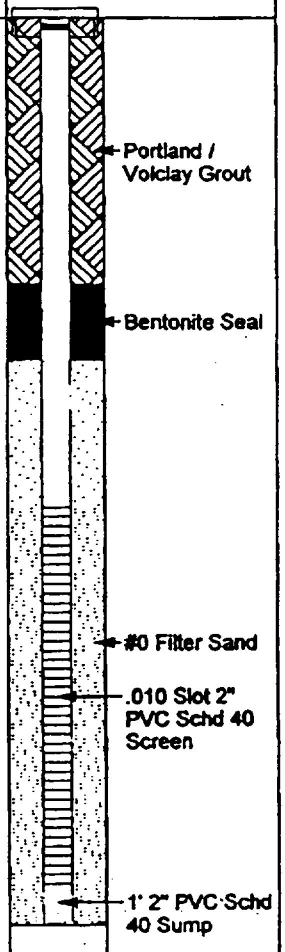
BORING/WELL CONSTRUCTION LOG

PROJECT NUMBER P009-001
PROJECT NAME Source Control Upper Reach Housatonic River
LOCATION Pittsfield, Massachusetts
DRILLING METHOD HSA
SAMPLING METHOD SS
GROUND ELEVATION 983.60
TOP OF CASING 983.26
LOGGED BY NSB
NORTHING 532406.3035

BORING/WELL NUMBER LSSC-08
DATE DRILLED 12/17/98
CASING TYPE/DIAMETER 2" PVC
SCREEN TYPE/SLOT .010 Slot 2" PVC
GRAVEL PACK TYPE #0 Silica Sand
GROUT TYPE/QUANTITY Portland/Volclay
DEPTH TO WATER 12.41 (12/21/1998)
GROUND WATER ELEVATION 970.85 (12/21/1998)
EASTING 130816.3352

FID (ppm)	BLOW COUNTS	SAMPLE ID.	EXTENT	DEPTH (ft. BGL)	U.S.C.S.	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0		SS01	☒				Loose, Dark yellowish Brown, SAND w/ few gravel, dry, well gradded, SW-GW	1.0
0	[illegible]	SS02	☒				Top 0.8 Loose, Dark yellowish Brown, SAND w/ coal fragments, dry, well graded, SW. Bottom 0.4 Light Brown and White, SAND and COAL ASH, dry, well graded, SW, (Fill).	3.0
0	[illegible]	SS03	☒				Loose, White and Grayish Red, fine to medium COAL ASH, moist, well graded, SW, (Fill).	5.0
0	[illegible]	SS04	☒	5			Similar to above w/ Dark yellowish Brown, SAND intervals and few little organics.	6.0
1	[illegible]	SS05	☒				Top 0.4 Same as above. Bottom 0.2 Loose, Light olive Brown, SAND, dry, well graded, SW.	8.0
1.7	[illegible]	SS06	☒				Loose, Light to Moderate olive Brown, interbedded SAND and SILT w/ little organics, dry, poorly graded, SM.	10.0
1.3	[illegible]	SS07	☒	10			Top 0.6 Same as above. Bottom 0.7 Loose, Light to olive Gray, SILT w/ some interbedded sand, moist, poorly graded, SM.	12.0
4	[illegible]	SS08	☒				Top 0.5 Same as above (Top). Bottom 0.8 Same as above (Bottom). ▼	14.0
6.1	[illegible]	SS09	☒				Top 0.5 Similar to above, moist. Bottom 0.3 Wood Core	15.0
1	[illegible]	SS10	☒	15			Wood Core	17.0
0	[illegible]	SS11	☒				Top 0.3 Wood Core. Bottom 0.7 Very loose, Olive Gray to Light Brown, GRAVEL w/ little sand, wet, well graded, subround, GW.	19.0
0	[illegible]	SS12	☒				Similar to above (Bottom) w/ trace fines.	20.0
18.7	[illegible]	SS13	☒	20			Top 0.4 Loose, Olive Gray, coarse SAND w/ few gravel, wet, well graded, sheen, SW-GW. Bottom 0.2 Moderate olive Gray, SILT and GRAVEL, wet, well graded, GM.	22.0
224	[illegible]	SS14	☒				Top 0.6 Same as above (Top). Bottom 0.6 Light olive Gray, SILT, wet, well graded, ML.	24.0

WELL DIAGRAM

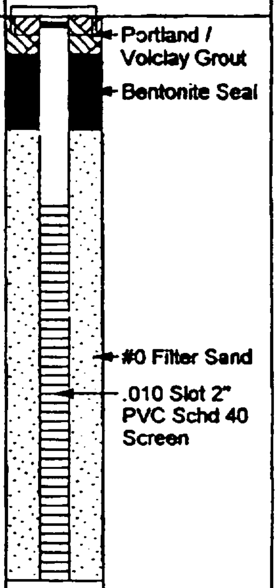


HSI GEOTRANS
A TETRA TECH COMPANY

BORING/WELL CONSTRUCTION LOG

PROJECT NUMBER P009-001
PROJECT NAME Source Control Upper Reach Housatonic River
LOCATION Pittsfield, Massachusetts
DRILLING METHOD HSA
SAMPLING METHOD SS
GROUND ELEVATION 983.64
TOP OF CASING 983.24
LOGGED BY NSB
NORTHING 532408.89

BORING/WELL NUMBER LSSC-08S
DATE DRILLED 3/29/99
CASING TYPE/DIAMETER 2" PVC
SCREEN TYPE/SLOT .010 Slot 2" PVC
GRAVEL PACK TYPE #0 Silica Sand
GROUT TYPE/QUANTITY None
DEPTH TO WATER 11.83 (4/14/1999)
GROUND WATER ELEVATION 971.41 (4/14/1999)
EASTING 130817.23

FID (ppm)	BLOW COUNTS	SAMPLE ID.	EXTENT	DEPTH (ft. BGL)	U.S.C.S.	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH	WELL DIAGRAM
							See Log for LSSC-08.		
				5					
				10			▼		
				15				15.0	

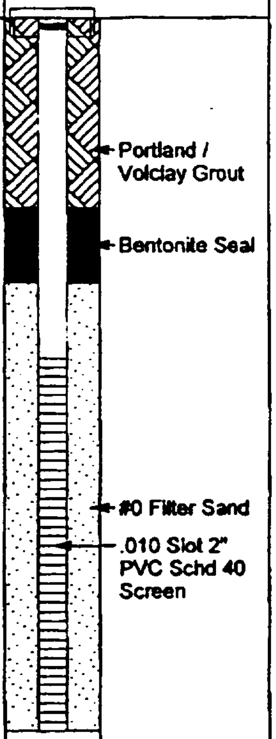
HSI GEOTRANS
A TETRA TECH COMPANY

BORING/WELL CONSTRUCTION LOG

PROJECT NUMBER P009-001
PROJECT NAME Source Control Upper Reach Housatonic River
LOCATION Pittsfield, Massachusetts
DRILLING METHOD HSA
SAMPLING METHOD SS
GROUND ELEVATION 987.66
TOP OF CASING 987.45
LOGGED BY SKC
NORTHING 532.664.56

BORING/WELL NUMBER LSSC-18
DATE DRILLED 3/29/99
CASING TYPE/DIAMETER 2" PVC
SCREEN TYPE/SLOT .010 Slot 2" PVC
GRAVEL PACK TYPE #0 Silica Sand
GROUT TYPE/QUANTITY Portland/Volclay
DEPTH TO WATER 15.66 (4/14/1999)
GROUND WATER ELEVATION 971.79 (4/14/1999)
EASTING 131102.78

FID (ppm)	BLOW COUNTS	SAMPLE ID.	EXTENT	DEPTH (ft. BGL)	U.S.C.S.	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH	WELL DIAGRAM
		SS01					Auger sample through asphalt. Moderate Yellow, SAND w/ asphalt fill, dry (FILL).	1.0	
	[illegible]	SS02					Medium dense, Black to Dark yellowish Brown, FILL (coal ash), dry, well graded, (FILL).	3.0	
	[illegible]	SS03					Similar to above with some red brick fragments and some glass.	5.0	
	[illegible]	SS04		5			Same as above, with more brick fragments.	6.0	
	[illegible]	SS05					Dense, Pale yellowish Orange to Dark yellowish Brown to White to Black, COAL ASH, dry, well graded, (FILL).	8.0	
	[illegible]	SS06					Same as above.	10.0	
	[illegible]	SS07		10			Loose, Moderate reddish Brown to Greyish Red, COAL ASH, moist, well gradded, (Fill).	12.0	
	[illegible]	SS08					Top 0.6 same as above. Bottom 0.7 loose, Olive Black to Black, fine SAND and SILT w/ organics, moist, laminated, poorly graded, (SM, OL).	14.0	
	[illegible]	SS09					Top 0.9 same as above. Bottom 0.1 Loose, Olive Gray, SAND, wet, well graded, (SW).	15.0	
	[illegible]	SS10		15			Top 0.5 same as above (Top). Bottom 1.0 loose, Olive Gray, SAND, few organics, laminated, wet, poorly graded, (SP). ▼	17.0	
	[illegible]	SS11					Top 1.8 similar to above, well graded, few organics, (SW). Bottom 0.3 dense, Light olive Gray, GRAVEL w/ some silt and fine sand, wet, well graded, sub-angular, (GW).	19.0	



EPA Approval Letter Dated May 7, 1999 for GE's: Letter RE: Results of Supplemental Soil Sampling in Support of Source Control Activities at Lyman Street Site, DEP Site No. 1-0856, USEPA Area 5A, April 26, 1999

United States Environmental Protection Agency
Region I
One Congress Street, Suite 1100
Boston, MA 02114-2023

May 7, 1999

ENVIRONMENTAL PROGRAMS
MAY 11 1999

Mr. Andrew T. Silfer, P.E.
General Electric Company
100 Woodlawn Avenue
Pittsfield, Massachusetts 01201

RE: Conditional Approval of GE's April 26, 1999 Submittal Titled *Results of Supplemental Soil Sampling in Support of Source Control Activities at Lyman Street Site, General Electric Company, Pittsfield, Massachusetts*

EPA approves the above-referenced submittal subject to the following:

1. GE shall submit the Detailed Containment Barrier Design Report to EPA for approval no later than July 12, 1999.

2. The Detailed Containment Barrier Design shall address the technical issues contained in EPA's March 23, 1999 letter conditionally approving GE's February 16, 1999 submittal titled *Conceptual Barrier Design for Lyman Street.*

If you have any questions, please contact me at (617) 918-1282

Sincerely,

Dean Tagliaferro

Dean Tagliaferro
On-Scene Coordinator

cc: John Ciampa, GE
Lyn Cutler, MA DEP
John Ziegler, MA DEP
John Kilborn, US EPA
Mike Nalipinski, US EPA
Steve Acree, US EPA
Dawn Veillieux, Roy F. Weston
Joel Lindsay, Roy F. Weston
John Kullberg, USACE

Margaret Meehan, EPA
Anton Giedt, NOAA
Dale Young, MA EOEA
Tom O'Brien, MA EOEA
Mayor Doyle, City of Pittsfield
Pittsfield Conservation Commission
Pittsfield City Council, c/o Tom Hickey
Site File

DNAPL Assessment, East Street Area 2 Site, April 28, 1999

Corporate Environmental Programs
General Electric Company
100 Woodlawn Avenue, Pittsfield, MA 01201

April 28, 1999

Mr. Bryan Olson
Mr. Dean Tagliaferro
Site Evaluation and Response Section (HBR)
U.S. Environmental Protection Agency
One Congress Street
Boston, MA 02203-2211

Mr. Alan Weinberg
Bureau of Waste Site Cleanup
Department of Environmental Protection
436 Dwight Street
Springfield, MA 01103

Re: General Electric --
East Street Area 2 Site
Pittsfield, Massachusetts

Dear Mr. Olson, Mr. Tagliaferro, Mr. Weinberg:

Enclosed please find the document entitled *DNAPL Assessment, East Street Area 2 Site, Pittsfield, Massachusetts.* This document has been prepared on behalf of the General Electric Company (GE) by HSI GeoTrans, Inc. It presents the results of investigations conducted for GE between March 11, 1999 and April 13, 1999, pursuant to the *Proposal for Supplemental Source Control Containment Recovery Measures (BBL, January 1999).*

Please contact me at (413) 494-3952 if you have any comments regarding the enclosed document.

Yours truly,

For

John D. Ciampa
Remediation Project Manager

cc:
S. Acree, EPA*
M. Nalipinski, EPA*
R. Child, DEP*
M. Holland, DEP
J. Bieke, Shea & Gardner *
Mayor G. Doyle
State Representative S. Kelly
State Senator A. Nuciforo
A. Thomas, GE*
J. Magee, GE
Pittsfield Conservation Commission*
S. Cooke, McDermott, Will & Emery*
J. Bridge, HSI GeoTrans*
Pittsfield Health Department*
Housatonic River Initiative
R. Bell, DEP*
J. Ziegler, DEP*
State Representative D. Bosley
State Representative C. Hodgkins
State Representative P. Larkin
J. Gardner, GE
A. Silfer, GE*
J. Nuss, BBL*
G. Bibler, Goodwin, Procter & Hoar*
D. Veilleux, Roy F. Weston*
Public Information Repositories
ECL I-P-IV(A)(1)* & (2)

(* with enclosures)

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DNAPL ASSESSMENT
EAST STREET AREA 2 SITE
PITTSFIELD, MASSACHUSETTS

PREPARED FOR:

GENERAL ELECTRIC COMPANY

PREPARED BY:

HSI GEOTRANS, INC.
6 LANCASTER COUNTY ROAD
HARVARD, MASSACHUSETTS 01451

TABLE OF CONTENTS

LIST OF TABLES

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1 INTRODUCTION

As described in the Proposal for Supplemental Source Control Contaminant/ Recovery Measures (BBL, 1999), coal-tar-derived dense non-aqueous phase liquids (DNAPL) are present beneath portions of the East Street Area 2 Site. This report presents the findings of the further evaluation of DNAPL occurrence at the East Street Area 2 Site as proposed in the Proposal for Supplemental Source Control Containment/Recovery Measures (BBL, 1999) and conditionally approved by EPA in a letter dated February 11, 1999. The activities described in this report supplement the source control information previously submitted to the United States Environmental Protection Agency and the Massachusetts Department of Environmental Protection (the Agencies) in the following reports:

- Letter Report regarding Source Control Investigations and Preliminary Containment Barrier Design For East Street Area 2, General Electric Pittsfield Massachusetts (GE, Nov. 18, 1998)

- Proposal for Supplemental Source Control Containment / Recovery Measures (BBL, 1999)

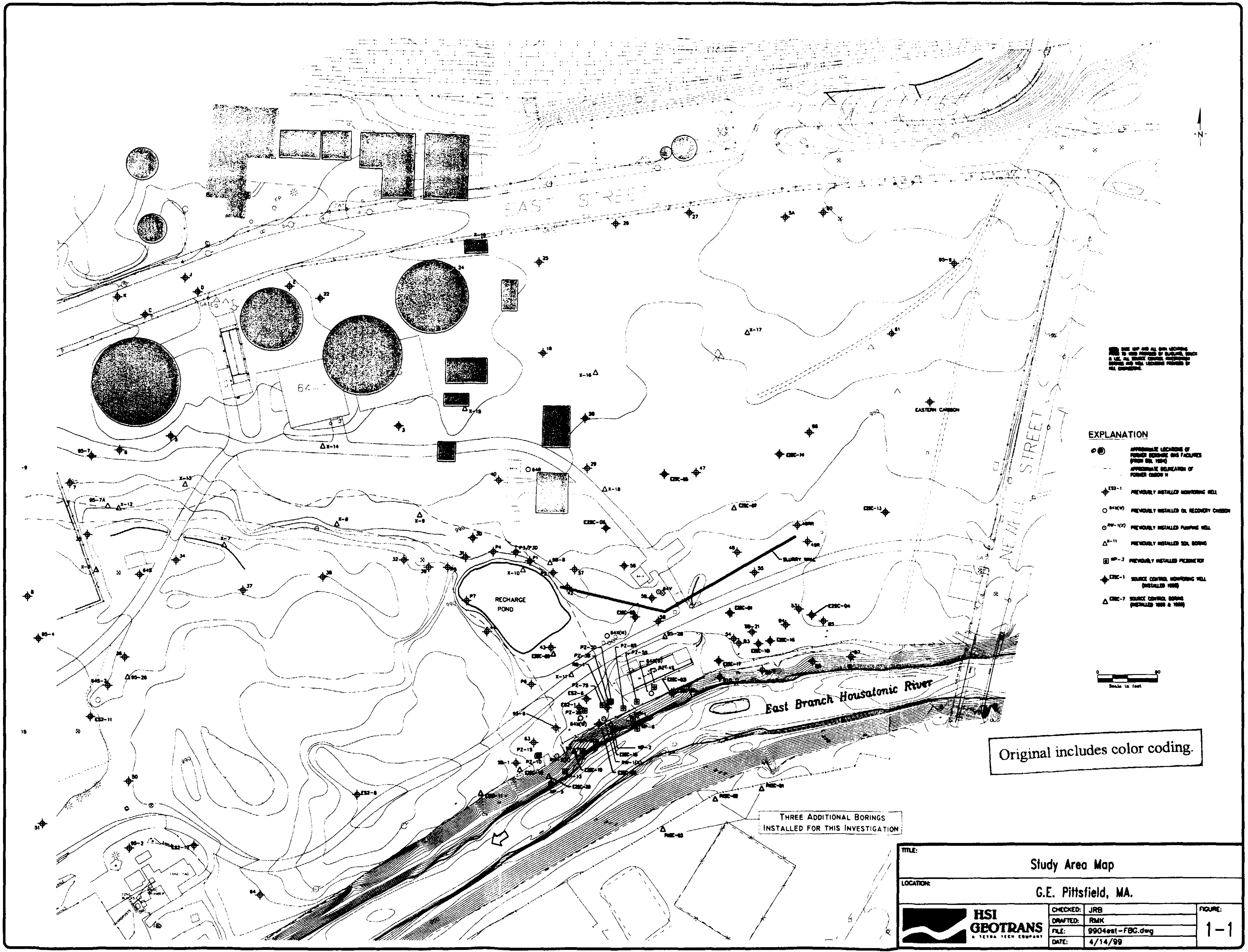
- Source Control Investigation Report Upper Reach of Housatonic River (First ½ Mile) (HSI GeoTrans, 1999)

The additional activities conducted for this evaluation of DNAPL occurrence included drilling and sampling three additional borings on the south side of the Housatonic River (opposite the East Street Area 2 Site) and DNAPL recovery testing of monitoring wells E2SC-17 and E2SC-03I. Results of previous physical and chemical testing of the DNAPL are also summarized in this report.

A portion of the Site was previously owned by the Berkshire Gas Company, which operated a Coal Gasification plant on this property from 1903 to 1972. Structures related to the Berkshire Gas facility, including gas receiver tanks and a tar separator, were located on the south side of East Street. The majority of these structures were removed prior to the 1973 GE purchase of the property (BBL, 1994). The locations of the former coal gasification plant structures are shown on Figure 1-1.

Prior investigations of the East Street Area 2 site downgradient of the former Berkshire Gas plant have shown that coal-tar related DNAPL is present beneath this portion of the Site. Coal-tar DNAPL was observed in soil cores during the drilling of several source control monitoring wells in October and November, 1998. DNAPL has subsequently accumulated in wells E2SC-02, E2SC-03I, and E2SC-17. DNAPL accumulations with the greatest apparent thickness have been observed in wells E2SC-03I and E2SC-17. Apparent DNAPL thicknesses of five to seven feet have been observed in these two wells. NAPL is also detected in monitoring well E2SC-06. Measurements made with an oil/water interface probe in this well indicate that the NAPL is lighter than the water. However, visual observations of a sample of the NAPL indicate both LNAPL and DNAPL components are present in E2SC-06.

The purposes of this most recent evaluation, as proposed by GE in the Proposal for Supplemental Source Control Containment/Recovery (BBL, 1999), were to further determine the areal extent of the DNAPL, determine the elevation of the till surface at three locations on the south side of the river, and evaluate the feasibility for removing DNAPL from the wells by pumping.



Original includes color coding.

TITLE: Study Area Map

LOCATION: G.E. Pittsfield, MA.

HSI GEOTRANS
A TETRA TECH COMPANY

CHECKED:	JRB
DRAFTED:	RMK
FILE:	9904est-FBC.dwg
DATE:	4/14/99

FIGURE: 1-1

2 FIELD INVESTIGATIONS

As outlined in Section 1, additional field investigations were undertaken in March and April 1999 to evaluate the areal extent of DNAPL, collect more information regarding the elevation of the till surface and evaluate the feasibility of pumping the DNAPL from the subsurface.

2.1 ADDITIONAL BORINGS

Between March 11 and March 15, 1999, three borings (PKSC-01, PKSC-02 and PKSC-03) were drilled in Lakewood Park/Hibbard Playground on the south side of the Housatonic River. The locations of the borings are shown on Figure 1-1. The borings were drilled to determine the elevation of the till surface at these locations and to evaluate whether DNAPL had migrated beneath and to the south side of the river. The borings were drilled using the hollow stem auger method. Continuous samples of the unconsolidated deposits were collected using the Standard Penetration Test Method (ASTM D1586). Samples of the unconsolidated deposits were screened in the field for the presence of volatile organic compounds (VOCs) using a photo-ionization detector (PID). All samples were visually screened for the presence of DNAPL. Field observations including geologic descriptions, blow counts, and PID readings were recorded on boring logs. After completing the borings, the locations and ground surface elevations were surveyed relative to the 1927 Massachusetts State Plane Coordinate System and the 1929 National Geodetic Vertical Datum (NGVD). Drilling logs for the three new borings are included in Appendix A.

Representative samples from selected split-spoon cores were collected for laboratory chemical analysis. Composite samples were collected from the following depth intervals:

- zero to one foot
- one to six feet
- six to 15 feet

Each composite sample was analyzed for PCBs. One of the composite samples was analyzed for the compounds listed in Appendix IX of 40 CFR Part 264, excluding herbicides and pesticides, plus three additional compounds, benzidine, 2-chloroethyvinyl ether, and 1,2-diphenyhydrazine. Samples were also collected in Encore samplers® from each split spoon core. The sample from the interval with the highest PID headspace screening measurement was analyzed for VOCs by EPA Method 5035. In addition, a sample of the unconsolidated deposits at the interface of the stratified deposits and the till was collected for PCB analyses. The results of the chemical analyses of the soil samples are summarized in Appendix B. All sampling and analysis was conducted in accordance with the October 1998 Sampling and Analysis Plan/Data Collection and Analysis Quality Assurance Plan (BBL, 1998b).

The three new borings penetrated fill, stratified deposits of sand interbedded with gravel, and till. The till consisted of very dense silt, sand, and gravel, and was encountered at depths ranging from 44 to 56 feet below ground surface. Figure 2-1 is a contour map of the till surface elevation in the portion of the East Street Area 2 Site near the 64X recovery system and the river. The contour map shows that a trough exists in the till surface in the vicinity of monitoring wells E2SC-03I and E2SC-17. The till surface slopes gently to the southeast from the area of monitoring wells E2SC-03I and E2SC-17 towards the new borings PKSC-01 and PKSC-02 on the south side of the river. Figures 2-2 and 2-3 are east/west and north/south cross sections, respectively, showing the stratigraphy and the stratigraphic level of the LNAPL and DNAPL observed in monitoring wells. The cross section locations are shown on Figure 2-1.

As indicated on cross section B-B^1, DNAPL was not observed in the borings on the south side of the river, nor were indications of DNAPL observed in any of the samples collected from the three new borings. As shown in Appendix B, low concentrations of PCBs were detected in several of the samples collected from new borings. However, PCB soil concentrations were below two parts per million (ppm) with the exception of a single sample collected from zero to one foot in boring PKSC-02, which contained PCBs at a concentration of 2.7 ppm. No PCBs were detected in the samples collected just above the till surface. No semi-volatile organic compounds (SVOCs) were detected in any samples collected from the new borings. Acetone was the only VOC detected. It was detected in three samples at low concentrations (estimated) ranging from .0086 to .031 ppm. Several inorganic and dioxin/dibenzofuran compounds were also detected in samples collected from the three new borings. These constituents were detected at concentrations which are within the ranges observed in previous background sampling of Housatonic River floodplain soils (BBL, 1996).

The SVOC polynuclear aromatic hydrocarbons (PAHs) were the constituents measured at the highest concentrations in the coal-tar DNAPL sample from monitoring well E2SC-03I. The VOCs benzene, toluene, ethylbenzene and xylene (BTEX) were also detected in the DNAPL sample from E2SC-03I. None of these compounds were detected in any of the samples collected from the three new borings.

2.2 DNAPL PUMPING AND RECOVERY TESTING

Since the installation of the Source Control Investigation monitoring wells at East Street Area 2 in October and November 1998, groundwater and DNAPL levels have been periodically monitored. Table 2-1 summarizes the groundwater level and NAPL levels measured. Because of the viscous nature of the DNAPL and its smearing on the inside of the well casing, these measurements are considered approximate.

DNAPL has also been removed from wells E2SC-03I and E2SC-17 manually since January 7, 1999. Initially, removal from both wells was done utilizing a bailer. Due to the high viscosity of the coal-tar DNAPL, manual removal using a bailer was difficult. A QED Pulse Pump (model LP 1301) was installed in monitoring well E2SC-17 on March 11, 1999 and in monitoring well E2SC-03I on March 31, 1999 to test the potential of improving DNAPL recovery. The QED pump was selected, after a review of available pumps, for its ability to pump viscous fluids and to fit into the two-inch diameter monitoring wells. This is also the same pump which has been successfully used to remove DNAPL at the Newell Street Area II Site. Table 2-2 summarizes the weekly removal activities from these wells.

To further evaluate DNAPL recovery, DNAPL pumping tests were conducted in monitoring wells E2SC-03I and E2SC-17, between March 29 and April 13, 1999. The tests consisted of pumping DNAPL from the wells until water was observed in the discharge tubing and recording the volume of DNAPL removed. The wells were then allowed to recover and were pumped at least one more time. On March 29, 1999, 5.7 liters of DNAPL were recovered from E2SC-17 in five and one-half hours. The DNAPL in monitoring well E2SC-17 was allowed to recover and the well was pumped again on March 31, 1999. During the second test, one liter of DNAPL was recovered in three hours and 20 minutes of pumping. Four liters of DNAPL were pumped from well E2SC-03I over a four hour and ten minute period on March 31. On April 2, 1.3 liters of DNAPL were pumped from E2SC-03I in 50 minutes. The well was allowed to recover for three hours and 17 minutes and pumped again for one hour. During the second hour of pumping, approximately 3.7 liters of DNAPL were recovered. Based on these initial results, a longer term pumping test of E2SC-03I was conducted on April 13, 1999. DNAPL was pumped for approximately six hours and forty minutes, and approximately 10 liters of DNAPL were recovered. Table 2-3 summarizes the data recorded during the DNAPL pumping and recovery testing.

Table 2-1. Water Level and NAPL Level Table for E2SC-02, E2SC-03I, E2SC-06 and E2SC-17.

Boring	Date Measured	Measuring Point Elevation	Depth to LNAPL	Depth to Water	Groundwater Elevation	LNAPL Thickness	Depth to DNAPL	DNAPL Elevation	Comments
E2SC-02									
	10/26/98	987.57		22.74	964.83				
	10/28/98	987.57		16.26	971.31				
	11/2/98	987.57		16.10	971.47				
	11/4/98	987.57		16.11	971.46				NAPL on probe, Sheen
	11/6/98	987.57		16.11	971.46				Sheen
	11/9/98	987.57		16.14	971.43				Sheen
	11/13/98	987.57		15.93	971.64				Sheen
	11/25/98	987.57		16.13	971.44				Sheen
	12/8/98	987.57		16.12	971.45				NAPL on probe
	12/17/98	987.57		16.18	971.39		42.73	944.84	
	12/29/98	987.57		16.12	971.45		43.30	944.27	
	1/7/99	987.57		16.19	971.38				NAPL on probe
E2SC-03I									
	10/22/98	982.12		10.29	971.83		40.68	941.44	
	10/26/98	982.12		10.45	971.67		40.35	941.77	
	10/28/98	982.12		10.49	971.63		38.96	943.16	
	11/6/98	982.12		10.59	971.53		38.54	943.58	
	11/10/98	982.12		10.55	971.57		38.72	943.40	
	11/13/98	982.12		10.41	971.71		38.83	943.29	
	11/25/98	982.12		10.57	971.55		38.53	943.59	
	12/8/98	982.12		10.53	971.59		38.82	943.30	
	12/17/98	982.12		10.61	971.51		38.71	943.41	
	12/29/98	982.12		11.59	970.53		38.31	943.81	
	1/7/99	982.12		10.60	971.52		38.60	943.52	
	1/7/99	982.12		10.54	971.58		38.59	943.53	
	1/14/99	982.12		10.30	971.82		38.62	943.50	
	1/21/99	982.12		9.55	972.57		39.04	943.08	
	1/28/99	982.12		9.29	972.83		37.75	944.37	

Table 2-1. Water Level and NAPL Level Table for E2SC-02, E2SC-03I, E2SC-06 and E2SC-17.

Boring	*Date Measured*	*Measuring Point Elevation*	*Depth to LNAPL*	*Depth to Water*	*Groundwater Elevation*	*LNAPL Thickness*	*Depth to DNAPL*	*DNAPL Elevation*	*Comments*
	2/4/99	982.12		8.57	973.55		39.49	942.63	
	2/11/99	982.12		9.45	972.67		38.07	944.05	
	2/18/99	982.12		9.61	972.51		37.94	944.18	
	2/25/99	982.12		10.06	972.06		37.78	944.34	
	3/4/99	982.12		7.41	974.71		41.56	940.56	
	3/11/99	982.12		9.46	972.66		37.60	944.52	
	3/18/99	982.12		9.33	972.79		38.30	943.82	
	3/25/99	982.12		8.20	973.92		38.60	943.52	
E2SC-06									
	10/26/98	992.49		20.25	972.24				2.5' NAPL on tape, Sheen
	10/28/98	992.49	15.40	20.51	971.98	5.11			
	11/2/98	992.49	21.50	21.90	970.59	0.40			
	11/4/98	992.49	16.90	18.01	974.48	1.11			
	11/6/98	992.49		20.42	972.07				NAPL on probe
	11/9/98	992.49	17.72						Probe will not sink through NAPL.
	11/13/98	992.49	17.73						Probe will not sink through NAPL.
	11/25/98	992.49							Could not measure, casing smeared with NAPL, NAPL on probe
E2SC-17									
	10/28/98	985.38		13.59	971.79				
	11/4/98	985.38		13.66	971.72		47.90	937.48	
	11/6/98	985.38		13.65	971.73		47.75	937.63	
	11/9/98	985.38		13.66	971.72		47.70	937.68	
	11/13/98	985.38		13.46	971.92		47.57	937.81	
	11/25/98	985.38		13.67	971.71		46.61	938.77	
	12/8/98	985.38		13.65	971.73		45.07	940.31	
	12/17/98	985.38		14.71	970.67		43.85	941.53	
	12/29/98	985.38		13.66	971.72		43.83	941.55	
	1/7/99	985.38		13.79	971.59		44.17	941.21	
	1/7/99	985.38		13.64	971.74		43.95	941.43	

Table 2-1. Water Level and NAPL Level Table for E2SC-02, E2SC-03I, E2SC-06 and E2SC-17.

Boring	*Date Measured*	*Measuring Point Elevation*	*Depth to LNAPL*	*Depth to Water*	*Groundwater Elevation*	*LNAPL Thickness*	*Depth to DNAPL*	*DNAPL Elevation*	*Comments*
	1/14/99	985.38		13.39	971.99		44.05	941.33	
	1/21/99	985.38		12.71	972.67		44.35	941.03	
	1/28/99	985.38		12.30	973.08		44.29	941.09	
	2/4/99	985.38		11.76	973.62		44.26	941.12	
	2/11/99	985.38		12.49	972.89		44.17	941.21	
	2/18/99	985.38		12.65	972.73		44.00	941.38	
	3/4/99	985.38		11.93	973.45		44.26	941.12	

NOTES:

-Elevations are feet above NGVD.

-Depths are feet below Measuring Point Elevation.

-The Elevations of the bottom of the monitoring wells are:

E2SC-02	943.93
E2SC-03I	934.93
E2SC-06	970.76
E2SC-17	936.06

Table 2-2. Summary of weekly DNAPL removal from wells E2SC-3I and E2SC-17

DATE	VOLUME REMOVED (LITERS)	
	E2SC-03I	**E2SC-17**
1/7/99	3.0	2.0
1/14/99	0.7	1.6
1/21/99	0.9	1.2
1/28/99	1.4	1.0
2/4/99	1.2	1.0
2/11/99	1.3	1.2
2/18/99	1.3	1.0
2/25/99	0.4	0.75
3/4/99	1.5	2.0
3/11/99	0.45	0.755 *
3/18/99	0.5	3.0 *
3/25/99	0.5	4.0 *
4/1/99	7.0*	0.1*
4/8/99	6.0*	4.0*
4/15/99	7.0*	4.0*
4/22/99	5.5*	0.5*

* DNAPL recovered with pump.

Table 2-3. DNAPL pumping and recovery test summary, E2SC-03I and E2SC-17

E2SC-03I **(Test 1)** **3/31/99**	
Elapsed Pumping Time (min)	**Cumulative DNAPL Recovery (L)**
40	0.025
44	0.05
70	0.1
76	0.175
82	0.275
88	0.35
94	0.425
100	0.875
158	1.125
174	1.425
178	1.605
185	1.88
204	2.23
210	2.53
224	2.78
230	3.18
235	3.58
246	4.03
250	4.08

Table 2-3. Continued

E2SC-03I (TEST 2) 4/2/99	
ELAPSED PUMPING TIME (MIN)	CUMULATIVE DNAPL RECOVERY (L)
0	0.05
7	0.3
23	0.7
40	1.05
50	1.3
247	1.7
253	1.9
263	2.125
274	2.475
279	2.825
285	3.15
293	3.525
300	3.875
305	4.225
307	4.725
309	4.975

Table 2-3. Continued

E2SC-03I (TEST 3) 4/13/99	
ELAPSED PUMPING TIME (MIN)	CUMULATIVE DNAPL RECOVERY (L)
0	0.1
8	0.15
16	0.151
24	0.15125
32	0.1515
40	0.15175
48	0.152
50	0.152
53	0.1525
55	0.153
61	0.158
66	0.258
71	0.333
76	0.383
85	0.433
94	0.533
102	0.608
109	0.708
117	0.783
126	0.883
134	1.008
142	1.183
151	1.383
161	1.733
169	2.233
178	2.758
187	3.033
195	3.333
203	3.508
211	3.758
219	4.008
227	4.283
236	4.533
244	4.783
253	5.008
262	5.258
270	5.508
278	5.758
286	5.983
295	6.208
303	6.433
312	6.658

E2SC-031
(TEST 3)
4/13/99

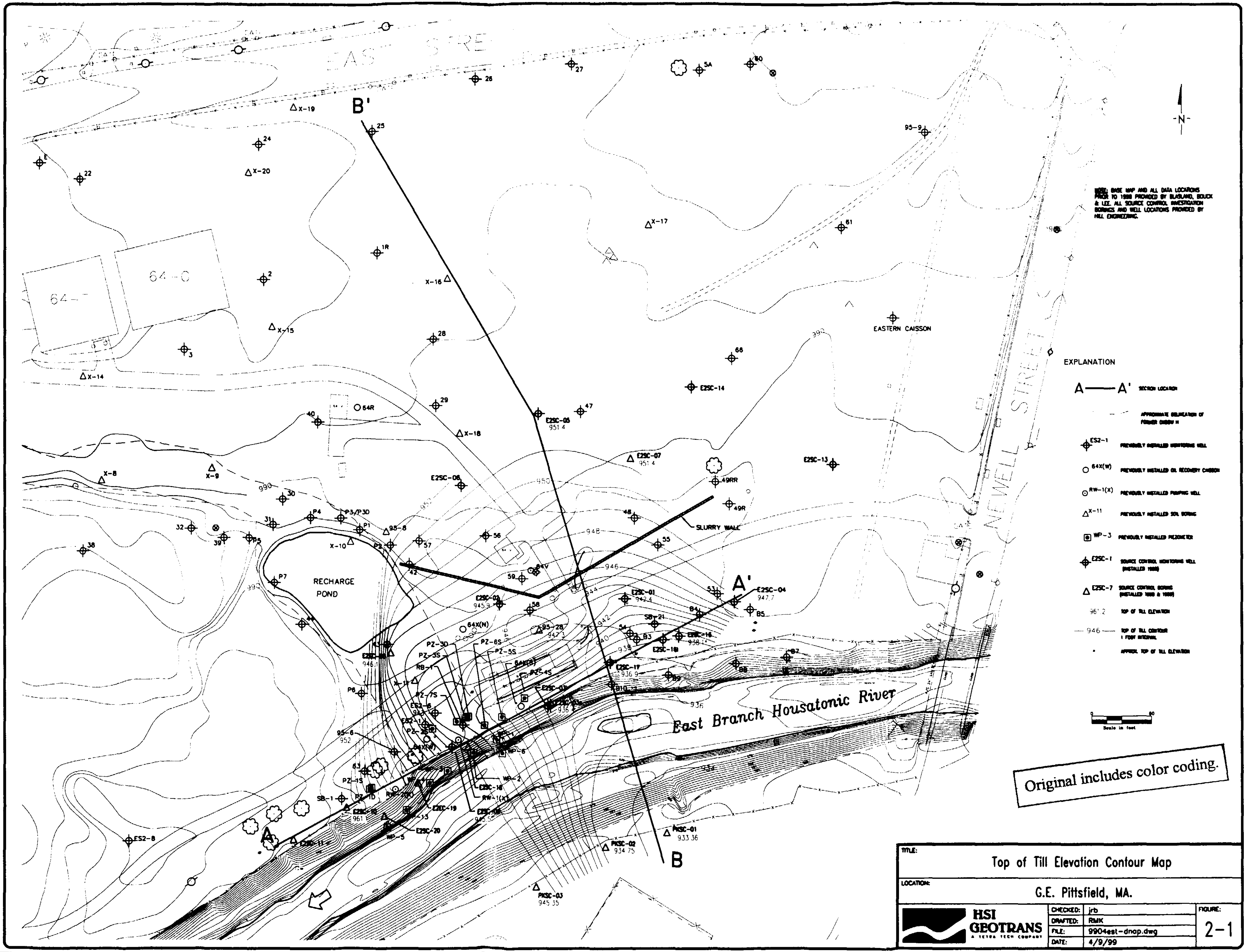
ELAPSED PUMPING TIME (MIN)	CUMULATIVE DNAPL RECOVERY (L)
320	6.858
329	7.058
337	7.258
346	7.458
354	7.658
362	7.858
370	8.158
379	8.483
387	9.733
396	9.983

E2SC-17
(TEST 1)
3/29/99

ELAPSED PUMPING TIME (MIN)	CUMULATIVE DNAPL RECOVERY (L)
330	5.7

E2SC-17
(TEST 2)
3/31/99

ELAPSED PUMPING TIME (MIN)	CUMULATIVE DNAPL RECOVERY (L)
150	0.65
160	0.75
170	0.87
180	0.97
190	1.02
200	1.045



Original includes color coding.

TITLE:	Top of Till Elevation Contour Map
LOCATION:	G.E. Pittsfield, MA.

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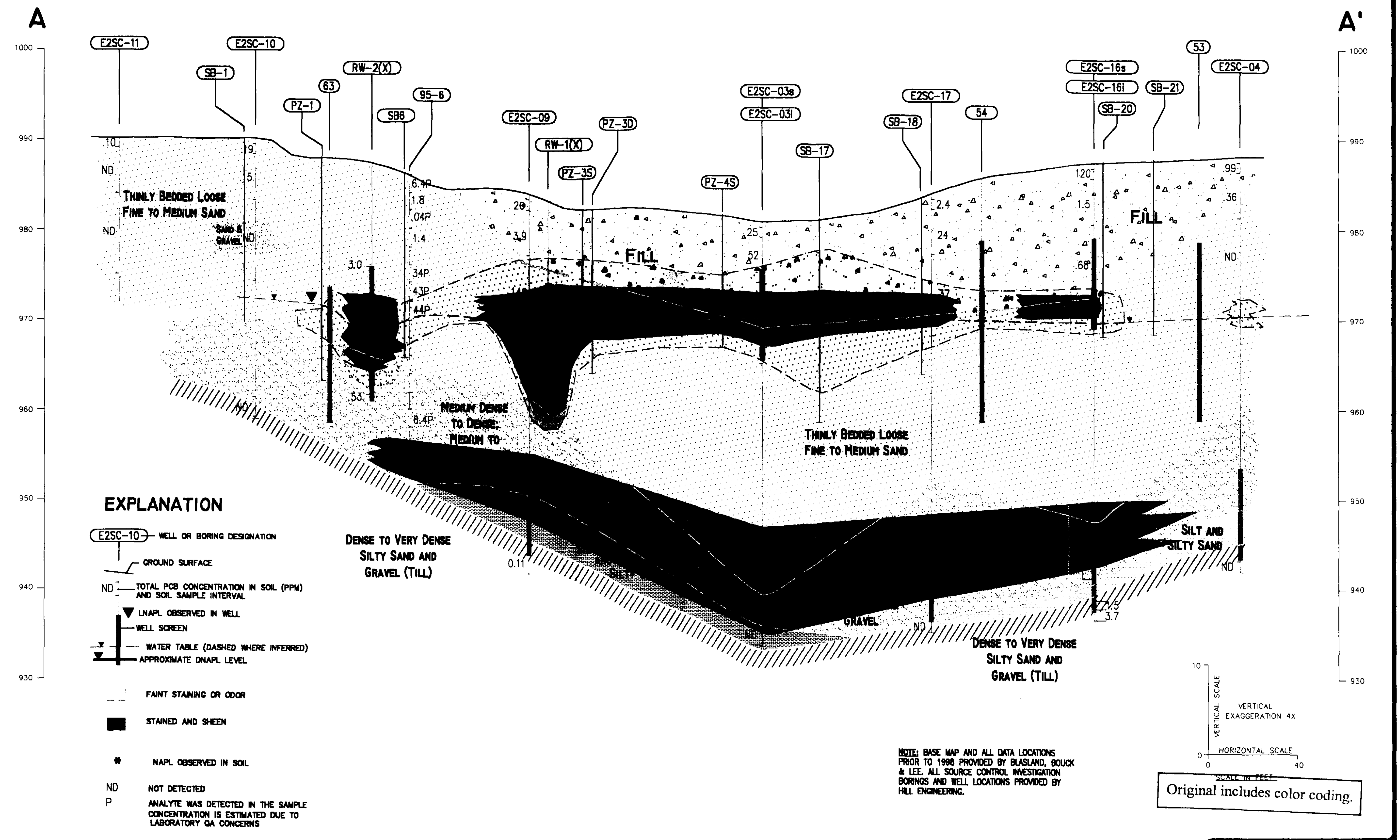
CHECKED:	jrb	FIGURE:
DRAFTED:	RMK	2-1
FILE:	9904est-dnap.dwg	
DATE:	4/9/99	



NOTE: BASE MAP AND ALL DATA LOCATIONS PRIOR TO 1998 PROVIDED BY BLASLAND, BOUCK & LEE. ALL SOURCE CONTROL INVESTIGATION BORINGS AND WELL LOCATIONS PROVIDED BY HILL ENGINEERING.

Original includes color coding.

Figure 2-2 Cross-Section A-A'

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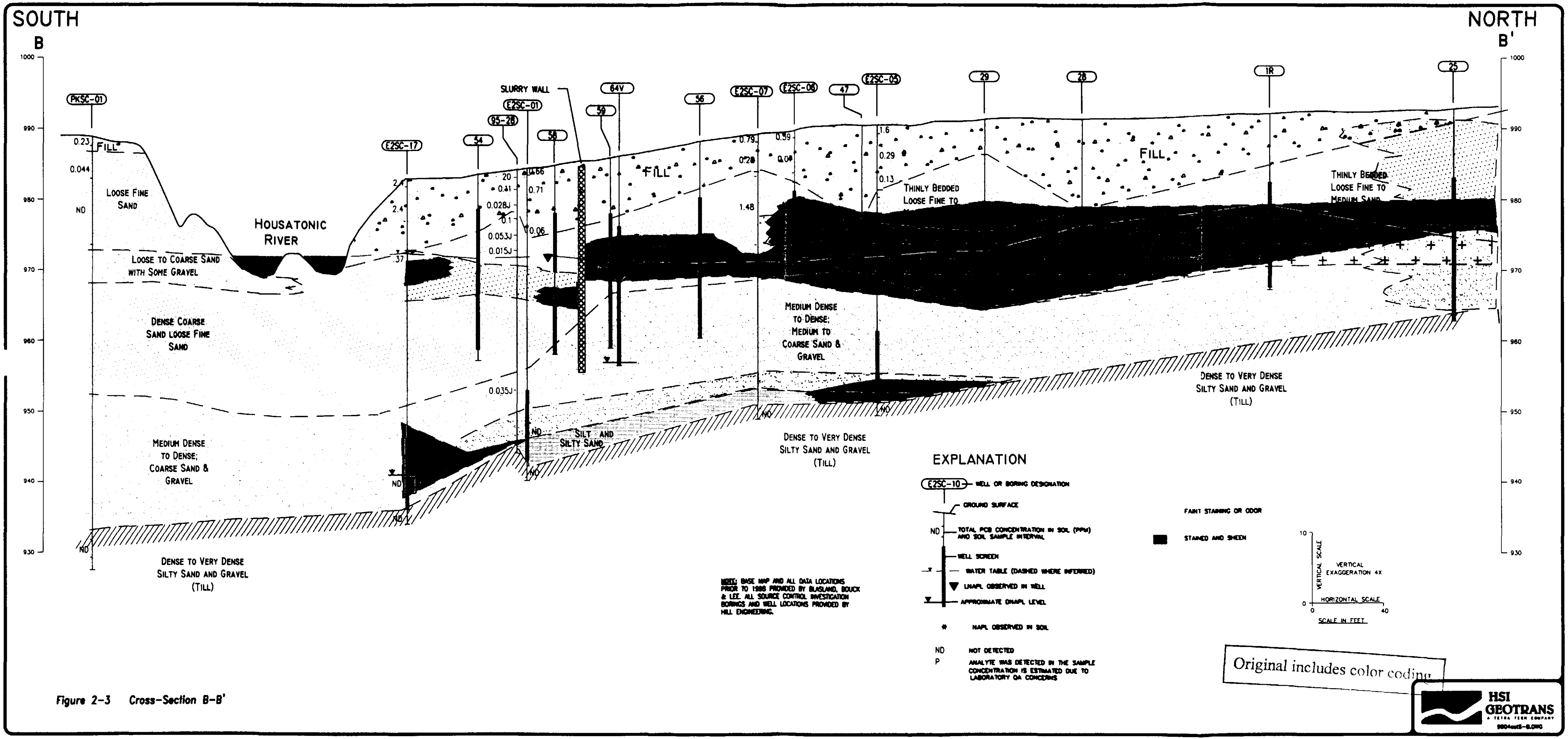


NOTE: BASE MAP AND ALL DATA LOCATIONS PRIOR TO 1998 PROVIDED BY BLASLAND, BOUCK & LEE. ALL SOURCE CONTROL INVESTIGATION BORINGS AND WELL LOCATIONS PROVIDED BY HILL ENGINEERING.

Original includes color coding

Figure 2-3 Cross-Section B-B'

3 DNAPL PHYSICAL AND CHEMICAL PROPERTIES

Samples of DNAPL from wells ES2-6, 64V, and E2SC-03I have been collected and analyzed for chemical and physical properties. The DNAPL was analyzed for PCBs and Appendix IX+3 constituents. Interfacial tension and specific gravity of the DNAPL were also measured.

3.1 PHYSICAL PROPERTIES

DNAPL samples from recovery well 64V and monitoring wells E2SC-03I and ES2-6 have been tested for specific gravity. Specific gravity ranges from 1.03 for DNAPL from recovery well 64V, to 1.39 for DNAPL from monitoring well ES2-6. The interfacial tension between DNAPL from well E2SC-03I and distilled water was determined using a DuNoy tensiometer. The interfacial tension at room temperature ranged from 27.7 to 29.2 dynes/cm. The viscosity of the DNAPL from well E2SC-03I could not be determined because it coated the capillary tube of the viscometer which prohibited the taking of visual measurements. Based on literature review, the viscosity of coal-tar DNAPLs ranges from 10 to 100 centipoise (Mercer and Cohen, 1993). Observations during pumping of E2SC-03I indicate that the viscosity of the DNAPL from the well is variable, ranging from a thick oil to a grease-like consistency. The results of specific gravity and interfacial tension measurements are summarized in Table 3-1.

3.2 CHEMICAL PROPERTIES

Samples of DNAPL from recovery well 64V and monitoring wells ES2-6 and E2SC-03I have been analyzed for PCBs, VOCs and SVOCs. The composition of the three samples are similar and typical of coal tar DNAPL. The major constituents of the DNAPL are the SVOC polynuclear aromatic hydrocarbons (PAHs). Naphthalene was the PAH compound detected at the highest concentration in all of the samples. Naphthalene concentrations ranged from 34,000 mg/kg in the sample from 64V to 110,000 mg/kg in the sample from E2SC-03I. The DNAPL also contains the VOCs benzene, toluene, ethylbenzene and xylene. Of these compounds, ethylbenzene was detected at the highest concentrations, ranging from 53 mg/kg in the sample from E2SC-03I, to 3700 mg/kg in the sample from ES2-6. No PCBs were detected in the samples from ES2-6 or E2SC-03I. Two samples from recovery well 64V were analyzed for PCBs and contained 202 mg/kg and 288 mg/kg total PCBs. At this location, the DNAPL in recovery well 64V occurs at a shallower depth and may be mixed with the LNAPL that is collected in this well. This mixing may account for the presence of PCBs in the DNAPL at this location and its lower density compared to the DNAPL found at greater depths in wells ES2-6 and E2SC-03I. Table 3-2 summarizes the concentrations of the detected compounds in the DNAPL samples from wells E2SC-03I, ES2-6 and 64V.

Table 3-1. Summary of DNAPL physical measurements

SPECIFIC GRAVITY	
ES2-6	1.39
64V	1.03
E2SC-03I	1.076
INTERFACIAL TENSION (DYNES/CM)	
E2SC-03I	
Oil to water	28.5
Oil to water	27.7
Oil to water	27.7
Water to Oil	29.2

Table 3-2. Summary of Detected Appendix IX Compound concentrations in DNAPL samples from monitoring wells E2SC-03I, ES2-6, and recovery well 64V.

	E2SC-03I		ES2-6*		64V*	
Compound	**Result**	**Units**	**Result**	**Units**	**Result**	**Units**
Metals						
Antimony	0.13 B	mg/kg				
Arsenic	3	mg/kg				
Barium	0.22 B	mg/kg				
Chromium	0.079 B	mg/kg				
Copper	8.7	mg/kg				
Lead	1.3	mg/kg				
Mercury	0.061 B	mg/kg				
Nickel	0.66 B	mg/kg				
Selenium	0.92	mg/kg				
Tin	2.2 B	mg/kg				
Zinc	2.2	mg/kg				
SVOC						
1-Methylnaphthalene					14000	mg/kg
2-Methylnaphthalene	34000	mg/kg	28000	mg/kg	11000	mg/kg
Acenaphthene	3800	mg/kg	18000	mg/kg	15000	mg/kg
Acenaphthylene	19000	mg/kg	5500	mg/kg	2900	mg/kg
Acetophenone	160 J	mg/kg				
Anthracene	8500	mg/kg	9200	mg/kg	6500	mg/kg
Benzo(a)anthracene	5500	mg/kg	6800	mg/kg	4900	mg/kg
Benzo(a)pyrene	4500	mg/kg	4900	mg/kg	4200	mg/kg
Benzo(b)fluoranthene	2800	mg/kg				
Benzo(b.k)fluoranthene			8100	mg/kg	4300	mg/kg
Benzo(ghi)perylene	1100 J	mg/kg			1700	mg/kg
Benzo(k)fluoranthene	1300 J	mg/kg				
Chrysene	4800	mg/kg	5400	mg/kg	3700	mg/kg
Dibenz(a.h)anthracene	320 J	mg/kg			320	mg/kg
Dibenzofuran	770 J	mg/kg			590	mg/kg
Fluoranthene	11000	mg/kg	13000	mg/kg	9900	mg/kg
Fluorene	11000	mg/kg				
Indeno(1.2.3-cd)pyrene	980 J	mg/kg			1500	mg/kg
N-Nitrosodiphenylamine	110 J	mg/kg				
Naphthalene	110000	mg/kg	75000	mg/kg	9700	mg/kg
Phenanthrene	32000	mg/kg	39000	mg/kg	26000	mg/kg
Pyrene	15000	mg/kg	22000	mg/kg	15000	mg/kg
VOC						
Benzene	1.3 J	mg/kg				
Ethylbenzene	53	mg/kg	3700	mg/kg	700	mg/kg
Toluene	19	mg/kg	250	mg/kg		
Xylenes (total)	43	mg/kg	2900	mg/kg	600	mg/kg

Notes:

* Sample not analyzed for metals.

B For organics, compound found in method blank. For metals, result is between Method Detection Limit and Reporting Limit.

J For organics, result is between Method Detection Limit and Reporting Limit.

4 RESULTS OF INVESTIGATION

The additional data collected during this investigation have provided a further understanding of the areal extent of the DNAPL at the East Street Area 2 Site, increased definition of the topography of the till surface, and an assessment of the ability to pump the DNAPL.

4.1 AREAL EXTENT OF DNAPL

Separate phase DNAPL has been directly observed in seven wells in the southeastern portion of the East Street Area 2 Site. Wells in which DNAPL has been observed are listed in Table 4-1 and shown on Figure 4-1. Additionally, boring X-19 (see Figure 4-1), drilled during prior investigations of the site, was drilled into a former tar separator associated with the previously existing manufactured gas plant (MGP) operated by Berkshire Gas Company. This tar separator may represent one potential DNAPL source in this area. As shown on Figure 4-1, wells located downgradient of the former MGP area show that DNAPL has accumulated in a narrow zone extending southward from the area of the former MGP. DNAPL has apparently migrated from the area of the former MGP along the sloping till surface. The thickest accumulation of DNAPL has been observed in monitoring well E2SC-03I, which is located in the center of a depression in the till surface near the 64X recovery system.

DNAPL has been consistently detected in monitoring wells E2SC-03I and E2SC-17 since they were completed in October 1998. DNAPL was first detected in monitoring well E2SC-02 on December 17, 1998, approximately two months after it was completed. DNAPL was measured a second time on December 29, 1998, and a thickness of 0.34 feet was measured. During the last measurement made in E2SC-02 on January 7, 1999, ameasurable thickness of DNAPL was not indicated but DNAPL was observed on the probe when it was removed from the well. As previously mentioned, NAPL has also been detected in monitoring well E2SC-06. The NAPL in E2SC-06 appears to be a mixture of DNAPL and LNAPL.

Wells from prior investigations in this portion of the site which have encountered separate phase DNAPL are monitoring wells ES2-6, 28 and recovery well 64V. DNAPL was detected in well ES2-6 shortly after it was installed in 1994. Subsequent monthly measurements of ES2-6 since May 1996 have not detected DNAPL. DNAPL was initially observed in well 28 during a well inventory conducted in May 1995. This well is not regularly monitored for DNAPL. In addition to the LNAPL collected from recovery well 64V, DNAPL (if present) is removed monthly. The DNAPL is removed, using a pneumatic piston pump. Table 4-2 summarizes the volume of DNAPL collected from recovery well 64V since 1997.

Monitoring wells 28, E2SC-06, and recovery well 64V were not drilled to the till surface. Based on the depths of these wells relative to the till surface, the DNAPL observed in these wells appears to be perched on shallower, low permeability layers.

4.2 RESULTS OF DNAPL PUMPING TESTS

The DNAPL pumping tests conducted on monitoring wells E2SC-03I and E2SC-17 indicate that it is possible to pump the viscous coal-tar DNAPL at low rates. The QED pulse pump was capable of pumping the DNAPL despite its high viscosity. During the first test in each well, different pressures and pulse rates were evaluated. Based on this evaluation, a pressure of 40 psi with a discharge pulse of 30 seconds and recharge time of eight minutes were used for the subsequent tests. The DNAPL pumping tests at well E2SC-17 indicated that the DNAPL recharge to that well is relatively slow. After pumping and a recovery period of two days, only one liter of DNAPL was removed from the well. Well E2SC-03I, however, appears to recharge more quickly. After pumping and allowing the well to recharge for two days, 4.9 liters of DNAPL were removed.

During the longer term pumping/recovery test conducted in well E2SC-03I approximately 10 liters of DNAPL were removed during the six hour and 36 minutes of pumping. Figure 4-2 is a cumulative DNAPL recovery graph for E2SC-03I. At the end of the test, water was removed with the DNAPL indicating that the well is not capable of sustaining the approximate 1.5 liter per hour average DNAPL pumping rate observed during the test.

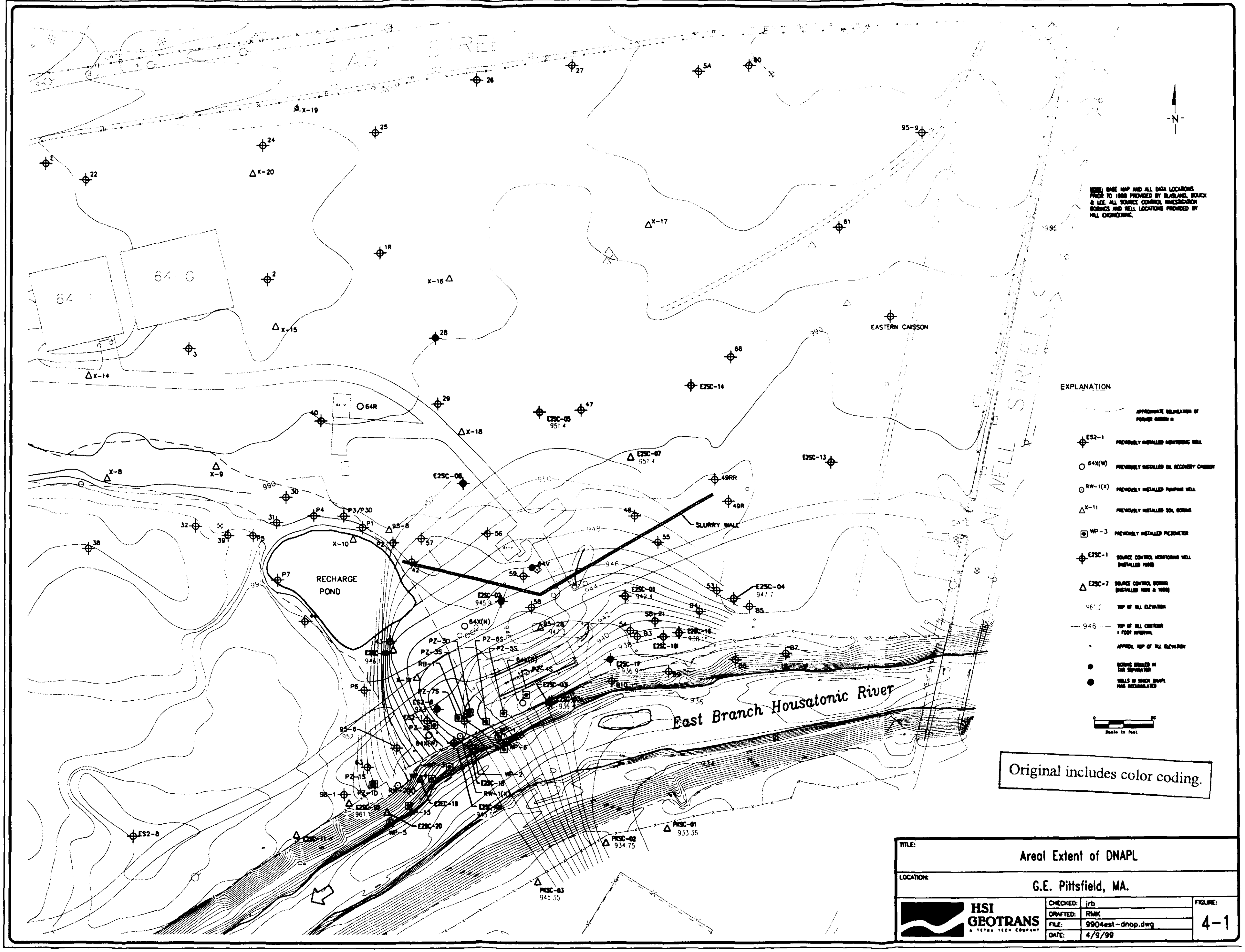
Increased DNAPL recovery rates may be sustainable from a larger diameter well with a screen that is compatibly sized for the grain size of the deposits above the till layer. The existing monitoring wells were not designed as extraction wells. They are constructed with 2-inch diameter casing with 10-slot well screens. The small well-screen diameter and slot size of the existing monitoring wells potentially limit the rate that the viscous DNAPL can enter the well. The deposits above the till layer are described as well-graded, medium to coarse sand and sandy gravel. Based on these descriptions, it is possible that a well screen with a larger slot size could be used to enhance DNAPL recovery near monitoring well cluster E2SC-03. A larger diameter well constructed with a larger screen slot size compared to that of the existing monitoring wells, may allow the DNAPL to enter the well more easily and be recovered at a higher rate.

Table 4-1. Wells in which separate phase DNAPL has been observed

28	E2SC-17
64V	E2SC-02
ES2-6	E2SC-06*
E2SC-03I	
* Oil/water interface probe indicated LNAPL in the well, visual observation of the NAPL indicated that both LNAPL and DNAPL components were present.	

Table 4-2. DNAPL recovery from recovery well 64V, in gallons

	1997	1998	1999
JANUARY	3	2	2
FEBRUARY	3	2	2
MARCH	2	3	2
APRIL	3	2	
MAY	4	2.5	
JUNE	4	0	
JULY	3	3.5	
AUGUST	4	5	
SEPTEMBER	5	2.5	
OCTOBER	5	2	
NOVEMBER	5	4	
DECEMBER	3	3	
TOTAL	44	31.5	6



Original includes color coding.

TITLE: Areal Extent of DNAPL

LOCATION: G.E. Pittsfield, MA.

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CHECKED:	jrb
DRAFTED:	RMK
FILE:	9904est-dnap.dwg
DATE:	4/9/99

FIGURE: 4-1

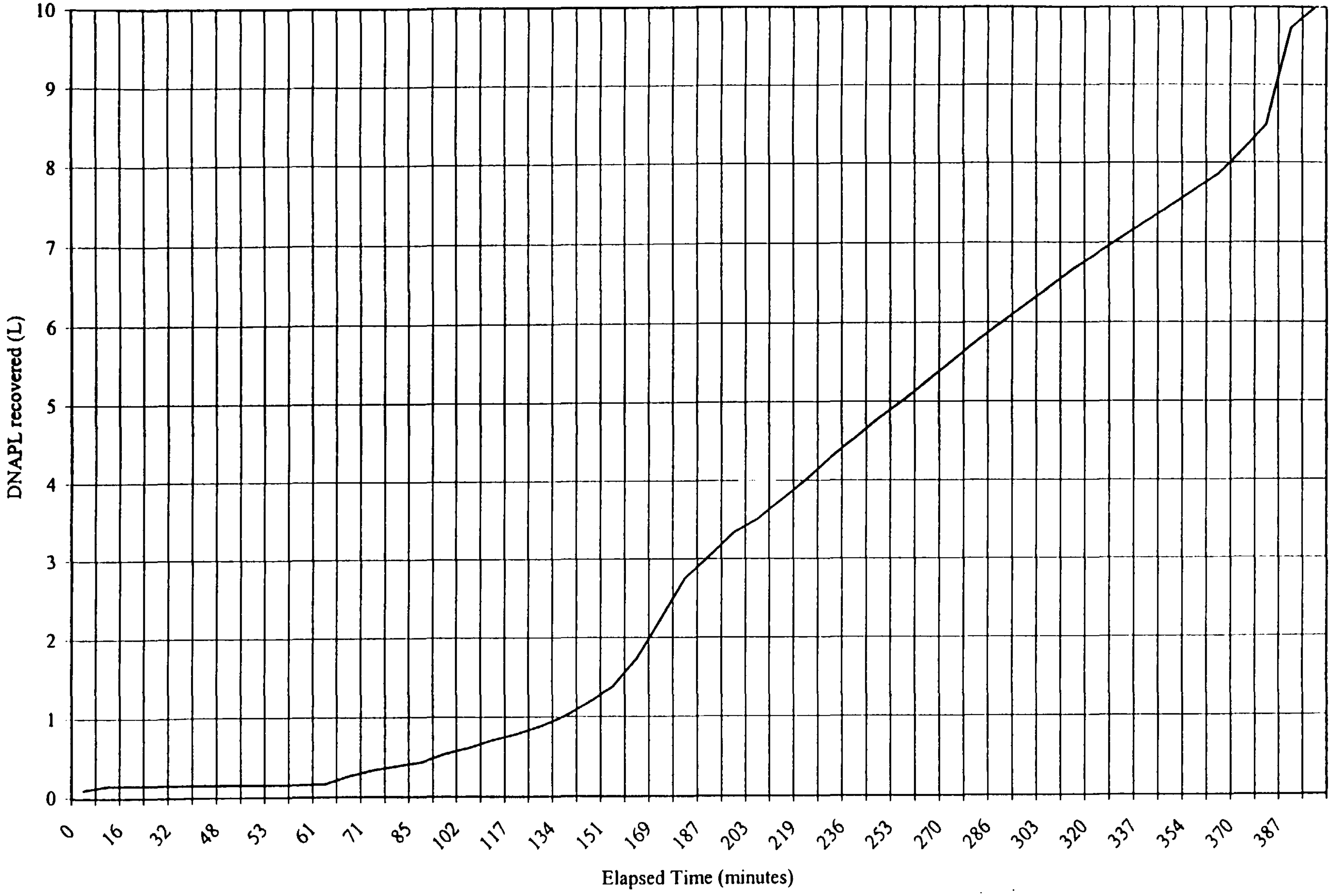

Figure 4-2 Cumulative DNAPL Recovery Well E2SC-03I

5 RECOMMENDATIONS

The testing conducted to date indicates that it is possible to pump coal tar DNAPL at low rates from existing monitoring wells. The DNAPL pumping rate from existing two-inch diameter monitoring wells may be limited by the well construction. A new well designed for recovery of viscous DNAPL may be capable of yielding DNAPL at a higher rate than was obtained from the monitoring wells. It is recommended that a four to six inch diameter well be installed to the top of the till adjacent to monitoring well cluster E2SC-03. This location was chosen based on the higher DNAPL recovery rate measured in well E2SC-03I and its position within the center of the till trough. The purpose of installing this well would be to conduct additional pumping to determine if DNAPL recovery can be sustained utilizing a larger diameter well with a larger screen slot size. If the DNAPL recovery is sustainable, an automated DNAPL collection system for this portion of the site may be warranted.

6 REFERENCES

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BBL, 1996, Evaluation of Housatonic River Sediment and Flood Plain Soil Data on Hazardous Constituents to Assess Need for Further Sampling, 1996.

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Cohen, R.M. and Mercer, 1993, DNAPL Site Evaluation, C.K. Smoey, Boca Raton, Florida.

GE, 1998, Letter Report Regarding Source Control Investigations and Preliminary Contaminant Barrier Design for East Street Area 2. General Electric, Pittsfield, Massachusetts, November, 1999.

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APPENDIX A

BORING LOGS

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BORING/WELL CONSTRUCTION LOG

PROJECT NUMBER P009-001
PROJECT NAME Source Control Upper Reach Housatonic River
LOCATION Pittsfield, Massachusetts
DRILLING METHOD HSA
SAMPLING METHOD SS
GROUND ELEVATION 989.36
TOP OF CASING None
LOGGED BY SKC
NORTHING 533345.2065

BORING/WELL NUMBER PKSC-01
DATE DRILLED 3/17/99
CASING TYPE/DIAMETER None
SCREEN TYPE/SLOT None
GRAVEL PACK TYPE None
GROUT TYPE/QUANTITY Portland/Volclay
DEPTH TO WATER
GROUND WATER ELEVATION
EASTING 133512.0729

FID (ppm)	BLOW COUNTS	SAMPLE ID.	EXTENT	DEPTH (ft. BGL)	U.S.C.S.	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0.5	4 3	SS01	☒				Loose, Yellowish Brown, SAND w/ some organics, dry, well graded, (Soil Horizon).	1.0
0	4 8 6 6	SS02	☒				Medium Dense, Moderate yellowish Brown, SAND w/ little coal slag, dry, well graded, (Fill).	3.0
12	1 1 2 2	SS03	☒				Very loose, Dusk Yellow, fine and coarse SAND w/ trace organics, dry, poorly graded, (SP).	5.0
0	1 2	SS04	☒	5			Same as above.	6.0
30	2 3 2 2	SS05	☒				Top 0.3 same as above.Middle 0.4 very loose, Light Brown, coarse SAND, dry, well graded, (SW). Bottom 0.1 Very loose, Dark Brown, SAND, dry, well graded, (SW).	8.0
6.5	2 2 2 3	SS06	☒				Loose, Moderate yellowish Brown, SAND w/ few gravel, dry, well graded, sub-rounded, (SW).	10.0
20	3 2 2 4	SS07	☒	10			Same as above.	12.0
1	1 2 3 3	SS08	☒				Loose, Moderate olive Brown, fine SAND w/ few silt, trace organics, dry, well graded, (SW).	14.0
3	1 1	SS09	☒				Loose, Olive Grey, fine SAND w/ few silt, trace organics,moist, well graded, (SW).	15.0
0	15 13	SS10	☒	15			Very loose, Moderate olive Brown, fine to medium SAND w/ little organics, moist, well graded, (SW).	16.0
0	2 2 6 6	SS11	☒				Top 1.5 same as above. Bottom 0.3 loose, Moderate olive Grey, coarse SAND w/ little gravel, moist, well graded, sub-rounded, (SW).	18.0
0	3 4 4 4	SS12	☒				Similar to above except Fe staining and wet.	20.0
0	1 3 4 7	SS13	☒	20			Top 0.7 same as above. Bottom 0.5 loose, Moderate olive Brown, fine SAND w/ trace silt, wet, well graded, (SW).	22.0
0	4 7 8 12	SS14	☒				Medium dense, Moderate olive Brown, fine SAND w/ trace silt, wet, well graded, lamination, (SW).	24.0
0	3 3 5 10	SS15	☒	25			Loose, Dark yellowish Brown, SAND w/ trace silt, wet, well graded, laminations, some Fe staining, (SW).	26.0
0	4 7 7 5	SS16	☒				Top 0.7 same as above. Bottom 0.8 medium dense,Olive Grey, coarse SAND w/ some gravel, wet, well graded, (SW-GW).	28.0
1	3 4 5 10	SS17	☒				Loose, Moderate olive Brown, fine SAND w/ little gravel, trace organics, wet, well graded, laminations, (SW).	30.0
0.5	4 4 5 8	SS18	☒	30			Loose, Dark yellowish Brown, 5 cm layers fine SAND and coarse GRAVEL , wet, poorly graded, some Fe staining in gravel layers, sub-angular, (SP-GP).	32.0
0	4 5 5 9	SS19	☒				Loose, Light olive Grey, fine to medium SAND w/ little fines, wet, poorly graded, (SP).	34.0
0	8 7	SS20	☒	35			Top 1.6 medium dense, Olive Grey, SAND and GRAVEL w/ little slit, wet, well graded,	

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HSI GEOTRANS
A TETRA TECH COMPANY

BORING/WELL CONSTRUCTION LOG

PROJECT NUMBER P009-001
BORING/WELL NUMBER PKSC-01
PROJECT NAME Source Control Upper Reach Housatonic River
DATE DRILLED 3/17/99

Continued from Previous Page

FID (ppm)	BLOW COUNTS	SAMPLE ID.	EXTENT	DEPTH (ft. BGL)	U.S.C.S.	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
	7 10						(SW-GW). Bottom 0.4 loose, Moderate olive Brown, SAND, wet, well graded, (SW).	36.0
0	2 5 7 8	SS21					Medium dense, Light Olive to Olive Grey, GRAVEL w/ little sand, wet, well graded, sub-angular, (GW).	38.0
0	12 10 12 10	SS22					Medium dense, Light olive Brown, coarse GRAVEL w/ some fine sand, little silt, wet, well graded, sub-angular, (GW).	40.0
0	12 14 14 16	SS23		40			Same as above.	42.0
N/A	7 25 35 [illegible]	SS24					No Recovery.	44.0
0	17 21 23 21	SS25		45			Dense, Dark yellowish Brown, coarse GRAVEL w/ some sand, trace silt, wet, well graded, sub-angular, (GW).	46.0
0	30 [illegible] 35 42	SS26					Dense, Moderate to Dark olive Brown, coarse GRAVEL w/ some coarse and fine sand, trace silt, wet, well graded, sub-angular, (GW-SW).	48.0
0	32 30 44 43	SS27					Very dense, Dark to Dusky yellowish Brown, gravelly coarse SAND w/ trace silt, moist, well graded, sub-round, (SW-GW).	50.0
0	33 44 33 35	SS28		50			Similar to above except Moderate olive Grey in color.	52.0
0	40 38 28 38	SS29					Dense, Light olive Grey to Olive Grey, fine SAND, wet, poorly graded, (SP).	54.0
0	23 25 21 29	SS30		55			Dense, Light olive Grey, SAND w/ little gravel, moist, well graded, (SW).	56.0
0	34 29	SS31					Hard, Dusky Yellow to Light olive grey, fine SAND and SILT, wet, well graded, (ML).	57.0
0	10 17 14 15	SS32					Medium dense, Dusky Yellow to Light olive Grey, coarse GRAVEL w/ fine sand, some silt, wet, well graded, sub-angular, (GM).	59.0
0	12 20 33 27	SS33		60			Similar to above w/ coarse GRAVEL and SILT w/ few fine sand, (Till).	61.0

HSI GEOTRANS
A TETRA TECH COMPANY

BORING/WELL CONSTRUCTION LOG

PROJECT NUMBER P009-001
PROJECT NAME Source Control Upper Reach Housatonic River
LOCATION Pittsfield, Massachusetts
DRILLING METHOD HSA
SAMPLING METHOD SS
GROUND ELEVATION 990.05
TOP OF CASING None
LOGGED BY NSB
NORTHING 533331.1171

BORING/WELL NUMBER PKSC-02
DATE DRILLED 3/11/99
CASING TYPE/DIAMETER None
SCREEN TYPE/SLOT None
GRAVEL PACK TYPE None
GROUT TYPE/QUANTITY Portland/Volclay
DEPTH TO WATER
GROUND WATER ELEVATION
EASTING 133450.2186

FID (ppm)	BLOW COUNTS	SAMPLE ID.	EXTENT	DEPTH (ft. BGL)	U.S.C.S.	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0	6 10	SS01					Loose, Olive Brown, SAND w/ little gravel and organics, dry, well graded, sub-angular, (SW).	1.0
0	9 6 9 8	SS02					Medium dense, Moderate olive Brown, SAND w/ 0.2 interval of organics, little gravel, dry, well graded, sub-angular, (Fill).	3.0
1	2 2 1 2	SS03					Very loose, Light olive Brown, medium to coarse SAND, trace organics, dry, well graded, (SW).	5.0
1	2 1	SS04		5			Similar to above except moist.	6.0
4	2 1 2 1	SS05					Same as above.	8.0
12	1 2 2 3	SS06					Very loose, Moderate olive Brown, medium to coarse SAND w/ trace gravel and organics, moist, well graded, sub-round, (SW).	10.0
11	4 3 3 3	SS07		10			Loose, Moderate olive Brown, SAND w/ trace gravel and organics, dry, well graded, sub-round, (SW).	12.0
10	3 2 3 3	SS08					Loose, Moderate olive Brown, fine SAND w/ some silt, trace organics, dry, well graded, laminated, (SW-ML).	14.0
8	2 3	SS09					Similar to above except moist.	15.0
12	1 1 2 1	SS10		15			Soft, Olive Brown to Olive Grey, medium to fine SAND and SILT w/ little organics, wet, well graded, (ML-SW).	17.0
28	2 3 6 10	SS11					Top 1.4 soft, Olive Grey, SILT and SAND w/ trace organics, wet, well graded, (ML-SW). Bottom 0.4 medium dense, coarse SAND w/ little gravel, wet, well graded, sub-angular, (SW).	18.4 19.0
30	3 5 6 8	SS12		20			Top 0.2 same as above (Bottom). Middle 0.6 medium dense, Moderate olive Brown, coarse SAND w/ few gravel, wet, well graded, sub-angular, Fe staining, (SW). Bottom 0.2 medium dense, Moderate olive Brown, SAND, wet, well graded, (SW).	21.0
150	4 2 3 5	SS13					Similar to above (Top to Bottom) except Bottom 0.1 Olive Grey, SAND and GRAVEL.	23.0
11	5 10 9 9	SS14					Medium dense, Moderate olive Brown, SAND w/ few silt, trace gravel, wet, graded, sub-angular, laminated, (SW).	25.0
4	4 11 12 14	SS15		25			Medium dense, Moderate olive Brown, SAND w/ few gravel, wet, well graded, sub-round (SW).	27.0
5	8 6 9 11	SS16					Medium dense, Moderate olive Brown, SAND w/ trace fine gravel, wet, well graded, sub-round, (SW).	29.0
0	9 10 11 10	SS17		30			Medium dense, Moderate olive Brown, SAND w/ trace fine gravel and silt, wet, well graded, (SW).	31.0
1	10 14 27 63	SS18					Dense, Moderate olive Brown, fine to medium SAND w/ trace gravel and silt, wet, well graded, (SW).	33.0
0.5	8 6 10 12	SS19					Medium dense, Moderate olive Brown, fine to medium SAND w/ little gravel and silt, wet, well graded, sub-round, (SW).	35.0
				35				

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BORING_WELL HSI_MA.GDT 4/12/99

BORING/WELL CONSTRUCTION LOG

PROJECT NUMBER P009-001
BORING/WELL NUMBER PKSC-02
PROJECT NAME Source Control Upper Reach Housatonic River
DATE DRILLED 3/11/99

Continued from Previous Page

FID (ppm)	BLOW COUNTS	SAMPLE ID.	EXTENT	DEPTH (ft. BGL)	U.S.C.S.	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0	5 7 11 13	SS20					Same as above.	37.0
0.5	5 7 13 24	SS21					Similar to above except few silt.	39.0
0.5	14 16 12 20	SS22		40			Medium dense, Moderate olive Brown, SAND w/ few gravel, trace silt, wet, well graded, sub-round (SW).	41.0
0.5	12 14 20 23	SS23					Same as above.	43.0
1	20 24 25 24	SS24					Medium dense, Moderate olive Brown, SAND and GRAVEL, w/ trace silt, wet, well graded, sub-round, (SW-GW).	45.0
0	19 21 23 22	SS25		45			Same as above.	47.0
1	15 20 19 25	SS26					Similar to above except little Fe staining.	49.0
0	23 24 20 23	SS27		50			Medium dense, Moderate olive Brown, medium to coarse SAND w/ trace silt, Wet, well graded, (SW).	51.0
0	16 31 35 32	SS28					Same as above.	53.0
0	12 28 31 18	SS29					Dense, Olive Brown, SAND w/ little gravel, wet, well graded, sub-rounded, (SW).	55.0
0	21 19 14 23	SS30		55			Top 0.3 medium dense, Olive Grey, SAND w/ some gravel, wet, well graded, sub-round, (SW). Bottom 1.7 medium dense, Moderate olive Brown, SAND and SILT w/ few coarse gravel, wet, well graded, (SW-ML).	57.0
0	14 19 46 42	SS31					Hard, Moderate olive Brown, coarse SILT w/ some fine sand and coarse gravel, wet, well graded, (ML).	59.0
0	15 23 32 33	SS32		60			Hard, Moderate olive Brown, SILT and GRAVEL w/ trace fine sand, moist, well graded, (Till).	61.0

HSI GEOTRANS
A TETRA TECH COMPANY

BORING/WELL CONSTRUCTION LOG

PROJECT NUMBER P009-001
PROJECT NAME Source Control Upper Reach Housatonic River
LOCATION Pittsfield, Massachusetts
DRILLING METHOD HSA
SAMPLING METHOD SS
GROUND ELEVATION 989.35
TOP OF CASING None
LOGGED BY SKC
NORTHING 533291.3937

BORING/WELL NUMBER PKSC-03
DATE DRILLED 3/15/99
CASING TYPE/DIAMETER None
SCREEN TYPE/SLOT None
GRAVEL PACK TYPE None
GROUT TYPE/QUANTITY Portland/Volclay
DEPTH TO WATER
GROUND WATER ELEVATION
EASTING 133380.7075

FID (ppm)	BLOW COUNTS	SAMPLE ID.	EXTENT	DEPTH (ft. BGL)	U.S.C.S.	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
0	2 3	SS01					Loose, Dark to dusky yellowish Brown, fine SAND w/ few organics, little gravel, dry, well graded, (SW).	1.0
0	6 16 19 18	SS02					Dense, Moderate yellowish Brown, fine SAND w/ trace organics and gravel, dry, well graded, sub-angular, (SW).	3.0
N/A	3 2 2 3	SS03					No Recovery.	5.0
1.3	2 2	SS04		5			Very loose, Moderate to Dusky yelowish Brown, fine SAND w/ trace organics and gravel, dry, well graded, sub-round, (SW).	6.0
N/A	2 2 2 4	SS05					Very loose, Moderate olive Brown, fine SAND w/ gravel, moist, well graded, sub-round, (SW).	8.0
0.3	4 3 3 3	SS06					Loose, Moderate olive Brown, fine SAND w/ some gravel, trace coal slag, dry, well graded, Fe staining, sub-angular, (SW).	10.0
1	2 3 3 4	SS07		10			Top 0.7 same as above. Bottom 0.6 loose, Moderate to Dusky yellowish Brown, fine SAND w/ some gravel, trace organics, dry, poorly graded, (SP).	12.0
0.3	2 3 4 4	SS08					Loose, Moderate yellowish Brown, fine SAND w/ few organics, dry, well graded, some Fe staining, (SW).	14.0
0.6	4 3	SS09					Loose, Moderate yellowish Brown, fine SAND w/ trace organics, moist, poorly graded, some Fe staining, (SP).	15.0
0	3 2	SS10		15			Top 0.5 loose, Moderate yellowish Brown, SAND, dry, well graded, (SW). Bottom 0.2 loose, Dusky yellowish Brown, fine SAND w/ trace organics, dry, well graded, (SW).	16.0
0	4 4 7 8	SS11					Loose, Dusky yellowish Brown, fine SAND, (3-5 mm laminations Moderate yellowish Brown, fine SAND, few organics), moist, well graded, (SW).	18.0
0	8 8 6 6	SS12					Top 0.25 similar to above except few coarse sand. Bottom 0.25 medium dense, Dusky yellowish Brown, coarse SAND, wet, poorly graded, some Fe staining, (SP).	20.0
0	2 5 4 7	SS13		20			Top 0.7 Same as above. Bottom 0.6 loose, Dark yellowish Brown, fine SAND, wet, poorly graded, little Fe staining, (SP).	22.0
0	5 7 9 12	SS14					Medium dense, Moderate olive Brown to olive Grey, fine SAND, wet, well graded, (SW).	24.0
0	7 10 18 13	SS15		25			Medium dense, Moderate olive Brown, fine SAND w/ trace silt and organics, wet, well graded, (SW).	26.0
0.5	5 5 4 6	SS16					Top 0.9 medium dense, Light olive Grey, fine SAND, wet, well graded, (SW).	26.9
							Bottom 0.6 stiff, Olive Grey, SILT, wet, well graded, (ML)	28.0
0	WOR 2 1 8	SS17					Loose, Dark greenish Grey, very fine SAND, wet, well graded, (SW-ML)	30.0
0	1 1 4 4	SS18		30			Same as above.	32.0
0	WOR 5 5 6	SS19					Same as above.	34.0
1	WOR 15	SS20		35			Dense, Very light Grey to Greenish Black, coarse to very coarse GRAVEL w/ some	

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HSI GEOTRANS
A TETRA TECH COMPANY

BORING/WELL CONSTRUCTION LOG

PROJECT NUMBER P009-001
BORING/WELL NUMBER PKSC-03
PROJECT NAME Source Control Upper Reach Housatonic River
DATE DRILLED 3/15/99

Continued from Previous Page

FID (ppm)	BLOW COUNTS	SAMPLE ID.	EXTENT	DEPTH (ft. BGL)	U.S.C.S.	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	CONTACT DEPTH
	14 10						sand, wet, poorly graded, (GP).	36.0
1	10 10 11 8	SS21					Top 0.5 similar to above except well graded, (GW). Bottom 0.1 loose, Light olive Grey, fine SAND, wet, well graded, (SW).	38.0
0.5	10 10 14 13	SS22					Medium dense, Light olive Grey, fine SAND w/ some gravel, wet, well graded, angular, (SW-GW).	40.0
0	8 8 12 15	SS23		40			Medium dense, Dark yellowish Brown, fine to medium SAND w/ some coarse gravel, wet, well graded, sub-angular (SP).	42.0
0	5 11 12 12	SS24					Same as above.	44.0
0	2 8 10 18	SS25		45			Medium dense, Dark yellowish Brown, coarse GRAVEL and fine SILT, moist, well graded, sub-angular (GM).	46.0
N/A	18 17 17 23	SS26					HARD, Dark yellowish Brown, coarse GRAVEL and SILT w/ some clay, moist, well graded, sub-angular, (Till).	48.0

APPENDIX B

SUMMARY OF SOIL CONCENTRATION DATA

Hibbard Playground/Lakewood Park PCB Soil Concentration Data (Preliminary)

Location	*Sample Name*	*Sample Depth*	*Compound*	*Result*	*Qualifier*	*Modifier*	*Units*
PKSC-01							
	CS01	0-1					
			Aroclor 1254	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1016	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1260	0.23			mg/kg
			Total PCBs	**0.23**			mg/kg
	CS0106	1-6					
			Aroclor 1260	0.044			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1016	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1254	ND			mg/kg
			Total PCBs	**0.044**			mg/kg
	CS0615	6-15					
			Aroclor 1248	ND			mg/kg
			Aroclor 1016	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1254	ND			mg/kg
			Aroclor 1260	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Total PCBs	**ND**			mg/kg
	CS5759	57-59					
			Aroclor 1254	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1016	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**ND**			mg/kg

Hibbard Playground/Lakewood Park PCB Soil Concentration Data (Preliminary)

Location	*Sample Name*	*Sample Depth*	*Compound*	*Result*	*Qualifier*	*Modifier*	*Units*
PKSC-02							
	CS01	0-1					
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1260	1.1			mg/kg
			Aroclor 1254	1.6			mg/kg
			Aroclor 1016	ND			mg/kg
			Total PCBs	**2.7**			mg/kg
	CS0106	1-6					
			Aroclor 1221	ND			mg/kg
			Aroclor 1016	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1260	0.6			mg/kg
			Aroclor 1254	1.2			mg/kg
			Aroclor 1248	ND			mg/kg
			Total PCBs	**1.8**			mg/kg
	CS0615	6-15					
			Aroclor 1242	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1016	ND			mg/kg
			Aroclor 1254	0.14			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1260	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Total PCBs	**0.14**			mg/kg
	CS5557	55-57					
			Aroclor 1254	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1016	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**ND**			mg/kg

Hibbard Playground/Lakewood Park PCB Soil Concentration Data (Preliminary)

Location	*Sample Name*	*Sample Depth*	*Compound*	*Result*	*Qualifier*	*Modifier*	*Units*
	CS5961	59-61					
			Aroclor 1242	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1016	ND			mg/kg
			Aroclor 1254	ND			mg/kg
			Aroclor 1260	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Total PCBs	**ND**			mg/kg
PKSC-03							
	CS01	0-1					
			Aroclor 1242	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1016	ND			mg/kg
			Aroclor 1254	0.14			mg/kg
			Aroclor 1260	0.21			mg/kg
			Total PCBs	**0.35**			mg/kg
	CS0106	1-6					
			Aroclor 1016	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1254	ND			mg/kg
			Aroclor 1260	0.17			mg/kg
			Aroclor 1242	ND			mg/kg
			Total PCBs	**0.17**			mg/kg
	CS0615	6-15					
			Aroclor 1260	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1016	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1254	ND			mg/kg
			Total PCBs	**ND**			mg/kg

Hibbard Playground/Lakewood Park PCB Soil Concentration Data (Preliminary)

Location	*Sample Name*	*Sample Depth*	*Compound*	*Result*	*Qualifier*	*Modifier*	*Units*
	CS4446	44-46					
			Aroclor 1221	ND			mg/kg
			Aroclor 1254	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1016	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**ND**			mg/kg

Hibbard Playground/Lakewood Park Detected Metals Soil Concentrations(Preliminary).

Location	*Sample Name*	*Sample Depth (feet)*	*Compound*	*Result*	*Qualifier*	*Units*
PKSC-01						
	CS0615	6-15				
			Arsenic	4.6		mg/kg
			Barium	33.9		mg/kg
			Beryllium	0.35	B	mg/kg
			Cadmium	0.45	B	mg/kg
			Chromium	10.2		mg/kg
			Cobalt	12.4		mg/kg
			Copper	20.6		mg/kg
			Lead	7.8		mg/kg
			Mercury	0.018	B	mg/kg
			Nickel	17.4		mg/kg
			Vanadium	11.2		mg/kg
			Zinc	64.9		mg/kg
PKSC-02						
	CS0615	6-15				
			Antimony	0.18	B	mg/kg
			Arsenic	7.5		mg/kg
			Barium	26.6		mg/kg
			Beryllium	0.22	B	mg/kg
			Cadmium	0.4	B	mg/kg
			Chromium	9		mg/kg
			Cobalt	11.9		mg/kg
			Copper	22.6		mg/kg
			Lead	9.4		mg/kg
			Mercury	0.089	B	mg/kg
			Nickel	16		mg/kg
			Vanadium	8.1		mg/kg
			Zinc	55.3		mg/kg
PKSC-03						
	CS0106	1-6				
			Arsenic	5.7		mg/kg
			Barium	24.5		mg/kg
			Beryllium	0.18	B	mg/kg
			Cadmium	0.38	B	mg/kg
			Chromium	10.3		mg/kg
			Cobalt	12.7		mg/kg
			Copper	27.4		mg/kg

Hibbard Playground/Lakewood Park Detected Metals Soil Concentrations(Preliminary).

Location	*Sample Name*	*Sample Depth (feet)*	*Compound*	*Result*	*Qualifier*	*Units*
			Lead	12.5		mg/kg
			Mercury	0.099	B	mg/kg
			Nickel	17.8		mg/kg
			Thallium	0.83	B	mg/kg
			Vanadium	9.2		mg/kg
			Zinc	63.4		mg/kg

Qualifier

B *Result is between MDL and RL*

Hibbard Playground/ Lakewood Park Detected VOC Soil Concentration Data (Preliminary).

Location	*Sample Name*	*Sample Depth (feet)*	*Compound*	*Result*	*Qualifier*	*Modifier*	*Units*
PKSC-01							
	SS05	6-8					
			Acetone	0.0086	J		mg/kg
PKSC-02							
	SS06	8-10					
			Acetone	0.031	J		mg/kg
PKSC-03							
	SS05	5-6					
			Acetone	0.015	J		mg/kg

Qualifier

J *For organics, result is between Method Detection Limit and ReportingLimit.*

Hibbard Playground/Lakewood Park Detected Dioxin and Furan Concentration Data (Preliminary).

Location	*Sample Name*	*Sample Depth*	*Compound*	*Result*	*Qualifier*	*Units*
PKSC-01	CS0615	6-15				
			2,3,7,8-TCDF	0.0000010		mg/kg
			OCDD	0.0000027	J	mg/kg
			TOTAL TCDF	0.0000010		mg/kg
PKSC-02	CS0615	6-15				
			1,2,3,4,6,7,8-HpCDD	0.0000162		mg/kg
			1,2,3,4,6,7,8-HpCDF	0.0000175		mg/kg
			1,2,3,4,7,8,9-HpCDF	0.0000031	J	mg/kg
			1,2,3,4,7,8-HxCDF	0.0000039	J	mg/kg
			1,2,3,6,7,8-HxCDF	0.0000023	J	mg/kg
			OCDD	0.0000678		mg/kg
			OCDF	0.0000194		mg/kg
			TOTAL HpCDD	0.0000194		mg/kg
			TOTAL HpCDF	0.0000229		mg/kg
			TOTAL HxCDF	0.0000069		mg/kg
			TOTAL PeCDF	0.0000118		mg/kg
			TOTAL TCDF	0.0000153		mg/kg
PKSC-03	CS0106	1-6				
			1,2,3,4,6,7,8-HpCDF	0.0000040	J	mg/kg
			2,3,7,8-TCDF	0.0000074		mg/kg
			OCDD	0.0000137		mg/kg
			OCDF	0.0000033	J	mg/kg
			TOTAL HpCDF	0.0000086		mg/kg
			TOTAL TCDF	0.0000385		mg/kg

Qualifier

J *Result is an estimated value that is below the lower calibration limit but above the target detection level.*

EPA Approval Letter Dated June 28, 1999 for GE's:
DNAPL Assessment, East Street Area 2 Site,
April 28, 1999

United States Environmental Protection Agency
Region I
One Congress Street, Suite 1100
Boston, MA 02114-2023

ENVIRONMENTAL PROGRAMS
JUN 29 1999

June 28, 1999

Mr. Andrew T. Silfer, P.E.
General Electric Company
100 Woodlawn Avenue
Pittsfield, Massachusetts 01201

RE: Conditional Approval of GE's April 28, 1999 Submittal Titled *DNAPL Assessment, East Street Area 2 Site, Pittsfield, Massachusetts*, by HSI Geotrans

EPA approves the above-referenced submittal subject to the following modifications:

Evaluation of Automated DNAPL Recovery

GE shall install a six-inch well for the proposed evaluation of an automated DNAPL collection system.

Manufactured Gas Plant Issues

The Report states that equipment and/or operations of the former manufactured gas plant appear to be the source of the DNAPL in this study area. Specifically, the Report states the boring X-19 was believed to have been advanced into the former coal tar separator. Since the submission of this Report, GE has performed additional investigations and now believes that boring X-19 was not advanced into the coal-tar separator, but into a different piece of equipment associated with the former manufactured gas plant.

In May 1999, GE located the former coal tar separator, advanced a boring into the separator, and collected samples. The analysis from this boring indicated the presence of primarily BTEX (benzene, toluene, ethyl benzene, and xylenes) and PAHs (polynuclear aromatic hydrocarbons). Total BTEXs detected were approximately 1,000 parts per million (ppm) and total PAHs detected were approximately 5,000 ppm. The analysis of samples collected from boring X-19 detected approximately 200,000 ppm PAHs, which is indicative of concentrated waste or product.

Therefore, GE shall perform the following:

1. Determine the layout of the former manufactured gas plant equipment intercepted by boring X-19. Following delineation, GE shall remove the waste contents of the equipment and either

remove the equipment itself or close it in place.

2. Install a monitoring well downgradient and within 25 feet of boring X-19. Sampling consistent with previous borings installed as part of Source Control activities shall be performed. The well shall be constructed to monitor for the presence of DNAPL. This well shall be included in the NAPL monitoring program for East Street Area II.

Schedule

GE shall complete all requirements proposed in the above-referenced Report, as modified by this letter, by September 27, 1999. GE shall also submit a report documenting (1) the results of the evaluation of an automated DNAPL collection system and proposed actions to recover the DNAPL, (2) the results of boring installed in the coal tar separator, (3) the removal/closure of the equipment associated with boring X-19, and, (4) the results of the additional investigative activities required by this letter (e.g., boring logs, sampling data, presences or absence of DNAPL, map identifying well locations and manufactured gas plant equipment, etc.).

Additional Work

EPA may require additional work to be performed, either as part of Source Control activities (e.g., the expansion of an automated DNAPL collection system) or as part of other regulatory mechanisms (e.g., actions to fully delineate the lateral extent of DNAPL, actions to locate additional sources of contamination, additional response actions to address threats posed by soil or groundwater contamination, etc.).

If you have any questions, please contact me at (617) 918-1282.

Sincerely,

Dean Tagliaferro

Dean Tagliaferro
On-Scene Coordinator

cc: John Ciampa, GE
Richard Nasman, Berkshire Gas
Lyn Cutler, MA DEP
John Ziegler, MA DEP
John Kilborn, US EPA
Mike Nalipinski, US EPA
Steve Acree, US EPA
Dawn Veillieux, Roy F. Weston
Joel Lindsay, Roy F. Weston

John Kullberg, USACE
Holly Inglis, EPA
Mayor Doyle, City of Pittsfield
Pittsfield Conservation Commission
Site File

Source Control Investigation Addendum Report, Upper Reach Housatonic River (First ½ Mile), June 15, 1999

Corporate Environmental Programs
General Electric Company
100 Woodlawn Ave., Pittsfield, MA 01201

June 15, 1999

Mr. Bryan Olson
Mr Dean Tagliaferro
Site Evaluation and Response Section (HBR)
U.S. Environmental Protection Agency
One Congress Street
Boston, MA 02203-2211

Mr. Alan Weinberg
Bureau of Waste Site Cleanup
Department of Environmental Protection
436 Dwight Street
Springfield, MA 01103

Re: Source Control Investigation Addendum Report,
Upper Reach of Housatonic River (First ½ Mile)

Dear Mr. Olson, Mr. Tagliaferro, Mr. Weinberg:

Enclosed please find the document entitled *Source Control Investigation Addendum Report Upper Reach of Housatonic River (First ½ Mile)*. This document has been prepared on behalf of the General Electric Company (GE) by HSI GeoTrans, Inc. It presents the results of investigations conducted for GE as proposed in the *Source Control Investigation Report Upper Reach of Housatonic River (First ½ mile)* (HSI GeoTrans, 1999) and pursuant to the EPA March 17, 1999 conditional approval letter. Also attached are responses to several EPA comments which were contained in its March 1999 letter.

Please contact me at (413) 494-3952 if you have any comments regarding the enclosed document.

Yours truly,

John D. Ciampa
Remediation Project Manager

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Corporate Environmental Programs
General Electric Company
100 Woodlawn Ave., Pittsfield, MA 01201

cc: S. Acree, EPA*
M. Nalipinski, EPA*
R. Child, DEP*
M. Holland, DEP
J. Bieke, Shea & Gardner *
Mayor G. Doyle
State Representative S. Kelly
State Senator A. Nuciforo
A. Thomas, GE*
M. Carroll, GE
Pittsfield Conservation Commission*
S. Cooke, McDermott, Will & Emery*
J. Bridge, HSI GeoTrans*
Pittsfield Health Department*
Housatonic River Initiative
R. Bell, DEP*
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State Representative D. Bosley
State Representative C. Hodgkins
State Representative P. Larkin
J. Gardner, GE
A. Silfer, GE*
J. Nuss, BBL*
G. Bibler, Goodwin, Procter & Hoar*
D. Veilleux, Roy F. Weston*
Public Information Repositories
ECL I-P-IV(A)(1)* & (2)

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EPA Comment	Response
Lyman Street Well LS-43 has no cap, either protective or internal. GE shall inspect, repair (or replace if warranted) and re-monitor this well. Repair may include redevelopment of the well. GE shall also inspect and, if necessary, repair monitoring wells LS-44 and LS-45.	GE has inspected monitoring wells LS-43, LS-44 and LS-45. Monitoring well LS-43 was redeveloped and the well cap and protective cover were replaced. Additionally, the protective cover for well LS-44 was also replaced. LS-45 required no maintenance.
Figures 3-2. 5-1 The elevation of the top of silt/till layer at location N2SC-03I may be incorrect. HSI GeoTrans identifies the top of silt/till at 947.53. Weston's boring logs identify the top of the silt at a depth of no greater than 946.53 ft, although the sample which confirms the presence of the silt was collected from 945.53 to 944.73 ft, below a 1-ft interval of no sample recovery. HSI GeoTrans appears to be identifying the top of the silt/till approximately one to two feet higher, as a silty sand with gravel underlying a dark-stained sand and gravel. A comparison of HSI GeoTrans and Weston boring logs show that non-recovery of samples is depicted as a data gap in Weston boring logs, while the data collected immediately above the data gap is extrapolated across the data gap in HSI GeoTrans boring logs. The HSI GeoTrans boring log appears to show that the silty sand extends continuously downward to the silt, which makes the higher elevation for the top of the silt/till seem reasonable. The Weston boring log, showing the data gap, indicates that a deeper top of silt/till is better supported by the data. The selection of the silt, rather than the silty sand, as the top of the silt/till is more consistent with the selection made at other locations at the Newell Street Area 2 site.	We have reviewed the N2SC-03I boring log and field notes from the drilling of that well and believe that the elevation of the top of the till, 947.53, shown on figures 3-2 and 5-1 in the Source Control Investigation Report Upper Reach of Housatonic River (First ½ Mile) (Source Control Investigation Report) is correct. The elevation of the top of the till was determined based on the deepest sample recovered from the boring. The sample, SS-21, was collected from a depth of 36 feet to38 feet. Based on a ground surface elevation of 983.53 feet the sample was collected from an elevation of 947.53 to 945.53 feet. There was one foot of sample recovered in the split spoon sampler. The sample description from the boring log is light olive brown silty sand with few gravel, well graded, sub-angular (SW) (Till). Based on the assumption that the one foot of sample that was recovered represents the depth interval of 36 to 37 feet, HSI GeoTrans made the determination that the top of this sample, 36 ft depth, represents the top of the till. Even if the top of the till occurred at a depth of 37 feet, rather than the 36 feet, this would only result in a minor modification to the till contour.

EPA Comment	Response
Figure 5-1 Top of silt/till elevations were omitted for locations 3-6-EB-23 to -29. Addition of the top-of-till elevations at these locations would better define the topography in this area.	Because of the regional scale of Figure 5-1 in the Source Control Report the top of till elevations from the closely spaced wells and borings 3-6-EB-23 to 3-6-EB-29 were not displayed on the figure. These data were considered, however, in the contouring. The top of till elevation at all of these locations is greater than 960 feet as indicated by the contours on the Figure 5-1. The detailed till topography for this portion of the site was shown in cross section view on Figure 5-2 of the Source Control Investigation Report.
Top of silt/till elevation for location LSSC-01 is 952.52 (noted correctly on Figures 4-2 and 4-8) not 953.52 ft.	The Top of Till elevation for monitoring well LSSC-01 was incorrectly noted on Figure 5-1 of the Source Control Report. However, since this was a regional map with a 10 ft. contour interval, this did not impact the validity of the figure. The correct till elevation for LSSC-01 is included in pertinent figures of the attached report.
The 950-ft depression contour located in the vicinity of Newell Street Area 2 should extend farther northward, as the top of the silt/till elevation at location E2SC-15 is 950.3 ft.	The top of till elevation contour map for the Newell Street Area II site, shown as figure 4-2 in the attached report, has been modified based on the new data collected from the recently drilled borings and wells. We have also included the top of till elevation data from the all of the borings and wells drilled near Building 68 on the north side of the river and revised the contouring based on these data. The 950 contour shown on the updated Newell Street Area II top of till elevation contour map extends to the north side of the river closer to boring E2SC-15 than was previously shown on Figure 5-1 in the Source Control Investigation Report.

EPA Comment	Response
Figure 5-2 A spot check of analytical results noted some errors. In soil boring E2SC-15, analytical data contained in the Proposal for Supplemental Source Control Containment/Recovery Measures, January 1999, does not agree with the posted total PCB results in Figure 5-2. Total PCB data for the zero to 1-ft interval bgs is not included in Table 2-4 (although Weston field notes confirm that a sample was collected from this interval, as does HSI GeoTrans Table 2-1). Further the total PCB concentration for the 1 to 6-ft interval bgs is reported as 8 mg/kg on Figure 5-2, but is actually 80 mg/kg in Table 2-4 in the same reference.	The PCB concentrations for the sample collected from zero to one foot in boring E2SC-15 shown on Figure 5-2 of the Source Control Investigation Report is correct. The PCB concentration data for the sample collected from zero to one foot in boring E2SC-15 was inadvertently omitted from Table 2-4 in the Proposal for Supplemental Source Control Containment / Recovery Measures. The PCB concentration for the sample collected from one to six feet in E2SC-15 is 80 mg/kg not the 8 mg/kg shown on Figure 5-2. A revised Table 2-4 and Figure 5-2 are attached.

Table 2-4. PCB soil concentration data

Boring	Sample Number	Depth (Ft.)	Aroclor Concentration (mg/kg)							
			1016	1221	1232	1242	1248	1254	1260	Total
E2SC-01	E2SC-01-CS01	0-1	ND	ND	ND	ND	ND	ND	0.66	0.66
E2SC-01	E2SC-01-CS0106	1-6	ND	ND	ND	ND	ND	ND	0.71	0.71
E2SC-01	E2SC-01-CS0615	6-15	ND	ND	ND	ND	ND	ND	0.06	0.06
E2SC-01	E2SC-01-CS3840	38-40	ND	ND	ND	ND	ND	ND	ND	ND
E2SC-01	E2SC-01-SS25	44-46	ND	ND	ND	ND	ND	ND	ND	ND
E2SC-02	E2SC-02-CS01	0-1	ND	ND	ND	ND	ND	ND	49.00	49.00
E2SC-02	E2SC-02-CS0106	1-6	ND	ND	ND	ND	ND	ND	43.00	43.00
E2SC-02	E2SC-02-CS0615	6-15	ND	ND	ND	ND	ND	ND	17.00	17.00
E2SC-02	E2SC-02-CS4042	40-42	ND	ND	ND	ND	ND	ND	ND	ND
E2SC-03	E2SC-03-CS01	0-1	ND	ND	ND	ND	ND	ND	25.00	25.00
E2SC-03	E2SC-03-CS0106	1-6	ND	ND	ND	ND	ND	ND	52.00	52.00
E2SC-03	E2SC-03-CS0615	6-15	ND	ND	ND	ND	ND	ND	22.00	22.00
E2SC-03	E2SC-03-CS4448	44-48	ND	ND	ND	ND	ND	ND	ND	ND
E2SC-04	E2SC-04-CS01	0-1	ND	ND	ND	ND	ND	ND	0.99	0.99
E2SC-04	E2SC-04-CS0106	1-6	ND	ND	ND	ND	ND	0.17	0.19	0.36
E2SC-04	E2SC-04-CS0615	6-15	ND	ND	ND	ND	ND	ND	ND	ND
E2SC-04	E2SC-04-CS4244	42-44	ND	ND	ND	ND	ND	ND	ND	ND
E2SC-04	E2SC-04-GS01	0-5	ND	ND	ND	ND	ND	ND	0.12	0.12
E2SC-04	E2SC-04-GS02	5-15.4	ND	ND	ND	ND	ND	ND	ND	ND
E2SC-04	E2SC-04-GS03	15.4-24	ND	ND	ND	ND	ND	ND	ND	ND
E2SC-04	E2SC-04-GS04	24-39	ND	ND	ND	ND	ND	ND	ND	ND
E2SC-04	E2SC-04-GS05	39-43	ND	ND	ND	ND	ND	ND	ND	ND
E2SC-04	E2SC-04-GS06	43-44	ND	ND	ND	ND	ND	ND	ND	ND
E2SC-05	E2SC-05-CS01	0-1	ND	ND	ND	ND	ND	ND	1.60	1.60
E2SC-05	E2SC-05-CS0106	1-6	ND	ND	ND	ND	ND	ND	0.29	0.29
E2SC-05	E2SC-05-CS0615	6-15	ND	ND	ND	ND	ND	ND	0.13	0.13
E2SC-05	E2SC-05-CS3840	38-40	ND	ND	ND	ND	ND	ND	ND	ND
E2SC-05	E2SC-05-CS4042	40-42	ND	ND	ND	ND	ND	ND	ND	ND

Table 2-4. Continued

Boring	Sample Number	Depth (Ft.)	Aroclor Concentration (mg/kg)							
			1016	1221	1232	1242	1248	1254	1260	Total
E2SC-06	E2SC-06-CS01	0-1	ND	ND	ND	ND	ND	ND	0.59	0.59
E2SC-06	E2SC-06-CS0106	1-6	ND	ND	ND	ND	ND	ND	0.07	0.07
E2SC-06	E2SC-06-CS0615	6-15	ND	ND	ND	ND	ND	ND	ND	ND
E2SC-07	E2SC-07-CS01	0-1	ND	ND	ND	ND	ND	ND	0.79	0.79
E2SC-07	E2SC-07-CS0106	1-6	ND	ND	ND	ND	ND	ND	0.28	0.28
E2SC-07	E2SC-07-CS0615	6-15	ND	ND	ND	ND	ND	ND	1.40	1.40
E2SC-07	E2SC-07-CS3840	38-40	ND	ND	ND	ND	ND	ND	ND	ND
E2SC-08	EW2SC-08-CS0106	1 - 6	ND	ND	ND	ND	ND	ND	170.00	170.00
E2SC-08	EW2SC-08-CS0615	6 - 15	ND	ND	ND	ND	ND	ND	210.00	210.00
E2SC-08	E2SC-08 CS4244	42-44	ND	ND	ND	ND	ND	ND	0.13	0.13
E2SC-09	E2SC-09-CS01	0-1	ND	ND	ND	ND	ND	ND	20.00	20.00
E2SC-09	E2SC-09-CS0106	1-6	ND	ND	ND	ND	ND	ND	3.90	3.90
E2SC-09	E2SC-09-CS0615	6-15	ND	ND	ND	ND	ND	ND	140.00	140.00
E2SC-09	E2SC-09-CS4042	40-42	ND	ND	ND	ND	ND	ND	0.11	0.11
E2SC10	E2SC-10-CS01	0-1	ND	ND	ND	ND	ND	ND	0.19	0.19
E2SC10	E2SC-10-CS0106	1-6	ND	ND	ND	ND	ND	ND	0.15	0.15
E2SC10	E2SC-10-CS0615	6-15	ND	ND	ND	ND	ND	ND	ND	ND
E2SC10	E2SC-10-CS2830	28-30	ND	ND	ND	ND	ND	ND	ND	ND
E2SC-11	E2SC-11-CS01	0-1	ND	ND	ND	ND	ND	ND	0.10	0.10
E2SC-11	E2SC-11-CS0106	1-6	ND	ND	ND	ND	ND	ND	ND	ND
E2SC-11	E2SC-11-CS0615	6-15	ND	ND	ND	ND	ND	ND	ND	ND
E2SC-12	E2SC-12-CS01	0-1	ND	ND	ND	ND	ND	ND	0.19	0.19
E2SC-12	E2SC-12-CS0106	1-6	ND	ND	ND	ND	ND	83.00	91.00	91.00
E2SC-12	E2SC-12-CS0615	6-15	ND	ND	ND	ND	ND	ND	65.00	65.00
E2SC-12	E2SC-12-CS3032	30-32	ND	ND	ND	ND	ND	0.11	0.15	0.26
E2SC-13	ES2C-13-CS01	0-1	ND	ND	ND	ND	ND	ND	0.21	0.21

Table 2-4. Continued

Boring	Sample Number	Depth (Ft.)	Aroclor Concentration (mg/kg)							
			1016	1221	1232	1242	1248	1254	1260	Total
E2SC-13	ES2C-13-CS0106	1-6	ND	ND	ND	ND	ND	ND	ND	ND
E2SC-13	ES2C-13-CS0615	6-15	ND	ND	ND	ND	ND	ND	0.05	0.05
E2SC-14	E2SC-14-CS01	0-1	ND	ND	ND	ND	ND	ND	0.60	0.60
E2SC-14	E2SC-14-CS0106	1-6	ND	ND	ND	ND	ND	ND	ND	ND
E2SC-14	E2SC-14-CS0615	6-15	ND	ND	ND	ND	ND	ND	ND	ND
E2SC-15	E2SC-15-CS01	0-1	ND	ND	ND	ND	ND	ND	18.0/19.0	
E2SC-15	E2SC-15-CS0106	1-6	ND	ND	ND	ND	ND	31.00	49.00	80.00
E2SC-15	E2SC-15-CS0615	6-15	ND	ND	ND	ND	ND	0.26	0.39	0.65
E2SC-15	E2SC-15-CS3436	34-36	ND	ND	ND	ND	ND	ND	ND	ND
E2SC-16	E2SC-16-CS01	0-1	ND	ND	ND	ND	ND	ND	120.00	120.00
E2SC-16	E2SC-16-CS0106	1-6	ND	ND	ND	ND	ND	ND	1.50	1.50
E2SC-16	E2SC-16-CS0615	6-15	ND	ND	ND	ND	ND	ND	0.68	0.68
E2SC-16I	E2SC-16-CS4042	40-42	ND	ND	ND	ND	ND	1.50	ND	1.50
E2SC-16I	E2SC-16-CS4850	48-50	ND	ND	ND	ND	ND	1.90	1.80	3.70
E2SC-17	E2SC-17-CS01	0-1	ND	ND	ND	ND	ND	ND	2.40	2.40
E2SC-17	E2SC-17-CS0106	1-6	ND	ND	ND	ND	ND	ND	24.00	24.00
E2SC-17	E2SC-17-CS0615	6-15	ND	ND	ND	ND	ND	ND	0.37	0.37
E2SC-17	E2SC-17-CS4244	42-44	ND	ND	ND	ND	ND	ND	ND	ND
E2SC-17	E2SC-17-CS4749	47-49	ND	ND	ND	ND	ND	ND	ND	ND

TARGET SHEET

THE MATERIAL DESCRIBED BELOW
WAS NOT SCANNED BECAUSE:

(X) OVERSIZED

() NON-PAPER MEDIA

() OTHER:

DESCRIPTION:

Figure 5-2: Cross-Section H-H'''

THE OMITTED MATERIAL IS AVAILABLE FOR REVIEW
BY APPOINTMENT
AT THE EPA NEW ENGLAND SUPERFUND RECORDS CENTER,
BOSTON, MA

SOURCE CONTROL INVESTIGATION
ADDENDUM REPORT
UPPER REACH HOUSATONIC RIVER (FIRST ½ MILE)

PITTSFIELD, MASSACHUSETTS

PREPARED FOR:
GENERAL ELECTRIC COMPANY
100 WOODLAWN AVE.
PITTSFIELD, MA 01201

PREPARED BY:

HSI GEOTRANS, INC.
6 LANCASTER COUNTY ROAD
HARVARD, MASSACHUSETTS 01451

HSI GEOTRANS PROJECT NO. P009-002

JUNE 15, 1999
HSI GeoTrans, inc.

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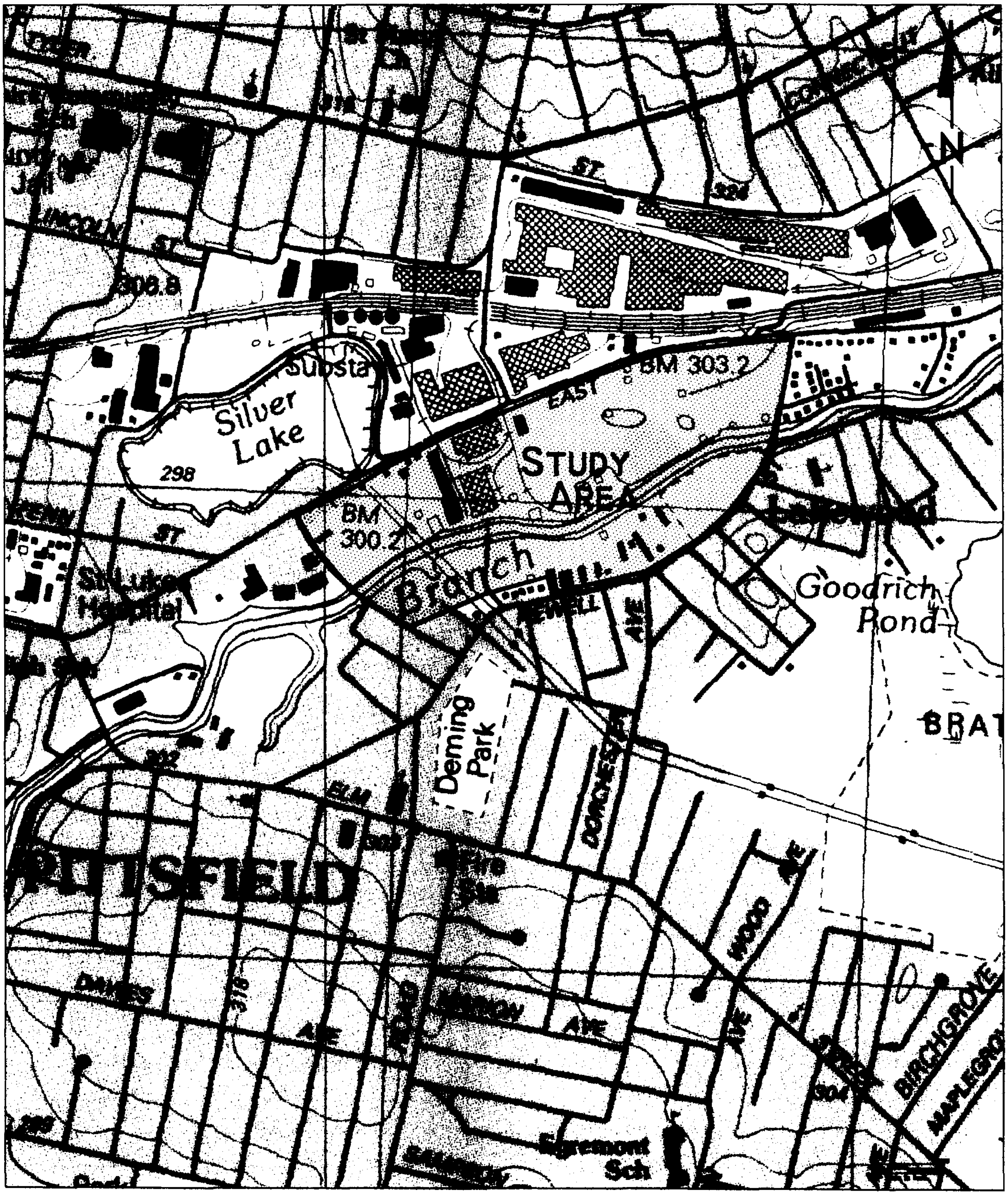
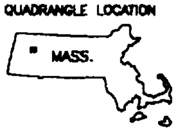
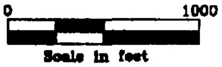
1 INTRODUCTION

This report describes additional source control investigations conducted between March 3 and April 30, 1999 at the General Electric Co. East Street Area 2, Newell Street Area II and Lyman Street sites in Pittsfield, Massachusetts. Figure 1-1 shows the general locations where these investigations were undertaken. These investigations were proposed in the February 9, 1999 Source Control Investigation Report Upper Reach of Housatonic River (First ½ Mile) (HSI GeoTrans, 1999) and the Conceptual Containment Barrier Design for the Lyman Street Site (GE, 1999) to supplement the data presented in these reports. The proposed investigations were approved by EPA in letters dated March 17, 1999 and March 23, 1999. The purposes of the additional investigations were to further evaluate the extent of dense non-aqueous phase liquids (DNAPL) and the topography of the till surface at the Newell Street Area II and Lyman Street Sites. Two monitoring wells were also installed adjacent to the Housatonic river at the east and west ends of the proposed sheet pile wall for the Lyman Street Site to monitor for the potential presence of light non-aqueous phase liquids (LNAPL) at these locations. Additionally, the extent of LNAPL in a small portion of the East Street Area 2 site near previously installed monitoring well 50 was further evaluated.

These investigations were conducted in accordance with the Source Control Work Plan-Upper Reach of Houastonic River (First ½ Mile) (BBL, 1998a) and the Sampling and Analysis Plan/Data Collection and Quality Assurance Plan (BBL, 1998b).







FROM U.S.G.S. QUADRANGLE
PITTSFIELD, MASSACHUSETTS

Contour Interval 3 Meters
National Geodetic Vertical Datum Of 1929

Figure 1–1 Study Area Location Map

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2 METHOD OF INVESTIGATION

As part of these most recent source control investigations, 14 borings were drilled to collect additional samples of the unconsolidated deposits underlying the East Street Area 2, Newell Street Area II and the Lyman Street sites. Monitoring wells were installed in 13 of the borings. Drilling methods used included hollow stem auger, drive and wash, and direct push methods. The drilling technique used at each location was selected based primarily on consideration of the planned boring depth and whether NAPL was encountered in samples collected during drilling. In some cases, the drive and wash technique was used to improve recovery of subsurface soil samples. The direct push technique was used in one area that was not accessible to a conventional drilling rig. Soil cores were collected in split spoon samplers using the standard penetration test method (ASTM D1586) and by the direct push method. Field screening of soil samples for volatile organic compounds (VOCs) was performed by the head space method using a Photo Ionization Detector (PID). Soil samples were also visually examined for the presence of NAPL. When field screening or visual observations indicated the possible presence of NAPL, water shake tests were performed. Staining, sheens and NAPL observations were noted on the boring logs. Oversight of the field activities was conducted by Roy F. Weston personnel, on behalf of EPA. The boring logs and well construction details for the newly installed wells are included in Appendix A.

A number of composite soil samples were collected for PCB analysis from the upper 15 feet in each boring. As approved by EPA, and discussed further in sections 3, 4 and 5, sample composite intervals varied by site to be consistent with the agreement in principle between GE, the U.S. Environmental Protection Agency and the Massachusetts Department of Environmental Protection (Agencies). Table 2-1 lists the sample composite intervals for each site. One discrete sample for VOC analysis was also collected from the upper 15 feet of each boring. The interval sampled for VOC analysis was the one which had the highest field-screening PID reading. To be consistent with updated EPA sampling methodologies and the draft revisions of the Sampling and Analysis Plan (BBL, 1998b), all soil samples for VOC analysis were placed directly into Encore® sample containers. This allowed the samples to be extracted and analyzed utilizing the new EPA method 5035.

In borings that extended to the till surface, one sample was collected for PCB analysis from the unconsolidated deposits directly above the till surface. A minimum of one sample from each boring was also selected for analysis of the Appendix IX +3 constituents. The sample for Appendix IX +3 analysis was collected from the interval with the highest field-screening PID reading. In addition, a soil sample was collected for Appendix IX+3 analysis when visual observations indicated the presence of DNAPL within a soil core.

Table 2-1. Composite soil sample intervals

SITE	SAMPLE INTERVAL DEPTH
EAST STREET AREA 2	0 to 1 Feet
	1 to 6 Feet
	6 to 15 Feet
NEWELL STREET AREA II	0 to 1 Feet
	1 to 3 Feet
	3 to 6 Feet
	6 to 10 Feet
	10 to 15 Feet
Lyman Street Site	0 to 1 Feet
	1 to 3 Feet
	3 to 6 Feet
	6 to 10 Feet
	10 to 15 Feet

3 EAST STREET AREA 2

As proposed in the Source Control Investigation Report (HSI GeoTrans,1999), two shallow monitoring wells were installed at the East Street Area 2 site to further evaluate the extent of a small isolated occurrence of LNAPL at existing monitoring well 50. The locations of the new wells, E2SC-21 and E2SC-22, and nearby existing monitoring wells are show on Figure 3-1. Both new wells were drilled to a depth of 15 feet. Based on the samples collected, the area is underlain by fill (consisting primarily of fine to medium sand), a thin layer of silt (1.5 to 3 feet), and coarse sand below the silt. Two-inch diameter PVC monitoring wells with ten-foot long screens, set from five to fifteen feet below ground surface, were constructed as proposed (HSI GeoTrans, 1999). After the wells were completed, they were developed using a Waterra pump.

As described in Section 2, and on Table 2-1, at least three composite samples of the unconsolidated deposits were collected from each boring for PCB analyses, and selected samples were analyzed for VOCs and Appendix IX+3 constituents. Table 3-1 lists the soil samples collected from the newly drilled wells and the analyses performed. The PCB analyses indicate that only Aroclor 1260 was detected in the samples. The PCB concentrations ranged from 0.26 mg/kg to 630 mg/kg. The only VOC detected was chlorobenzene at 0.071 mg/kg in one sample from boring E2SC-21. No SVOCs were detected in any of the samples. One sample from boring E2SC-22 contained dioxin and dibenzofuran compounds at low concentrations. Furthermore, no detected metals concentrations were greater than the Massachusetts DEP Method 1 S-1 soil standards under the Massachusetts Contingency Plan (MCP). The soil concentration data are summarized in Tables 3-2, 3-3, 3-4 and 3-5.

Water level and LNAPL observations have been made in the newly installed wells approximately weekly since the wells were completed. LNAPL has not been detected in either of the new wells. Water level measurements from the newly installed wells are summarized in Table 3-4. LNAPL has been observed in monitoring well 50 occasionally, and 0.13 gallons of oil was removed from monitoring well 50 during weekly manual removal activities in 1998. Three monitoring wells (95-2, E2S-12 and 64), which are located downgradient of well 50, were previously installed to evaluate the extent of LNAPL observed in monitoring well 50. These three wells are included in the East Street Area 2 semi-annual monitoring program. No LNAPL has ever been detected in any of these wells since they were installed. Based on the observations in the new and previously installed monitoring wells near well 50, it appears that the LNAPL observed in monitoring well 50 is a small localized occurrence which is not migrating towards the river. With the existing and newly installed monitoring wells there is sufficient monitoring in the area near monitoring well 50 to assess any potential changes in LNAPL distribution.

Table 3-1. East Street Area 2 Soil Samples Collected and Analyses Performed, Wells E2SC-21 and E2SC-22

Location	Sample Depth	Sample Name	Type
E2SC-21			
	0-1	CS01	PCB
	1-6	CS0106	PCB
	6-15	CS0615	SVOC
	6-15	CS0615	PCB
	6-15	CS0615	Metals
	6-15	CS0615	Dioxin/Dibenzofuran
	14-15	SS09	VOC
E2SC-22			
	0-1	CS01	PCB
	1-6	CS0106	PCB
	6-15	CS0615	SVOC
	6-15	CS0615	PCB
	6-15	CS0615	Metals
	6-15	CS0615	Dioxin/Dibenzofuran
	10-12	SS08	VOC

Table 3-2. Soil PCB Concentrations, East Street Area 2, Wells E2SC-21 and E2SC-22

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
E2SC-21							
	CS01	0-1					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	ND			mg/kg
			Aroclor 1260	78			mg/kg
			Total PCBs	**78**			
	CS0106	1-6					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	ND			mg/kg
			Aroclor 1260	110			mg/kg
			Total PCBs	**110**			
	CS0615	6-15					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	ND			mg/kg
			Aroclor 1260	31			mg/kg
			Total PCBs	**31**			

Table 3-2. (continued)

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
E2SC-22							
	CS01	0-1					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	ND			mg/kg
			Aroclor 1260	140			mg/kg
			Total PCBs	**140**			
	CS0106	1-6					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	ND			mg/kg
			Aroclor 1260	630			mg/kg
			Total PCBs	**630**			
	CS0615	6-15					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	ND			mg/kg
			Aroclor 1260	0.26			mg/kg
			Total PCBs	**0.26**			

Qualifier

ND	*Not Detected*
J	*Result is between MDL and RL.*

Table 3-3. Detected Soil VOC Concentrations, East Street Area 2, Wells E2SC-21 and E2SC-22

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
E2SC-21							
	SS09	14-15					
			Chlorobenzene	0.071			mg/kg

Qualifier

J *Result is between MDL and RL.*

E *Result exceeds calibration range.*

Table 3-4. Detected Soil Metals Concentrations, East Street Area 2, Wells E2SC-21 and E2SC-22

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
E2SC-21							
	CS0615	6-15					
			Aluminum	9720			mg/kg
			Arsenic	3.2			mg/kg
			Barium	28			mg/kg
			Calcium, Total	1540			mg/kg
			Chromium	13.6			mg/kg
			Copper	30.7			mg/kg
			Iron	17600			mg/kg
			Magnesium	5210			mg/kg
			Manganese	858			mg/kg
			Mercury	0.97			mg/kg
			Nickel	21.9			mg/kg
			Potassium, Total	279	!		mg/kg
			Sulfide	47			mg/kg
			Vanadium	64.8			mg/kg
			Zinc	82.5			mg/kg
E2SC-22							
	CS0615	6-15					
			Aluminum	6740			mg/kg
			Arsenic	3.2			mg/kg
			Barium	25.3			mg/kg
			Calcium, Total	11100			mg/kg
			Chromium	8.6			mg/kg
			Copper	14.9			mg/kg
			Iron	13800			mg/kg
			Magnesium	8760			mg/kg
			Manganese	218			mg/kg
			Nickel	14			mg/kg
			Potassium, Total	313	!		mg/kg
			Sulfide	28.9			mg/kg
			Zinc	52.6			mg/kg

Qualifier

B	*Result is between MDL and RL*
!	*Result is between MDL and LOQ*

Table 3-5. Detected Soil Dioxin and Dibenzofuran Concentrations, East Street Area 2, Wells E2SC-21 and E2SC-22

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
E2SC-22							
	CS0615	6-15					
			1,2,3,4,6,7,8-HpCDD	0.00875	J		µg/kg
			1,2,3,4,6,7,8-HpCDF	0.02534			µg/kg
			1,2,3,4,7,8,9-HpCDF	0.0136			µg/kg
			1,2,3,4,7,8-HxCDF	0.01837			µg/kg
			1,2,3,6,7,8-HxCDF	0.00402	J		µg/kg
			2,3,4,6,7,8-HxCDF	0.00352	J		µg/kg
			OCDD	0.07063			µg/kg
			OCDF	0.175			µg/kg
			TOTAL HpCDD	0.02001			µg/kg
			TOTAL HpCDF	0.03966			µg/kg
			TOTAL HxCDF	0.04307			µg/kg
			TOTAL PeCDF	0.08821			µg/kg
			TOTAL TCDF	0.06776			µg/kg

Qualifier

J	*Result is an estimated value that is below the lower calibration limit but above the target detection level.*
g	*2, 3, 7, 8, -TCDF results have been confirmed on a DB-225 column.*
E	*Result exceeds calibration range.*
F	*Reported value estimated due to an interference.*
a	*See narrative.*
s	*Result detected is below the lowest standard and above zero.*
D	*Compound quantified using a secondary dilution.*

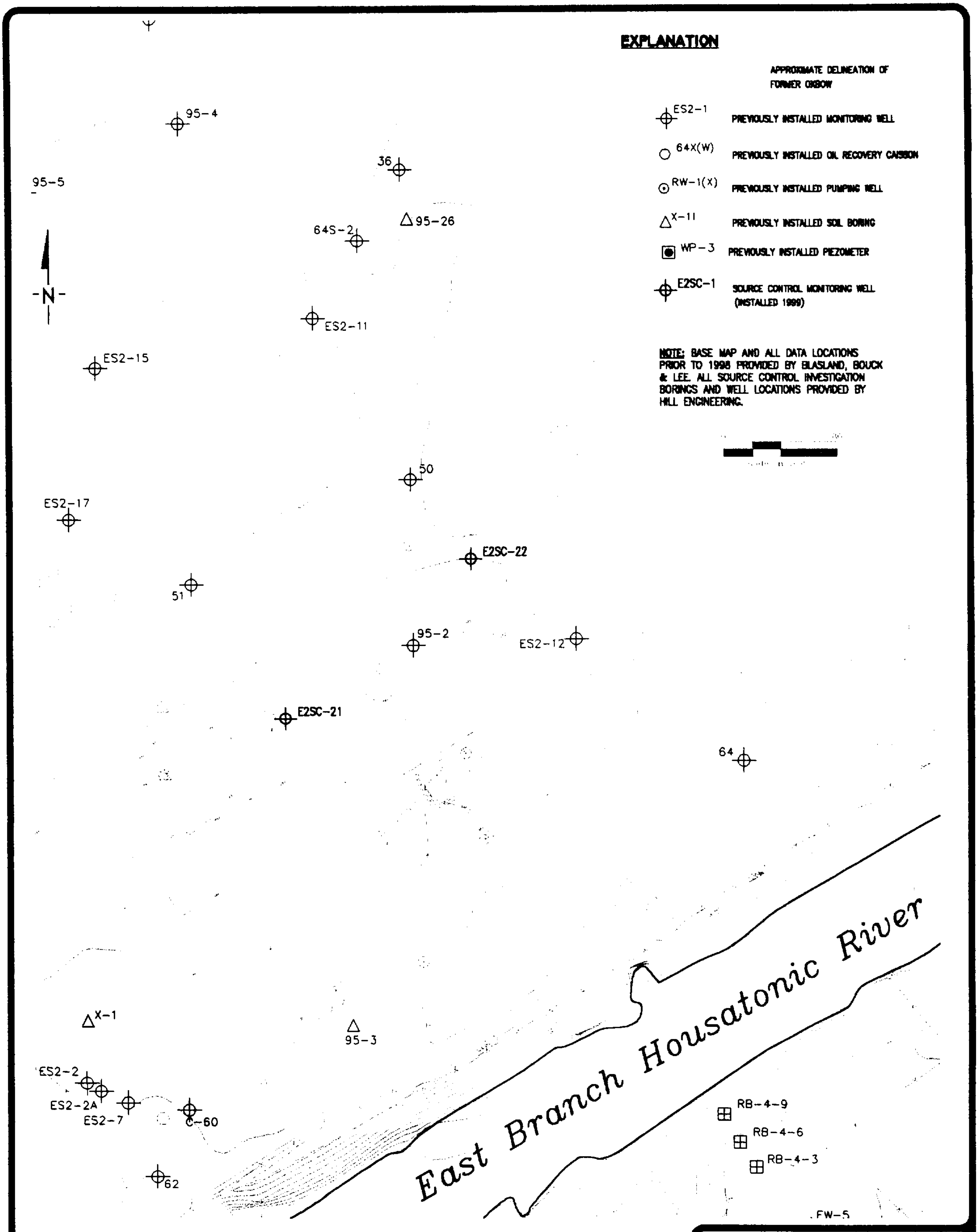

Figure 3-1 East Street Area 2 Well & Boring Location Map

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4 NEWELL STREET AREA II

Between April 1 and April 30, 1999, additional borings were drilled at the Newell Street Area II site to further evaluate the southern and western extent of DNAPL occurrence and to provide additional information regarding the top of till topography beneath the site. One of the new monitoring wells, N2SC-08, contained sufficient DNAPL to allow a recovery test to be done. Samples of DNAPL were also collected for chemical analysis and determination of physical properties. A description of the properties of the Newell Street Area II site LNAPL and DNAPL is presented in section 4.5.

4.1 BORING AND WELL INSTALLATION

Six additional borings were drilled with monitoring wells being installed in five of them. The locations of the newly drilled borings/wells and the existing borings/wells are shown on Figure 4-1. Boring logs and well construction diagrams are included in Appendix A. Well N2SC-08 was installed adjacent to previously installed shallow monitoring well NS-19. Two monitoring wells, one shallow and one deep, were installed at the N2SC-09 location. The western most boring location (N2SC-10) could not be accessed with a conventional drilling rig and was completed by the direct push method. No indication of NAPL was observed during the drilling of boring N2SC-10. Consequently, a well was not installed at this location. DNAPL was observed in the wells at N2SC-08 and N2SC-09. To locate the southern limit of the DNAPL, two additional wells were installed. Monitoring wells N2SC-11 and N2SC-12 were installed adjacent to previously installed shallow monitoring wells NS-33 and NS-20 respectively. Because soil samples from the existing shallow wells had already been chemically analyzed, only a sample from the top of till was collected from N2SC-11 and N2SC-12 for PCB analysis. No indications of DNAPL were observed in either N2SC-11 or N2SC-12.

The unconsolidated deposits penetrated by the new borings are similar to those that have been observed in prior borings at the Newell Street Area II site. The Newell Street

Area II site is underlain by a sequence of unconsolidated deposits consisting of fill (0 to 19 feet thick), interbedded fine sand and silt with peat (0 to 12 feet thick), and fine to coarse sand and gravel (5 to 24 feet thick). The fill is not present at the southernmost wells or at N2SC-10, the westernmost new boring. Recent alluvium consisting of soft silt with a small amount of sand was observed from the ground surface to a depth of three feet in boring N2SC-10.

All of the stratified unconsolidated deposits beneath the Newell Street Area II site occur above a till layer which constitutes a low permeability confining layer. The till consists of stiff to hard silt, and dense to very dense silty sand with gravel. Figure 4-2 is an elevation contour map of the till surface incorporating the data from the new broings. In accordance with the EPA March 17, 1999 letter, Figure 4-2 also includes the top of till elevation data from the borings 3-6C-EB-23 to 3-6C-EB-41, along the north bank of the Housatonic River near building 68. As illustrated, there is a northwest/southeast trending depression in the top of till surface with its lowest determined elevation being 945.2 feet at monitoring well N2SC-08. This elevation is approximately 38 feet below land surface and 22 to 24 feet below the bed of the Housatonic River. Data from the newly installed wells (N2SC-11, N2SC-12) confirm that the till surface rises from the center of the site to the south towards Newell Street, this is shown on Figure 4-2. Figures 4-3 and 4-4 are cross sections showing the stratigraphy of the unconsolidated deposits beneath the Newell Street Area II site. Soil borings/monitoring wells which contain NAPL are shown on the cross-sections. Additionally, soil zones which were observed to contain staining and sheens during drilling are also shown on the cross sections. However, it should be noted that these zones do not necessarily indicate the presence of separate phase NAPL.

4.2 RESULTS OF SOIL CHEMICAL ANALYSES

As described in section 2 of this report, samples of the unconsolidated deposits were collected for PCB analyses. Certain samples were also analyzed for VOCs and/or Appendix

IX+3 constituents. Table 4-1 lists the samples collected in the latest borings drilled at the Newell Street Area II site and the analyses performed on each sample.

The areal distribution of soil PCB concentrations, based on samples collected from the 1998 and 1999 source control borings and wells, is shown on Figure 4-5. The concentrations of detected analytes are summarized in Tables 4-2 through 4-6. Table 4-2 summarizes PCB analyses, Table 4-3 summarizes VOC analyses, Table 4-4 summarizes SVOC analyses, Table 4-5 summarizes metals analyses and Table 4-6 summarizes the dioxin and furan analyses.

4.3 EXTENT OF NAPL

The extent of the DNAPL beneath the Newell Street Area II site have been adequately defined with the data from the monitoring wells and borings that were installed in 1998 and 1999. Water level and NAPL measurements have been collected weekly from these newly installed wells at the Newell Street Area II site since development of the wells was completed. The water level and NAPL measurement data are presented in Table 4-7. These data indicate that there is separate phase DNAPL contained in unconsolidated deposits above the till layer. The DNAPL occurs primarily in deposits immediately above a depression in the till surface which exists in the central portion of the site. However, in several wells (N2SC-03S, N2SC-09S and MW-IS) DNAPL has also been observed on shallower perched layers. In addition to the wells monitored during these investigations, GE gauges 21 other wells as part of the ongoing monitoring program for the site. These wells are: NS-1, NS-10, NS-11, NS-15, NS-16, NS-17, NS-18, NS-19, NS-20, NS-21, NS-23, NS-30, NS-31, NS-32, NS-33, NS-34, NS-35, NS-36, NS-37, MW-1S and MW-1D. Data from the ongoing monitoring are submitted to the agencies in the monthly reports. Figure 4-6 shows the wells in which DNAPL and LNAPL have been observed. The DNAPL extends from the area of wells NS-15, NS-30 and NS-31, located in the northern portion of the site, to wells N2SC-08 and N2SC-9S, located to the south. The westernmost well in which DNAPL has been observed is well cluster MW-1D and 1S. The easternmost well with DNAPL is N2SC-08.

Figure 4-3 corresponds to cross section J-J[1] from the February 9, 1999 Source Control Investigation Report modified with the data from the new monitoring wells. Figure 4-4 is a southwest to northeast cross section through the new borings and monitoring wells N2SC-08, N2SC-09, and N2SC-10. The cross sections show the vertical distribution of staining, sheens, and DNAPL. Typically, DNAPL occurs at a depth of approximately 35 feet below the surface, which equates to a depth of approximately 20 feet below the Housatonic River bed. Localized occurrences of DNAPL have been observed in shallow wells N2SC-03S, N2SC-09S and MW-1S which are located 200 to 300 feet from the river. At these locations, it appears that a small amount of DNAPL is perched on shallower low permeability layers. Monitoring wells adjacent to the river do not contain the more shallow perched DNAPL.

4.4 NAPL PROPERTIES

In its March 17 letter, EPA requested that GE compare the chemical constituents, density and viscosity of the LNAPL and DNAPL at the Newell Street Area II site. Physical and chemical properties of one LNAPL and five DNAPL samples collected from monitoring wells at the Newell Street Area II site have been determined. The physical properties, including specific gravity, interfacial tension and viscosity, were measured at the General Electric environmental laboratory. Chemical analyses for PCBs, VOCs, SVOCs, metals dioxins and dibenzofurans were performed by various laboratories. The physical and chemical analyses have been performed as part of the ongoing investigations at the Newell Street Area II site since 1995.

LNAPL has only been observed in one well, NS-10, at the Newell Street Area II site. One suspect indication 0.01 feet of LNAPL was reported for well N2SC-01I. However, this well is screened too deep to allow LNAPL to enter the well. A shallow well, N2SC-01S, located next to N2SC-01I is screened across the water table. No indication of LNAPL has been observed in well N2SC-01S. A sample of the LNAPL from well NS-10 was collected on July 12, 1995 and analyzed for metals, VOCs, SVOCs, and PCBs. In addition, the specific gravity of the LNAPL was determined to be 0.905 (see Table 4-8). The laboratory data reports for this sample are included in Appendix B. The PCB concentration in the LNAPL was 2.4% . The sample also contained 1,3-Dichlorobenzene, 1,4-Dichlorobenzene, Xylenes, p-Isopropyltoluene, Napthlaene, 1,3,5-Trimethylbenzene, and 1,2,4-Trimethylbenzene. Another sample of the LNAPL was collected for the determination of physical properties on April 15, 1999. However, a sufficient volume of LNAPL could not be collected at that time to make the measurements.

Five samples of DNAPL have been collected from monitoring wells at the Newell Street Area II site. The physical properties of the DNAPL samples are summarized in Table 4-8. The specific gravity of the samples was measured with an Anton Parr Density meter at a temperature of 23.5^0 C. The specific gravity of the samples ranged from 1.154 to 1.196. These specific gravity measurements, which are greater than the specific gravity of water, distinguish the DNAPL from the LNAPL observed in well NS-10 (which has a specific gravity less than water). The interfacial tension between the DNAPL and groundwater was determined using a Dunoy Tensiometer. The interfacial tension was measured by both pushing the tensiometer ring from the water into the DNAPL and pulling the ring from the DNAPL into the water. The water to oil interfacial tension of the samples ranged from 6.1 dyne/cm to 15.4 dyne/cm. Measurements of the oil to water interfacial tension are also listed in Table 4-8. The viscosity of the DNAPL samples was determined using a Cannon-Fenske viscometer at a constant temperature of 28^0 C. The viscosity of the samples ranged from 10.9 to 14.8 centistokes.

The chemical analyses of the DNAPL samples indicate that the DNAPL consists primarily of PCB Aroclor 1254, ranging from 29% in samples from monitoring wells N2SC-01I and N2SC-03S, to 32% in the sample from well N2SC-02. In addition to the PCB, the DNAPL samples contained 6.8% to 14.5% VOCs and 1.59% to 46.4% SVOCs. The SVOCs detected at the highest concentrations were chlorinated benzenes. The VOCs detected at the highest concentrations were trichloroethene, xylene, toluene and tetrachloroethene. The SVOCs detected in the highest concentration were 1, 2, 4-trichlorobenzene and 1, 4-dichlorobenzene. The results of the chemical analyses of the four recently collected DNAPL samples are summarized in Table 4-9. The laboratory data report for the DNAPL sample from NS-15 is included in Appendix B. The SVOCs in the DNAPL sample collected from the shallow well N2SC-3S included several more PAH compounds than the other Newell Street Area II DNAPL samples. The differences in composition of the NAPL is likely a result of the spatial variability of chemical constituents which were disposed of at the Newell Street Area II site.

Based on the NS-10 NAPL sample specific gravity of 0.905, this NAPL is less dense than water and occurs at the top of the water table. This confirms that the NAPL at this location is LNAPL, not DNAPL perched on a low permeability layer. Because LNAPL is only observed in well NS-10 and has not been observed in any of the nearby monitoring wells or borings, the LNAPL in well NS-10 represents a small localized occurrence and does not appear to have mixed with the DNAPL at the site.

4.5 DNAPL PUMPING TEST

A DNAPL pumping test was conducted in monitoring well N2SC-08 on May 25 and 26, 1999 to evaluate the potential for pumping DNAPL from that well. Prior to conducting the recovery test, a DNAPL level measurement on May 21, 1999 indicated that there was 1.7 feet of DNAPL in the well. On May 25, the well was tested over a six hour period using a pneumatically operated QED pulse pump. A total of 1.95 liters of DNAPL was pumped from the well in the first 183 minutes of the test. The recovery rate declined rapidly and no DNAPL was recovered during the remainder of the test. The following day, the well was again evaluated. After an initial removal of 0.19 liters, no DNAPL recharged the well for a two hour period and the test was terminated. The DNAPL level was measured again on May 27, 1999 and only 0.03 feet of DNAPL had accumulated in the well since the testing was completed on May 26. These tests indicate that the recovery rate in monitoring well N2SC-08 is slow and does not appear to justify the installation of an automated DNAPL pumping system in this well. Table 4-10 summarizes the results of the DNAPL pumping test.

4.6 DNAPL RECOVERY

GE has operated an automated DNAPL recovery system at the Newell Street Area II Site since March 1999. The automated system pumps DNAPL from wells NS-15, NS-30 and NS-32. Prior to March 1999, DNAPL was removed from these wells manually using pumps or bailers. In addition, DNAPL is monitored and pumped daily from wells N2SC-02, N2SC-03I, N2SC-03S and N2SC-01I using manually controlled pumps. On a weekly basis, the following wells are also monitored: NS-10, NS-31, NS-33, NS-34, NS-35, NS-36, NS-37, MW-1S and MW-1D. If NAPL is present and its thickness exceeds 0.5 feet, it is manually removed from these wells. For the period January 1, 1999, through May 31, 1999, a total of 1,322 gallons of DNAPL have been recovered from the Newell Street Area II Site. Table 4-11 summarizes the DNAPL recovery for the January to May 1999 time period. An additional automated DNAPL recover system is currently being constructed for well N2SC-01I and will become operational in July 1999.

Table 4-1. Newell Street Area II Soil Samples Collected and Analyses Performed

Location	Sample Depth	Sample Name	Type
N2SC-08			
	0-1	CS01	PCB
	1-3	CS0103	PCB
	3-6	CS0306	PCB
	6-10	CS0610	Dioxin/Dibenzofuran
	6-10	CS0610	PCB
	6-10	CS0610	Metals
	10-15	CS1015	PCB
	8-10	SS06	VOC
	38-40	SS22	PCB
	38-40	SS22	SVOC
	38-40	SS22	VOC
	38-40	SS22	Metals
	38-40	SS22	Dioxin/Dibenzofuran
	40-42	SS23	PCB
N2SC-09			
	0-1	CS01	PCB
	1-3	CS0103	PCB
	3-6	CS0306	PCB
	6-10	CS0610	PCB
	10-15	CS1015	Dioxin/Dibenzofuran
	10-15	CS1015	Metals
	10-15	CS1015	PCB
	10-15	CS1015	SVOC
	36-40	CS3640	Dioxin/Dibenzofuran
	36-40	CS3640	Metals
	36-40	CS3640	PCB
	36-40	CS3640	SVOC
	8-10	SS09	VOC
	36-38	SS20	VOC
	38-40	SS22	PCB
N2SC-10			
	0-1	CS01	PCB
	1-3	CS0103	PCB
	3-6	CS0306	PCB
	6-10	CS0610	PCB

Table 4-1. (continued)

Location	Sample Depth	Sample Name	Type
	10-15	CS1015	SVOC
	10-15	CS1015	PCB
	10-15	CS1015	Metals
	10-15	CS1015	Dioxin/Dibenzofuran
	18-22	CS1822	PCB
	28-32	CS2832	PCB
	10-12	SS07	VOC
N2SC-11			
	34-36	SS11	PCB
N2SC-12			
	36-38	SS12	PCB

Table 4-2. Soil PCB Concentrations, Newell Street Area II

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
N2SC-08							
	CS01	0-1					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	780			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**780**			
	CS0103	1-3					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	140			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**140**			
	CS0306	3-6					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	570			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**570**			

Table 4-2. (continued)

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
	CS0610	6-10					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	14			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**14**			
	CS1015	10-15					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	3.1			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**3.1**			
	SS22	38-40					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	340			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**340**			
	SS23	40-42					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	300			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**300**			

Table 4-2. (continued)

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
N2SC-09							
	CS01	0-1					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	ND			mg/kg
			Aroclor 1260	27			mg/kg
			Total PCBs	**27**			
	CS0103	1-3					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	8700			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**8700**			
	CS0306	3-6					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	1300			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**1300**			
	CS0610	6-10					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	13000			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**13000**			

Table 4-2. (continued)

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
	CS1015	10-15					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	3500			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**3500**			
	CS3640	36-40					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	510			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**510**			
	SS22	38-40					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	5.8			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**5.8**			
N2SC-10							
	CS01	0-1					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	1.6			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**1.6**			

Table 4-2. (continued)

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
	CS0103	1-3					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	0.092			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**0.092**			
	CS0306	3-6					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	0.04			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**0.04**			
	CS0610	6-10					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	0.02	J		mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**0.02**			
	CS1015	10-15					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	0.025	J		mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**0.025**			

Table 4-2. (continued)

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
	CS1822	18-22					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	0.024	J		mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**0.024**			
	CS2832	28-32					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	0.051			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**0.051**			
N2SC-11							
	SS11	34-36					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	0.034	J		mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**0.034**			
N2SC-12							
	SS12	36-38					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	ND			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**0**			

Table 4-2. (continued)

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
	SS12D	36-38					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	ND			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**0**			

Qualifier

ND	*Not Detected*
J	*Result is between MDL and RL.*

Table 4-3. Detected Soil VOC Concentrations, Newell Street Area II

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
N2SC-08							
	SS06	8-10					
			Trichloroethene	0.013			mg/kg
	SS22	38-40					
			1,2-Dichloroethane	0.01			mg/kg
			Benzene	0.01			mg/kg
			Chlorobenzene	0.01			mg/kg
			Chloroform	0.01			mg/kg
			Ethylbenzene	0.02			mg/kg
			Tetrachloroethene	0.04			mg/kg
			Toluene	0.1			mg/kg
			Trichloroethene	3.1			mg/kg
			Xylenes (total)	0.09			mg/kg
N2SC-09							
	SS09	8-10					
			Benzene	0.2			mg/kg
			Chlorobenzene	1.3	E		mg/kg
			Ethylbenzene	0.19			mg/kg
			Toluene	0.02			mg/kg
			Xylenes (total)	1.9	E		mg/kg
	SS20	36-38					
			Chlorobenzene	0.034			mg/kg
			Ethylbenzene	0.0086			mg/kg
			Xylenes (total)	0.017			mg/kg

Qualifier

J	*Result is between MDL and RL.*
E	*Result exceeds calibration range.*

Table 4-4. Detected Soil SVOC Concentrations, Newell Street Area II

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
N2SC-08							
	SS22	38-40					
			1,2,4-Trichlorobenzene	3.7			mg/kg
			bis(2-Ethylhexyl) phthalate	0.48			mg/kg
N2SC-09							
	CS1015	10-15					
			1,2,4-Trichlorobenzene	3.7			mg/kg
			1,3-Dichlorobenzene	0.57			mg/kg
			1,4-Dichlorobenzene	3			mg/kg
	CS3640	36-40					
			1,2,4-Trichlorobenzene	2.6			mg/kg
			bis(2-Ethylhexyl) phthalate	0.52			mg/kg

Qualifier

J *Result is between MDL and RL.*

E *Result exceeds calibration range.*

Table 4-5. Detected Soil Metals Concentrations, Newell Street Area II

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
N2SC-08							
	CS0610	6-10					
			Aluminum	4430			mg/kg
			Arsenic	2.3			mg/kg
			Barium	15.2			mg/kg
			Calcium, Total	4510			mg/kg
			Chromium	6.8			mg/kg
			Copper	14.8			mg/kg
			Iron	12100			mg/kg
			Magnesium	4260			mg/kg
			Manganese	171			mg/kg
			Nickel	13.3			mg/kg
			Sulfide	21.5			mg/kg
			Zinc	37.2			mg/kg
	SS22	38-40					
			Aluminum	7660			mg/kg
			Arsenic	4.7			mg/kg
			Barium	18.8			mg/kg
			Calcium, Total	27200			mg/kg
			Chromium	9.8			mg/kg
			Copper	21.3			mg/kg
			Iron	18900			mg/kg
			Magnesium	17800			mg/kg
			Manganese	372			mg/kg
			Nickel	20			mg/kg
			Sulfide	49.7			mg/kg
			Zinc	56.2			mg/kg
N2SC-09							
	CS1015	10-15					
			Aluminum	5750			mg/kg
			Arsenic	2.9			mg/kg
			Barium	52.2			mg/kg
			Calcium, Total	10700			mg/kg
			Chromium	18.2			mg/kg
			Copper	65.4			mg/kg
			Iron	12400			mg/kg
			Lead	30.2			mg/kg

Table 4-5. (continued)

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
			Magnesium	6040			mg/kg
			Manganese	166			mg/kg
			Mercury	0.22	!		mg/kg
			Nickel	14.7			mg/kg
			Sodium, Total	128	!		mg/kg
			Sulfide	98.2			mg/kg
			Zinc	210			mg/kg
	CS3640	36-40					
			Aluminum	6600			mg/kg
			Arsenic	6.2			mg/kg
			Barium	18.9			mg/kg
			Calcium, Total	82900			mg/kg
			Chromium	8			mg/kg
			Copper	16.1			mg/kg
			Iron	2930			mg/kg
			Magnesium	47200			mg/kg
			Manganese	454			mg/kg
			Nickel	17.5			mg/kg
			Sulfide	53.6			mg/kg
			Zinc	89			mg/kg
N2SC-10							
	CS1015	10-15					
			Aluminum	6800			mg/kg
			Aluminum	9660			mg/kg
			Arsenic	5.8			mg/kg
			Arsenic	7.8			mg/kg
			Barium	15.7			mg/kg
			Barium	28.4			mg/kg
			Calcium, Total	1700			mg/kg
			Calcium, Total	935	!		mg/kg
			Chromium	11			mg/kg
			Chromium	7.9			mg/kg
			Cobalt	11.7			mg/kg
			Copper	23.1			mg/kg
			Copper	31.5			mg/kg
			Iron	16900			mg/kg
			Iron	24800			mg/kg
			Magnesium	4390			mg/kg

Table 4-5. (continued)

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
			Magnesium	3020			mg/kg
			Manganese	637			mg/kg
			Manganese	611			mg/kg
			Nickel	15.8			mg/kg
			Nickel	21.2			mg/kg
			Sulfide	15.8			mg/kg
			Sulfide	18.1			mg/kg
			Zinc	60.5			mg/kg
			Zinc	44.5			mg/kg

Qualifier

B *Result is between MDL and RL*

! *Result is between MDL and LOQ*

Table 4-6. Detected Soil Dioxin and Dibenzofuran Concentrations, Newell Street Area II

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
N2SC-08							
	CS0610	6-10					
			1,2,3,4,6,7,8-HpCDF	0.71266			µg/kg
			1,2,3,4,7,8,9-HpCDF	0.04604			µg/kg
			1,2,3,4,7,8-HxCDF	0.15655			µg/kg
			1,2,3,6,7,8-HxCDF	0.06908			µg/kg
			1,2,3,7,8-PeCDF	0.03939			µg/kg
			2,3,4,6,7,8-HxCDF	0.02199			µg/kg
			2,3,4,7,8-PeCDF	0.05302			µg/kg
			2,3,7,8-TCDF	0.06517			µg/kg
			OCDF	0.37187			µg/kg
			TOTAL HpCDF	1.25477			µg/kg
			TOTAL HxCDF	0.68652			µg/kg
			TOTAL PeCDF	0.63311			µg/kg
			TOTAL TCDF	0.55185			µg/kg
	SS22	38-40					
			1,2,3,4,6,7,8-HpCDD	0.51922			µg/kg
			1,2,3,4,6,7,8-HpCDF	0.3677			µg/kg
			1,2,3,4,7,8,9-HpCDF	0.28455			µg/kg
			1,2,3,4,7,8-HxCDD	0.06124			µg/kg
			1,2,3,4,7,8-HxCDF	0.78868			µg/kg
			1,2,3,6,7,8-HxCDD	0.20869			µg/kg
			1,2,3,6,7,8-HxCDF	0.24662			µg/kg
			1,2,3,7,8,9-HxCDD	0.13272			µg/kg
			1,2,3,7,8,9-HxCDF	0.02139			µg/kg
			1,2,3,7,8-PeCDD	0.11253			µg/kg
			1,2,3,7,8-PeCDF	0.05228			µg/kg
			2,3,4,6,7,8-HxCDF	0.18663			µg/kg
			2,3,4,7,8-PeCDF	0.1663			µg/kg
			2,3,7,8-TCDD	0.00361			µg/kg
			2,3,7,8-TCDF	0.1388			µg/kg
			OCDD	0.72647			µg/kg
			OCDF	0.48492			µg/kg
			TOTAL HpCDD	1.2293			µg/kg
			TOTAL HpCDF	1.11004			µg/kg
			TOTAL HxCDD	2.23334			µg/kg

Table 4-6. (continued)

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
			TOTAL HxCDF	2.67642			µg/kg
			TOTAL PeCDD	1.05232			µg/kg
			TOTAL PeCDF	1.82667			µg/kg
			TOTAL TCDD	0.31546			µg/kg
			TOTAL TCDF	0.62475			µg/kg
N2SC-09							
	CS1015	10-15					
			1,2,3,4,6,7,8-HpCDD	0.14515			µg/kg
			1,2,3,4,6,7,8-HpCDF	3.12715			µg/kg
			1,2,3,4,7,8,9-HpCDF	2.5327			µg/kg
			1,2,3,4,7,8-HxCDD	0.02095			µg/kg
			1,2,3,4,7,8-HxCDF	7.97551	E		µg/kg
			1,2,3,6,7,8-HxCDD	0.04683			µg/kg
			1,2,3,6,7,8-HxCDF	3.47631			µg/kg
			1,2,3,7,8,9-HxCDD	0.03351			µg/kg
			1,2,3,7,8,9-HxCDF	0.19081			µg/kg
			1,2,3,7,8-PeCDD	0.0527			µg/kg
			1,2,3,7,8-PeCDF	0.52219			µg/kg
			2,3,4,6,7,8-HxCDF	1.69729			µg/kg
			2,3,4,7,8-PeCDF	1.81489			µg/kg
			2,3,7,8-TCDD	0.0017	J		µg/kg
			2,3,7,8-TCDF	1.03491	E		µg/kg
			OCDD	0.26909			µg/kg
			OCDF	3.35095			µg/kg
			TOTAL HpCDD	0.44725			µg/kg
			TOTAL HpCDF	9.06709	E		µg/kg
			TOTAL HxCDD	0.54785			µg/kg
			TOTAL HxCDF	24.6755	E		µg/kg
			TOTAL PeCDD	0.31394			µg/kg
			TOTAL PeCDF	15.5241	E		µg/kg
			TOTAL TCDD	0.23854			µg/kg
			TOTAL TCDF	6.11388	E		µg/kg
	CS3640	36-40					
			1,2,3,4,6,7,8-HpCDF	0.45983			µg/kg
			1,2,3,4,7,8,9-HpCDF	0.45495			µg/kg
			1,2,3,4,7,8-HxCDF	1.4729			µg/kg
			1,2,3,6,7,8-HxCDF	0.59902			µg/kg
			1,2,3,7,8-PeCDF	0.07124			µg/kg

Table 4-6. (continued)

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
			2,3,4,6,7,8-HxCDF	0.29617			µg/kg
			2,3,4,7,8-PeCDF	0.29673			µg/kg
			2,3,7,8-TCDF	0.14295			µg/kg
			OCDF	0.50278			µg/kg
			TOTAL HpCDD	0.02174			µg/kg
			TOTAL HpCDF	1.36197			µg/kg
			TOTAL HxCDD	0.03982			µg/kg
			TOTAL HxCDF	4.17269	E		µg/kg
			TOTAL PeCDF	2.48101			µg/kg
			TOTAL TCDD	0.01896			µg/kg
			TOTAL TCDF	0.55872			µg/kg
N2SC-10							
	CS1015	10-15					
			OCDD	0.0325			µg/kg
			OCDF	0.00295	J		µg/kg

Qualifier

J	*Result is an estimated value that is below the lower calibration limit but above the target detection level.*
g	*2, 3, 7, 8, -TCDF results have been confirmed on a DB-225 column.*
E	*Result exceeds calibration range.*
F	*Reported value estimated due to an interference.*
a	*See narrative.*
s	*Result detected is below the lowest standard and above zero.*
D	*Compound quantified using a secondary dilution.*

Table 4-7. Water Level and NAPL Measurements, Newell Street Area II

Boring	Date Measured	Measuring Point Elevation	Depth to LNAPL	Depth to Water	Groundwater Elevation	LNAPL Thickness	Depth to DNAPL	DNAPL Elevation	*Notes*
N2SC-01I									
	11/4/98	984.99		13.62	971.37		35.48	949.51	
	11/6/98	984.99		13.64	971.35		35.43	949.56	
	11/9/98	984.99		13.71	971.28		35.43	949.56	
	11/13/98	984.99		13.38	971.61		35.24	949.75	
	11/25/98	984.99		13.66	971.33		35.28	949.71	
	12/8/98	984.99		13.62	971.37		35.41	949.58	
	12/17/98	984.99		13.71	971.28				NAPL on bottom 5 feet of probe tape
	12/29/98	984.99	13.63	13.64	971.35	0.01	36.32	948.67	Well not screened across water table; LNAPL Measurement Suspect
	1/7/99	984.99		13.70	971.29		35.35	949.64	
N2SC-01S									
	11/4/98	985.1		10.96	974.14				
	11/6/98	985.1		11.00	974.10				
	11/9/98	985.1		11.02	974.08				Trace Sheen on probe
	11/13/98	985.1		11.11	973.99				
	11/25/98	985.1		11.12	973.98				
	12/8/98	985.1		10.87	974.23				
	12/17/98	985.1		13.91	971.19				
	12/29/98	985.1		11.02	974.08				
	1/7/99	985.1		11.13	973.97				
	1/22/99	985.1		10.72	974.38				
	1/29/99	985.1		10.69	974.41				

Table 4-7. (continued)

Boring	Date Measured	Measuring Point Elevation	Depth to LNAPL	Depth to Water	Groundwater Elevation	LNAPL Thickness	Depth to DNAPL	DNAPL Elevation	*Notes*
	2/5/99	985.1		9.91	975.19				
	3/11/99	985.1		10.16	974.94				
	3/18/99	985.1		10.34	974.76				
	3/24/99	985.1		9.65	975.45				
	4/2/99	985.1		9.42	975.68				Sheen on probe tip
	4/6/99	985.1		9.54	975.56				NAPL on tip of probe
	4/14/99	985.1		9.88	975.22				
	4/23/99	985.1		10.12	974.98				
	4/29/99	985.1		10.23	974.87				slight trace NAPL on probe
	5/7/99	985.1		10.33	974.77				trace NAPL on probe
	5/14/99	985.1		10.34	974.76				
	5/21/99	985.1		10.13	974.97				
	5/27/99	985.1		9.74	975.36				NAPL on probe
N2SC-02									
	11/6/98	985.07		13.82	971.25		34.95	950.12	
	11/9/98	985.07		13.90	971.17		34.89	950.18	
	11/13/98	985.07		13.53	971.54		34.76	950.31	
	11/25/98	985.07		13.82	971.25		34.86	950.21	
	12/8/98	985.07		13.29	971.78		34.90	950.17	
	12/17/98	985.07		13.86	971.21		35.00	950.07	
	12/29/98	985.07		13.80	971.27		35.94	949.13	
	1/7/99	985.07							Not measured, pump in well.
N2SC-03I									
	11/4/98	985.33		13.88	971.45				Sheen on probe
	11/6/98	985.33		13.97	971.36				Sheen on probe
	11/9/98	985.33		13.97	971.36				Sheen on probe

Table 4-7. (continued)

Boring	Date Measured	Measuring Point Elevation	Depth to LNAPL	Depth to Water	Groundwater Elevation	LNAPL Thickness	Depth to DNAPL	DNAPL Elevation	*Notes*
	11/13/98	985.33		13.62	971.71		36.64	948.69	
	11/25/98	985.33		13.90	971.43		36.51	948.82	
	12/8/98	985.33		13.85	971.48		36.61	948.72	
	12/17/98	985.33		13.93	971.40				NAPL on last 4.0 feet of probe tape
	12/29/98	985.33							Not measured, pump in well
	1/7/99	985.33							Not measured, pump in well.
N2SC-03S									
	11/4/98	985.18		11.99	973.19				Sheen on probe
	11/6/98	985.18		11.91	973.27				
	11/9/98	985.18		11.99	973.19				Trace Sheen on probe
	11/13/98	985.18		12.30	972.88		19.91	965.27	
	11/25/98	985.18		12.74	972.44		20.70	964.48	
	12/8/98	985.18		12.25	972.93		21.38	963.80	
	12/17/98	985.18		11.19	973.99				Well recently bailed, NAPL on tape
	12/29/98	985.18		12.05	973.13				NAPL on probe
	1/7/99	985.18		12.00	973.18				Sheen on probe
	1/22/99	985.18		11.98	973.20				NAPL on probe
	1/29/99	985.18		12.01	973.17				NAPL on probe
	2/5/99	985.18		11.11	974.07				NAPL on probe
	3/11/99	985.18		11.00	974.18				
	3/18/99	985.18		8.26	976.92		21.50	963.68	
	3/24/99	985.18		10.46	974.72				NAPL on probe
	4/2/99	985.18		11.13	974.05		21.15	964.03	
	4/6/99	985.18		11.53	973.65		21.16	964.02	

Table 4-7. (continued)

Boring	Date Measured	Measuring Point Elevation	Depth to LNAPL	Depth to Water	Groundwater Elevation	LNAPL Thickness	Depth to DNAPL	DNAPL Elevation	*Notes*
	4/14/99	985.18		12.82	972.36		20.60	964.58	
	4/23/99	985.18		12.06	973.12		21.47	963.71	
	4/29/99	985.18		11.94	973.24		21.43	963.75	
	5/7/99	985.18		11.81	973.37		21.45	963.73	
	5/14/99	985.18		11.86	973.32		21.49	963.69	
	5/21/99	985.18		10.18	975.00		21.43	963.75	
	5/27/99	985.18		10.90	974.28		21.27	963.91	
N2SC-04									
	11/9/98	981.56		10.62	970.94				Sheen on probe
	11/13/98	981.56		10.19	971.37				
	11/25/98	981.56		10.47	971.09				
	12/8/98	981.56		10.41	971.15				
	12/17/98	981.56		10.50	971.06				
	12/29/98	981.56		10.44	971.12				
	1/7/99	981.56		10.47	971.09				
	1/22/99	981.56		9.34	972.22				
	1/29/99	981.56		9.28	972.28				
	2/5/99	981.56		8.56	973.00				
	2/19/99	981.56		9.37	972.19				
	3/11/99	981.56		9.34	972.22				
	3/18/99	981.56		9.30	972.26				
	3/24/99	981.56		7.94	973.62				
	4/2/99	981.56		8.36	973.20				
	4/6/99	981.56		9.00	972.56				
	4/14/99	981.56		9.77	971.79				
	4/23/99	981.56		9.81	971.75				

Table 4-7. (continued)

Boring	Date Measured	Measuring Point Elevation	Depth to LNAPL	Depth to Water	Groundwater Elevation	LNAPL Thickness	Depth to DNAPL	DNAPL Elevation	*Notes*
	4/29/99	981.56		9.96	971.60				
	5/7/99	981.56		9.70	971.86				
	5/14/99	981.56		9.75	971.81				
	5/21/99	981.56		8.83	972.73				
	5/27/99	981.56		9.01	972.55				
N2SC-05									
	11/9/98	982.54		11.57	970.97				
	11/13/98	982.54		11.27	971.27				
	11/25/98	982.54		11.46	971.08				
	12/8/98	982.54		11.41	971.13				
	12/17/98	982.54		11.52	971.02				
	12/29/98	982.54		11.43	971.11				
	1/7/99	982.54		11.45	971.09				
	1/22/99	982.54		10.37	972.17				
	1/29/99	982.54		10.11	972.43				
	2/5/99	982.54		9.64	972.90				
	2/19/99	982.54		10.42	972.12				
	3/11/99	982.54		10.39	972.15				
	3/18/99	982.54		10.34	972.20				
	3/24/99	982.54		8.90	973.64				
	4/2/99	982.54		9.35	973.19				
	4/6/99	982.54		10.03	972.51				
	4/14/99	982.54		10.77	971.77				
	4/23/99	982.54		10.82	971.72				
	4/29/99	982.54		10.97	971.57				
	5/7/99	982.54		10.73	971.81				

Table 4-7. (continued)

Boring	Date Measured	Measuring Point Elevation	Depth to LNAPL	Depth to Water	Groundwater Elevation	LNAPL Thickness	Depth to DNAPL	DNAPL Elevation	*Notes*
	5/14/99	982.54		10.64	971.90				
	5/21/99	982.54		9.92	972.62				
	5/27/99	982.54		10.02	972.52				
N2SC-06									
	11/6/98	985.27		14.10	971.17				
	11/9/98	985.27		14.14	971.13				
	11/13/98	985.27		13.81	971.46				
	11/25/98	985.27		14.08	971.19				
	12/8/98	985.27		14.03	971.24				
	12/17/98	985.27		14.14	971.13				
	12/29/98	985.27		14.06	971.21				
	1/7/99	985.27		14.10	971.17				
	1/22/99	985.27		12.93	972.34				
	1/29/99	985.27		12.64	972.63				
	2/5/99	985.27		12.06	973.21				
	2/19/99	985.27		12.93	972.34				
	3/11/99	985.27		12.86	972.41				
	3/18/99	985.27		9.00	976.27				
	3/24/99	985.27		11.25	974.02				
	4/2/99	985.27		11.87	973.40				
	4/6/99	985.27		12.48	972.79				
	4/14/99	985.27		13.26	972.01				
	4/23/99	985.27		13.40	971.87				
	4/29/99	985.27		13.51	971.76				
	5/7/99	985.27		13.24	972.03				
	5/14/99	985.27		13.28	971.99				

Table 4-7. (continued)

Boring	Date Measured	Measuring Point Elevation	Depth to LNAPL	Depth to Water	Groundwater Elevation	LNAPL Thickness	Depth to DNAPL	DNAPL Elevation	*Notes*
	5/21/99	985.27		11.38	973.89				
	5/27/99	985.27		12.51	972.76				
N2SC-07									
	11/13/98	984.61		13.24	971.37				
	11/25/98	984.61		13.52	971.09				
	12/8/98	984.61		13.48	971.13				
	12/17/98	984.61		13.55	971.06				
	12/29/98	984.61		13.52	971.09				
	1/7/99	984.61		13.53	971.08				
	1/22/99	984.61		12.42	972.19		31.80	952.81	Well pumping indicates apparent DNAPL measurements due to sediment in well
	1/29/99	984.61		12.21	972.40		32.45	952.16	Well pumping indicates apparent DNAPL measurements due to sediment in well
	2/5/99	984.61		11.57	973.04		33.70	950.91	Well pumping indicates apparent DNAPL measurements due to sediment in well
	2/19/99	984.61		12.47	972.14				
	3/11/99	984.61		12.43	972.18				
	3/18/99	984.61		12.41	972.20				
	3/24/99	984.61		10.91	973.70				
	4/2/99	984.61		11.37	973.24				
	4/6/99	984.61		9.05	975.56				
	4/14/99	984.61		12.80	971.81				
	4/23/99	984.61		12.86	971.75				
	4/29/99	984.61		13.00	971.61				

Table 4-7. (continued)

Boring	Date Measured	Measuring Point Elevation	Depth to LNAPL	Depth to Water	Groundwater Elevation	LNAPL Thickness	Depth to DNAPL	DNAPL Elevation	*Notes*
	5/7/99	984.61		12.76	971.85				
	5/14/99	984.61		12.80	971.81				
	5/21/99	984.61		10.93	973.68				
	5/27/99	984.61		12.05	972.56				
N2SC-08									
	4/6/99	986.07		12.00	974.07				Not developed
	4/14/99	986.07		12.71	973.36		39.45	946.62	
	4/23/99	986.07		13.04	973.03		41.29	944.78	
	4/29/99	986.07		13.11	972.96		37.35	948.72	
	5/7/99	986.07		13.80	972.27		40.84	945.23	
	5/14/99	986.07		13.75	972.32		40.82	945.25	
	5/21/99	986.07		11.54	974.53		40.67	945.40	
	5/27/99	986.07		12.15	973.92		42.40	943.67	
N2SC-09I									
	4/5/99	987.77		13.67	974.10				Not developed
	4/6/99	987.77		12.67	975.10				Not developed
	4/14/99	987.77		14.42	973.35				
	4/23/99	987.77		14.73	973.04				
	4/29/99	987.77		14.81	972.96				trace NAPL on probe
	5/7/99	987.77		14.49	973.28				
	5/14/99	987.77		14.52	973.25				
	5/21/99	987.77		13.26	974.51				trace NAPL on tip of probe
	5/27/99	987.77		14.84	972.93				
N2SC-09S									
	4/2/99	987.84		11.44	976.40				Not developed, slight sheen
	4/5/99	987.84		12.31	975.53				Not developed, heavy sheen

Table 4-7. (continued)

Boring	Date Measured	Measuring Point Elevation	Depth to LNAPL	Depth to Water	Groundwater Elevation	LNAPL Thickness	Depth to DNAPL	DNAPL Elevation	*Notes*
	4/6/99	987.84		12.53	975.31				
	4/14/99	987.84		13.35	974.49		19.31	968.53	
	4/23/99	987.84		13.90	973.94		18.31	969.53	
	4/29/99	987.84		13.79	974.05		18.30	969.54	
	5/7/99	987.84		13.03	974.81				trace NAPL on probe
	5/14/99	987.84		13.00	974.84				
	5/21/99	987.84		11.16	976.68				
	5/27/99	987.84		11.42	976.42				slight sheen
N2SC-11									
	5/7/99	988.05		13.20	974.85				
	5/14/99	988.05		13.25	974.80				
	5/21/99	988.05		12.75	975.30				
	5/27/99	988.05		12.76	975.29				
N2SC-12									
	5/7/99	987.26		11.55	975.71				rusty water
	5/14/99	987.26		11.57	975.69				
	5/21/99	987.26		11.39	975.87				
	5/27/99	987.26		11.21	976.05				

Table 4-8. NAPL physical properties, Newell Street Area II

Well	Specific Gravity	Interfacial Tension (dyne/cm)	Viscosity (centistokes)
NS-10	0.905	NM	NM
NS-15	1.196	water to oil 9.1 water to oil 13.0 oil to water 10.8 oil to water 11.2	12.3
N2SC-01I	1.185	water to oil 13.3 water to oil 13.4 oil to water 9.1 oil to water 9.2	10.9
N2SC-02	1.174	water to oil 6.9 water to oil 7.5 oil to water 8.4 oil to water 8.4	12.2
N2SC-3S	1.154	water to oil 13.8 water to oil 15.4 oil to water 9.5 oil to water 7.3	14.8
N2SC-3I	1.168	water to oil 6.1 water to oil 6.7 oil to water 9.1 oil to water 9.9	14.4

NM Not Measured

Table 4-9. Summary of NAPL Chemical Analyses, Newell Street Area II

Type	Compound	N2SC-01I (13771):	N2SC-02 (A0257):	N2SC-03I (13773):	N2SC-03S (13772):
VOC					
	Carbon tetrachloride (mg/kg)	ND	ND	ND	ND
	cis-1,2-Dichloroethene (mg/kg)	1100 J	ND	ND	4800
	Methylene chloride (mg/kg)	ND	ND	ND	ND
	Tetrachloroethene (mg/kg)	2800	2100 J	ND	ND
	Toluene (mg/kg)	2700	2400 J	1600 J	1600 J
	Trichloroethene (mg/kg)	56000	66000	62000	69000
	Xylenes (total) (mg/kg)	5500	6900	6300	ND
	Total VOC (mg/kg)	**68100**	**77400**	**69900**	**75400**

Table 4-9. (continued)

Type	Compound	N2SC-01I (13771):	N2SC-02 (A0257):	N2SC-03I (13773):	N2SC-03S (13772):
SVOC					
	1,2,4,5-Tetrachlorobenzene (mg/kg)	970 J	670 J	360 J	250 J
	1,2,4-Trichlorobenzene (mg/kg)	31000	24000	16000	13000
	1,2-Dichlorobenzene (mg/kg)	600 J	470 J	280 J	170 J
	1,4-Dichlorobenzene (mg/kg)	1200 J	1100 J	650 J	140 J
	2-Methylnaphthalene (mg/kg)	110 J	100 J	110 J	110 J
	Acenaphthene (mg/kg)	ND	ND	ND	83 J
	Anthracene (mg/kg)	ND	ND	ND	59 J
	Benzo(a)anthracene (mg/kg)	ND	ND	ND	100 J
	Benzo(a)pyrene (mg/kg)	ND	ND	ND	61 J
	Benzo(b)fluoranthene (mg/kg)	ND	ND	ND	120 J
	Benzo(k)fluoranthene (mg/kg)	ND	ND	ND	60 J
	Chrysene (mg/kg)	ND	ND	ND	97 J
	Dibenzofuran (mg/kg)	ND	ND	ND	53 J
	Fluoranthene (mg/kg)	ND	ND	55 J	320 J
	Fluorene (mg/kg)	ND	ND	ND	87 J
	Naphthalene (mg/kg)	230 J	200 J	260 J	670 J
	Pentachlorobenzene (mg/kg)	260 J	59 J	ND	ND
	Phenanthrene (mg/kg)	ND	ND	79 J	360 J
	Pyrene (mg/kg)	ND	ND	ND	180 J
	Total SVOC (mg/kg)	**34370**	**26599**	**17794**	**15920**
PCB					
	Aroclor 1254 (mg/kg)	290000	320000	300000	290000
	Total PCB (mg/kg)	**290000**	**320000**	**300000**	**290000**

Table 4-9. (continued)

Type	Compound	N2SC-01I (13771):	N2SC-02 (A0257):	N2SC-03I (13773):	N2SC-03S (13772):
Miscellaneous					
	Dieldrin (mg/kg)		ND	ND	ND
	Endosulfan II (mg/kg)	2700	3500	ND	ND
Metals					
	Antimony (mg/kg)	0 B	ND	- B	- B
	Arsenic (mg/kg)	0 B	ND	ND	1
	Barium (mg/kg)	1 B	- B	1 B	1 B
	Chromium (mg/kg)	0 B	- B	- B	1 B
	Copper (mg/kg)	0 B	1 B	2 B	6
	Lead (mg/kg)	1	1	2	6
	Mercury (mg/kg)	0 B	- B	- B	- B
	Nickel (mg/kg)		ND	ND	3 B
	Selenium (mg/kg)		ND	ND	ND
	Silver (mg/kg)		ND	ND	- B
	Tin (mg/kg)	10	2 B	6 B	7 B
	Vanadium (mg/kg)	0 B	ND	- B	1 B
	Zinc (mg/kg)		1 B	ND	2 B

Table 4-9. (continued)

Type	Compound	N2SC-01I (13771):		N2SC-02 (A0257):		N2SC-03I (13773):		N2SC-03S (13772):	
Dioxin									
	1,2,3,4,6,7,8-HpCDD (µg/kg)	210		170		88		66	
	1,2,3,4,6,7,8-HpCDF (µg/kg)	300	E	240	E	290	E	520	E
	1,2,3,4,7,8,9-HpCDF (µg/kg)	220		190		220	E	320	E
	1,2,3,4,7,8-HxCDD (µg/kg)	50		35		16		15	
	1,2,3,4,7,8-HxCDF (µg/kg)	840	D	840	E	1000	E	1200	D
	1,2,3,6,7,8-HxCDD (µg/kg)	210		150		50		6.9	
	1,2,3,6,7,8-HxCDF (µg/kg)	340	E	250	E	340	E	520	E
	1,2,3,7,8,9-HxCDD (µg/kg)	100		72		29		8.3	
	1,2,3,7,8,9-HxCDF (µg/kg)	290	E	210	E	210	E	240	E
	1,2,3,7,8-PeCDD (µg/kg)	48		38		19	a	7.4	
	1,2,3,7,8-PeCDF (µg/kg)	51		37		55		68	
	2,3,4,6,7,8-HxCDF (µg/kg)	240	E	180		200	E	350	E
	2,3,4,7,8-PeCDF (µg/kg)	160		120		110		140	
	2,3,7,8-TCDD (µg/kg)	7.5		3.8		1	a	ND	
	2,3,7,8-TCDF (µg/kg)	140	E	100	E	69		67	
	HpCDDs (total) (µg/kg)	490		390		190		130	
	HpCDFs (total) (µg/kg)	950		770		920		1600	
	HxCDDs (total) (µg/kg)	1900		1300		490		110	
	HxCDFs (total) (µg/kg)	2800		2400		3100		4500	
	OCDD (µg/kg)	230		180		180		400	
	OCDF (µg/kg)	230		200		220		340	
	PeCDDs (total) (µg/kg)	260		310		77	a	15	
	PeCDFs (total) (µg/kg)	970		780		810		670	
	TCDDs (total) (µg/kg)	82		120		31	a	7.7	
	TCDFs (total) (µg/kg)	310		260		200		230	

Table 4-9. (continued)

Type	Compound	N2SC-01I (13771):	N2SC-02 (A0257):	N2SC-03I (13773):	N2SC-03S (13772):

Qualifier

J	*For organics, result is between MDL and RL.*
B	*Result is between MDL and RL*
g	*2, 3, 7, 8, -TCDF results have been confirmed on a DB-225 column.*
E	*Result exceeds calibration range.*
F	*Reported value estimated due to an interference.*
a	*See narrative.*
s	*Result detected is below the lowest standard and above zero.*
D	*Compound quantified using a secondary dilution.*
j	*Result is an estimated value that is below the lower calibration limit but above the target detection level.*
ND	*Not detected.*

Table 4-10. Summary of May 25 and 26, 1999 DNAPL pumping test, monitoring well N2SC-08

May 25, 1999

TIME	ELAPSE TIME (MIN)	DNAPL RECOVERED (ML)	WATER RECOVERED (ML)
1012	0		
1015	3	800	0
1016	4	450	100
1026	22	100	705
1046	54	110	620
1215	123	405	1910
1315	183	90	1890
1415	243	0	2060
1515	303	0	1990
1615	363	0	1870

May 26, 1999

TIME	ELAPSE TIME (MIN)	DNAPL RECOVERED (ML)	WATER RECOVERED (ML)
0930	.75	190	3810
1030	60	0	2000
1130	120	0	2000

Table 4-11 Summary of 1999 DNAPL Recovery, Newell Street Area II Site.

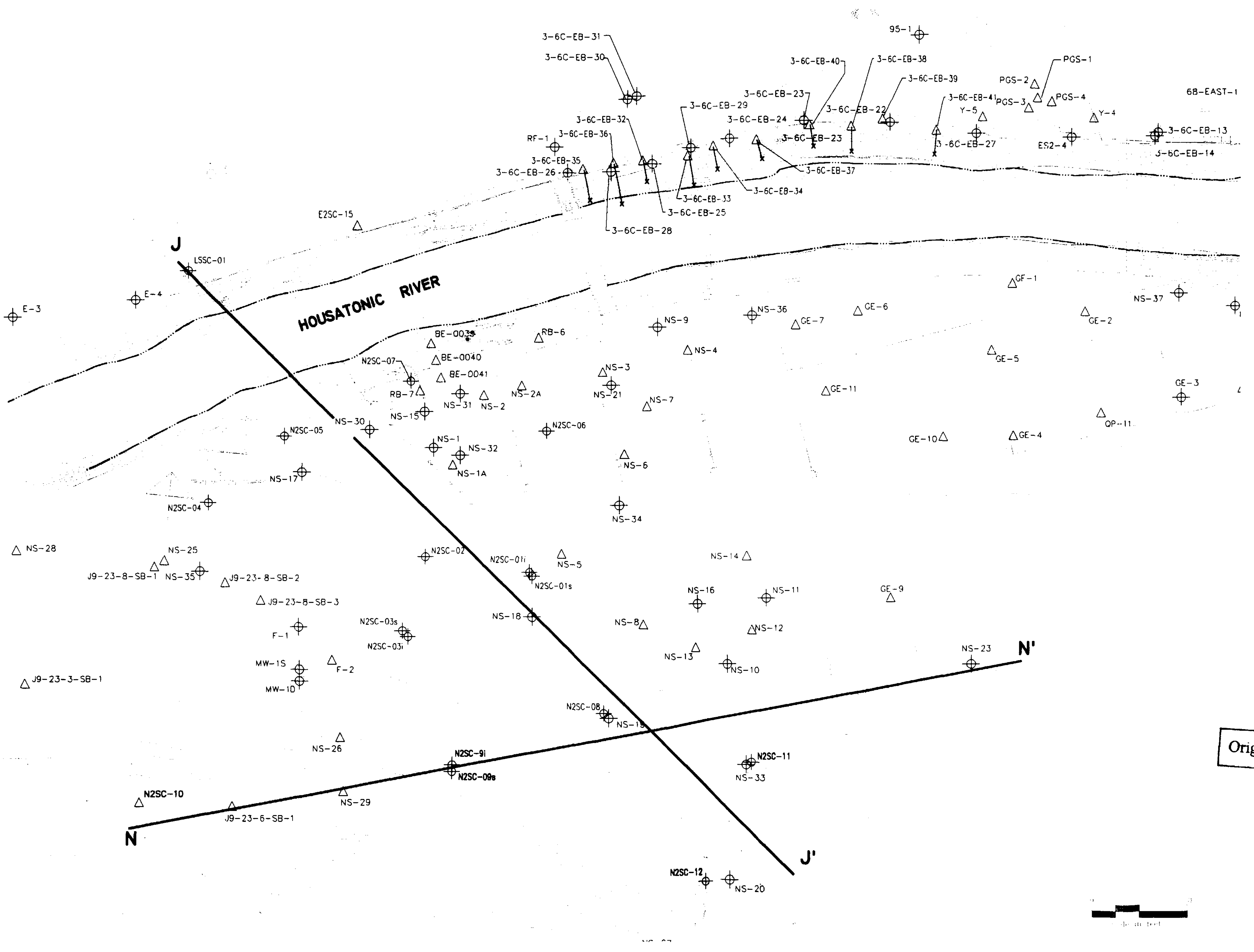
Month	DNAPL Recovery, in Gallons								
Well	NS-15	NS-30	NS-32	N2SC-02	N2SC-03I	N2SC-03S	N2SC-01I	MW-1S	System 1 [1]
Jan	13.93	9.99	11.88	12.80	9.72	0.45	123.4	0.11	
Feb	7.12 [2]	4.46 [2]	5.74 [2]	14.05	5.40	0.5	194.3	0.37	
March	[3]	[3]	[3]	16.75	11.69	0.46	179.36	.09	120
April	[3]	[3]	[3]	16.64	11.72	0.07	217.82	.05	90
May	[3]	[3]	[3]	14.76	10.93	0.0	160.43	0.0	58
Total	21.05	14.45	17.62	75.00	49.46	1.48	875.31	0.62	268

Notes:

[1] System 1 includes wells NS-15, NS-30 and NS-32 System 1 started pumping in March

[2] Wells pumped February 1 through February 12

[3] DNAPL pumpage totaled in System 1



EXPLANATION

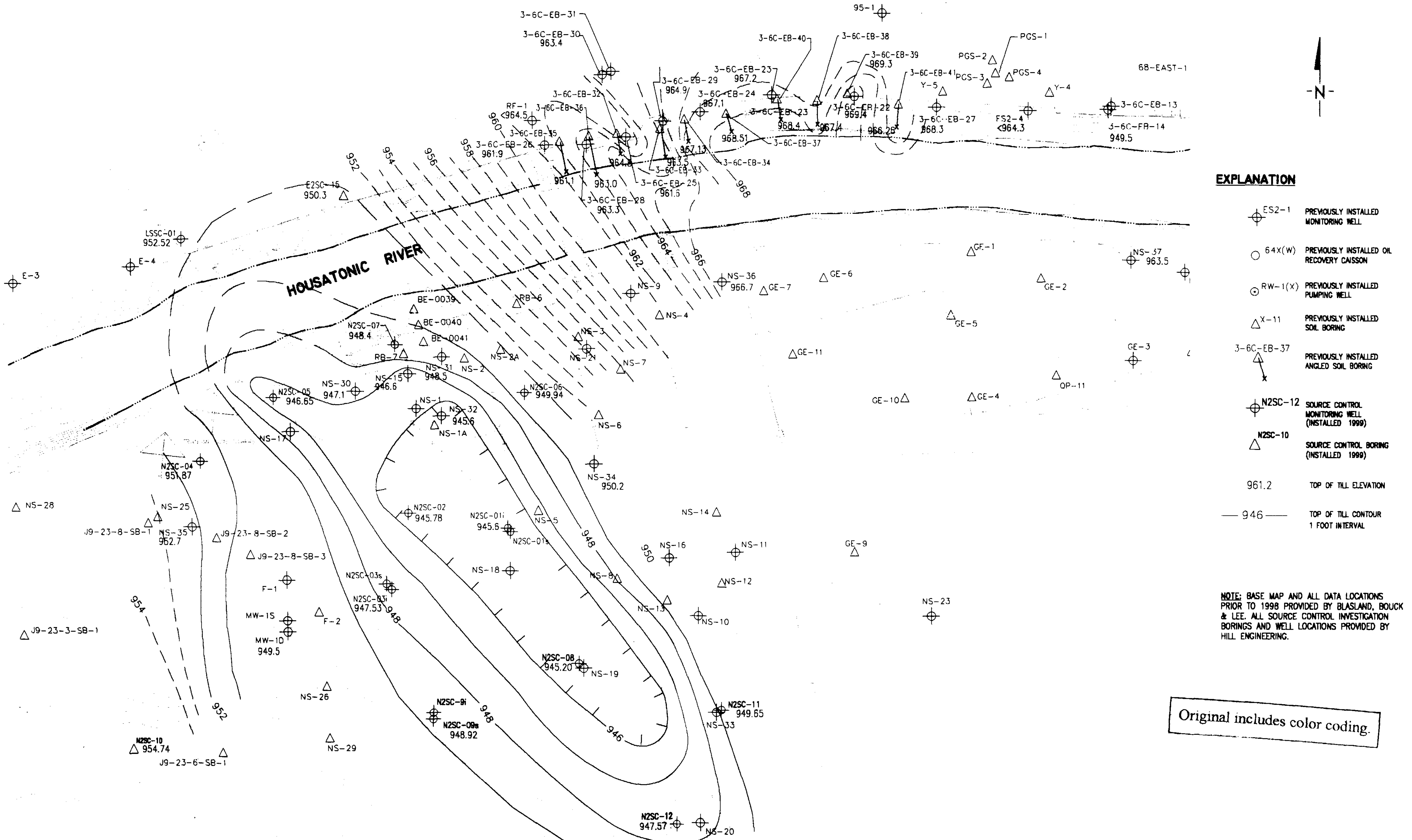
J——J'	SECTION LOCATION
ES2-1	PREVIOUSLY INSTALLED MONITORING WELL
○ 64X(W)	PREVIOUSLY INSTALLED OIL RECOVERY CAISSON
⊙ RW-1(X)	PREVIOUSLY INSTALLED PUMPING WELL
△ X-11	PREVIOUSLY INSTALLED SOIL BORING
3-6C-EB-37	PREVIOUSLY INSTALLED ANGLED SOIL BORING
N2SC-12	SOURCE CONTROL MONITORING WELL (INSTALLED 1999)
△ N2SC-10	SOURCE CONTROL BORING (INSTALLED 1999)

NOTE: BASE MAP AND ALL DATA LOCATIONS PRIOR TO 1998 PROVIDED BY BLASLAND, BOUCK & LEE. ALL SOURCE CONTROL INVESTIGATION BORINGS AND WELL LOCATIONS PROVIDED BY HILL ENGINEERING.

Original includes color coding.

Figure 4-1 Newell Street Area II Monitoring Well & Soil Boring Location Map with Section Lines

HSI GEOTRANS
A TETRA TECH COMPANY
9906newl-sp.dwg

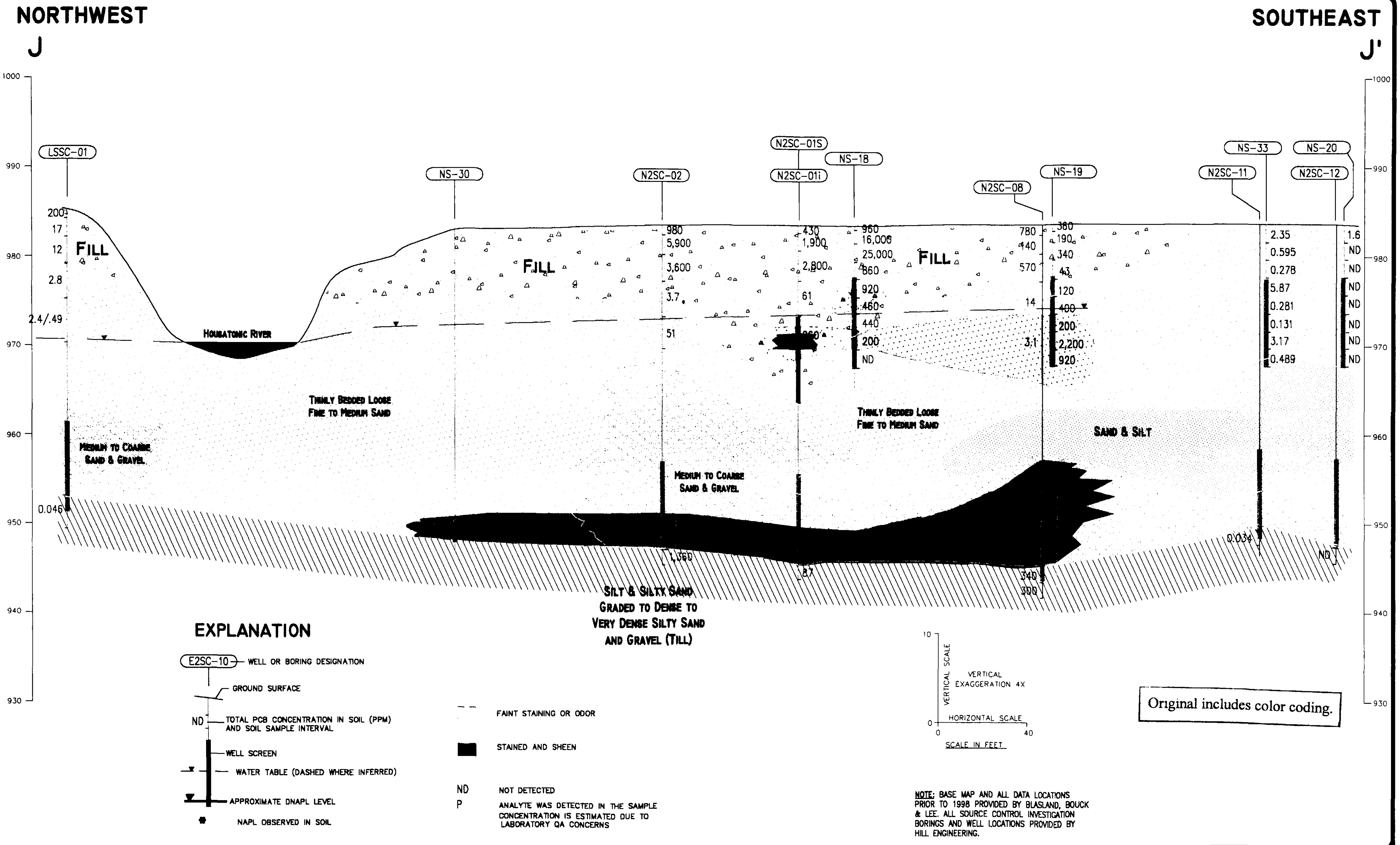


NOTE: BASE MAP AND ALL DATA LOCATIONS PRIOR TO 1998 PROVIDED BY BLASLAND, BOUCK & LEE. ALL SOURCE CONTROL INVESTIGATION BORINGS AND WELL LOCATIONS PROVIDED BY HILL ENGINEERING.

Original includes color coding.

HSI GEOTRANS
A TETRA TECH COMPANY
9906newtill.dwg

Figure 4-2 Newell Street Area II Top of Till Elevation Contour Map

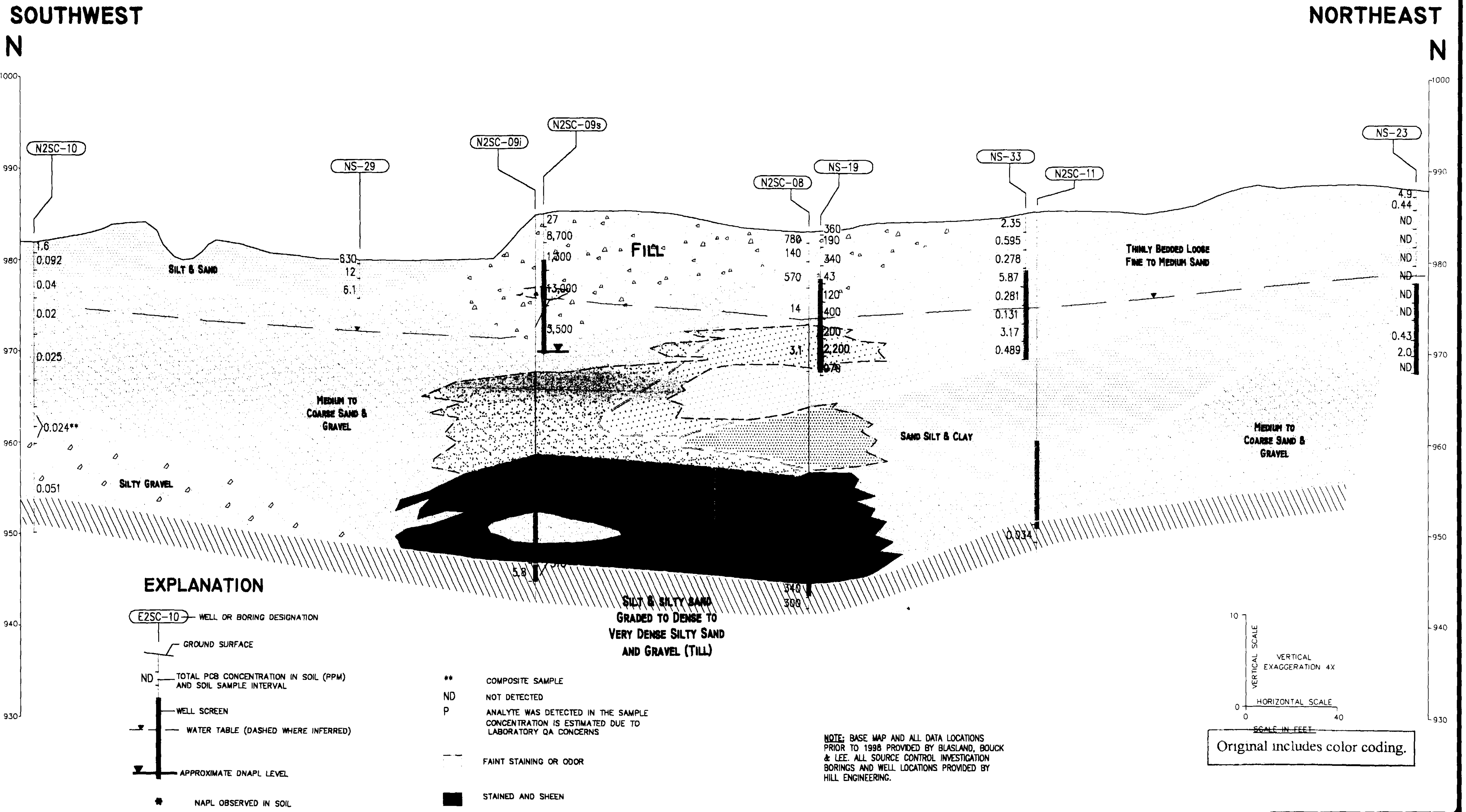


Original includes color coding.

NOTE: BASE MAP AND ALL DATA LOCATIONS PRIOR TO 1998 PROVIDED BY BLASLAND, BOUCK & LEE. ALL SOURCE CONTROL INVESTIGATION BORINGS AND WELL LOCATIONS PROVIDED BY HILL ENGINEERING.

Figure 4-3 Newell Street Area II Cross-Section J–J'

HSI GEOTRANS
A TETRA TECH COMPANY
9906-s-J.dwg

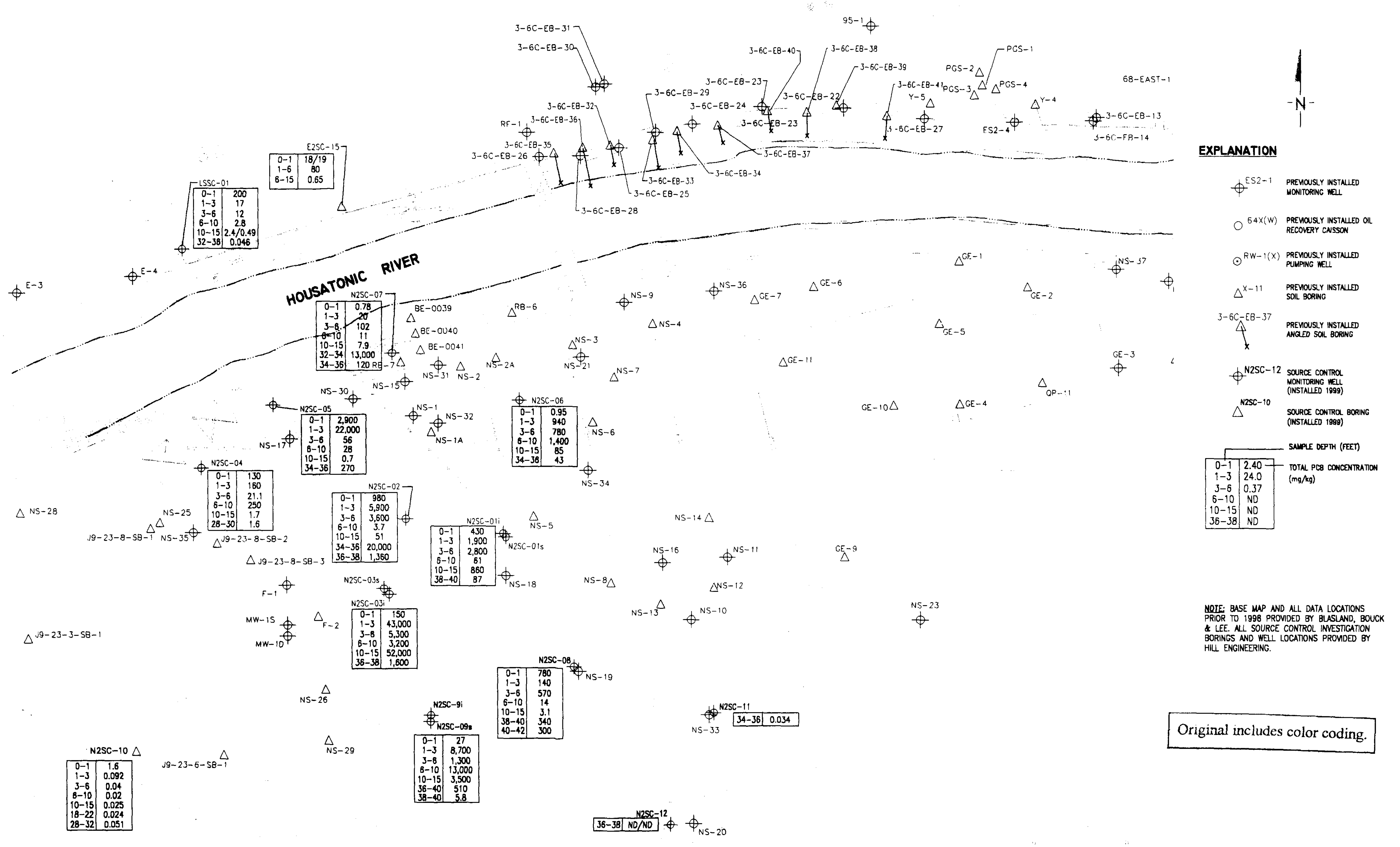


NOTE: BASE MAP AND ALL DATA LOCATIONS PRIOR TO 1998 PROVIDED BY BLASLAND, BOUCK & LEE. ALL SOURCE CONTROL INVESTIGATION BORINGS AND WELL LOCATIONS PROVIDED BY HILL ENGINEERING.

Original includes color coding.

Figure 4-4 Newell Street Area II Section F-F'

HSI GEOTRANS
A TETRA TECH COMPANY
9906-s-N.dwg

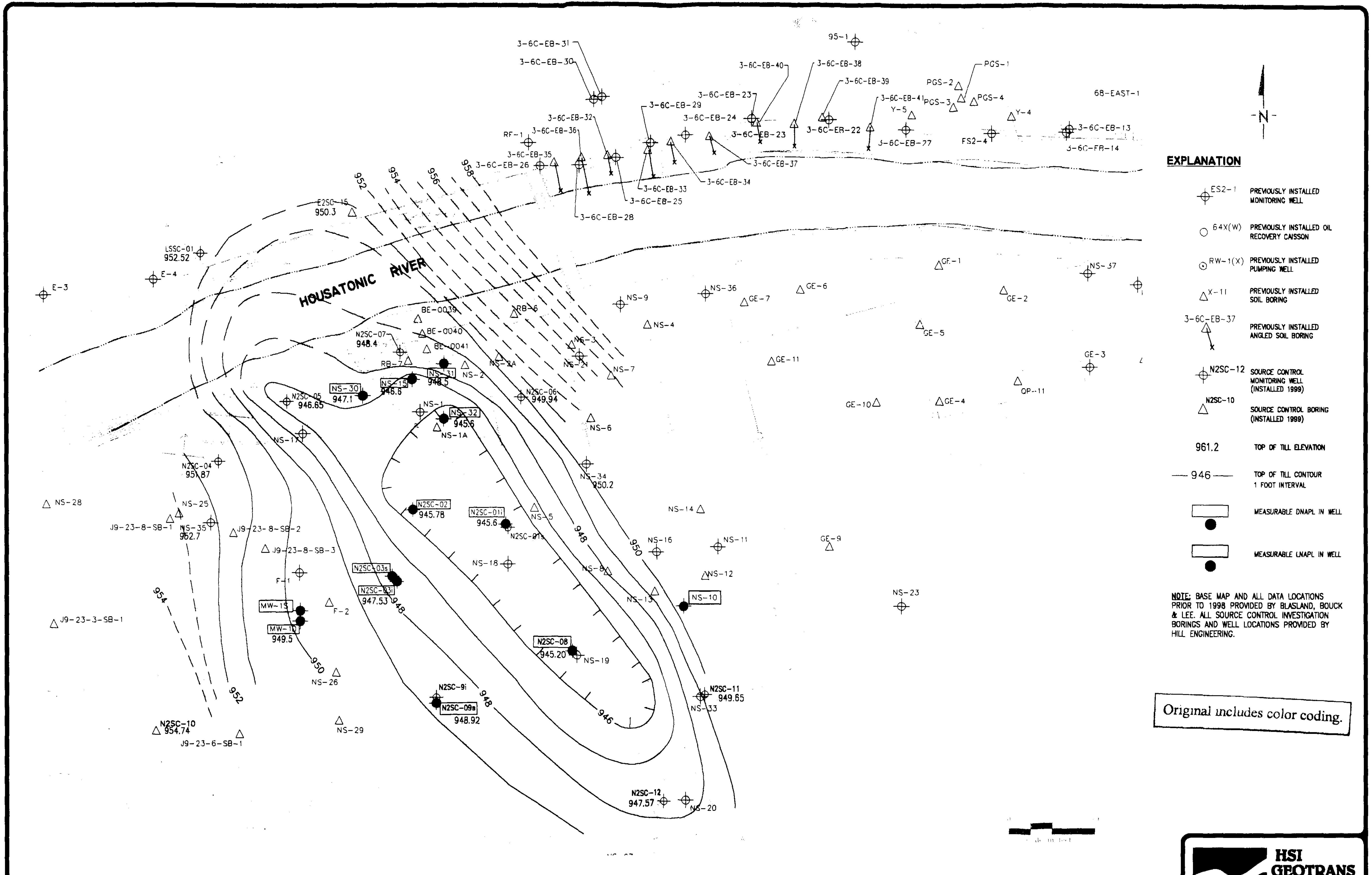


NOTE: BASE MAP AND ALL DATA LOCATIONS PRIOR TO 1998 PROVIDED BY BLASLAND, BOUCK & LEE. ALL SOURCE CONTROL INVESTIGATION BORINGS AND WELL LOCATIONS PROVIDED BY HILL ENGINEERING.

Original includes color coding.

Figure 4-5 Map of Soil Total PCB Concentrations, Newell Street Area II

HSI GEOTRANS
A TETRA TECH COMPANY
9906newlPCB.dwg



Original includes color coding.

Figure 4-6 Extent of DNAPL and LNAPL, Newell Street Area II

5 LYMAN STREET

Borings and monitoring wells installed at and adjacent to the Lyman Street Site in 1998, as part of the source control investigations, identified DNAPL at the 10 Lyman Street property. This property is located to the west of the Lyman Street site across the street from the General Electric parking lot. Six additional monitoring wells were installed at the Lyman Street site and on the adjacent Lyman Street property between March 4, 1999 and April 2, 1999, to further evaluate the extent of DNAPL, refine the interpretation of the till topography and evaluate the potential presence of LNAPL near the ends of the proposed sheet pile wall near the Housatonic River.

5.1 BORING AND MONITORING WELL INSTALLATION

Six additional monitoring wells were installed at five locations at the Lyman Street site and on the adjacent parcel. Three of the locations were selected to further evaluate the extent of the DNAPL previously identified. The locations of the new wells and the previously installed wells are shown on Figure 5-1. Boring logs and well construction diagrams are included in Appendix A. Two wells were installed at the LSSC-16 location on the 10 Lyman Street property adjacent to the Lyman Street Parking Lot. Monitoring well LSSC-16I was drilled west of existing well LSSC-07, as close as possible to the building on the property. This well was installed to evaluate the western extent of the DNAPL. Shallow monitoring well LSSC-16S was installed adjacent to LSSC-16I to collect a groundwater sample from the top of the water table to evaluate the potential for VOCs to be present in the groundwater in this area. Monitoring well LSSC-17 was installed to evaluate the southern extent of the DNAPL found in monitoring well LSSC-07. Monitoring well LSSC-19 was installed to evaluate the northern extent of the DNAPL found in the central portion of the parking lot. Monitoring wells LSSC-8S and LSSC-18 were installed near the western and eastern end, respectively, of the proposed sheet pile wall to determine if LNAPL is present at these locations and to provide for future monitoring following the installation of that wall.

The unconsolidated deposits encountered in the newly installed wells are similar to those previously observed beneath the Lyman Street site. The Lyman Street site is underlain by fill and fluvial deposits overlying a basal till. The fill ranges in thickness from 0 to 20 feet. The underlying fluvial deposits consist of thinly bedded, fine to medium sand with lenses of coarse sand and sandy gravel. The fluvial deposits range in thickness from less than a foot to more than 30 feet. These fluvial deposits overlie a relatively dense silt and silty sand deposit which is interpreted to be till. The till layer has a maximum thickness of at least 41 feet.

Based on the observations from numerous borings, the relatively dense till is continuous beneath the site. Figure 5-2 is a revised contour map of the top of the till elevation based on data from the existing borings/wells and the newly installed wells. It also incorporates data from soil borings recently installed along the base of the river bank in connection with the preliminary design of the proposed containment barrier (GE, 1999). The top of till is highest in the north central portion of the site and slopes to the northeast and southwest. There appears to be a trough in the top of till surface that begins near borings LS-8 and SB-7 and slopes southwesterly towards monitoring well LS-45. Figure 5-3 (cross section F-F^1) illustrates the stratigraphy beneath the site. The presence of NAPL, staining, and sheens in the borings and wells is depicted on the cross-section. It should be noted that soil zones which contain staining and/or sheens do not necessarily indicate the presence of separate phase NAPL.

5.2 RESULTS OF CHEMICAL ANALYSES

As described in section 2 of this report, samples of the subsurface soil were collected for PCB and for VOC and/or Appendix IX+3 analyses. Table 5-1 lists the samples collected at the Lyman Street site and the analyses performed on each sample.

The areal distribution of soil PCB concentrations based on the 1998 and 1999 Source Control borings and monitoring wells is shown on Figure 5-4. The soil PCB concentration data are shown in section view on Figure 5-3. The concentrations of detected analytes are summarized in Tables 5-2 through 5-6.

A groundwater sample was collected, by the low-flow method, from monitoring well LSSC-16S. The sample was analyzed for the Appendix IX+3 constituents. The sample contained Aroclor 1254 at a concentration of .0012 mg/l. The only VOC detected was acetone at a concentration of .0046 mg/l. No SVOCs were detected in the sample. One Dioxin compound (1,2,3,4,6,7,8,9-Octachlorodibenzo [1,4] dioxin) was detected in the sample at a concentration of 0.000012 μg/l. The concentrations of detected analytes in the groundwater sample from LSSC-16S are summarized in Table 5-7.

5.3 EXTENT OF NAPL

LNAPL at the site is currently subject to ongoing remediation by three groundwater/NAPL recovery systems. Since well development was completed, water level and NAPL measurements have been collected approximately weekly from the wells installed at the site in 1998 and 1999. Table 4-8 summarizes these measurements. In addition, GE regularly monitors 37 other wells at the site as part of ongoing monitoring activities. These data have been previously reported in monthly reports for the site and the annual Short-Term Measure Effectiveness Report (Golder Associates, 1998). Based on these combined data, the following evaluation of the extent of NAPL at the site has been made.

With the exception of one suspect measurement (of the twelve made) in well LSSC-17, LNAPL was not observed in any of the six new wells recently drilled. On March 24, 1999, an apparent LNAPL thickness of 0.01 feet was detected in monitoring well LSSC-17 using an oil/water interface probe. It is unlikely that this reading actually represents the presence of LNAPL at this location since the screen in this well does not cross the water table and there were no indications, neither visual or analytical, of LNAPL in the soil samples collected from the boring. Based on the 1998 and 1999 monitoring performed at this site, the extent of LNAPL is shown on Figure 5-5. It is noted that the LNAPL generally occurs within the limits of the former oxbow D. The western extent of the LNAPL is conservatively shown to include well LS-38, which is monitored weekly and only detected very small quantities of LNAPL (.01 feet) on two occasions in 1998 and once in 1999. These were the only occasions that LNAPL was detected in this well since monitoring was initiated in late 1995. Available data indicate that LNAPL does not extend west of Lyman Street. In addition to the one suspect indication of LNAPL in monitoring well LSSC-17 discussed above, a suspect measurement was also obtained in well LSSC-07 on May 7, 1999. Although 0.01 feet of LNAPL was apparently detected with the oil/water interface probe, well LSSC-07 is screened too deep to allow LNAPL to enter the well. Furthermore, no indication of LNAPL was observed in the soil samples collected near the water table from the boring. DNAPL is currently being monitored and removed from this well on a weekly basis. It is likely that the one apparent LNAPL measurement in this well was actually a small amount of DNAPL held on the water surface by surface tension. The DNAPL may have came off of an oil/water interface probe or a bailer as it was being removed from the well.

The extent of the DNAPL at the site, based on the monitoring conducted in 1998 and 1999, is shown on Figure 5-6. A measurable thickness of DNAPL was observed in one of the six newly installed monitoring wells, LSSC-16I. This monitoring well is located west of Lyman Street directly adjacent to the building on the property at 10 Lyman Street and approximately 30 feet west of monitoring well LSSC-07 where DNAPL was previously observed. The presence of DNAPL in monitoring wells LSSC-07 and LSSC-16I appears related to a trough in the till surface. DNAPL has not been observed in monitoring wells LS-43, LS-44 and LS-45 which are located in the trough downslope from wells LSSC-07 and LSSC-16I, nor in newly installed monitoring well LSSC-17 located approximately 40 feet southeast of well LSSC-07. No DNAPL has been observed in monitoring well LSSC-19 located approximately 120 feet north of well LS-12. Based on these observations, DNAPL is found primarily in an L-shaped area which extends eastward from well LSSC-16I to well LS-31, and then southward to the vicinity of well RW-1. The western limit of the DNAPL, based on the available data, is located between monitoring wells LSSC-16I and LS-45. It should be noted that a small amount of DNAPL was recently detected in LS-38.

Although measurements indicate an approximate DNAPL thickness of 0.25 feet, well pumping indicated that the material consisted primarily of silt, settled to the well bottom, which contained a small amount of DNAPL. In this area the till confining layer slopes northwest towards the trough where monitoring well LSSC-16I and LSSC-17 are located.

5.4 NAPL PROPERTIES

In accordance with the EPA March 17, 1999 conditional approval letter, several samples of LNAPL and DNAPL have been collected for analysis of physical and chemical properties from wells at the Lyman Street site during the ongoing investigations of the site. Additionally, physical and chemical NAPL properties have been previously reported in the Additional Hydrogeologic Assessment and Short-Term Measure Evaluation and Proposal, Lyman Street Parking Lot (Oxbow Area D) (Golder, 1992), MCP Phase I Report for Lyman Street Parking Lot (Oxbow Area D) and Current Assessment Summary for USEPA Area 5A (BBL, 1994), the Addendum to MCP Supplemental Phase II/RCRA Facility Investigation Proposal for Lyman Street/USEPA Area 5A Site (BBL,1997) and in the Source Control Investigation Report (HSI GeoTrans, 1999). Additional samples of DNAPL were collected from monitoring wells LSSC-07 and LSSC-16I for the determination of physical properties during this investigation. The measurements of the physical properties were made by the methods described in section 4.5.

The specific gravity and viscosity of LNAPL samples collected from monitoring wells LS-2 and LS-21 were measured in 1991. The specific gravity ranged from 0.92 to 0.93 g/ml and the viscosity ranged from 65 to 67 centistokes (Golder, 1992) (see Table 5-9). A composite LNAPL sample was collected from wells LS-4, LS-23 and RW-1 for chemical analysis in April 1992. The sample was analyzed for the Appendix IX +3 constituents. The results of the analysis, which are shown in Table 12-1 of Appendix B, indicate that the sample contained 2.7% Aroclor 1254, 4.2 % total SVOC and 0.11% total VOC. In addition, metals, dioxins and dibenzofurans were detected. The SVOCs detected included PAHs, chlorinated benzenes and phtalates. The VOCs detected included chlorinated and nonchlorinated compounds (BBL, 1997). LNAPL samples collected from recovery wells RW-1(R) and RW-3 in January 1999 were analyzed for total petroleum hydrocarbons (TPH). These analyses indicated that the LNAPL is made up of approximately 66% petroleum hydrocarbons (BBL, 1999). The results of the analyses are summarized in Table 1 in Appendix B.

Several DNAPL samples have been collected for physical property and chemical analyses. The physical properties of the DNAPL are summarized in Table 5-9. The specific gravity of DNAPL samples collected from wells LS-4, LS-12 and RW-1 ranged from 1.076 to 1.165. Viscosity of the samples ranged from 32.95 to 44.35 centistokes (Golder, 1992). DNAPL samples from monitoring wells LSSC-07 and LSSC-16I were collected for physical property analyses in January and April 1999. The specific gravities of these samples were 1.073 and 1.078, respectively. The viscosities of the samples were 8.6 and 13.6 centistokes. Interfacial tension was also determined for these samples. The water to oil interfacial tension ranged from 5.4 to 9.9 dynes/cm, the oil to water interfacial tension ranged from 6.4 to 11.4 dynes/cm. Interfacial tension measurements are also summarized in Table 5-9.

Chemical analyses of DNAPL samples from the Lyman Street site indicate that the DNAPL samples contained Aroclor 1254 ranging from 9.8% to 66%, total SVOCs ranging from 0.4% to 15%, and VOCs from .02% to 11%. In addition, metals, dioxins and dibenzofurans were detected in the samples. The results of the DNAPL chemical analyses from previous reports are summarized in Appendix B. Table 5-10 summarizes the result of the chemical analyses of the DNAPL sample from monitoring well LSSC-07.

The results of the NAPL analyses indicate that although the LNAPL and DNAPL occur as separate plumes with distinct chemical and physical properties, there is some spatial overlap in their distribution and some mixing may have occurred. The principal difference between the DNAPL and LNAPL is the percentage of petroleum hydrocarbons and PCBs. The high percentage of petroleum hydrocarbons and the lower amount of PCBs in the LNAPL, compared to the DNAPL, cause its specific gravity to be less than that of water.

Other organic compounds such as SVOCs and VOCs are present in both the DNAPL and LNAPL. The only PCB detected in the NAPL samples from Lyman Street was Aroclor 1254. Observations of staining and sheens in the soil samples collected from borings and wells indicate that in some areas of the Lyman Street site, such as the area of LS-30 and LS-31 (shown in Figure 5-3) there is a continuous zone of stains and sheens between areas of LNAPL and DNAPL. This indicates that there has likely been some mixing of the LNAPL and DNAPL constituents.

Table 5-1. Lyman Street Site Soil Samples Collected and Analyses Performed

Location	Sample Depth	Sample Name	Type
LSSC-16			
	0-1	CS01	PCB
	1-3	CS0103	PCB
	3-6	CS0306	PCB
	6-10	CS0610	PCB
	10-15	CS1015	Dioxin/Dibenzofuran
	10-15	CS1015	Metals
	10-15	CS1015	PCB
	10-15	CS1015	SVOC
	10-15	CS1015	VOC
	25-27	CS2527	VOC
	25-27	CS2527	SVOC
	25-27	CS2527	PCB
	25-27	CS2527	Metals
	25-27	CS2527	Dioxin/Dibenzofuran
	27-29	CS2729	PCB
	12-14	SS08	VOC
LSSC-17			
	0-1	CS01	PCB
	1-3	CS0103	PCB
	3-6	CS0306	PCB
	6-10	CS0610	PCB
	10-15	CS1015	Dioxin/Dibenzofuran
	10-15	CS1015	Metals
	10-15	CS1015	PCB
	10-15	CS1015	SVOC
	10-15	CS1015	VOC
	23-25	CS2325	PCB
	23-25	CS2325	SVOC
	23-25	CS2325	VOC
	23-25	CS2325	Dioxin/Dibenzofuran
	23-25	CS2325	Metals
	25-27	CS25227	PCB
	10-12	SS07	VOC
	23-25	SS14	VOC

Table 5-1. (continued)

Location	Sample Depth	Sample Name	Type
LSSC-18			
	0-1	CS01	PCB
	1-3	CS0103	PCB
	3-6	CS0306	PCB
	6-10	CS0610	PCB
	10-15	CS1015	SVOC
	10-15	CS1015	PCB
	10-15	CS1015	Metals
	10-15	CS1015	Dioxin/Dibenzofuran
	12-14	SS08	VOC
LSSC-19			
	0-1	CS01	PCB
	1-3	CS0103	PCB
	3-6	CS0306	PCB
	6-10	CS0610	PCB
	10-15	CS1015	Dioxin/Dibenzofuran
	10-15	CS1015	Metals
	10-15	CS1015	PCB
	10-15	CS1015	SVOC
	20-22	CS2022	PCB
	10-12	SS07	VOC

Table 5-2. Soil PCB Concentrations, Lyman Street Site

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
LSSC-16							
	CS01	0-1					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	0.43			mg/kg
			Aroclor 1260	0.57			mg/kg
			Total PCBs	**1**			
	CS0103	1-3					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	0.3			mg/kg
			Aroclor 1260	0.36			mg/kg
			Total PCBs	**0.66**			
	CS0306	3-6					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	ND			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**0**			

Table 5-2. (continued)

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
	CS0610	6-10					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	ND			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**0**			
	CS0610 DUP	6-10					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	ND			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**0**			
	CS1015	10-15					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	ND			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**0**			
	CS2527	25-27					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	2900			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**2900**			

Table 5-2. (continued)

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
	CS2729	27-29					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	1.9			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**1.9**			
LSSC-17							
	CS01	0-1					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	0.44			mg/kg
			Aroclor 1260	0.48			mg/kg
			Total PCBs	**0.92**			
	CS0103	1-3					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	43			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**43**			
	CS0306	3-6					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	8.6			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**8.6**			

Table 5-2. (continued)

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
	CS0610	6-10					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	2.3			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**2.3**			
	CS1015	10-15					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	0.49			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**0.49**			
	CS2325	23-25					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	220			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**220**			
	CS25227	25-27					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	4.3			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**4.3**			

Table 5-2. (continued)

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
LSSC-18							
	CS01	0-1					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	0.24			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**0.24**			
	CS0103	1-3					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	7.3			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**7.3**			
	CS0306	3-6					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	0.53			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**0.53**			
	CS0610	6-10					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	0.14			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**0.14**			

Table 5-2. (continued)

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
	CS1015	10-15					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	0.2			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**0.2**			
LSSC-19							
	CS01	0-1					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	0.43			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**0.43**			
	CS0103	1-3					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	16000			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**16000**			
	CS0306	3-6					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	1600			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**1600**			

Table 5-2. (continued)

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
	CS0610	6-10					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	270			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**270**			
	CS1015	10-15					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	810			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**810**			
	CS1015DUP	10-15					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	600			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**600**			
	CS2022	20-22					
			Aroclor 1016	ND			mg/kg
			Aroclor 1221	ND			mg/kg
			Aroclor 1232	ND			mg/kg
			Aroclor 1242	ND			mg/kg
			Aroclor 1248	ND			mg/kg
			Aroclor 1254	0.18			mg/kg
			Aroclor 1260	ND			mg/kg
			Total PCBs	**0.18**			

Table 5-2. (continued)

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units

Qualifier

ND	*Not Detected*
J	*Result is between MDL and RL.*

Table 5-3. Detected Soil VOC Concentrations, Lyman Street Site

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
LSSC-16							
	CS1015	10-15					
			Acetone	0.0075	J		mg/kg
	CS2527	25-27					
			Carbon tetrachloride	0.057			mg/kg
			Ethylbenzene	0.0021	J		mg/kg
			Tetrachloroethene	0.0042	J		mg/kg
			Trichloroethene	0.006			mg/kg
			Xylenes (total)	0.077			mg/kg
LSSC-19							
	SS07	10-12					
			Tetrachloroethene	0.013			mg/kg
			Trichloroethene	0.19			mg/kg

Qualifier

J	*Result is between MDL and RL.*
E	*Result exceeds calibration range.*

Table 5-4. Detected Soil SVOC Concentrations, Lyman Street Site

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
LSSC-16							
	CS2527	25-27					
			1,2,4-Trichlorobenzene	150			mg/kg
LSSC-17							
	CS1015	10-15					
			Benzo(a)pyrene	0.39	J		mg/kg
	CS1015 DUP	10-15					
			Benzo(a)pyrene	0.44	J		mg/kg
	CS2325	23-25					
			1,2,4-Trichlorobenzene	8.6			mg/kg

Qualifier

J	*Result is between MDL and RL.*
E	*Result exceeds calibration range.*

Table 5-5. Detected Soil Metals Concentrations, Lyman Street Site

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
LSSC-16							
	CS1015	10-15					
			Arsenic	2			mg/kg
			Barium	11.1	B		mg/kg
			Beryllium	0.14	B		mg/kg
			Cadmium	0.077	B		mg/kg
			Chromium	7.4			mg/kg
			Cobalt	6.1			mg/kg
			Copper	6.9			mg/kg
			Lead	4.5			mg/kg
			Nickel	9.8			mg/kg
			Selenium	0.41	B		mg/kg
			Thallium	0.84	B		mg/kg
			Tin	3.4	B		mg/kg
			Vanadium	5.9	B		mg/kg
			Zinc	34.6			mg/kg
	CS1015 DUP	10-15					
			Antimony	0.19			mg/kg
			Arsenic	2.9			mg/kg
			Barium	11.1			mg/kg
			Beryllium	0.2			mg/kg
			Cadmium	0.043			mg/kg
			Chromium	8			mg/kg
			Cobalt	8.3			mg/kg
			Copper	17.5			mg/kg
			Lead	6.7			mg/kg
			Nickel	21.1			mg/kg
			Selenium	0.43			mg/kg
			Vanadium	8			mg/kg
			Zinc	51.6			mg/kg
	CS2527	25-27					
			Arsenic	8.1			mg/kg
			Barium	17.7	B		mg/kg
			Beryllium	0.13	B		mg/kg
			Cadmium	0.48	B		mg/kg
			Chromium	12.2			mg/kg

Table 5-5. (continued)

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
			Cobalt	15.3			mg/kg
			Copper	34			mg/kg
			Lead	14.2			mg/kg
			Mercury	0.031	B		mg/kg
			Nickel	22.6			mg/kg
			Thallium	0.58	B		mg/kg
			Vanadium	9.4			mg/kg
			Zinc	69.5			mg/kg
LSSC-17							
	CS1015	10-15					
			Arsenic	2.2			mg/kg
			Barium	28.9			mg/kg
			Beryllium	0.25	B		mg/kg
			Cadmium	0.17	B		mg/kg
			Chromium	9.3			mg/kg
			Cobalt	7.3			mg/kg
			Copper	10.1			mg/kg
			Lead	7.7			mg/kg
			Mercury	0.016	B		mg/kg
			Nickel	12.3			mg/kg
			Selenium	0.33	B		mg/kg
			Thallium	0.74	B		mg/kg
			Vanadium	8.1			mg/kg
			Zinc	47.7			mg/kg
	CS1015 DUP	10-15					
			Antimony	0.18			mg/kg
			Arsenic	1.9			mg/kg
			Arsenic	2.3			mg/kg
			Barium	31.5			mg/kg
			Barium	25.5			mg/kg
			Beryllium	0.24			mg/kg
			Beryllium	0.27	B		mg/kg
			Cadmium	0.18	B		mg/kg
			Cadmium	0.13			mg/kg
			Chromium	8.2			mg/kg
			Chromium	8.2			mg/kg
			Cobalt	7.8			mg/kg
			Cobalt	7			mg/kg

Table 5-5. (continued)

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
			Copper	10.6			mg/kg
			Copper	9			mg/kg
			Lead	4.8			mg/kg
			Lead	4.5			mg/kg
			Mercury	0.015	B		mg/kg
			Nickel	11.3			mg/kg
			Nickel	13.7			mg/kg
			Thallium	0.87	B		mg/kg
			Tin	5.9			mg/kg
			Vanadium	8.2			mg/kg
			Vanadium	8.2			mg/kg
			Zinc	44.2			mg/kg
			Zinc	47.2			mg/kg
	CS2325	23-25					
			Arsenic	7.1			mg/kg
			Barium	13	B		mg/kg
			Beryllium	0.11	B		mg/kg
			Cadmium	0.41	B		mg/kg
			Chromium	10.3			mg/kg
			Cobalt	11.6			mg/kg
			Copper	23.6			mg/kg
			Lead	8.5			mg/kg
			Nickel	19.1			mg/kg
			Silver	0.084	B		mg/kg
			Vanadium	6.9			mg/kg
			Zinc	50.9			mg/kg
LSSC-18							
	CS1015	10-15					
			Aluminum	6600			mg/kg
			Arsenic	25.4			mg/kg
			Barium	88.3			mg/kg
			Calcium, Total	5940			mg/kg
			Chromium	18.6			mg/kg
			Copper	72.5			mg/kg
			Iron	25600			mg/kg
			Magnesium	3590			mg/kg
			Manganese	245			mg/kg
			Mercury	0.17	!		mg/kg

Table 5-5. (continued)

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
			Nickel	17.3			mg/kg
			Potassium, Total	841	!		mg/kg
			Sulfide	298			mg/kg
			Vanadium	20			mg/kg
			Zinc	42.1			mg/kg
LSSC-19							
	CS1015	10-15					
			Aluminum	8750			mg/kg
			Arsenic	3.4			mg/kg
			Barium	4.3			mg/kg
			Calcium, Total	1510			mg/kg
			Chromium	9.9			mg/kg
			Copper	28.2			mg/kg
			Iron	21000			mg/kg
			Magnesium	4260			mg/kg
			Manganese	540			mg/kg
			Nickel	18.5			mg/kg
			Potassium, Total	136	!		mg/kg
			Sulfide	144			mg/kg
			Zinc	74.3			mg/kg

Qualifier

B	*Result is between MDL and RL*
!	*Result is between MDL and LOQ*

Table 5-6. Detected Soil Dioxin and Dibenzofuran Concentrations, Lyman Street Site

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
LSSC-16							
	CS1015	10-15					
			1,2,3,4,6,7,8-HpCDD	0.01841	J		µg/kg
			1,2,3,4,6,7,8-HpCDF	0.01017	J		µg/kg
			OCDD	0.12572			µg/kg
			OCDF	0.01525	J		µg/kg
			TOTAL HpCDD	0.03083			µg/kg
			TOTAL HpCDF	0.01585	J		µg/kg
	CS2527	25-27					
			1,2,3,4,6,7,8-HpCDD	2.13501	E		µg/kg
			1,2,3,4,6,7,8-HpCDF	2.56241	E		µg/kg
			1,2,3,4,7,8,9-HpCDF	1.57278			µg/kg
			1,2,3,4,7,8-HxCDD	0.10386			µg/kg
			1,2,3,4,7,8-HxCDF	4.26784	E		µg/kg
			1,2,3,6,7,8-HxCDD	0.08888			µg/kg
			1,2,3,6,7,8-HxCDF	1.72669			µg/kg
			1,2,3,7,8,9-HxCDD	0.08315			µg/kg
			1,2,3,7,8-PeCDD	0.04061			µg/kg
			1,2,3,7,8-PeCDF	0.1878			µg/kg
			2,3,4,6,7,8-HxCDF	0.17033			µg/kg
			2,3,4,7,8-PeCDF	0.68308			µg/kg
			2,3,7,8-TCDF	0.44785	E		µg/kg
			OCDD	16.496	E		µg/kg
			OCDF	7.07344			µg/kg
			TOTAL HpCDD	3.667	E		µg/kg
			TOTAL HpCDF	7.62763	E		µg/kg
			TOTAL HxCDD	2.13289	E		µg/kg
			TOTAL HxCDF	13.2839	E		µg/kg
			TOTAL PeCDD	0.32742			µg/kg
			TOTAL PeCDF	6.76195	E		µg/kg
			TOTAL TCDD	0.39254			µg/kg
			TOTAL TCDF	2.65886	E		µg/kg
LSSC-17							
	CS1015	10-15					
			OCDD	0.00598	J		µg/kg
	CS1015 DUP	10-15					
			1,2,3,4,6,7,8-HpCDD	0.00294	J		µg/kg

Table 5-6. (continued)

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
			OCDD	0.01599	J		µg/kg
			OCDF	0.00384	J		µg/kg
			TOTAL HpCDD	0.00678	J		µg/kg
	CS2325	23-25					
			1,2,3,4,6,7,8-HpCDD	0.38188			µg/kg
			1,2,3,4,6,7,8-HpCDF	0.36497			µg/kg
			1,2,3,4,7,8,9-HpCDF	0.25533			µg/kg
			1,2,3,4,7,8-HxCDD	0.01747			µg/kg
			1,2,3,4,7,8-HxCDF	0.50795			µg/kg
			1,2,3,6,7,8-HxCDD	0.01527			µg/kg
			1,2,3,6,7,8-HxCDF	0.18806			µg/kg
			1,2,3,7,8,9-HxCDD	0.01590			µg/kg
			1,2,3,7,8,9-HxCDF	0.01459			µg/kg
			1,2,3,7,8-PeCDD	0.00808			µg/kg
			1,2,3,7,8-PeCDF	0.01700			µg/kg
			2,3,4,6,7,8-HxCDF	0.02659			µg/kg
			2,3,4,7,8-PeCDF	0.08416			µg/kg
			2,3,7,8-TCDF	0.04121			µg/kg
			OCDD	2.88819			µg/kg
			OCDF	1.17960			µg/kg
			TOTAL HpCDD	0.63770			µg/kg
			TOTAL HpCDF	1.14921			µg/kg
			TOTAL HxCDD	0.24762			µg/kg
			TOTAL HxCDF	1.40507			µg/kg
			TOTAL PeCDD	0.04813			µg/kg
			TOTAL PeCDF	0.68267			µg/kg
			TOTAL TCDD	0.07216			µg/kg
			TOTAL TCDF	0.17943			µg/kg
LSSC-18							
	CS1015	10-15					
			2,3,7,8-TCDF	0.00434			µg/kg
			TOTAL TCDF	0.00715			µg/kg
LSSC-19							
	CS1015	10-15					
			1,2,3,4,6,7,8-HpCDD	0.04162			µg/kg
			1,2,3,4,6,7,8-HpCDF	0.54708			µg/kg
			1,2,3,4,7,8,9-HpCDF	0.43004			µg/kg
			1,2,3,4,7,8-HxCDD	0.00706	J		µg/kg

Table 5-6. (continued)

Location	Sample Name	Sample Depth (feet)	Compound	Result	Qualifier	Modifier	Units
			1,2,3,4,7,8-HxCDF	1.35815			µg/kg
			1,2,3,6,7,8-HxCDD	0.01327			µg/kg
			1,2,3,6,7,8-HxCDF	0.50428			µg/kg
			1,2,3,7,8,9-HxCDD	0.01095			µg/kg
			1,2,3,7,8-PeCDF	0.05479			µg/kg
			2,3,4,6,7,8-HxCDF	0.32648			µg/kg
			2,3,4,7,8-PeCDF	0.20862			µg/kg
			2,3,7,8-TCDF	0.06378			µg/kg
			OCDD	0.10117			µg/kg
			OCDF	0.67235			µg/kg
			TOTAL HpCDD	0.11309			µg/kg
			TOTAL HpCDF	1.5546			µg/kg
			TOTAL HxCDD	0.13931			µg/kg
			TOTAL HxCDF	4.07838	E		µg/kg
			TOTAL PeCDD	0.06057			µg/kg
			TOTAL PeCDF	2.43457			µg/kg
			TOTAL TCDD	0.09649			µg/kg
			TOTAL TCDF	0.66038			µg/kg

Qualifier

J	*Result is an estimated value that is below the lower calibration limit but above the target detection level.*
g	*2, 3, 7, 8, -TCDF results have been confirmed on a DB-225 column.*
E	*Result exceeds calibration range.*
F	*Reported value estimated due to an interference.*
a	*See narrative.*
s	*Result detected is below the lowest standard and above zero.*
D	*Compound quantified using a secondary dilution.*

Table 5-7. Groundwater Sample Analyses Summary, Well LSSC-16I

Location	Sample Name	Compound	Result	Qualifier	Units
VOC					
LSSC-16S					
	GW0315				
		Acetone	0.004600	J	mg/L
PCB					
LSSC-16S					
	GW0315				
		Aroclor 1016	ND		mg/L
		Aroclor 1221	ND		mg/L
		Aroclor 1232	ND		mg/L
		Aroclor 1242	ND		mg/L
		Aroclor 1248	ND		mg/L
		Aroclor 1254	0.001200		mg/L
		Aroclor 1260	ND		mg/L
		Total PCBs	**0.001200**		**mg/L**
Metals					
LSSC-16S					
	GW0315				
		Barium	0.029800	B	mg/L
		Chromium	0.000970	B	mg/L
		Copper	0.001400	B	mg/L
		Selenium	0.004100	B	mg/L
		Thallium	0.004200	B	mg/L
		Zinc	0.052800		mg/L
Dioxin					
LSSC-16S					
	GW0315				
		OCDD	0.000012	J	µg/L

Qualifier

B	*For Metals, Result is between MDL and RL*
J	*For Organics, Result is between MDL and RL*
ND	*Not Detected*

Table 5-8. Water Level and NAPL Measurements, Lyman Street Site

Boring	Date Measured	Measuring Point Elevation	Depth to LNAPL	Depth to Water	Groundwater Elevation	LNAPL Thickness	Depth to DNAPL	DNAPL Elevation	*Notes*
LSSC-01									
	1/7/99	986.95		15.81	971.14				
	1/22/99	986.95		14.80	972.15				
	1/29/99	986.95		14.69	972.26				
	2/5/99	986.95		14.17	972.78				
	2/19/99	986.95		14.84	972.11				
	3/11/99	986.95		14.88	972.07				
	3/18/99	986.95		14.73	972.22				
	4/2/99	986.95		13.74	973.21				
	4/6/99	986.95		14.43	972.52				
	4/14/99	986.95		15.12	971.83				
	4/23/99	986.95		15.14	971.81				
	4/30/99	986.95		15.52	971.43				
	5/7/99	986.95		15.10	971.85				
	5/14/99	986.95		15.48	971.47				
	5/27/99	986.95		14.42	972.53				
LSSC-03									
	12/21/98	988.96		17.23	971.73				
	12/28/98	988.96		17.16	971.80				
	1/7/99	988.96		17.25	971.71				
	1/22/99	988.96		16.45	972.51				
	1/29/99	988.96		16.22	972.74				
	2/5/99	988.96		15.82	973.14				
	2/19/99	988.96		16.35	972.61				

Table 5-8. (continued)

Boring	Date Measured	Measuring Point Elevation	Depth to LNAPL	Depth to Water	Groundwater Elevation	LNAPL Thickness	Depth to DNAPL	DNAPL Elevation	*Notes*
	3/5/99	988.96		15.51	973.45				
	3/11/99	988.96		16.31	972.65				
	3/17/99	988.96		16.40	972.56				
	3/24/99	988.96		15.07	973.89				
	4/2/99	988.96		15.39	973.57				
	4/6/99	988.96		15.80	973.16				
	4/14/99	988.96		16.42	972.54				
	4/23/99	988.96		16.52	972.44				
	4/30/99	988.96		16.63	972.33				
	5/7/99	988.96		16.45	972.51				
	5/14/99	988.96		16.68	972.28				
	5/21/99	988.96		15.20	973.76				
	5/27/99	988.96		15.87	973.09				
LSSC-04									
	12/17/98	988.9		17.21	971.69				
	12/21/98	988.9		17.21	971.69				
	12/28/98	988.9		17.15	971.75				
	1/7/99	988.9		17.22	971.68				
	1/22/99	988.9		16.42	972.48				
	1/29/99	988.9		16.20	972.70				
	2/5/99	988.9		15.80	973.10				
	2/19/99	988.9		16.32	972.58				
	3/5/99	988.9		15.47	973.43				
	3/11/99	988.9		16.26	972.64				
	3/17/99	988.9		16.39	972.51				
	3/24/99	988.9		15.05	973.85				

Table 5-8. (continued)

Boring	Date Measured	Measuring Point Elevation	Depth to LNAPL	Depth to Water	Groundwater Elevation	LNAPL Thickness	Depth to DNAPL	DNAPL Elevation	*Notes*
	4/2/99	988.9		15.35	973.55				
	4/6/99	988.9		15.79	973.11				
	4/14/99	988.9		16.40	972.50				
	4/23/99	988.9		16.52	972.38				
	4/30/99	988.9		16.61	972.29				
	5/7/99	988.9		16.42	972.48				
	5/14/99	988.9		16.63	972.27				
	5/21/99	988.9		15.17	973.73				
	5/27/99	988.9		15.86	973.04				
LSSC-05									
	12/17/98	984.87		13.61	971.26				Trace NAPL on probe
	12/21/98	984.87		13.60	971.27				Sheen on probe
	12/28/98	984.87		13.55	971.32				
	1/7/99	984.87		13.62	971.25				
	1/22/99	984.87		12.79	972.08				
	1/29/99	984.87		12.62	972.25				
	2/5/99	984.87		12.22	972.65				
	2/19/99	984.87		12.79	972.08				
	3/5/99	984.87		11.90	972.97				
	3/11/99	984.87		12.74	972.13				
	3/17/99	984.87		12.84	972.03				
	3/24/99	984.87		11.46	973.41				
	4/2/99	984.87		11.76	973.11				
	4/6/99	984.87		12.23	972.64				
	4/14/99	984.87		12.86	972.01				
	4/23/99	984.87		12.94	971.93				

Table 5-8. (continued)

Boring	Date Measured	Measuring Point Elevation	Depth to LNAPL	Depth to Water	Groundwater Elevation	LNAPL Thickness	Depth to DNAPL	DNAPL Elevation	*Notes*
	4/30/99	984.87		13.05	971.82				
	5/7/99	984.87		12.86	972.01				NAPL on probe
	5/14/99	984.87		12.90	971.97				
	5/21/99	984.87		11.54	973.33				
	5/27/99	984.87	12.25	12.30	972.57	0.05			
LSSC-06									
	12/17/98	985.04		13.82	971.22				
	12/21/98	985.04		13.00	972.04				
	12/28/98	985.04		13.75	971.29				
	1/7/99	985.04		13.82	971.22				
	1/22/99	985.04		13.98	971.06				NAPL on probe
	1/29/99	985.04		12.83	972.21				
	2/5/99	985.04		12.43	972.61				1.5' NAPL on probe
	2/19/99	985.04	12.95	13.37	971.67	0.42			
	3/5/99	985.04	12.11	12.20	972.84	0.09			
	3/11/99	985.04	12.91	13.15	971.89	0.24			
	3/17/99	985.04	13.00	13.81	971.23	0.81			
	3/24/99	985.04	11.65	11.91	973.13	0.26			
	4/2/99	985.04	11.91	12.29	972.75	0.38			
	4/6/99	985.04	12.41	12.90	972.14	0.49			
	4/14/99	985.04	13.01	13.77	971.27	0.76			
	4/23/99	985.04	13.08	13.85	971.19	0.77			
	4/30/99	985.04	13.19	14.04	971.00	0.85			
	5/7/99	985.04	13.01	13.50	971.54	0.49			
	5/14/99	985.04	13.05	13.51	971.53	0.46			
	5/21/99	985.04	11.78	11.91	973.13	0.13			

Table 5-8. (continued)

Boring	Date Measured	Measuring Point Elevation	Depth to LNAPL	Depth to Water	Groundwater Elevation	LNAPL Thickness	Depth to DNAPL	DNAPL Elevation	*Notes*
	5/27/99	985.04	12.41	13.05	971.99	0.64			
LSSC-07									
	1/7/99	982.61		11.07	971.54		23.36	959.25	
	1/22/99	982.61		10.31	972.30				2' NAPL on probe
	1/29/99	982.61		10.13	972.48		23.22	959.39	
	2/5/99	982.61		9.74	972.87		22.98	959.63	
	2/19/99	982.61		10.31	972.30		22.27	960.34	Flush mount full of ice
	3/5/99	982.61		9.42	973.19		23.79	958.82	NAPL pumped 3/4/99
	3/11/99	982.61		10.26	972.35		22.41	960.20	
	3/17/99	982.61		10.33	972.28		23.45	959.16	
	3/24/99	982.61		9.02	973.59		22.43	960.18	
	4/2/99	982.61		9.30	973.31		23.46	959.15	
	4/6/99	982.61		9.79	972.82		23.50	959.11	
	4/30/99	982.61		10.65	971.96		23.55	959.06	
	5/7/99	982.61	10.41	10.42	972.19	0.01	23.58	959.03	LNAPL measurement suspect; well screen does not cross water table
	5/14/99	982.61		10.71	971.90		23.96	958.65	
	5/21/99	982.61		8.74	973.87		24.01	958.60	
	5/27/99	982.61		9.86	972.75		24.75	957.86	
LSSC-08									
	12/21/98	983.26		12.41	970.85				
	12/28/98	983.26		12.40	970.86				
	1/7/99	983.26		12.41	970.85				
	1/22/99	983.26		11.46	971.80				
	1/29/99	983.26		11.43	971.83				

Table 5-8. (continued)

Boring	Date Measured	Measuring Point Elevation	Depth to LNAPL	Depth to Water	Groundwater Elevation	LNAPL Thickness	Depth to DNAPL	DNAPL Elevation	*Notes*
	2/5/99	983.26		10.96	972.30				
	2/19/99	983.26		11.59	971.67				
	3/5/99	983.26		10.41	972.85				
	3/11/99	983.26		11.62	971.64				
	3/17/99	983.26		11.69	971.57				
	3/24/99	983.26		10.29	972.97				
	4/2/99	983.26		10.52	972.74				
	4/6/99	983.26		11.20	972.06				
	4/14/99	983.26		11.85	971.41				
	4/23/99	983.26		11.84	971.42				
	4/30/99	983.26		11.98	971.28				
	5/7/99	983.26		11.77	971.49				
	5/14/99	983.26		12.09	971.17				
	5/21/99	983.26		10.24	973.02				
	5/27/99	983.26		11.18	972.08				
LSSC-08S									
	4/2/99	983.24		10.49	972.75				Not developed
	4/5/99	983.24		10.92	972.32				Not developed
	4/6/99	983.24		11.12	972.12				Not developed
	4/14/99	983.24		11.83	971.41				
	4/23/99	983.24		11.81	971.43				
	4/30/99	983.24		11.97	971.27				rusty water
	5/7/99	983.24		11.75	971.49				
	5/14/99	983.24		12.08	971.16				
	5/21/99	983.24		10.19	973.05				
	5/27/99	983.24		11.15	972.09				

Table 5-8. (continued)

Boring	Date Measured	Measuring Point Elevation	Depth to LNAPL	Depth to Water	Groundwater Elevation	LNAPL Thickness	Depth to DNAPL	DNAPL Elevation	*Notes*
LSSC-09									
	12/17/98	985.19		14.16	971.03				
	12/21/98	985.19		14.20	970.99				
	12/28/98	985.19		14.11	971.08				
	1/7/99	985.19		14.22	970.97				
	1/22/99	985.19		13.58	971.61				
	1/29/99	985.19		13.33	971.86				
	2/5/99	985.19		13.08	972.11				
	2/19/99	985.19		13.51	971.68				
	3/5/99	985.19		13.08	972.11				
	3/11/99	985.19		13.46	971.73				
	3/17/99	985.19		13.58	971.61				
	3/24/99	985.19		12.39	972.80				
	4/2/99	985.19		12.69	972.50				
	4/6/99	985.19		12.97	972.22				
	4/14/99	985.19		13.52	971.67				
	4/23/99	985.19		13.65	971.54				
	4/30/99	985.19		13.69	971.50				
	5/7/99	985.19		13.51	971.68				rusty water
	5/14/99	985.19		13.85	971.34				
	5/21/99	985.19		12.53	972.66				
	5/27/99	985.19		12.88	972.31				rusty water
LSSC-10									
	1/7/99	987.18		9.73	977.45				
	1/22/99	987.18		9.26	977.92				
	1/29/99	987.18		8.57	978.61				

Table 5-8. (continued)

Boring	Date Measured	Measuring Point Elevation	Depth to LNAPL	Depth to Water	Groundwater Elevation	LNAPL Thickness	Depth to DNAPL	DNAPL Elevation	*Notes*
	2/5/99	987.18		8.26	978.92				
	2/19/99	987.18		8.36	978.82				
	3/5/99	987.18		8.20	978.98				sheen on probe
	3/11/99	987.18		7.99	979.19				
	3/17/99	987.18		8.04	979.14				
	3/24/99	987.18		7.38	979.80				
	4/2/99	987.18		7.42	979.76				
	4/6/99	987.18		7.49	979.69				
	4/14/99	987.18		6.70	980.48				
	4/23/99	987.18		7.99	979.19				
	4/30/99	987.18		8.16	979.02				
	5/7/99	987.18		8.21	978.97				
	5/14/99	987.18		8.29	978.89				
	5/21/99	987.18		8.18	979.00				
	5/27/99	987.18		7.81	979.37				
LSSC-161									
	3/5/99	981.01		7.80	973.21				odor
	3/11/99	981.01		8.56	972.45		28.51	952.50	
	3/17/99	981.01		8.71	972.30		28.39	952.62	
	3/24/99	981.01		6.38	974.63		28.10	952.91	
	4/2/99	981.01		7.65	973.36		27.68	953.33	
	4/6/99	981.01		8.22	972.79		27.92	953.09	
	4/14/99	981.01		8.76	972.25		27.60	953.41	
	4/23/99	981.01		8.84	972.17		28.12	952.89	
	4/30/99	981.01		7.98	973.03		27.84	953.17	
	5/7/99	981.01		8.78	972.23		27.59	953.42	

Table 5-8. (continued)

Boring	Date Measured	Measuring Point Elevation	Depth to LNAPL	Depth to Water	Groundwater Elevation	LNAPL Thickness	Depth to DNAPL	DNAPL Elevation	*Notes*
	5/14/99	981.01		9.04	971.97		27.63	953.38	
	5/21/99	981.01		7.10	973.91		27.67	953.34	
	5/27/99	981.01		8.24	972.77		28.48	952.53	
LSSC-16S									
	3/5/99	981.41		8.21	973.20				
	3/11/99	981.41		9.00	972.41				sheen
	3/15/99	981.41		8.97	972.44				
	3/17/99	981.41		9.08	972.33				
	3/24/99	981.41		6.77	974.64				
	4/2/99	981.41		8.04	973.37				
	4/6/99	981.41		8.50	972.91				
	4/14/99	981.41		9.15	972.26				
	4/23/99	981.41		8.82	972.59				
	5/7/99	981.41		9.16	972.25				
	5/14/99	981.41		9.41	972.00				
	5/21/99	981.41		7.56	973.85				
	5/27/99	981.41		8.59	972.82				
LSSC-17									
	3/11/99	982.53		10.37	972.16				
	3/17/99	982.53		10.46	972.07				
	3/24/99	982.53	9.09	9.10	973.43	0.01			LNAPL measurement suspect; well screen does not cross water table
	4/2/99	982.53		9.38	973.15				Very slight sheen
	4/6/99	982.53		9.89	972.64				
	4/14/99	982.53		10.52	972.01				

Table 5-8. (continued)

Boring	Date Measured	Measuring Point Elevation	Depth to LNAPL	Depth to Water	Groundwater Elevation	LNAPL Thickness	Depth to DNAPL	DNAPL Elevation	*Notes*
	4/23/99	982.53		10.61	971.92				
	4/30/99	982.53		10.74	971.79				slight sheen on probe
	5/7/99	982.53		10.52	972.01				
	5/14/99	982.53		10.82	971.71				
	5/21/99	982.53		8.98	973.55				
	5/27/99	982.53		9.96	972.57				sheen on probe tip
LSSC-18									
	4/2/99	987.45		14.34	973.11				Not developed
	4/5/99	987.45		14.76	972.69				Not developed
	4/14/99	987.45		15.66	971.79				
	4/23/99	987.45		15.69	971.76				
	4/30/99	987.45		15.83	971.62				
	5/7/99	987.45		15.60	971.85				
	5/14/99	987.45		15.91	971.54				
	5/21/99	987.45		13.85	973.60				
	5/27/99	987.45		14.96	972.49				
LSSC-19									
	4/2/99	987.16		12.21	974.95				Not developed
	4/5/99	987.16		12.36	974.80				Not developed
	4/14/99	987.16		12.88	974.28				
	4/23/99	987.16		13.17	973.99				
	4/30/99	987.16		13.24	973.92				
	5/7/99	987.16		13.19	973.97				
	5/14/99	987.16		13.25	973.91				
	5/21/99	987.16		12.71	974.45				
	5/27/99	987.16		12.63	974.53				

Table 5-9. NAPL physical properties, Lyman Street site

WELL	SPECIFIC GRAVITY	INTERFACIAL TENSION (DYNE/CM)	VISCOSITY (CENTISTOKES)
LSSC-07	1.073	water to oil 5.4 water to oil 9.6 oil to water 11.4 oil to water 6.4	8.6
LSSC-16I	1.078	water to oil 7.7 water to oil 9.9 oil to water 11.0 oil to water 10.7	13.6
LS-12	1.165	NM	44.35
LS-4	1.091	NM	32.95
RW-1	1.076	NM	42.43
LS-2	0.9205	NM	65.68
LS-21	0.9333	NM	67.16

Table 5-10. Summary of NAPL Chemical Analyses, Well LSSC-07

Type	Compound	LSSC-07 (#A0260)	
VOC			
	Carbon tetrachloride (mg/kg)	78000	
	cis-1,2-Dichloroethene (mg/kg)	ND	
	Methylene chloride (mg/kg)	3400	
	Tetrachloroethene (mg/kg)	ND	
	Toluene (mg/kg)	ND	
	Trichloroethene (mg/kg)	20000	
	Xylenes (total) (mg/kg)	10000	
	Total VOC (mg/kg)	**111400**	
SVOC			
	1,2,4,5-Tetrachlorobenzene (mg/kg)	570	J
	1,2,4-Trichlorobenzene (mg/kg)	30000	
	1,2-Dichlorobenzene (mg/kg)	490	J
	1,4-Dichlorobenzene (mg/kg)	640	J
	2-Methylnaphthalene (mg/kg)	150	J
	Acenaphthene (mg/kg)	ND	
	Anthracene (mg/kg)	ND	
	Benzo(a)anthracene (mg/kg)	ND	
	Benzo(a)pyrene (mg/kg)	ND	
	Benzo(b)fluoranthene (mg/kg)	ND	
	Benzo(k)fluoranthene (mg/kg)	ND	
	Chrysene (mg/kg)	ND	
	Dibenzofuran (mg/kg)	ND	
	Fluoranthene (mg/kg)	ND	
	Fluorene (mg/kg)	ND	
	Naphthalene (mg/kg)	ND	
	Pentachlorobenzene (mg/kg)	ND	
	Phenanthrene (mg/kg)	ND	
	Pyrene (mg/kg)	ND	
	Total SVOC (mg/kg)	**31850**	
PCB			
	Aroclor 1254 (mg/kg)	260000	
	Total PCB (mg/kg)	**260000**	
Miscellaneous			
	Dieldrin (mg/kg)	1300	
	Endosulfan II (mg/kg)	ND	

Table 5-10. (continued)

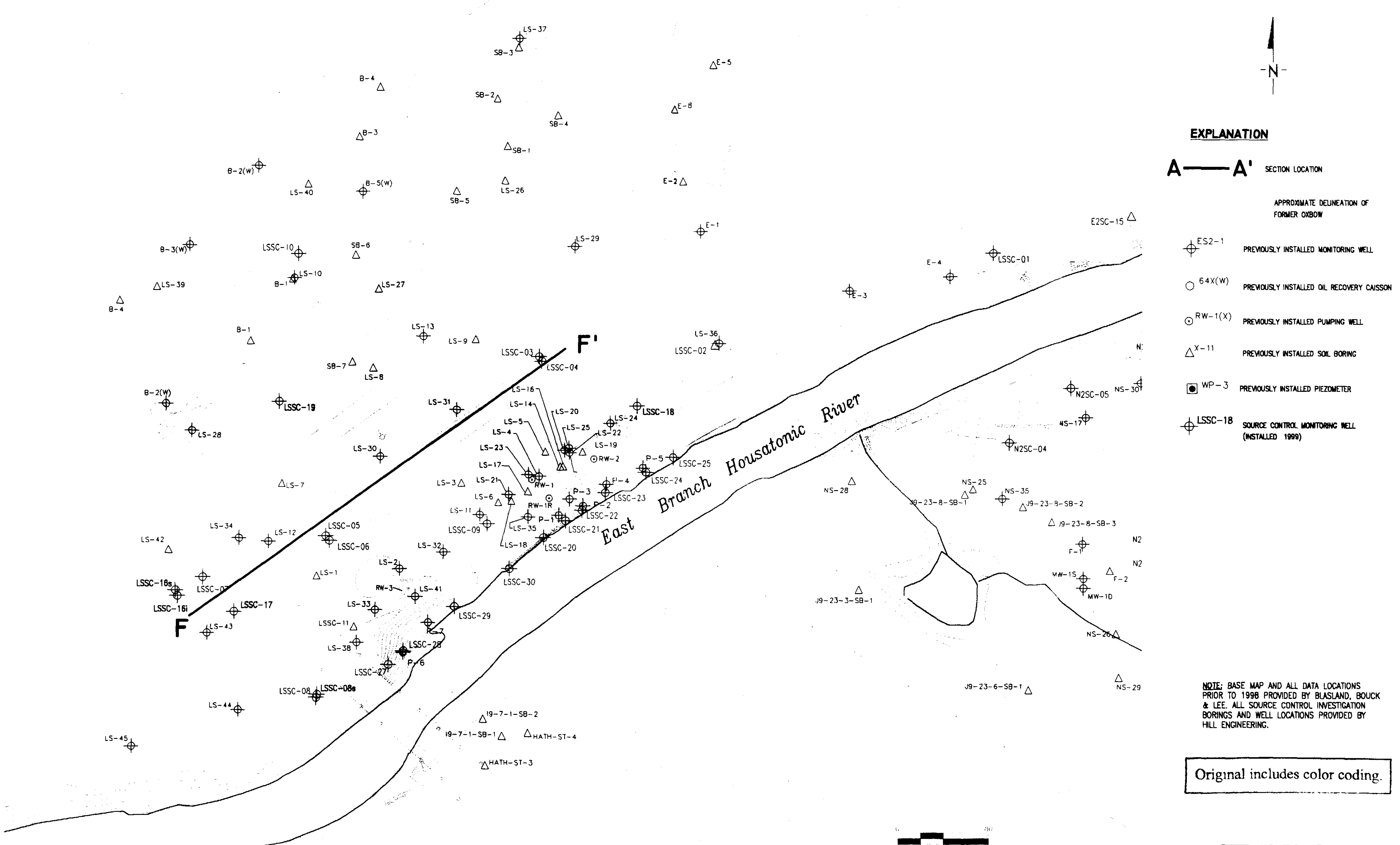
Type	Compound	LSSC-07 (#A0260)	
Metals			
	Antimony (mg/kg)	ND	
	Arsenic (mg/kg)	ND	
	Barium (mg/kg)	3.3	B
	Chromium (mg/kg)	0.52	B
	Copper (mg/kg)	1.3	B
	Lead (mg/kg)	7	
	Mercury (mg/kg)	0.74	
	Nickel (mg/kg)	ND	
	Selenium (mg/kg)	0.23	B
	Silver (mg/kg)	0.051	B
	Tin (mg/kg)	2.6	B
	Vanadium (mg/kg)	ND	
	Zinc (mg/kg)	0.96	B

Table 5-10. (continued)

Type	Compound	LSSC-07 (#A0260)	
Dioxin			
	1,2,3,4,6,7,8-HpCDD (µg/kg)	180	
	1,2,3,4,6,7,8-HpCDF (µg/kg)	340	E
	1,2,3,4,7,8,9-HpCDF (µg/kg)	260	E
	1,2,3,4,7,8-HxCDD (µg/kg)	12	
	1,2,3,4,7,8-HxCDF (µg/kg)	770	E
	1,2,3,6,7,8-HxCDD (µg/kg)	11	s
	1,2,3,6,7,8-HxCDF (µg/kg)	310	E
	1,2,3,7,8,9-HxCDD (µg/kg)	9.8	s
	1,2,3,7,8,9-HxCDF (µg/kg)	170	
	1,2,3,7,8-PeCDD (µg/kg)	ND	
	1,2,3,7,8-PeCDF (µg/kg)	24	
	2,3,4,6,7,8-HxCDF (µg/kg)	150	
	2,3,4,7,8-PeCDF (µg/kg)	86	
	2,3,7,8-TCDD (µg/kg)	ND	
	2,3,7,8-TCDF (µg/kg)	ND	
	HpCDDs (total) (µg/kg)	280	
	HpCDFs (total) (µg/kg)	1100	
	HxCDDs (total) (µg/kg)	150	
	HxCDFs (total) (µg/kg)	2300	
	OCDD (µg/kg)	1500	E
	OCDF (µg/kg)	660	E
	PeCDDs (total) (µg/kg)	72	a
	PeCDFs (total) (µg/kg)	700	
	TCDDs (total) (µg/kg)	47	a
	TCDFs (total) (µg/kg)	260	

Qualifier

J	*For organics, result is between MDL and RL.*
B	*Result is between MDL and RL*
g	*2, 3, 7, 8, -TCDF results have been confirmed on a DB-225 column.*
E	*Result exceeds calibration range.*
F	*Reported value estimated due to an interference.*
a	*See narrative.*
s	*Result detected is below the lowest standard and above zero.*
D	*Compound quantified using a secondary dilution.*
j	*Result is an estimated value that is below the lower calibration limit but above the target detection level.*



NOTE: BASE MAP AND ALL DATA LOCATIONS PRIOR TO 1998 PROVIDED BY BLASLAND, BOUCK & LEE. ALL SOURCE CONTROL INVESTIGATION BORINGS AND WELL LOCATIONS PROVIDED BY HILL ENGINEERING.

Original includes color coding.

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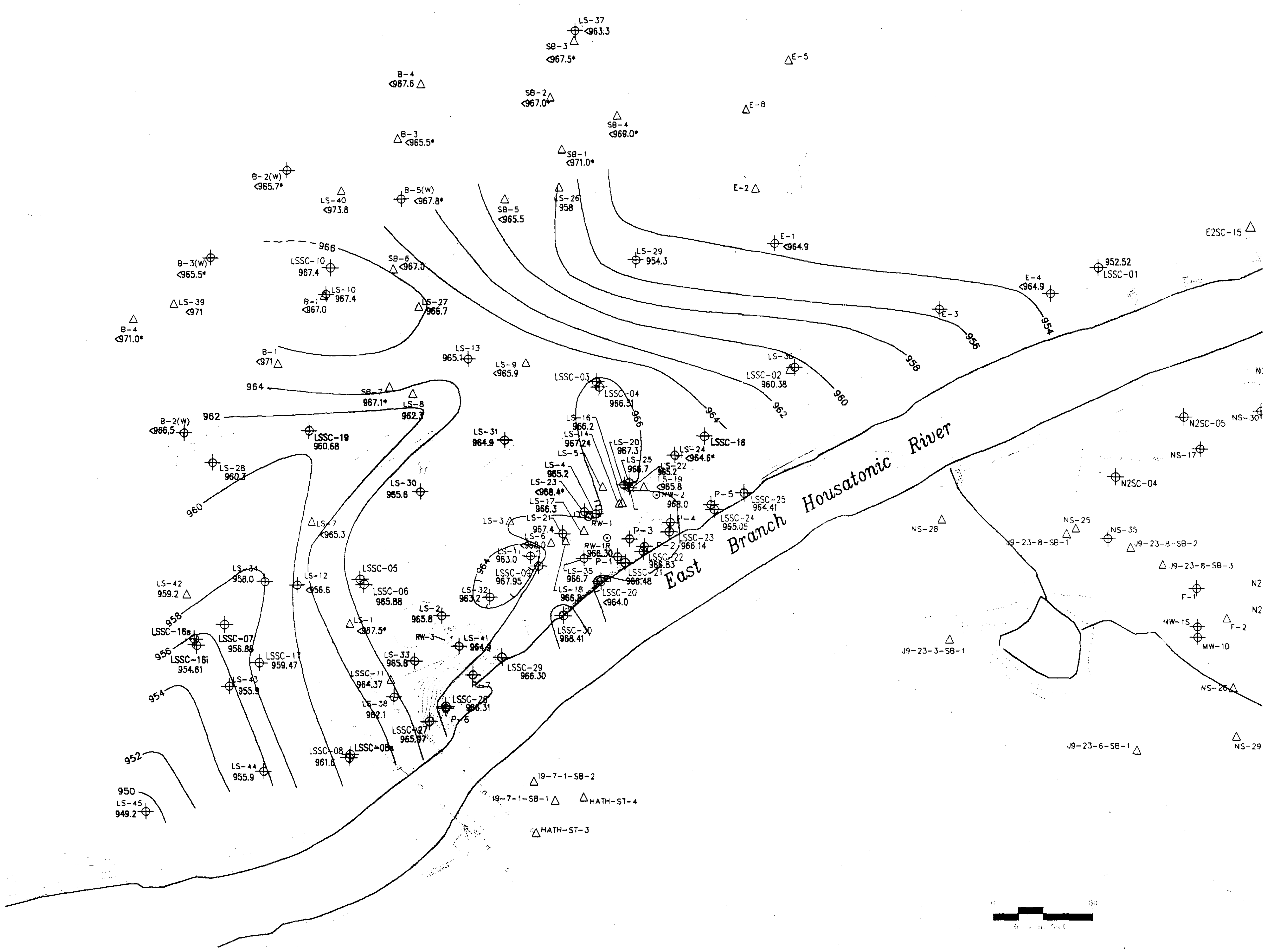
Figure 5-1 Lyman Street Site, Well & Boring Location Map Showing Section Locations



EXPLANATION

APPROXIMATE DELINEATION OF FORMER OXBOW

⌖ ES2-1	PREVIOUSLY INSTALLED MONITORING WELL
○ 64X(W)	PREVIOUSLY INSTALLED OIL RECOVERY CAISSON
⊙ RW-1(X)	PREVIOUSLY INSTALLED PUMPING WELL
△ X-11	PREVIOUSLY INSTALLED SOIL BORING
▣ WP-3	PREVIOUSLY INSTALLED PIEZOMETER
⌖ LSSC-18	SOURCE CONTROL MONITORING WELL (INSTALLED 1999)
961.2	TOP OF TILL ELEVATION
— 946 —	TOP OF TILL CONTOUR 1 FOOT INTERVAL
*	APPROX. TOP OF TILL ELEVATION

NOTE: BASE MAP AND ALL DATA LOCATIONS PRIOR TO 1998 PROVIDED BY BLASLAND, BOUCK & LEE. ALL SOURCE CONTROL INVESTIGATION BORINGS AND WELL LOCATIONS PROVIDED BY HILL ENGINEERING.

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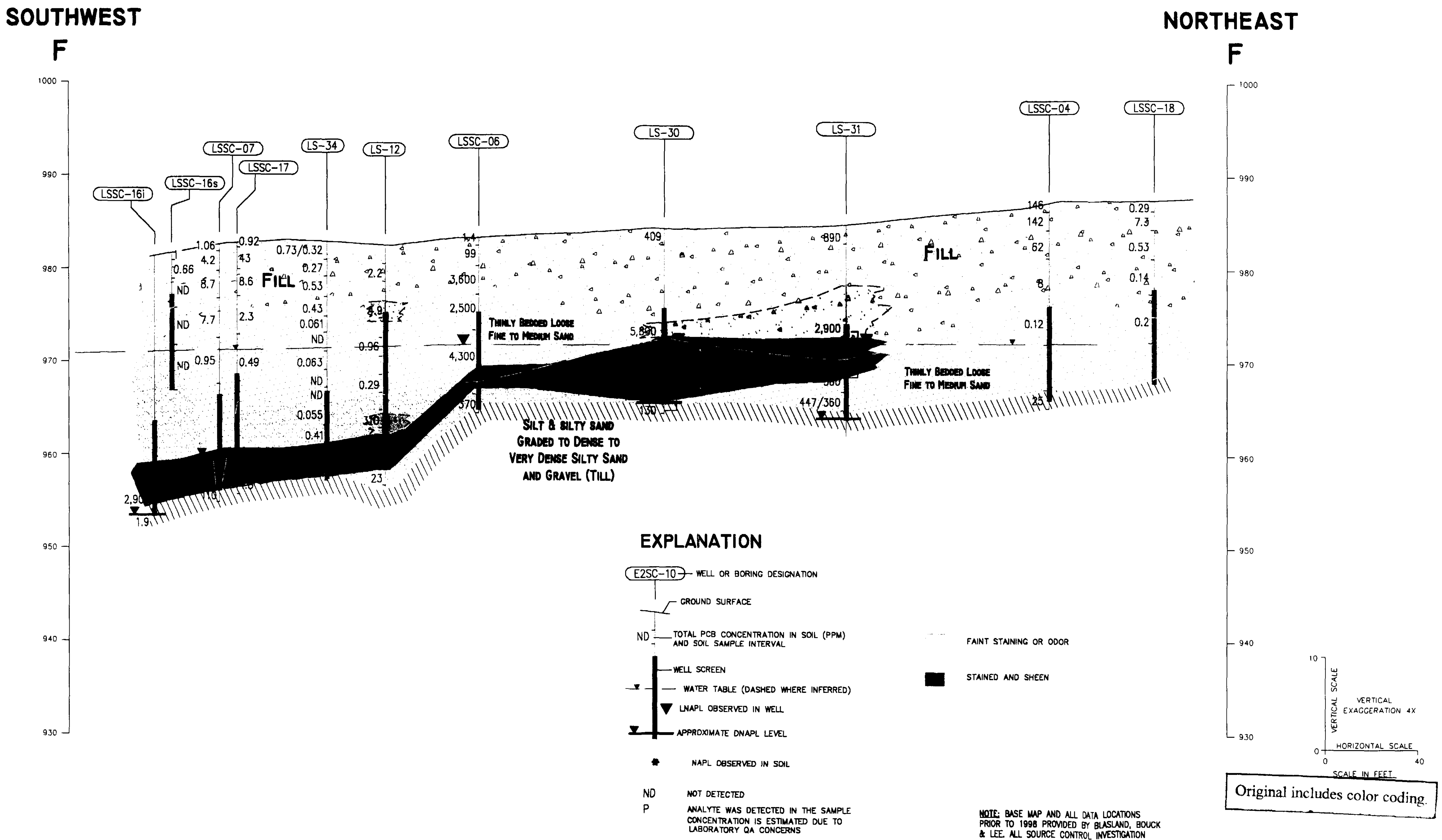
Figure 5-2 Lyman Street Site Top of Till Elevation Contour Map



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NOTE: BASE MAP AND ALL DATA LOCATIONS PRIOR TO 1998 PROVIDED BY BLASLAND, BOUCK & LEE. ALL SOURCE CONTROL INVESTIGATION BORINGS AND WELL LOCATIONS PROVIDED BY HILL ENGINEERING.

Figure 5-3 Lyman Street Cross-Section F-F'

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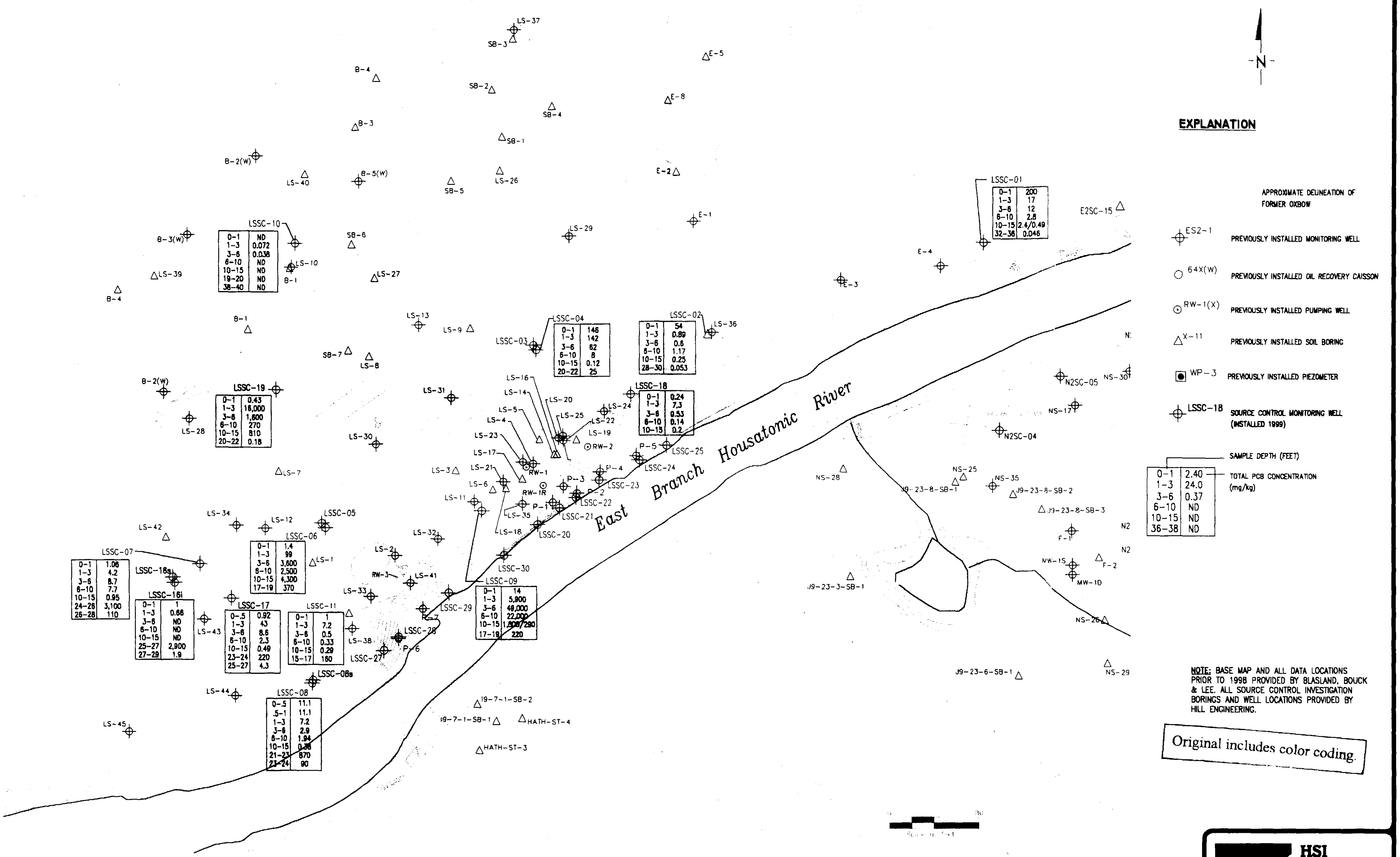
9908-s-F.dwg



NOTE: BASE MAP AND ALL DATA LOCATIONS PRIOR TO 1998 PROVIDED BY BLASLAND, BOUCK & LEE. ALL SOURCE CONTROL INVESTIGATION BORINGS AND WELL LOCATIONS PROVIDED BY HILL ENGINEERING.

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Figure 5-4 Map of Soil Total PCB Concentrations, Lyman Street Site

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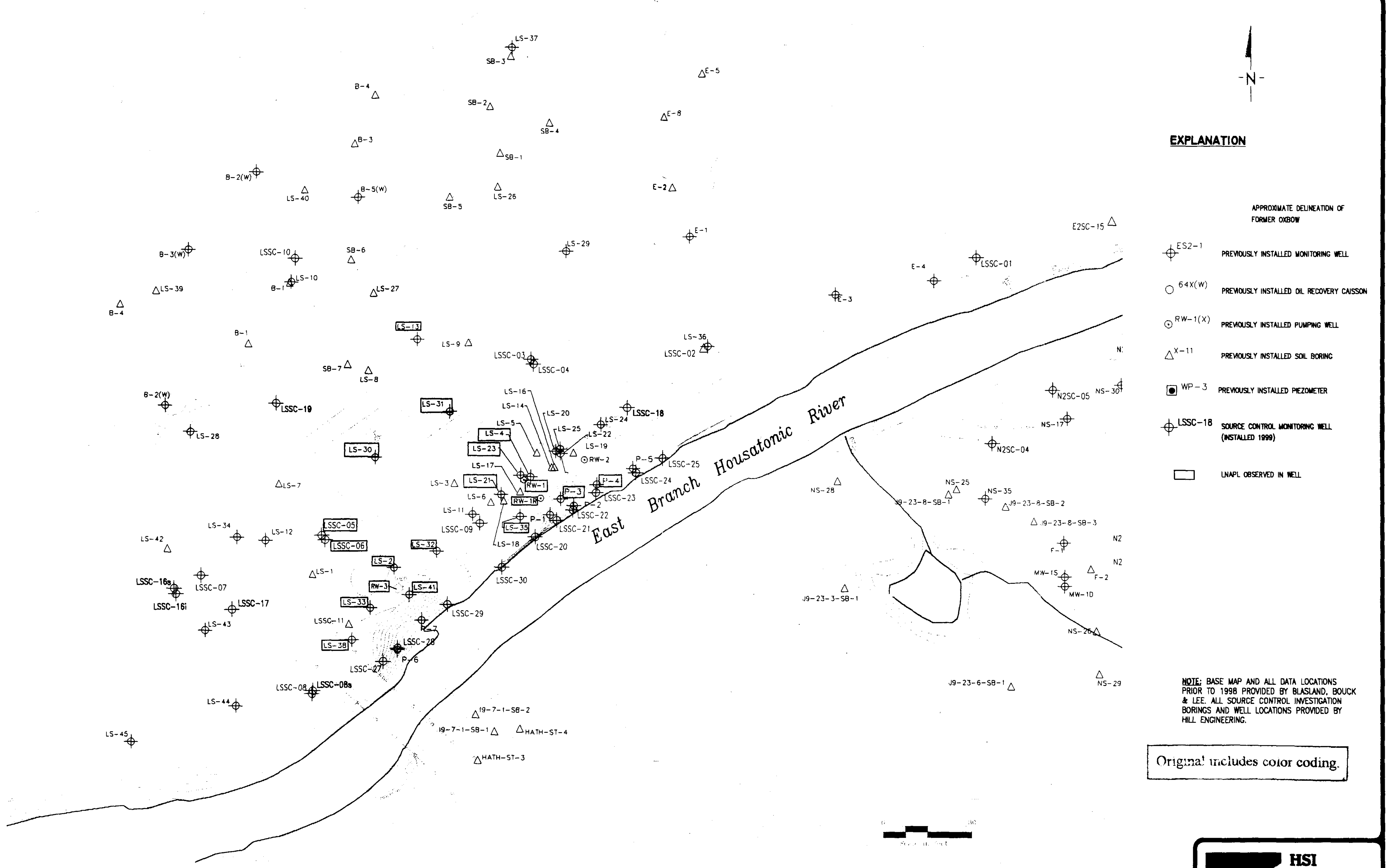

NOTE: BASE MAP AND ALL DATA LOCATIONS PRIOR TO 1998 PROVIDED BY BLASLAND, BOUCK & LEE. ALL SOURCE CONTROL INVESTIGATION BORINGS AND WELL LOCATIONS PROVIDED BY HILL ENGINEERING.

Original includes color coding.

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Figure 5-5 Extent of LNAPL, Lyman Street Site

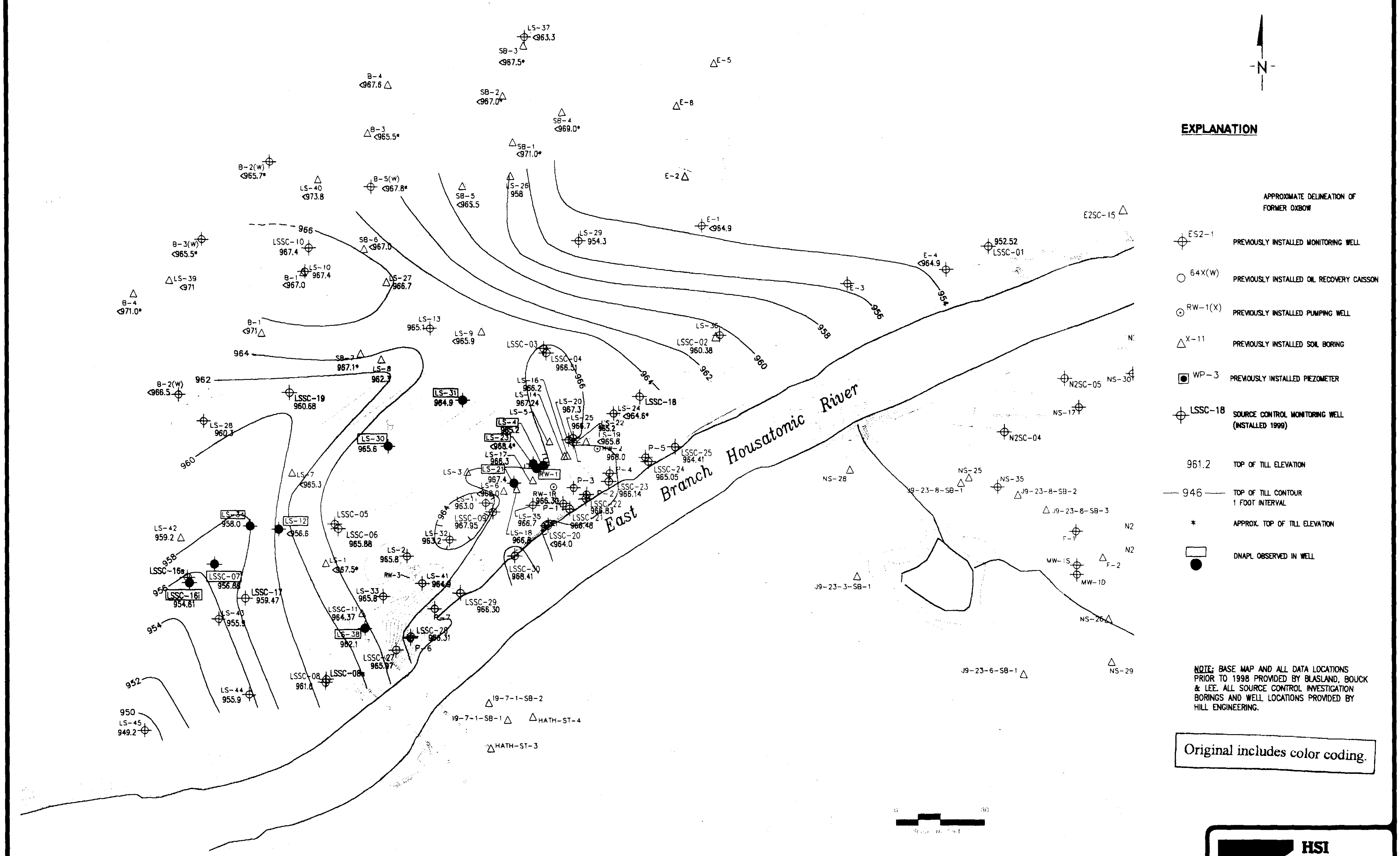

Figure 5-6 Extent of DNAPL, Lyman Street Site

NOTE: BASE MAP AND ALL DATA LOCATIONS PRIOR TO 1998 PROVIDED BY BLASLAND, BOUCK & LEE. ALL SOURCE CONTROL INVESTIGATION BORINGS AND WELL LOCATIONS PROVIDED BY HILL ENGINEERING.

Original includes color coding.

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9906lyman-DNAPL.dwg

6 PROPOSED ADDITIONAL INVESTIGATIONS AND SCHEDULE

To further evaluate the extent of DNAPL beneath the 10 Lyman Street property and to further monitor potential changes in the LNAPL distribution in the Lyman Street parking lot, three additional monitoring wells are proposed. Additions to the well-monitoring program at the East Street Area 2, Lyman Street and Newell Street Area II sites are also proposed.

6.1 PROPOSED ADDITIONAL MONITORING WELLS-LYMAN STREET SITE

Additional information is necessary to more fully evaluate the extent of the NAPL found at the 10 Lyman Street property. Two additional borings/monitoring wells are proposed to be drilled to the till surface on the south-side of the property, between the existing building and the Housatonic River. Data from these borings/wells will be used to further assess the interpretation of the top of till topography and the extent of DNAPL. One additional shallow monitoring well to monitor for the potential presence of LNAPL will also be drilled adjacent to existing boring LS-1. The proposed locations of the wells are shown on Figure 6-1. The wells will be drilled and installed following the procedures described in the Work Plan (BBL, 1998) and the Sampling and Analysis Plan/Data Collection and Quality Assurance Plan (BBL, 1998b). Installation of the wells will begin within 14 days following EPA approval. A letter report presenting the data collected from the new borings will be submitted to the agencies within 45 days after completion of the drilling.

6.2 PROPOSED ADDITIONS TO MONITORING PLAN

Select newly installed monitoring wells will be added to the current well-monitoring program. To assess any potential changes to the LNAPL distribution near monitoring well 50 on the East Street Area 2 site, the newly installed monitoring wells E2SC-21 and E2SC-22 will be added to the semi-annual monitoring program.

At the Newell Street Area II site, newly installed monitoring wells N2SC-02, N2SC-03S, N2SC-03I, N2SC-08, N2SC-09S and N2SC-09I will be added to the weekly

DNAPL monitoring. To monitor north and south of the known DNAPL area, monitoring wells N2SC-07, N2SC-11 and N2SC-12 will be added to the monthly monitoring program.

To monitor for the potential presence of LNAPL at the east and west ends of the proposed sheet pile wall at the Lyman Street site, newly installed wells LSSC-18 and LSSC-08S will be added to the weekly monitoring program. Because of its location on the western edge of the LNAPL area at Lyman Street, well LSSC-06 will also be added to the monthly LNAPL monitoring. GE has already added wells LSSC-16I and LSSC-07 to the weekly DNAPL monitoring schedule and will continue this effort. These proposed additions to the ongoing monitoring will take effect immediately.

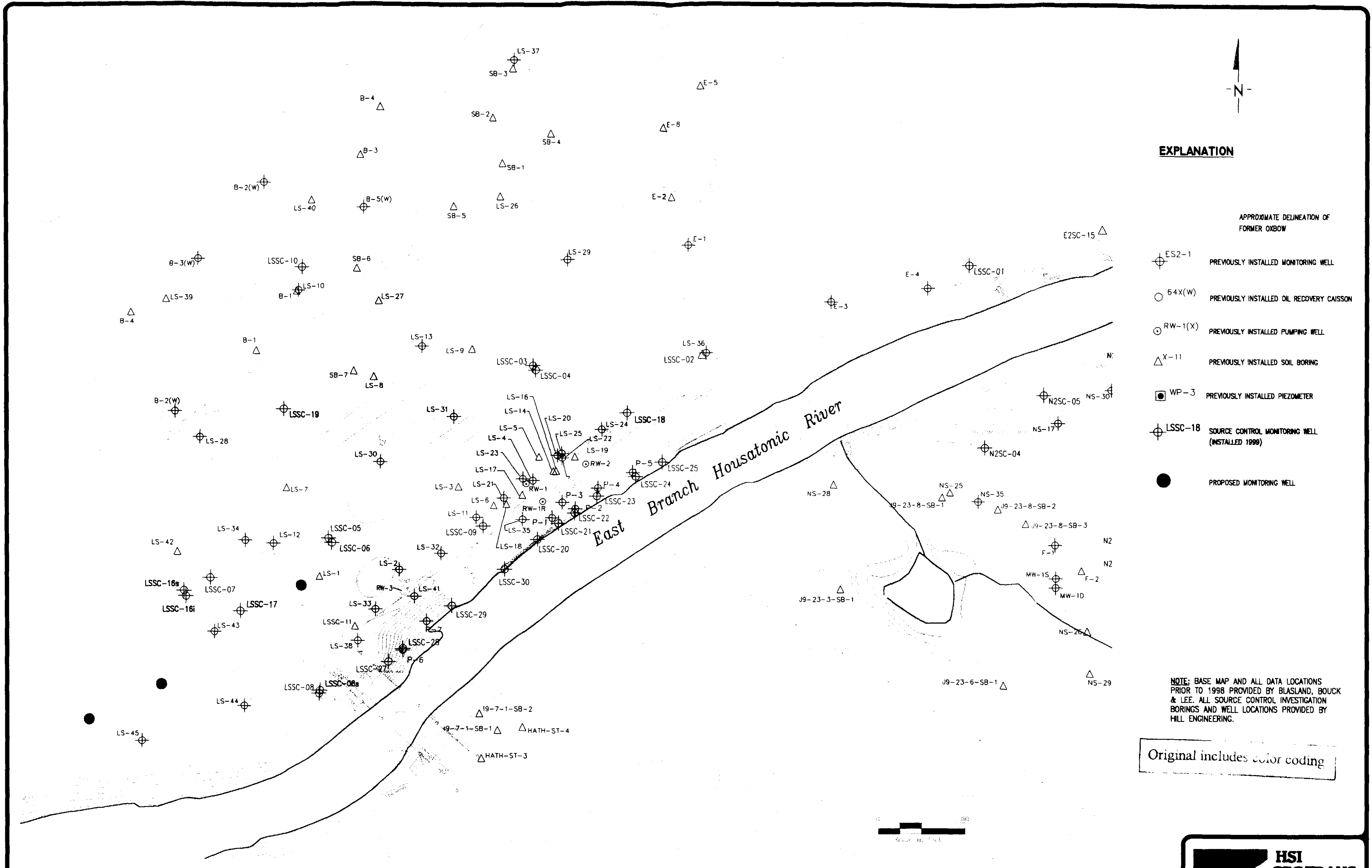

Figure 6-1 Proposed Monitoring Well Locations, Lyman Street Site

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9906lyman-Pro.dwg

7 REFERENCES

BBL 1994, MCP Phase I Report for Lyman Street Parking Lot (Oxbow Area D) and Current Assessment Summary for USEPA Area 5A, February, 1994.

BBL 1997, Addendum to MCP Supplemental Phase II/RCRA Facility Investigation Proposal for Lyman Street/USEPA Area 5A site, October, 1997.

BBL 1998a, Source Control Work Plan-Upper Reach of Housatonic River (First ½ Mile), September, 1998.

BBL 1998b, Revised Sampling and Analysis Plan/Data Collection and Quality Assurance Plan, October, 1998.

GE 1999, Conceptual Containment Barrier Design for Lyman Street Site, February 16, 1999.

Golden 1992, Additional Hydrogeologic Assessment and Short Term Measure Evaluation and Proposal, Lyman Street Parking Lot (Oxbow Area D), Pittsfield, Massachusetts, January, 1992.

HSI GeoTrans 1999, Source Control Investigation Report Upper Reach of Housatonic River (First ½ mile), February 9, 1999.