FINAL REPORT

HENDRICK STREET WELLFIELD TCE STUDY
TOWN OF EASTHAMPTON, MASSACHUSETTS

PHASE II
DATA ANALYSIS AND FINDINGS

JANUARY 1992

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EXECUTIVE SUMMARY

The purpose of the Hendrick Street Wellfield Trichloroethylene (TCE) contamination investigations was to define the contaminant plume currently impacting the Hendrick Street Wellfield and the Pines Well and evaluate remediation alternatives available to the Town for bringing the 4 million gallon per day (mgd) water supply back on-line. The Study was divided into two phases. Phase I - Limited Site Investigation of the Hendrick Street Wellfield, summarized the available information concerning the Wellfield and the documented contamination. The Draft Phase I Report was submitted to the Town of Easthampton in August 1990. Phase II of the Study consisted of the installation of sixteen groundwater monitoring wells throughout the Hendrick Street Wellfield recharge area and the subsequent analysis of groundwater from these wells, along with the remediation alternatives available to the Town.

The Phase II monitoring well installation was completed in two steps. As part of the first step (Phase IIA), monitoring wells MW-1, MW-2, MW-3, MW-4A, MW-4B, MW-5A, MW-5B, MW-6, MW-7 and MW-8 were installed downgradient of potential sources of contamination, which were identified during Phase I of the Study. The Phase IIA groundwater analyses, completed in December 1990, were considered in the placement and installation of the Phase IIB wells; MW-9A, MW-9B, MW-9C, MW-10A, MW-10B and MW-11. Included in the Phase IIA sampling program was the sampling of three existing wells, MW-M1, MW-M2 and MW-M6, which were installed by others as part of an earlier study. Upon completion of the Phase IIB wells, the Phase IIA and IIB wells were sampled and analyzed for volatile organic chemical contamination in May/June 1991.

The volatile organics analyses performed on the groundwater samples obtained during the Phase IIB step of the Investigation established that trichlorethylene contamination was present only in those wells directly north of the Hendrick Street Wellfield. These wells, located less than 200 feet north of the Wellfield, were installed to document contamination which may be emanating from an alleged automobile repair equipment cleaning and repair operation at House No. 126, Hendrick Street. The field data obtained during this Investigation would suggest that additional investigation of the past operations at House No. 126 may be warranted, but also that other unknown sources of contamination may exist hydraulically upgradient of this location, as the contamination was found both up and downgradient of the site.

Based on the information obtained during the Phase II field investigation, several groundwater remediation alternatives were evaluated. These alternatives, which included wellhead treatment, source control and the development of alternative water supplies, were evaluated to determine the most cost-effective method of bringing approximately 4 mgd of potable water back on-line to meet Easthampton's water demand.

The evaluation of the wellhead treatment processes most appropriate for the documented type and level of contamination impacting the Wellfield, air stripping and granular activated carbon adsorption, showed that air stripping would be the most cost-effective wellhead treatment to implement and operate.

Another option available to the Town, Source Control, was also evaluated during the Phase II Investigation. Source control, or the remediation of contaminated material at the contamination site, is a more direct method of remediating the Hendrick Street Wellfield, as long as the source of contamination is well defined. The source control options discussed in this Investigation included soil removal, soil vapor extraction and groundwater extraction.

One conclusion reached in the Phase II Investigation is that, although source control would appear to be a viable option which should be pursued, much more subsurface investigation of the potential contamination source at House No. 126, Hendrick Street, is required. The additional information is needed to determine which source control option is appropriate and how cost-effective such a remediation alternative would be.

The third option available to the Town which was evaluated during the Investigation, consists of "abandoning" the existing Hendrick Street and Pines Wells and developing new alternative water supplies in other areas of Easthampton. Based on a review of the potential alternative water supplies in Easthampton, along with the estimated costs, both financial and time, it is a recommendation of the Phase II Investigation that the development of alternative water supplies not be pursued as an option to bringing the Hendrick Street Wellfield back on-line.

FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

Findings

The Phase II Trichloroethylene (TCE) contamination investigations of the Easthampton Hendrick Street Wellfield consisted of the installation of sixteen groundwater monitoring wells throughout the Hendrick Street Wellfield recharge area and the subsequent analysis of groundwater from these wells. The sampling program determined that the flow of groundwater in the recharge area was generally southwest to northeast. The soil within the recharge area encountered during the well installation varied from silty sand to coarse gravel.

The Phase II monitoring well installation was completed in two steps. As part of the first step (Phase IIA), monitoring wells MW-1, MW-2, MW-3, MW-4A, MW-4B, MW-5A, MW-5B, MW-6, MW-7 and MW-8 were installed downgradient of potential sources of contamination which were identified during Phase I of the Investigation. The Phase IIA groundwater analyses, which also included samples from existing monitoring wells MW-M1, MW-M2 and MW-M6, were considered in the placement and installation of the Phase IIB wells; MW-9A, MW-9B, MW-9C, MW-10A, MW-10B and MW-11A. Upon completion of the Phase IIB wells, the Phase IIA and IIB wells were sampled and analyzed for volatile organic chemical contamination.

The volatile organics analyses performed on the groundwater samples obtained during the Phase IIA step of the Investigation established that volatile organic chemical contamination was present in only two of the well samples. Groundwater samples taken on December 3, 1990 from a shallow, hand driven well (MW-6) in the vicinity of 111 Southampton Road and downgradient from the former site of Rock Valley Patterns, a metal working operation, showed 14 parts per billion (ppb) of xylene contamination but no trichloroethylene contamination. A subsequent Phase IIB sample taken May 22, 1991 did not confirm the initial Phase IIA findings, as no volatile organic chemical contamination was detected at this location.

Groundwater samples taken on December 3, 1990, from the deep (110') well MW-4A in a residential neighborhood at the end of Jones Circle, showed 2.3 ppb of 1,1,1-trichloroethane contamination. No volatile organic chemical contamination was found at this location during the May 1991 sampling round.

As part of the installation of the Phase IIB groundwater monitoring wells, MW-9A, MW-9B and MW-9C, in the vicinity of a residential dwelling located at 126 Hendrick Street, low levels of TCE contamination were observed during field gas chromatograph screening of soil boring sample headspaces. The soil contamination (5-12 ppb concentration) was confirmed by groundwater analyses performed on samples taken as part of the Phase IIB sampling round which showed groundwater TCE contamination of 7.2 and 12.0 ppb, at depths of approximately 55 feet and 119 feet, respectively, downgradient of House No. 126. The sampling of MW-9C confirmed that TCE contaminated groundwater was also found at a 119 feet depth upgradient of House No. 126. House No. 126 is less than 200 feet north of the Wellfield and the site of an alleged air compressor/machine cleaning and repair operation. This data would suggest that additional investigation of the past activities at House No. 126 may be warranted, but also that other unknown sources of contamination may exist further upgradient of this location.

Conclusions

Several groundwater remediation alternatives were evaluated, based on the information obtained during the Phase I and II field investigations. These alternatives, which included wellhead treatment, source control and the development of alternative water supplies, were evaluated to determine the most cost-effective method of bringing the Hendrick Street Wellfield, or an alternative source, back on-line to meet Easthampton's current water demand.

Wellhead Treatment

The wellhead treatment processes evaluated included air stripping and granular activated carbon adsorption. Both processes, proposed to be located at the Hendrick Street Water Pump Station site, are proven technologies and are very effective in removing TCE from groundwater. An outstanding issue associated with the installation of an air stripper is the potential need to treat the air, or off-gas, being released from the air stripper. It is unclear at this time if the Department of Environmental Protection (DEP) will require off-gas treatment at the Hendrick Street site. As DEP is currently evaluating its policy (DEP Policy 88-01) concerning the treatment of TCE contaminated air stripper off-gases, both air stripper options, with and without off-gas treatment, were evaluated to assist in the final selection of wellhead treatment options. A present worth analysis was performed in order to compare life cycle capital, operation and maintenance costs. Table C.1 summarizes the present worth results based on a 10 year analysis and an EPA approved discount rate of 8.75%.

TABLE C.1
SUMMARY OF PRESENT WORTH COST COMPARISON OF WELLHEAD TREATMENT ALTERNATIVES

	Capital Cost	Annual Operation Cost	Annual Maintenance Cost	Total Present Worth
Air Stripping w/ Off-Gas Treatment	$1,431,000	$ 130,000	$ 14,000	$ 2,365,000
Air Stripping w/o Off-Gas Treatment	1,089,000	110,000	10,000	1,868,000
Carbon Adsorption	1,667,000	105,000	17,000	2,459,000

A review of each alternative's present worth costs shows that air stripping is the most cost-effective treatment option regardless of whether off-gas treatment is required by DEP.

Source Control

Another option available to the Town, Source Control, was also evaluated during the Phase II Investigation. Source control, or the remediation of contaminated material at the contamination source(s), is a more direct method of remediating the Hendrick Street Wellfield, as long as the source of contamination is well defined. The source control options discussed in this Investigation included soil removal, soil vapor extraction and groundwater extraction. Of the three alternatives, soil removal is more appropriate where the contamination is still confined to areas close to the surface. Soil vapor extraction is typically implemented when the volatile organic chemical contamination has percolated deep into the vadose, or unsaturated, zone and groundwater is relatively deep. Groundwater extraction is used if high concentrations of contamination are found in the groundwater under the contamination source area. The Phase II groundwater sampling has not conclusively defined the source(s) of contamination impacting the Hendrick Street Wellfield. The Phase II sampling showed TCE contamination in the vicinity of House No. 126, Hendrick Street, but contamination was found both up and downgradient from House No. 126. Before any source control is implemented, more investigation would be needed to confirm if there are other sources of contamination.

The Phase II Investigation concluded that, although source control would appear to be a viable option which should be pursued, much more subsurface investigation of the potential contamination source at House No. 126, Hendrick Street, is needed to determine which source control option is appropriate and how cost-effective such a remediation alternative would be.

Alternative Water Supplies

A third option available to the Town consists of "abandoning" the existing Hendrick Street and Pines Wells and developing new alternative water supplies in other areas of Easthampton. In order to determine, in this very preliminary screening phase, which areas in Town would be able to supply at least 4 mgd of uncontaminated drinking water, groundwater favorability mapping, along with land use information, were reviewed.

The preliminary screening process identified two areas, the Nonotuck Park area and the New England Forestry Foundation area off Loudville Road, as two areas which would have the best potential to meet the required criteria. Both sites have significant limitations. The New England Forestry Foundation site has the potential for becoming contaminated by the documented contaminant plume originating from the Easthampton Landfill, located east of the Foundation site. The Nonotuck Park site has been investigated previously by the Town and it was determined that excessive fines in the subsurface strata would significantly impact the capacity of any production wells placed in the area.

The process of developing and obtaining DEP approval of water supplies at either, or both these sites, requires the Town to complete the DEP New Source Approval process. This process, estimated to take approximately 24 months to complete, requires a multi-phased approach, in conjunction with numerous, intermediate DEP checkpoints, to document the acceptability of any new water supply. This two year delay in bringing a new source on-line would severely impact the Town's ability to meet current water demands without the continued use of the Hendrick Street Wellfield.

A present worth analysis was also completed to determined the total life cycle cost of developing and maintaining an alternative water supply, and abandoning the Hendrick Street and Pines Wells. Table C.2 summarizes the results of the present worth analysis, which was calculated on a 10 year life cycle to be consistent with present worth analyses completed on the wellhead treatment alternatives.

TABLE C.2
SUMMARY OF PRESENT WORTH ANALYSIS OF DEVELOPING ALTERNATIVE WATER SUPPLIES

New Source Approval Cost	Capital Cost[1]	Annual Operation Cost	Annual Maintenance Cost	Total Present Worth
$ 300,000	$ 1,944,000	$ 80,000	$ 29,000	$ 2,951,000

[1] New Source Approval Costs not included in Capital Cost

Recommendations

Based on a review of the available information and the evaluations performed as part of the Phase I and II Investigations, the following recommendations are made:

1. Based on the uncertainty associated with finding adequate alternative water supplies and the associated cost of developing any such supply, eliminate from further evaluation the alternative of developing alternative water supplies and abandoning the Hendrick Street Wellfield.

2. Complete a focused contaminant investigation program designed to document the horizontal and vertical extent of contamination in the vicinity of House No. 126, Hendrick Street. This recommendation should be implemented through the DEP as part of the Massachusetts Contingency Plan (MCP).

3. Complete a subsurface investigation program designed to establish the potential for and extent of any sources of TCE contamination upgradient of House No. 126, Hendrick Street. This recommendation should also be implemented under the MCP.

4. Implement wellhead treatment at the Hendrick Street Wellfield and Pines Well site. A present worth analysis of the appropriate treatment options, namely air stripping and carbon adsorption, determined that air stripping was the most cost-effective. The need for air stripper off-gas treatment will be a function of DEP's then current policy concerning the off-gas treatment of TCE air strippers.

CHAPTER 1
INTRODUCTION

General

S E A Consultants Inc. (S E A) was engaged on March 28, 1990 by the Town of Easthampton to investigate the Hendrick Street Wellfield and the TCE contamination which has been impacting the Wellfield since 1984. The Hendrick Street Wellfield TCE Investigation was completed in two phases. Phase I was a limited site investigation of the Hendrick Street Wellfield and potential contaminant sources located within the Wellfield's recharge area. Phase II of the Hendrick Street Wellfield TCE Investigation consisted of evaluating the geology and hydrogeology of the Hendrick Street Wellfield recharge area and determining the impact the TCE contamination will have on the wellfield. During Phase I of the Investigation, S E A reviewed the existing available information associated with the Wellfield. This information was used to establish a subsurface boring program and groundwater sampling plan which were completed during Phase II. The findings and results of the boring and groundwater sampling tasks are described in this Phase II report.

Purpose and Scope

The purpose of this Investigation is to document the extent of the TCE contamination within the Hendrick Street Wellfield recharge area, estimate the duration of any treatment required to purge the Hendrick Street Wellfield of TCE contamination, and evaluate the various remediation alternatives available to the Town for bringing the Hendrick Street water supply back on-line as a public water supply.

Phase I of the Investigation evaluated potential sources of contamination within the Hendrick Street Wellfield recharge area. The Phase II boring program was set up to confirm or eliminate these potential sources of contamination. The boring program was completed in two steps. The first step was to locate ten borings/monitoring wells within the recharge area and down gradient of each of the identified potential sources of contamination. Based on the chemical analytical results obtained from samples from the ten original wells, an additional six wells were located in the vicinity of the potential contaminant sources.

The Phase II report has identified several treatment, source control or replacement options available to the Town and describes these options in greater detail in Chapter 4. The options evaluated in this Investigation include wellhead treatment, source control and development of alternative water supplies.

Background

The Hendrick Street Wellfield, located in the Barnes Aquifer, has experienced TCE contamination since 1984. The adjacent Pines Well has also been contaminated with TCE, to a lesser degree, since 1984. Table 1.1 shows the historical variations associated with the TCE contamination documented at both the Hendrick Street Wellfield and the Pines Well. The Town of Easthampton Engineering Department has been graphically tracking the concentration of TCE over time as seen in Appendix F. The historical data shows that the Pines Well has a lower level of TCE than that found in the Hendrick Street Wellfield.

In 1989 the Town removed the Hendrick Street Wellfield from the Town's water supply system. The Pines Well, because of its lower levels of TCE contamination, was allowed to remain on-line. After removing the Hendrick Street Wellfield from the water supply, the Town continued to pump approximately 1 mgd from the wellfield to waste to Broad Brook in an attempt to flush the wellfield of contaminants. In 1991, due to high water demands, and the Town's inability to meet these demands with Hendrick Street off-line, DEP granted the Town emergency temporary approval to bring the Hendrick Street supply back on-line only during periods of high demand. As of July 16, 1991, the Pines Well was pumping into the Town's water distribution system while the Hendrick Street Wellfield was not being pumped at all.

Table 1.1

SUMMARY OF TRICHLOROETHYLENE CONCENTRATIONS AT THE HENDRICK STREET WELLFIELD AND PINES WELL

Date	Hendrick Street Wellfield	Pines Well
2-4-80[1]	ND	ND
10-4-84[1]	3.2	< 1
12-5-84[1]	2.7	< 1
5-6-86[1]	4.5	1.9
7-8-86[1]	4.7	1.7
10-2-87[1]	6.7	2.9
2-2-88[1]	5.7	3.5
4-30-88[2]	8.5	3.0
7-4-88[1]	7.6	3.5
7-4-88[2]	2.8 (7.6)*	2.2
7-11-88[2]	7.7	2.0
12-88[2]	8.3	4.0
6-5-89[2]	6.1	Not Sampled
8-14-89[2]	11	5.0
8-16-89[2]	8.2	5.4
8-18-89[2]	8.3	4.9
9-5-89[2]	8.5	4.6
9-25-89[2]	11	4.6
10-10-89[2]	Not Sampled	4.6
11-27-89[2]	8.1	4.9
11-6-89[2]	4.5	3.0
12-29-89[2]	11	5.5
3-13-90[2]	6.3	3.8
6-6-90[2]	4.1	6.4
6-18-90[2]	7.1	3.3
7-23-90[2]	9.1	Not Sampled
8-14-90[2]	3.8	3.5
9-19-90[2]	9.8	Not Sampled
12-14-90[2]	9.0	5.1
1-8-91[2]	10	Not Sampled
2-1-91[2]	7.3	Not Sampled
4-26-91[2]	9.5	5.9
5-6-91[2]	9.5	5.9
6-28-91[2]	11	7.1
12-5-91[2]	12	5.6
12-26-91[2]	8.3	6.4
1-21-92[2]	6.0	Not Sampled

* Sampling procedure for this sample was deemed incorrect. Results of the DEP split sample are given in parenthesis and are considered valid.

1 Sampling and Analyses performed by DEP (1980-1988).
2 Sampling and Analyses performed by Town of Easthampton.
"ND" means not detected

NOTE: All concentrations are reported in ug/L. Hendrick Street Wellfield samples were obtained from a combined outflow from multiple wells within the wellfield.

Additional Potential Sources of Contamination

After the completion of the Phase I report, S E A was informed by a town official that there was an additional potential source of contamination in the Hendrick Street Wellfield recharge area which had not been previously identified. The potential source was an alleged automobile repair equipment cleaning and repair operation located in the backyard of House No. 126, Hendrick Street, no more than 200 feet from the Wellfield. Since the 1970's, when the alleged equipment repair operation was first observed, to the present time, used equipment was solvent cleaned in the backyard area. The excess solvent was allegedly improperly stored or disposed of on-site and eventually percolated down into the soil.

This information was used to locate monitoring wells MW-9A, 9B and 9C, so that any contamination entering the Wellfield from the direction of House No. 126, Hendrick Street could be documented.

CHAPTER 2

SITE GEOLOGY AND HYDROGEOLOGY

Site Geology

The site lies in the Broad Brook valley at the western foot of the basaltic Mt. Tom Range. Glacial outwash sands capped by varved clay deposits overlie arkosic bedrock in the study area. Descriptive studies of geology in the Mt. Tom area are contained in a doctoral dissertation by Larsen (1972) and a masters thesis by Hinthorne (1967). These two sources, along with a report prepared by IEP, Inc. (1988), and the information obtained during the Phase II subsurface investigation, are the main sources of the following discussion of the geology and hydrogeology in the study area.

Bedrock Geology

Bedrock in the study area consists of sedimentary and igneous rocks of the Late Triassic Newark Series (approximate age - 225 million years). The belt west of the Mt. Tom Range, in the area of the subject site, is underlain by the Upper Triassic Sugarloaf Arkose. These continentally-derived rocks were deposited over highly metamorphosed Paleozoic rocks (approximate age - 400 million years), in the northwest portion of a graben tilted 20 to 25 degrees east-southeast.

The Sugarloaf Arkose is composed of alluvial fan and fluvial deposits of arkosic sandstones, conglomerates and siltstones, chiefly coarse-grained arkose. The arkosic rocks are easily eroded and exhibit cross bedding and scour-and-fill features. Groundwater can percolate through bedding planes, joints and faults in this bedrock.

The Mt. Tom Range is mainly composed of Late Triassic Basaltic rocks, primarily the Holyoke Basalt, which were deposited after the Sugarloaf Arkose. The Holyoke Basalt is a dense, homogenous, medium to dark gray, very fine to fine-grained, basalt which exhibits intense vertical jointing along the western face of the Mt. Tom Range. An arkosic sandstone to siltstone of the East

Berlin Formation conformably overlies the Holyoke Basalt. Overlying the East Berlin Formation is the Hampden Basalt which is similar in lithology to the Holyoke Basalt.

The Manhan River Basin was formed by glacial scouring during the last major glacial advance. Ridges of more resistant Sugarloaf Arkose, such as Whiteloaf Mountain, divide the Manhan Basin. The bedrock surface in this area is undulating, ranging from 22 feet above sea level north of Broad Brook, to 85 feet below sea level south of Broad Brook near Hampton Ponds (Pequot, Horse, Buck and Doe Ponds). This irregular surface has been filled with till and glacial outwash deposits. Depth to bedrock in this area will therefore vary greatly.

A major bedrock fault lies within the Mt. Tom Range. The Mount Tom fault is oriented north-northeast to south-southwest and is located south of Mountain Road in Easthampton along Broad Brook. The fault is approximately nine miles in length and continues into Holyoke (Barosh and others, 1977). Smaller faults may branch from the dominant Mt. Tom fault and have a generally east-west orientation.

Surficial Geology

All of the Mt. Tom Range was covered by ice during the last glacial advance, as evidenced by striations observed on rocks at an elevation of 1,205 feet on Mt. Tom. The ice advanced in a southerly direction through this area. Till found west of the Mt. Tom Range, in the study area, is derived from the underlying arkose bedrock and is reddish-brown and sandy. Larsen (1972) describes this till as 68.5 - 73.5% sand, 13.6 - 27.4% silt and 2.6 - 15.2% clay. Such a sandy till can be a relatively permeable deposit.

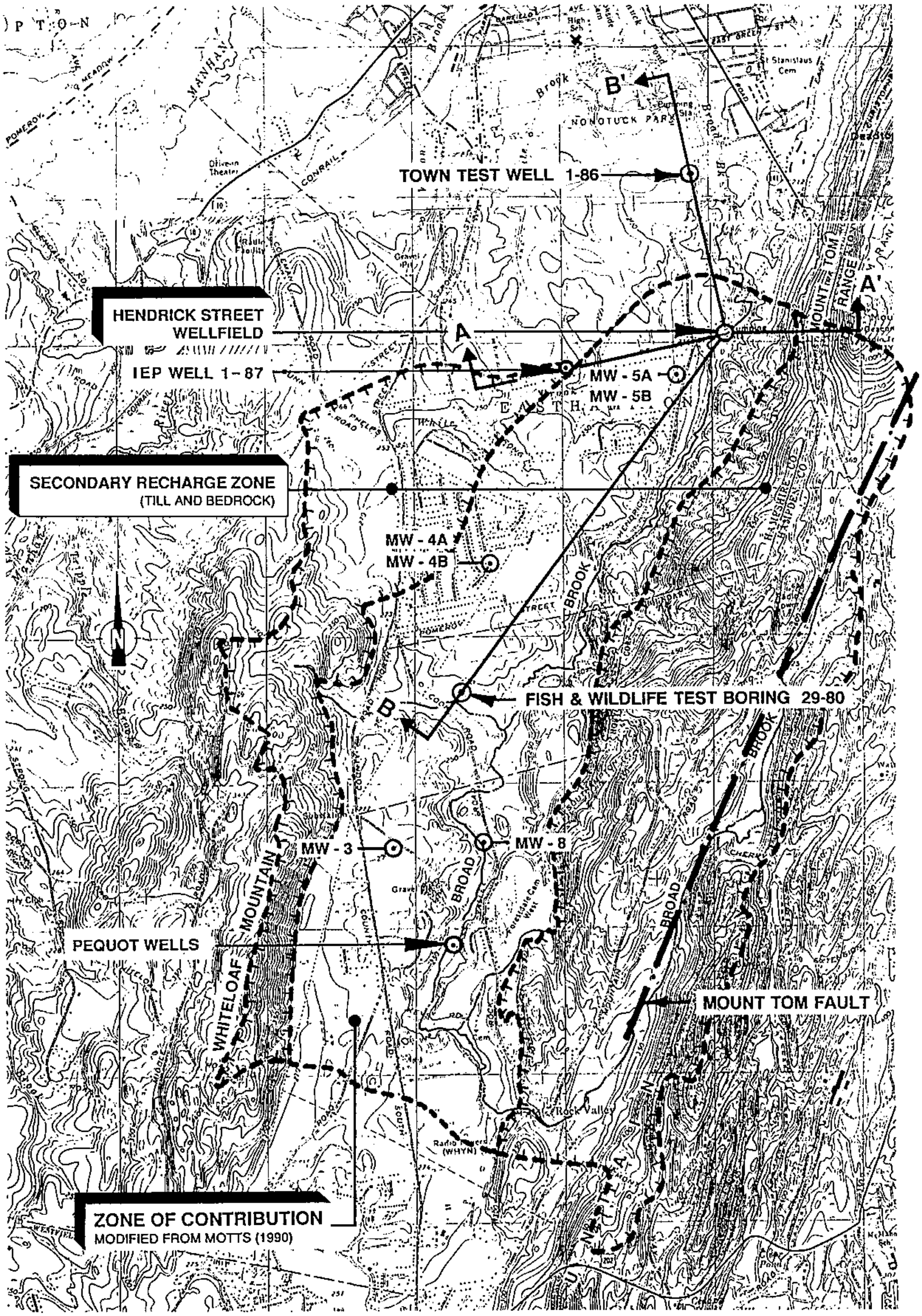
The northward retreat of the ice sheet was punctuated by four ice-edge standstills, during which glacial outwash deltas and proglacial lake sediments were deposited in the Broad Brook valley (Larsen, 1972). These deltas comprise the highly permeable Barnes Aquifer system from which the Hendrick wells draw. The Barnes Outwash Plain, which is 100 to 300 feet thick, was built out southward from the ice margin, positioned approximately 0.3 miles south of Pomeroy Street, into a proglacial lake south of the ice edge. This outwash plain comprises approximately 10 square miles.

As the ice margin retreated, subsequent outwash deltas were deposited north of the Barnes Outwash Plain. The Pomeroy Street Delta was deposited off an ice margin situated just north of Phelps Street, 1.2 to 1.5 miles north of the previous stand-still position. The ice sheet again retreated, to a position near Plain Street, 0.4 miles from its prior position, with the White Brook delta deposited into a small glacial lake off its flank. During the subsequent glacial retreat, glacial Lake Hitchcock spread from the east side of the Mt. Tom Range, through the Holyoke Narrows, and occupied the area north of Plain Street in Easthampton. The clay deposited in glacial Lake Hitchcock serves as the aquiclude for the confined aquifer at the Hendrick Street Wellfield.

Two regional geologic cross-sections, as shown on Figure 2.1, are provided in Figures 2.2 and 2.3. Cross-section A-A' (Figure 2.2) is oriented along a west-east axis, approximately perpendicular to the direction of groundwater flow. The direction of groundwater flow is south-southwest to north-northeast. Cross-section B-B' (Figure 2.3) is oriented along a south-north axis through Easthampton approximately parallel to the direction of groundwater flow. The geologic cross-sections are a compilation of existing subsurface data and data obtained during the Phase II investigation. Soil borings which were felt to be too far away from the cross-section were not used in estimating the cross-sectional stratigraphy.

Site Hydrogeology

The Barnes Aquifer, the water supply source for the Hendrick Street Wellfield and Pines Well, is composed of Pleistocene outwash sands and gravel. The Barnes Aquifer is an unconfined system south of Plain Street in Easthampton. North of Plain Street, the aquifer is confined by an overlying clay layer and is artesian. Bedrock underlying the surficial deposits is an arkosic sandstone/conglomerate/siltstone of the Sugarloaf Formation. Groundwater can be expected to infiltrate the bedrock via bedding planes, fractures, faults and joints.



0' 2000'
Scale in Feet

Reference:

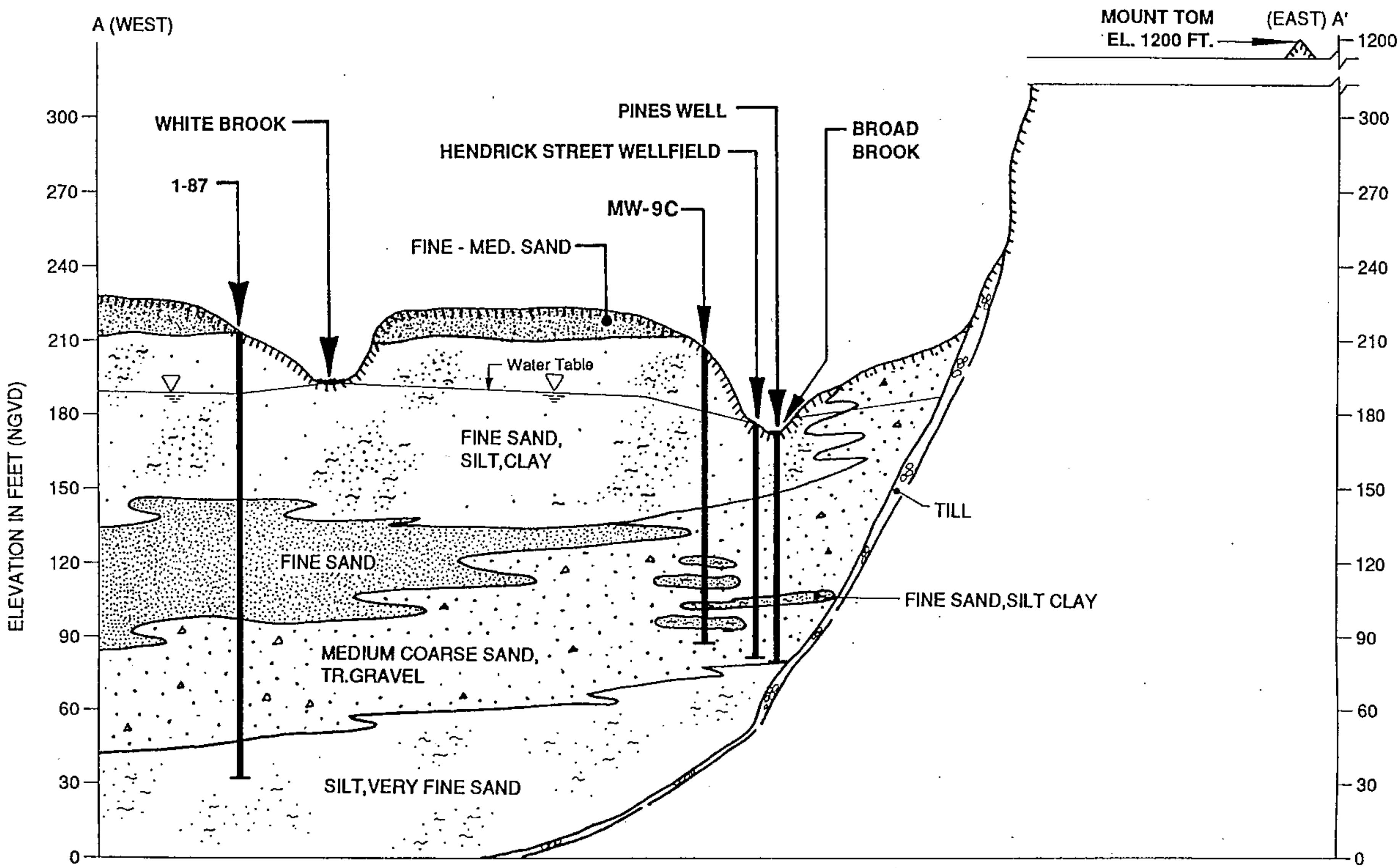
From the U.S.G.S. Topographic Map of the Mount Tom Quadrangle.

Figure 2.1

ZONE OF CONTRIBUTION
HENDRICK STREET WELLFIELD

Town of Easthampton, Massachusetts

SEA Consultants Inc.
Engineers / Architects



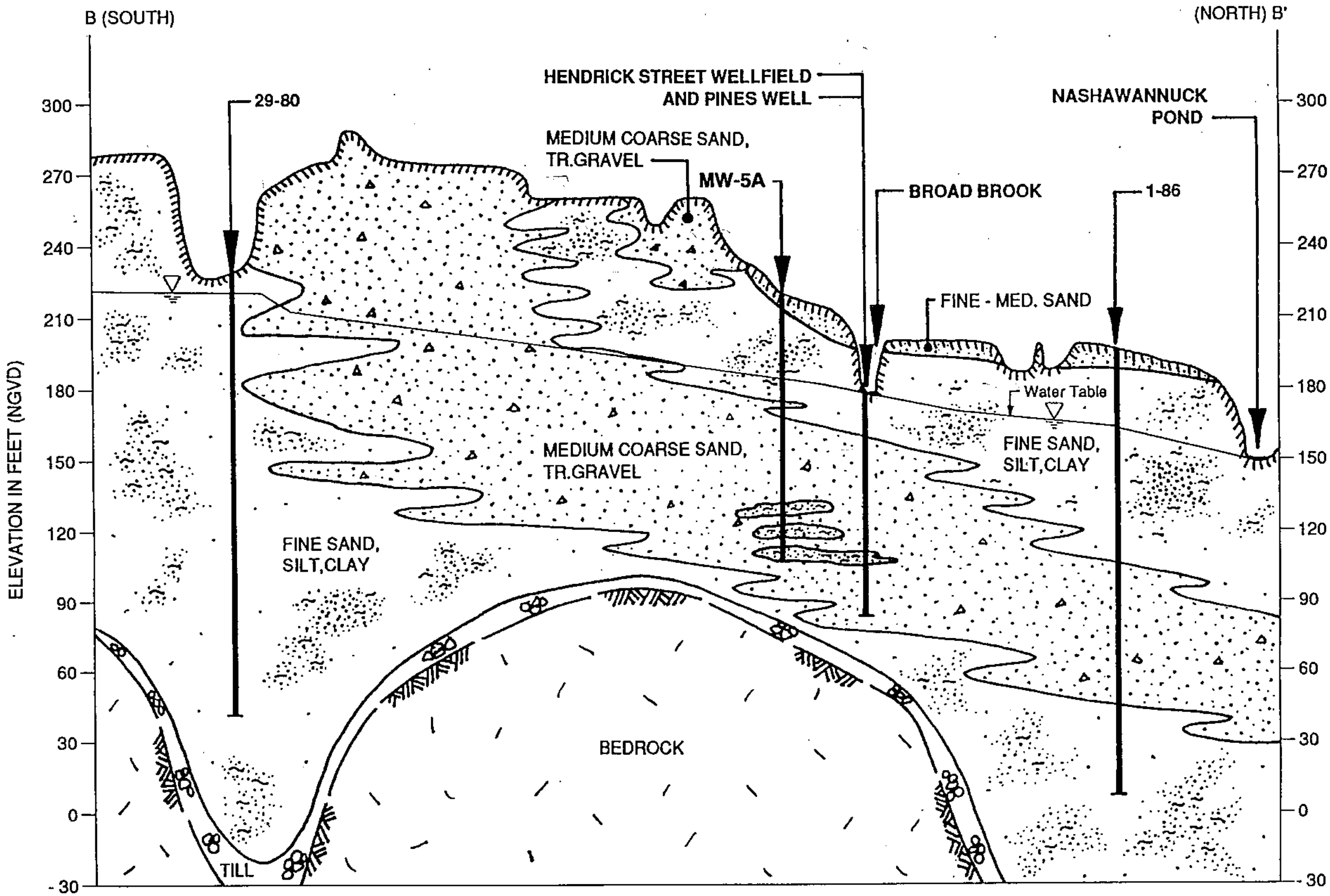
HORIZONTAL SCALE : 1" = 900'
VERTICAL SCALE : 1" = 60'
VERTICAL EXAGGERATION = 15X
CONTACTS ARE ASSUMED

Figure 2.2

GEOLOGIC CROSS-SECTION A - A'

Easthampton, Massachusetts

SEA Consultants Inc.
Engineers /Architects



HORIZONTAL SCALE : 1" = 2083'
VERTICAL SCALE : 1" = 60'
VERTICAL EXAGGERATION = 34.7X
CONTACTS ARE ASSUMED

Figure 2.3

GEOLOGIC CROSS-SECTION B - B'

Easthampton, Massachusetts

SEA Consultants Inc.
Engineers /Architects

The zone of contribution and secondary recharge zone for the Hendrick Street Wellfield are shown in Figure 2.1. The zone of contribution constitutes the area of the aquifer from which groundwater flows to the Hendrick Street Wellfield under pumping conditions. The delineation of this zone has been modified from Motts (1990), which showed the combined Hendrick Street and Nonotuck Park zone of contribution, in order to isolate the Hendrick Street Wellfield zone of contribution from that of the Nonotuck Park Wells. The Motts zone of contribution was modified to eliminate any portion of Pequot Pond, and its surface and groundwater watersheds. Motts modelled the zone of contribution under conditions of maximum pumping at Holyoke's Pequot Wells. However, these wells are not currently in service, and the southern limit of the zone delineated in Figure 2.1 reflects the static groundwater divide as modified from Motts.

The secondary recharge area for the Hendrick Street Wellfield and Pines Well, consisting of glacial till and bedrock within the surface watershed of the zone of contribution, is also shown on Figure 2.1. This secondary zone recharges both groundwater and surface water to the zone of contribution, though less intensively per unit area than comparable areas within the primary zone of contribution.

The delineated zone of contribution corresponds in general to Zone II as defined by DEP, and the secondary recharge area corresponds to Zone III. However, S E A has chosen not to use the Zone II, III labels for these areas because of the implication that anything labeled Zone II or III must correspond exactly to officially adopted zones of contribution.

Sources of recharge for the aquifer in the vicinity of the subject site include the following:

(1) Precipitation percolating through surficial sediments south of Plain Street;

(2) Infiltration from surface water, mainly the Broad Brook, south of Plain Street;

(3) Slow percolation through the confining layer to the confined portion of the aquifer;

(4) Recharge from the underlying bedrock; and

(5) Percolation of precipitation and runoff through the extensively jointed rocks of the Mt. Tom Range east of the study area and migration into the Barnes Aquifer.

Given that the zone of contribution for the Hendrick Street Wellfield lies mainly to the south of Plain Street, where the aquifer is unconfined, the first two sources of recharge listed are the primary sources. Due to the unconfined conditions, percolation through surficial sediments is probably the major recharge source. A slow hydrologic communication exists between the Broad Brook and the aquifer at the Hendrick Street Wellfield, so that surface water infiltration may be a major recharge source. Percolation through the confining layer is probably a less important recharge source since the aquifer is unconfined within most of the zone of contribution for the wellfield. The underlying bedrock, which exhibits bedding planes and fractures, could also have sufficiently high transmissivity to serve as a source of recharge. Recharge in the form of sheet flow from the Mt. Tom Range is also possible.

Surface Drainage

On a regional scale, the site is located within the Manhan River sub-basin of the Connecticut Lowlands Drainage Basin. The Connecticut River is located approximately two miles east of the site, on the opposite side of the Mt. Tom Range. The Manhan River sub-basin is bounded by Little Mountain to the west and the Mt. Tom Range to the east. The headwaters of the Manhan River are located west of Whiteloaf Mountain. The Manhan then flows north of Easthampton town center and discharges into The Oxbow, a cut-off meander of the Connecticut River.

The local drainage basin, the Broad Brook sub-sub basin of the Connecticut Basin, is bounded by Whiteloaf Mountain to the west and the Mount Tom Range to the east. The southern boundary lies to the north of Pequot Pond. Broad Brook flows southerly from a wetland south of Mt. Tom and loops around to a northerly direction at Rock Valley. The brook discharges to Nashawannuck Pond in Easthampton Center. The area south of Rock Valley is within the Westfield River Basin and local drainage is to the south.

In the vicinity of the Hendrick Street Wellfield site, the mean annual runoff (including surface and groundwater runoff), as mapped by the USGS (Brackley and Thomas, 1979), is 19 to 20 inches per year or 0.90 to 0.95 million gallons per day per square mile.

CHAPTER 3
SUBSURFACE INVESTIGATIONS

Boring Program

Purpose

The purpose of installing sixteen (16) monitoring wells during Phase II of the Investigation was to determine the location and concentration of chemical contamination that is currently impacting the Pines and Hendrick Street Wells, or may impact the wells in the future. The monitoring wells were installed under specific procedures described below at locations specified by S E A and approved by the Town of Easthampton and the DEP. The monitoring wells were installed in two steps, Phase IIA and Phase IIB. Phase IIA included the installation and sampling of 10 monitoring wells, along with the sampling of three existing wells, MW-M1, MW-M2 and MW-M6. Phase IIB included the installation of six additional monitoring wells, with their locations determined by the results of the Phase IIA program.

Monitoring Well Installation

Monitoring wells were installed in boreholes advanced by the drive-and-wash casing method. The drive-and-wash technique involves advancing a steel casing through the overburden using a 300 pound weight falling approximately 24-inches, with blow counts being recorded at five foot intervals. A steam cleaned 4-inch casing was advanced to refusal or the desired well depth and a 2-inch PVC riser and screen was placed within the borehole and cleaned of sand with a washing bit. Water used during the washing operation was supplied and brought to the site by the driller from the Lovefield Street (Maloney) Wellfield in Easthampton. The Lovefield Street Wellfield water was sampled and submitted for laboratory analysis for VOCs by EPA Method 524 and total petroleum hydrocarbons (TPH) by EPA Method 5520. A sample was also collected from the first buffalo tank of water used by the drillers and analyzed for the same parameters with a 24-hour turn-around time. Both samples showed no detectable volatile organic chemical contamination. Soil samples were then obtained using a split spoon sampler. All wells have been capped and either a protector pipe has been secured with a lock or the well casing has been surrounded by a lockable flush mounted road box.

Given the area hydrogeology, monitoring wells were installed into either a confined or unconfined aquifer (or both), depending on well location. A confined aquifer system was identified by the on-site geologist during well installation based on the presence of a clay/silt confining layer identified from split spoon samples. Following well installation, the wells were developed by pumping and surging with a submersible pump until groundwater discharge was free of suspended sediment. Wells were screened with 20 feet of 10-slot, pre-slotted, flush joint PVC. The interval to be screened was based on the stratigraphy, in conjunction with any contamination detected in the field.

The annular space between the screen and the borehole was filled with Ottawa Silica Sand extending to at least five feet above and one foot below the screened interval. A minimum of five feet of bentonite slurry or pellets, depending upon the water table location, was placed above the silica sand pack, in the annular space between the riser and the borehole, as an impermeable seal. If no VOCs were detected in the soil samples obtained from the boring, backfill which in the opinion of the on-site geologist was suitable to the proper operation of the monitoring well, was placed above the impermeable seal, extending to a height of within 2 feet of the existing ground surface. Above the backfill, either a concrete standpipe or flush mounted road box was cemented into place.

Location of Monitoring Wells

Phase IIA Monitoring Wells

A total of sixteen monitoring wells were located and constructed within the Hendrick Street Wellfield recharge area, or zone of contribution, in Phases IIA and IIB. Because trichloroethylene (TCE) is an organic solvent found in degreasers, paints, dry cleaning chemicals and dye coloring, particular attention was given to local land use which may have involved use or storage of any of these materials. The placement of the monitoring wells was done in two steps. Phase IIA consisted of the placement of ten (10) monitoring wells at locations which were downgradient of existing potential sources which were identified during Phase I of the Investigation. Phase IIB consisted of the placement of six (6) additional monitoring wells to further define the contaminant plume, based on results from the Phase IIA program.

The Phase IIA monitoring wells were located from a survey of local and state release incident files, interviews with local officials and observations by S E A personnel regarding land use and spill incident reports within the study area are summarized in Appendix E of the Phase I Limited Site Investigation Final Report. Because the concentrations of TCE detected in the Barnes Aquifer are very low, it is possible that the source could be a relatively small, isolated spill incident. However, the low concentrations do not rule out the possibility of a larger, continuing source. The slowly increasing concentrations could represent the migration of a larger plume across the Hendrick Street Wellfield area. The majority of the spill reports listed in Appendix E do not involve TCE-containing materials, or were followed-up by DEP, and are not probable groundwater contaminant sources.

The Phase IIA groundwater monitoring program also included the sampling and analysis of groundwater obtained from three existing monitoring wells, MW-M1, MW-M2, and MW-M6, which were installed by others as part of an earlier study of the Barnes Aquifer.

The sites listed below were considered to warrant further investigation during Phase II as potential TCE sources. These sites were identified because files described past discharges or land use which indicated that relevant hazardous materials may have been used or generated at these locations. Also, only those sites where there was a mechanism for transport of the TCE from the site via the Barnes Aquifer to the Hendrick Street Wellfield zone of contribution warranted further study. Only TCE has historically been detected in the groundwater at the Hendrick Street Wellfield and most of the sites identified as potential sources would generate other contaminants, especially petroleum products, along with the TCE. The lack of petroleum contaminants in any of the samples previously analyzed may be due to adsorption of petroleum contaminants onto the soil particles with which they have come into contact.

The following list summarizes the potential contaminant sources, arranged in alphabetical order, which were identified in Phase I and used to locate the Phase II monitoring wells. Listed sites are located on Figure 3.1.

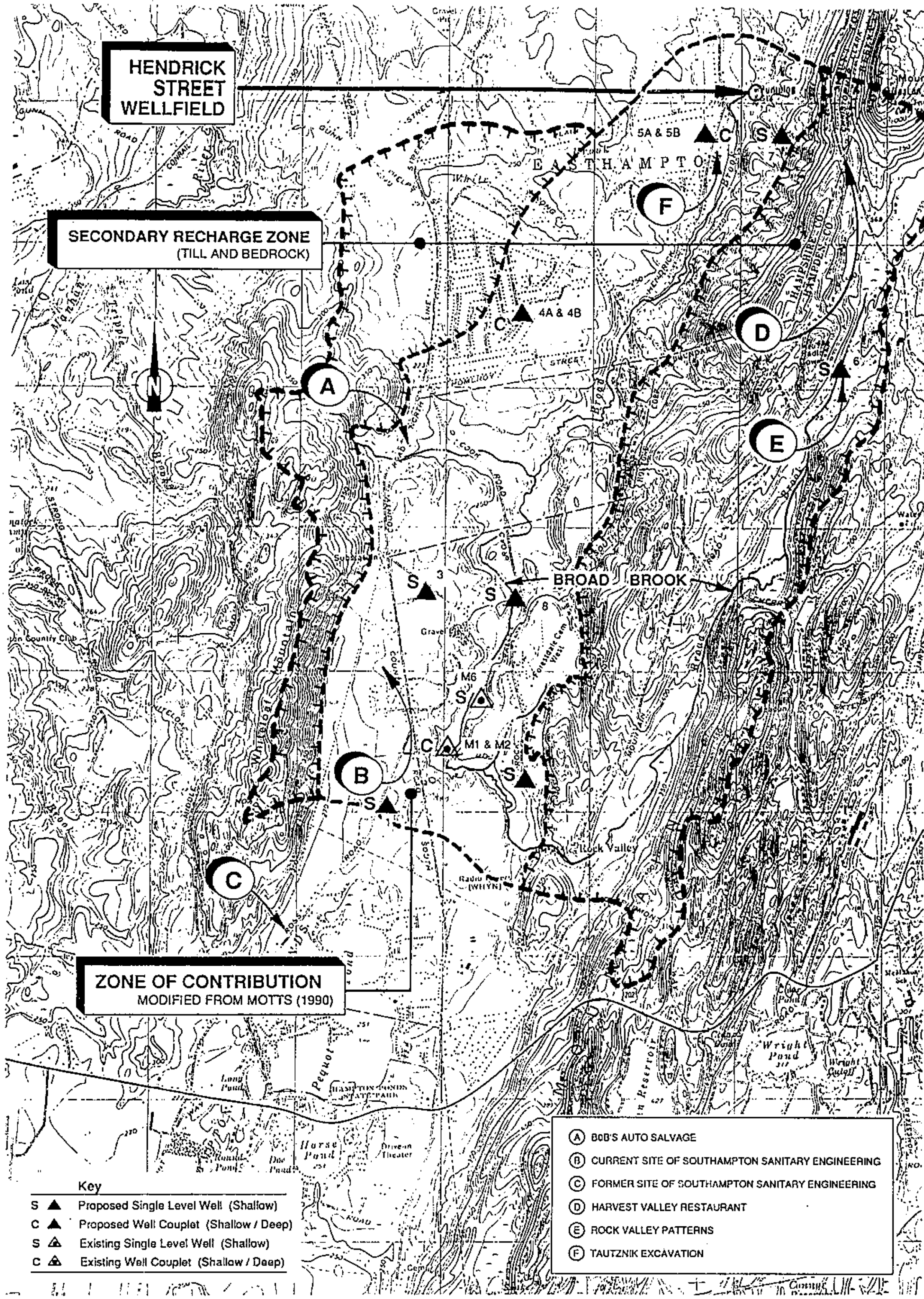
Bob's Auto Salvage, 113 County Road, Southampton

This site is located approximately 2 miles southwest of the Hendrick Street Wellfield, within the mapped zone of contribution. A site inspection was not performed at the facility; however, junkyards may use solvents for metal parts cleaning, machinery maintenance and degreasing. Based on the area reconnaissance survey performed by S E A, it appears that a tributary of Broad Brook runs through or along the property line of the salvage yard, which could serve as a conduit for transport of discharge from the site to the aquifer. Hydrogeologic mapping of the area indicates that the aquifer is probably unconfined in this area.

Current Site of Southampton Sanitary Engineering Corporation, 168 County Road, Southampton

Since the 1970's, the Southampton Sanitary Engineering Corporation (SSE) facility has been located at 168 County Road in the Town of Southampton, approximately 1.7 miles north of the intersection of Route 202 and County Road. The facility is a container and tank storage operation which serves western Massachusetts. The facility handles hazardous wastes such as oil and chemical wastes obtained from spill clean-ups, metal finishing and machining, chemical, electronic, paint and other manufacturing, as well as commercial and public hazardous waste generators.

All wastes which are collected from generators and spill clean-up activities are transported off-site to a permitted treatment, recycling, or disposal facility. No treatment, reclamation, or disposal of hazardous wastes occurs at the SSE facility, which currently operates as a storage site. DEP has no current records of spills or releases at this site. However, because this is the only EPA Hazardous Waste generator identified within the Hendrick Street Wellfield zone of contribution, it was given consideration as a potential source of TCE contamination.



Reference:

From the U.S.G.S. Topographic Map Of the Mount Tom Quadrangle

0' 2000'
Scale In Feet

Figure 3.1

PHASE IIA MONITORING WELL LOCATIONS

Town of Easthampton, Massachusetts

SEA Consultants Inc.
Engineers / Architects

Former Site of Southampton Sanitary Engineering Corporation, Pequot Road, Southampton

Prior to the 1970's, SSE was located on Pequot Road. Until the late 1970's to early 1980's, SSE was operating as a septage hauler. SSE collected septage from residential, commercial and industrial subsurface disposal systems in Southampton and disposed of it in lagoons and/or pits located at their Pequot Road facility.

Septage is a highly concentrated waste with a variable composition. Some common constituents of septage that are potential groundwater contaminants include pathogenic bacteria and viruses, heavy metals, nitrates, sodium, chloride, and volatile organic compounds such as benzene, toluene, 1,1,1-trichloroethane (TCA), 1,1,2-trichloroethane, and trichloroethylene (TCE). Heavy metals and volatile organic compounds are typically found in the waste streams from a variety of commercial and industrial facilities. In Southampton, subsurface disposal systems were used to dispose of the sanitary sewage from these types of businesses. The presence of heavy metals and volatile organic compounds in septage can also be attributed to the improper disposal of household hazardous waste, and the use of toilet bowl and septic system cleaners.

The lagoon and pits provided a system for the dewatering of septage. They are usually unlined and sited in well-drained, permeable soils. Lagoons and pits provide minimal or no treatment of septage and, therefore, pose a serious threat to groundwater quality. Although the site is not located within the zone of contribution modelled for the Hendrick Street Wellfield, contamination could have been drawn into the zone when the Holyoke Pequot Wells were pumping. Residual contamination could be impacting the Barnes Aquifer at the Hendrick Street Wellfield.

Harvest Valley Restaurant, Rte. 41, Easthampton

This site is currently a restaurant, located on the flank of the ridge east of the Hendrick Street Wellfield. Formerly, a gas station and well drilling business both operated on the property. There is no information in Easthampton Fire Department files regarding underground storage tanks at the site, but Armand Lapointe, Fire Prevention Officer, believes that there were tanks removed before

1960. The site is located within the secondary recharge area for the Hendrick Street Wellfield. It is possible that any spills from the site could flow through joints and fractures of the basalt ridge and flow in groundwater to the Hendrick Street Wellfield.

Rock Valley Patterns, 111 Southampton Road, Holyoke

Rock Valley Patterns is a former cottage industry which operated out of the basement of a home located at 111 Southampton Road, south of the intersection of Route 141 and Southampton Road in Holyoke, Massachusetts. The house is located on the banks of the Broad Brook, approximately 100 feet from the brook which could potentially serve as a conduit for contaminants being transported to the Barnes Aquifer. The land surrounding the house is frequently flooded by the brook. There is also a potential for fractured bedrock to act as a conduit for contamination to travel to the Hendrick Street Wellfield.

Rock Valley Patterns began manufacturing metal and wood patterns for the machine tool industry in the mid-1940's. The business was closed in the early 1980's. At that time, Rock Valley Patterns employed approximately thirty (30) people. According to Ms. Connie Baker, member of the Holyoke Conservation Commission who performed several site inspections of the property, drums containing unidentified materials were stored, unprotected, outside the house. The house was served by a septic system.

Machine shops and metal working operations typically perform many different processes which generate grinding sludges and wastewater. Oil is generally used in the machining or stamping process as a lubricant. Most machine shops use degreasing solvents for routine maintenance on machinery and for cleaning metal parts. Trichloroethylene is a typical solvent used for these purposes. Process wastewaters and spent machinery cleanser from the Rock Valley Patterns operations could have been disposed of via the domestic septic system. The cleanser used by Rock Valley Patterns employees to clean parts and machinery may have contained TCE. The former Rock Valley Patterns site was considered a potential source of TCE contamination, since the Broad Brook could possibly serve as a conduit for transport of TCE from the site to the Barnes Aquifer at the Hendrick Street Wellfield.

Tautznik Excavation, 165 Hendrick Street, Easthampton

Heavy equipment related to this excavation business is stored behind a residence located on Hendrick Street. The storage area is on the western bank of Broad Brook, approximately 1500 feet south of the Hendrick Street Wellfield. Solvents are routinely used in vehicle maintenance and may be expected to be stored on this property. Any spills at this site could be transported via Broad Brook to the Barnes Aquifer at the Hendrick Street Wellfield. This site was identified during the area reconnaissance survey although an on-site inspection was not performed.

Computer flow simulation was also used during Phase IIA to assist in locating the Phase IIA monitoring wells downgradient of the potential contaminant sources. The numerical groundwater model "AQUIFER" was constructed to simulate the Barnes Aquifer system. The model employs a 24 column by 45 row node-centered finite difference grid with variable grid spacings ranging from 260 feet to 2080 feet at various locations within the model. The output from this model can be used as input into CONTRANS (a contaminant transport simulation model). This model can generate computer simulated travel times. The original "AQUIFER" model and travel time contours were developed by James C. Hall, Ph.D, for the report "Aquifer-Protection Study of Barnes Aquifer For Easthampton, Massachusetts" (Motts, 1990).

Although the model initially selected to simulate the Barnes Aquifer was the MODFLOW code developed by IEP, the AQUIFER code developed by Dr. Hall was developed more recently and incorporates several refinements:

1. The multi-layer nature of AQUIFER allows true hydraulic conductivities to be used, rather than fictitious permeabilities which are an artifact of the 2-layer model developed by IEP.

2. With AQUIFER, true groundwater velocity and travel time data can be derived from the water table and hydraulic conductivity input data.

3. AQUIFER takes into account recharge from the highlands to the east and west, unlike the MODFLOW code.

4. AQUIFER accounts for the thinning of the clay layer along the eastern and western flanks of the valley, thus allowing for a more realistic depiction of the head differential between the lower and upper aquifer layers.

The model was obtained by S E A and a steady state water table map was generated with the Lovefield and Nonotuck Park Wells pumping at 1.5 million gallons per day (mgd), and the Hendrick Street and Pines Wells pumping at a combined 4.3 mgd. Pumping rates are those used in the Motts (1990) study. The water table elevation output from this run was then used as the water table input for the next run, which utilized pumping rates for the Pines Well at 1 mgd and the Lovefield and Nonotuck Park Wells at 1.5 mgd. This run was intended to simulate the conditions under which the water quality samples and groundwater elevations were obtained. The locations of proposed Phase IIA groundwater monitoring wells were determined through the use of the flownet generated by the computer modelling, so as to follow groundwater flow patterns downgradient of the suspected contaminant sources identified during the Phase I Investigation.

Each Phase IIA monitoring well location is shown on Figure 3.1 and a summary of the purpose of each well is outlined in Table 3.1.

Phase IIB Monitoring Wells

Due to the lack of detection of TCE in any monitoring wells during Phase IIA, the source of contamination of the Hendrick Street Wellfield was thought unlikely to be one of the previously mentioned potential contaminant sources. As the only known locations of TCE contamination at the time were the Hendrick Street Wellfield and the Pines Well, the Phase IIB program was designed

Table 3.1

Phase IIA Monitoring Well Locations

Proposed Well Location		Purpose
(MW-1)	Single well at Ross Road in Southampton, 3500' NE of the former SSE facility.	1. To evaluate the impact of the Former SSE facility on groundwater quality. 2. To monitor the southern boundary of the Hendrick St. Wellfield Zone of Contribution.
(MW-2)	Single well at intersection of Rock Valley and Keyes Rd. in Holyoke, 500' E of Broad Brook.	1. To evaluate discharge from Broad Brook, especially Rock Valley Patterns.
(MW-3)	Single well at Southampton Rd. 500' E of County Rd. in Holyoke, 2,000' NE (downgradient) of the current SSE facility.	1. To evaluate the impact of the current SSE facility on groundwater quality.
(MW-4A & MW-4B)	In Easthampton, 3000' NE of Bob's Salvage yard, 750' N of Pomeroy St., shallow and deep couplet.	1. To evaluate the impact of Bob's Auto Salvage on groundwater quality.
(MW-5A & MW-5B)	At Hendrick St., Easthampton, 200' N downgradient of Tautznik Excavation, 1300' SW of Hendrick St. Wellfield, shallow and deep couplet.	1. To evaluate the impact of Tautznik Excavation on groundwater quality.
(MW-6)	At the Rock Valley Patterns site in Holyoke. (Hand driven wellpoint)	1. To evaluate the impact of Rock Valley Patterns on groundwater quality.
(MW-7)	At the base of the Mt. Tom Range, 1500' E-NE of Harvest Valley Restaurant in Easthampton.	1. To monitor runoff from the Mt. Tom Range. 2. Evaluate the impact of Harvest Valley site on groundwater quality.
(MW-8)	At Rock Valley Rd. and Southampton Rd. intersection.	1. To document any contamination in the Broad Brook valley.

to concentrate on the area adjacent to the Wellfield. Groundwater was modelled during Phase I as flowing to the wellfield from the north, west, and south, so during the Phase IIB program a monitoring well was constructed within 500 feet of the well field in each of the upgradient flow directions.

Between the Phase IIA and Phase IIB steps, as previously discussed, S E A Consultants Inc. was informed of an additional potential contaminant source in the vicinity of House No. 126, Hendrick Street. From the 1970's to present times, it has been reported that a small scale automobile repair equipment cleaning and repair operation has existed at 126 Hendrick Street. The alleged operation involved rinsing the equipment with solvent, allowing the spent solvent to percolate into the ground. Based on this information, the Phase IIB monitoring wells included wells MW-9A and MW-9B, a deep/shallow couplet located downgradient, and well MW-9C, a single well located upgradient of 126 Hendrick Street. These wells were to establish if any contamination was coming from 126 Hendrick Street (MW-9A and MW-9B) or upgradient of the property (MW-9C). Wells MW-9A, MW-9B and MW-9C, as shown on Figure 3.2, were installed to depths of approximately 118, 55, and 121 feet, respectively. Stratification at MW-9A (deep well) and MW-9B (shallow well) consisted of very fine sand above fine to coarse sand with trace gravel, periodically interbedded with thin layers of very fine sand. The stratification at MW-9C consisted of approximately three layers of fine to coarse sand with some trace gravel interbedded with two layers (the upper being approximately 60 feet thick) of very fine sand and silt with trace clay lenses. The borings for MW-9A and MW-9C were taken to refusal as noted on the boring logs, see Appendix A.

The western monitoring wells (MW-10A and MW-10B) were located hydraulically downgradient and upgradient, respectively, of Tautznik Excavation. These wells were to establish if any contamination was coming from the Tautznik property (MW-10A) or upgradient of the property (MW-10B). The Phase IIA wells (MW-5A and MW-5B), which were also installed to document any contamination coming from the vicinity of Tautznik Excavation, had been installed in the public right-of-way along Hendrick Street. Upon receipt of Mr. Tautznik's invitation to install wells directly on his property, it was felt wells MW-10A and MW-10B would better document any contamination entering the Wellfield from the south than was done under the Phase IIA program. The boreholes for each of

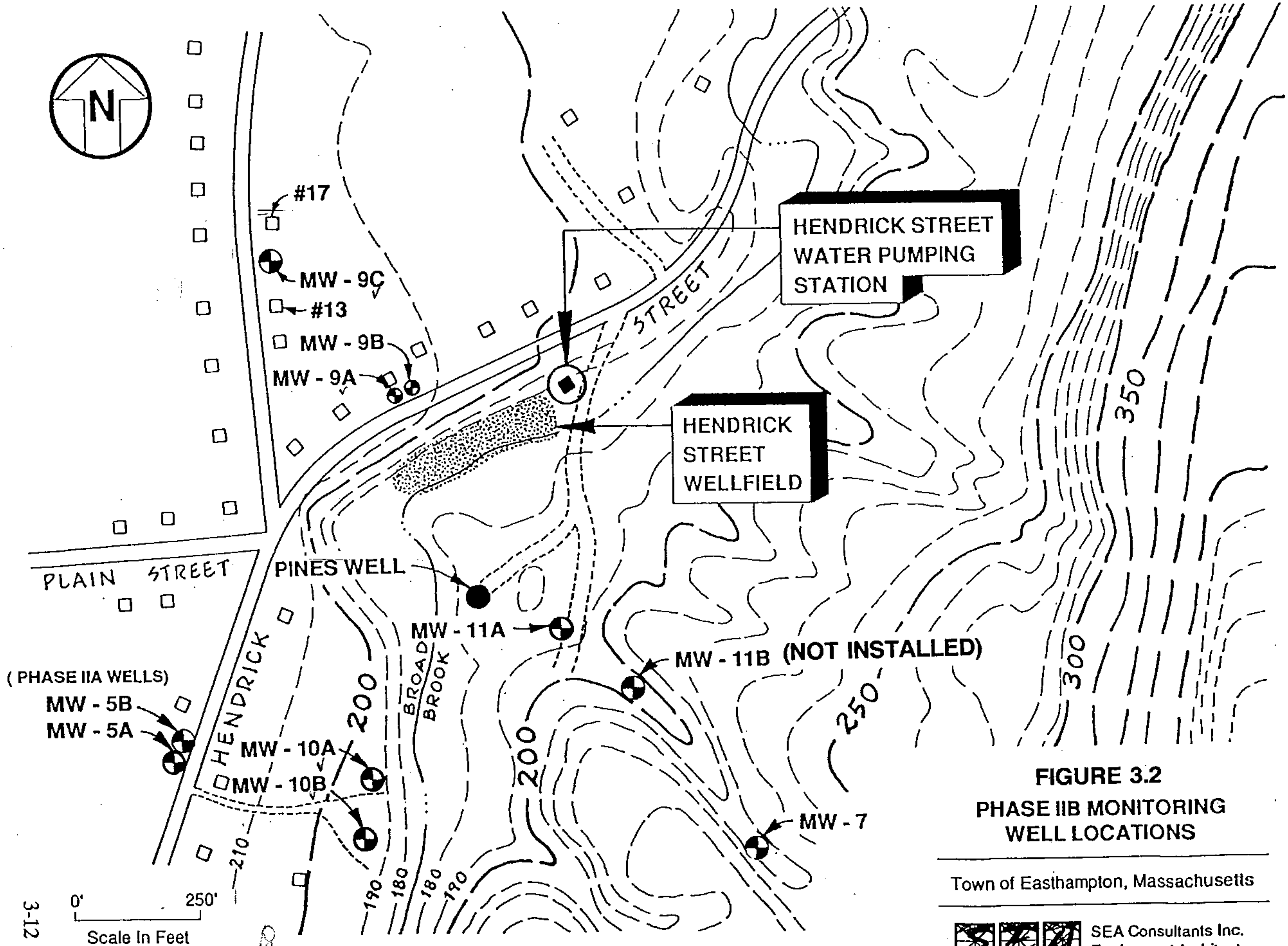


FIGURE 3.2
PHASE IIB MONITORING WELL LOCATIONS

Town of Easthampton, Massachusetts

SEA Consultants Inc.
Engineers / Architects

these wells were taken to refusal, as noted on the boring logs. Both of these wells were installed to a depth of approximately 84 feet. The stratification consisted of approximately three layers of fine to coarse sand with some trace gravel interbedded with two layers of very fine sand and silt.

The southern monitoring well (MW-11A) was located south of the Pines Well. The purpose of MW-11A was to establish if any contamination was traveling down the mountain side from Harvest Valley Restaurant, Rock Valley Patterns, or other potential source in that direction. MW-11A was installed to a depth of approximately 96 feet, which was the refusal depth for the borehole, and consisted of approximately three layers of fine to coarse sand with some trace gravel interbedded with two layers of very fine sand and silt. Monitoring well MW-11B, which was to be installed upgradient of MW-11A if contamination was found in MW-11A, was not installed as no contamination was found.

All monitoring well boring logs are located in Appendix A. Monitoring well MW-6 is a hand driven well point with no accompanying log. There are two sets of boring logs contained in Appendix A, the S E A geologist's logs were prepared by the S E A geologist who oversaw the field drilling activities. The driller's (Soil Exploration Corporation) logs have also been included. Any discrepancies in soil classification between the sets of logs is due to personal interpretation of the site soils.

Description of Groundwater Sampling Program

The Phase II groundwater sampling program was completed in two steps. The Phase IIA sampling was performed on the ten (10) monitoring wells installed to document the potential sources of contamination identified in Phase I plus the three (3) existing monitoring wells, MW-M1, MW-M2 and MW-M6. The Phase IIB sampling program encompassed all sixteen (16) monitoring wells installed during Phase II. Three of the sixteen wells installed, MW-3, MW-4B (shallow) and MW-7, could not be sampled due to the wells being dry at the time of sampling. Field analysis of soil samples obtained while completing the boring at each of these locations did not detect any volatile organic chemical contamination at these locations.

The intent of the sampling program was to evaluate the level of VOC contamination and to determine the direction of contaminant migration. Additionally, testing was also conducted for the detection of TPH in soil samples, and iron and manganese in groundwater samples. The field sampling program consisted of obtaining the groundwater samples, while monitoring the pH, temperature and specific conductivity at each well location. The depth to groundwater was also measured from the top of the well casing. The elevation of each well casing was determined by survey based on USGS datum.

Split Spoon Sampling Procedure

At 5-foot intervals during well installation, a soil sample was taken according to ASTM D-1586 - Standard Penetration using a split spoon sampler of stainless steel construction. The number of blows to drive the sampler into the soil for each six inches of penetration was recorded and are shown in the boring logs included in Appendix A. Between samples, the split spoon was cleaned by the following procedure:

1. Rinsed with distilled water;
2. Rinsed with methanol (pesticide grade); and
3. Rinsed with distilled water.

S E A's on-site geologist performed field screening of split-spoon soil samples for volatile organics by jar headspace analysis using a portable Photovac 10S50 gas chromatograph (GC) in accordance with the quality assurance plan previously approved by DEP.

Soil Analysis Procedure

At least one soil sample was collected from each boring and submitted to a DEP certified laboratory, Alpha Analytical Laboratories, to validate the field screening results based on the following criteria.

- If no soil contamination was detected during VOC screening of split spoon samples, a single soil sample was collected at the depth of placement of the well screen. This sample was submitted for VOC analysis by EPA Method

8260 and for TPH.

- If VOCs were detected during screening of soil samples, up to five samples were collected from the boring and submitted for laboratory analysis for VOCs (Method 8260) and for TPH (Method 5520). The VOC soil samples were collected from the following zones, as delineated by GC screening:

  a) at a depth where contamination is first identified;
  b) the zone midway between the initial detection and the maximum contamination;
  c) the zone of maximum contamination; and
  d) at the boring's maximum depth.

<u>Soil Sampling Results</u>

Headspace analysis using gas chromatography (GC) was performed on soil samples obtained during the installation of the Phase IIA wells. No contamination was found during these analyses at any of the well locations. A soil sample obtained from each monitoring well and tested for volatile organics and TPH also revealed no contamination. Table 3.2 summarizes the laboratory soil sample analyses results.

GC headspace analysis was also performed during the installation of the Phase IIB monitoring wells and indicated no soil contamination above background levels at wells MW-10A, MW-10B and MW-11A. TCE was detected in the soil at MW-9A at a maximum concentration of approximately 8 ppb at a depth of 120 feet below land surface. Well MW-9B was screened at a depth of 35 - 55 feet, where TCE was detected in the soil at approximately 2 ppb during field analysis of the MW-9A soil samples. The contamination identified during the field GC analysis was later confirmed by laboratory analysis. The data for the field GC analyses performed is contained in Appendix D. Well MW-9C was installed upgradient of MW-9A and MW-9B after survey and water elevation data were obtained in order to accurately determine the upgradient direction. Field GC analysis performed during the installation of MW-9C detected a maximum TCE concentration of approximately 4 ppb at a depth of 115 feet in the soil. Soil samples taken at each boring location and sent to a laboratory for volatile organic chemical and TPH analyses, showed results as seen in Table 3.2.

Groundwater Sampling Results

All equipment was cleaned by the following procedure before being brought to the field:

1. Rinsed with tap water;
2. Cleaned with alconox soap and distilled water mixture, using a brush when necessary;
3. Rinsed with distilled water;
4. Rinsed with pesticide grade methanol; and
5. Rinsed with distilled water.

Following decontamination, bailers were wrapped in aluminum foil. Bailers were dedicated to specific wells and were not cleaned in the field. Equipment used to measure field parameters was cleaned between sample points by rinsing with pesticide grade methanol followed by a distilled water rinse.

Wells were purged by using a pump or by bailing, and efforts were made to avoid pumping a well dry. Tubing which came in contact with formation water was of teflon or high density polyethylene construction and dedicated to each well. Three (3) well volumes were removed by bailing or pumping as appropriate to each well. After removing three well volumes, sample bottles (supplied by Alpha Analytical and including preservatives as needed) were filled. Additional care was taken to ensure that all VOC vials were filled to the septum with no air within. All monitoring wells were tested for VOCs, soluble iron and manganese, temperature, specific conductivity and pH.

Water quality analysis of samples obtained from each Phase IIA monitoring well showed volatile

Table 3.2

Phase II Soil Sample Analytical Data

Well Location	Depth of Sample (ft.)	Lab I.D. No.	Volatile Organics[1]	TPH[2]
MW-1	49-51	906147.1	None Detected	None Detected
MW-2	9-11	906147.2	None Detected	None Detected
MW-3	39-41	906147.3	None Detected	None Detected
MW-4A	99-101	906147.4	None Detected	None Detected
MW-4B	49-51	906147.5	None Detected	None Detected
MW-5A	89-90	906147.6	None Detected	None Detected
MW-5B	49-51	906147.7	None Detected	None Detected
MW-6	Hand Driven Wellpoint - No Soil Samples Taken			
MW-7	24-26	906147.8	None Detected	None Detected
MW-8	9-11	906147.9	None Detected	None Detected
MW-9A (4 samples at varying depths)	49-51	912139.1	None Detected	None Detected
	69-71	912139.2	None Detected	None Detected
	89-91	912139.3	None Detected	None Detected
	119-121	912139.4	None Detected	None Detected
MW-9B (1 sample)	44-46	912139.5	None Detected	None Detected
MW-9C (1 sample)	114-116	912656.1	None Detected	66 mg/kg (Detection Limit = 40 mg/kg)
MW-10A (1 sample)	69-71	912139.6	None Detected	None Detected
MW-10B (1 sample)	79-81	912139.7	None Detected	None Detected
MW-11A (1 sample)	79-81	912139.8	None Detected	None Detected

[1] EPA Method 8260
[2] EPA Method 5520

organic chemical contamination present only at monitoring wells MW-4A and MW-6. None of the Phase IIA monitoring wells showed signs of TCE contamination.

Table 3.3 summarizes the sampling program completed as part of this investigation.

The Phase IIA sampling results, as shown in Table 3.4, eliminated all of the potential contaminant sources, identified in Phase I, from further investigation. The low level of 1,1,1 - trichloroethane contamination found in MW-4A (2.3 ppb) is below the contaminant's Federal Drinking Water Maximum Contaminant Level (MCL) of 200 ppb. The xylene contamination (14 ppb) found at MW-6 is below the Federal Drinking Water MCL for xylene of 10,000 ppb.

Table 3.5 summarizes the field data obtained during the Phase IIB monitoring well sampling program.

Tables 3.4 and 3.5 also summarize the Phase IIA and Phase IIB groundwater analyses, respectively. The water level was also recorded at each well. Based on the results listed in Tables 3.4 and 3.5, the only area where the presence of TCE was detected in concentrations similar to those monitored in the Wellfield, was northwest of the Hendrick Street Well Field and the Pines Well, at MW-9A, MW-9B, and MW-9C. The contamination was initially detected below the confining or semi-confining layer at a concentration of 7.2 ppb in MW-9B. TCE was detected in MW-9A at the lower portion of the aquifer at a concentration of approximately 12.0 ppb. TCE was also detected upgradient of MW-9A within the confined portion of the aquifer in MW-9C at a concentration of 5.7 ppb. The field GC data, as included in Appendix D, provides supporting evidence that the TCE concentration increases with depth below the initial depth of detection and is decreasing upgradient of MW-9A and MW-9B. This indicates that the contaminant plume is migrating downward within the aquifer. The potentiometric surface elevations observed at MW-9A and MW-9B suggests that there is an upward groundwater flow in the area as the deep well, MW-9A, had an observed potentiometric surface elevation 0.4 feet higher than that observed in MW-9B, the shallow well. This suggests that the density of TCE is high enough to counter the upward flow and still allow for the downward migration of the TCE.

Table 3.3
Summary of Sampling Program

Date of Sampling	**Media**/Parameter	Sampling Location	Comments
10/26/90 to 11/8/90	**SOIL**/TPH, VOC(8260)	B-1,B-2,B-3, B-4A,B-4B,B-5A, B-5B,B-7,B-8	Phase IIA soil samples. Soil borings sampled as completed.
12/3/90	**WATER**/DEPTH,pH, TEMP,SC,VOC(524), S-Fe/Mn	MW-2,MW-4A, MW-5A,MW-5B, MW-6,MW-8,MW-M6	Phase IIA groundwater sampling program.
12/5/90	**WATER**/DEPTH,pH, TEMP,SC,VOC(524), S-Fe/Mn	MW-1,MW-M1, MW-M2	Phase IIA groundwater sampling program.
3/27/91 to 4/8/91	**SOIL**/TPH, VOC(8260)	B-9A(4),B-9B,B-10A, B-10B,B-11A	Phase IIB soil samples.
5/21/91	**WATER**/DEPTH,pH, TEMP,SC,VOC(524), T-Fe/Mn	MW-4A,MW-5A, MW-5B,MW-9A, MW-10A,MW-10B	Phase IIB groundwater sampling. Analyzed for total Fe/Mn by error. MW-9B not sampled due to error.
5/22/91	**WATER**/DEPTH,pH, TEMP,SC,VOC(524), T-Fe/Mn	MW-1,MW-2,MW-M6, MW-6,MW-8,MW-9C, MW-11A	Phase IIB groundwater sampling. Analyzed for total Fe/Mn by error.
6/20/91	**WATER**/DEPTH,pH, TEMP,SC,S-Fe/Mn	MW-2,MW-4A, MW-5A,MW-5B, MW-6,MW-8, MW-9A,MW-10A, MW-10B,MW-11A	Phase IIB groundwater sampling. Wells resampled for soluble Fe/Mn.
6/21/91	**WATER**/DEPTH,pH, TEMP,SC,S-Fe/Mn	MW-1,MW-9C	Phase IIB groundwater sampling. Wells resampled for soluble Fe/Mn.
6/25/91	**WATER**/DEPTH,pH, TEMP,SC,VOC(524), S-Fe/Mn	MW-9B	Phase IIB groundwater sampling.

Notes:
SC=specific conductivity; S-Fe/Mn=soluble iron and manganese; T-Fe/Mn=total iron and manganese.

Table 3.4
Phase IIA Sampled Monitoring Well Data

WELL NO.	LOCATION	TOP OF CASING ELEVATION (ft.) USGS	BORING DEPTH (ft.)	SCREEN DEPTH (ft.)	DATE SAMPLED	pH	TEMP. (°C)	SPECIFIC CONDUCTIVITY (mhos)	MEASURED WELL DEPTH (ft.)	MEASURED WATER LEVEL (ft.)	WATER LEVEL (USGS) (ft.)	WATER VOC (ppb)	SOL. IRON (mg/l)	SOLUBLE MANGANESE (mg/l)
1	PEQUOT ROAD	283.08	61	39.5-59.5	12/5/90	7	7.5	109	59.73	40.94	242.14	ND	0.06	0.09
2	KEYES ROAD	281.08	76	5-15	12/3/90	6.6	8.9	90	17.73	10.05	271.03	ND	0.05	0.47
3	SOUTHAMPTON ROAD	283.55	80	31-51	No Groundwater Sample Obtained				51	>52	<231	NA	NA	NA
4A (4D)	JONES CIRCLE	279.17	110	90-110	12/3/90	6.9	6.5	170	110.32	71.67	207.50	2.3 (1,1,1 TCA)	0.02	0.05
4B (4S)	JONES CIRCLE	279.01	70	50-70	No Groundwater Sample Obtained				70	>61	<218	NA	NA	NA
5A (5D)	HENDRICK STREET (#164)	217.99	111	80-100	12/3/90	7.1	8	140	101.15	32.32	185.67	ND	0.01	ND
5B (5S)	HENDRICK STREET (#164)	218.2	60	40-60	12/3/90	7.3	8.5	130	62.36	32.27	185.93	ND	0.08	0.02
6	BROAD BROOK	524.74	6	3-6	12/3/90	6.8	5	650	5	1.68	523.06	14 (XYLENE)	0.73	4.89
7	SE of HENDRICK WELLFIELD	230.05	48.25	17-27	No Groundwater Sample Obtained				27	>27	<203	NA	NA	NA
8	ROCK VALLEY ROAD	236.28	24	5-20	12/3/90	6.5	10.5	410	21.15	8.38	227.90	ND	0.04	0.16
M1	KEYES ROAD	235[1]	115	94-104	12/5/90	7.0*	7.2*	90*	90.3	2.59*	232[1]	ND	0.04*	0.1*
M2	KEYES ROAD	235[1]	24	19-24	12/5/90	7.0*	5.5*	45*	17.94	1.92*	233[1]	ND	0.14*	0.06*
M6	PEQUOT WELL	240[1]	85	NA	12/3/90	6.8*	7.5*	120*	83.05	5.63*	234[1]	ND	0.87*	0.06*

[1] Approximate Elevation Based on USGS Topographic Map.
* Data collected during Phase IIA Program only.
ND - None Detected.
NA - Not Available.

232 - 234

Table 3.5
Phase IIB Sampled Monitoring Well Data

WELL NO.	LOCATION	TOP OF CASING ELEVATION (ft.) USGS	BORING DEPTH (ft.)	SCREEN DEPTH (ft.)	DATE SAMPLED	pH	TEMP. (°C)	SPECIFIC CONDUCTIVITY (mhos)	MEASURED WELL DEPTH (ft.)	MEASURED WATER LEVEL (ft.)	WATER LEVEL (USGS) (ft.)	WATER VOC (ppb)	SOL. IRON (mg/l)	SOLUBLE MANGANESE (mg/l)
1	PEQUOT ROAD	283.08	61	39.5-59.5	5/22/91[1]	6.1	13.2	109	60.1	39.66	243.42	ND	0.05	ND
2	KEYES ROAD	281.08	76	5-15	5/22/91[2]	5.5	14.5	56	17.6	9.37	271.71	ND	0.058	ND
3	SOUTHAMPTON ROAD	283.55	80	31-51	No Groundwater Sample Obtained				51	>52	<231	NA	NA	NA
4A	JONES CIRCLE	279.17	110	90-110	5/21/91[2]	6.3	14	190	112.6	70.61	208.56	ND	ND	ND
4B	JONES CIRCLE	279.01	70	50-70	No Groundwater Sample Obtained				70	>61	<218	NA	NA	NA
5A	HENDRICK(#164)	217.99	111	80-100	5/21/91[2]	6.7	12	155	101.8	31.45	186.54	1.0 (TCE)	0.08	ND
5B	HENDRICK(#164)	218.2	60	40-60	5/21/91[2]	6.7	12.3	200	62.1	31.46	186.74	0.5 (TCE)	0.04	ND
6	BROAD BROOK	524.74	6	3-6	5/22/91[2]	6.5	14.2	775	4.8	2.24	522.50	ND	0.17	0.57
7	SE of HENDRICK WELLFIELD	230.05	48.25	17-27	No Groundwater Sample Obtained				27	>27	<203	NA	NA	NA
8	ROCK VALLEY	236.28	24	5-20	5/22/91[2]	7.1	13	25	20.8	8.20	228.08	ND	0.10	0.03
M6	PEQUOT WELL	240	85	NA	5/22/91	NA	NA	NA	NA	NA	NA	ND	NA	NA
9A	HENDRICK(#126)	214.50	124	99-119	5/21/91[2]	7	14.8	158	118	32.51	181.99	12 (TCE)	0.34	ND
9B	HENDRICK(#126)	214.56	55	35-55	6/25/91	6.1	14.8	162	55	32.97	181.59	7.2 (TCE) 2.7 (Toluene) 1.8 (1,1,1 TCA)	ND	0.01
9C	BROOK ST.(#13)	219.74	121	99-119	5/22/91[1]	6.8	14.6	154	121.4	37.49	182.25	5.7 (TCE)	ND	ND
10A	TAUTZNIK CONSTR.	196.32	81	61-81	5/21/91[2]	6.6	12.3	185	84.4	11.59	184.73	ND	0.03	ND
10B	TAUTZNIK CONSTR.	199.42	85	64-84	5/21/91[2]	6.9	14.3	167	84.5	13.29	186.13	ND	0.03	ND
11A	SE of HENDRICK WELLFIELD	190.04	96	75-95	5/22/91[2]	6.7	12.7	118	95.6	9.24	180.80	ND	ND	ND

[1] Sampled for water level, pH, specific conductivity, temperature and soluble iron and manganese on June 21, 1991.
[2] Sampled for water level, pH, specific conductivity, temperature and soluble iron and manganese on June 20, 1991.
NA - Not Available.
ND - None Detected.

The Phase IIB sampling also showed very low concentrations of TCE in MW-5A and MW-5B. This contamination, 1.0 and 0.5 ppb, respectively, was not seen during the Phase IIA sampling program. Therefore additional groundwater analysis is needed to conclusively document any TCE contamination which may exist in the area.

The Phase II analytical work, including field screening of soil boring samples with a portable gas chromatograph, and laboratory testing of soil and groundwater samples, produced results which correlated fairly well. It should be noted that the low levels of TCE contamination found in the soil boring samples during field screening, and later confirmed in laboratory analyses of groundwater samples, were not confirmed by laboratory analyses of the soil samples.

Of the three analytical results, the laboratory soil results are the least reliable. The low levels of TCE initially found during the field screening make any volatilization of TCE during the soil sampling and bottling procedure very critical. The holding time between when the soil samples were taken and when they were laboratory analyzed ranged from 13 to 27 days. The extended holding times, coupled with the analytical procedures associated with preparing a soil sample for analyses, probably account for the non-confirmatory nature of the soil samples.

The Phase II groundwater sampling also showed that there were no detectable signs of TCE contamination in the Pequot Wells (MW-M6), although this well was shutdown in 1986 due to TCE contamination (8-16 ppb). The exact reason for this inconsistency is not known, but the fact that the well is shutdown and no longer drawing groundwater toward it may be significant. Several possibilities exist, such as the well, when pumping, drawing water into the zone of contribution that would not normally flow toward the well during non-pumping conditions. Also, as discussed in the following discussion of contaminant transport theories, the pumping of the well may draw contamination into the area from bedrock fractures. More investigation is required to better understand the impact pumping the Pequot Well has on the Barnes Aquifer.

Contaminant Transport

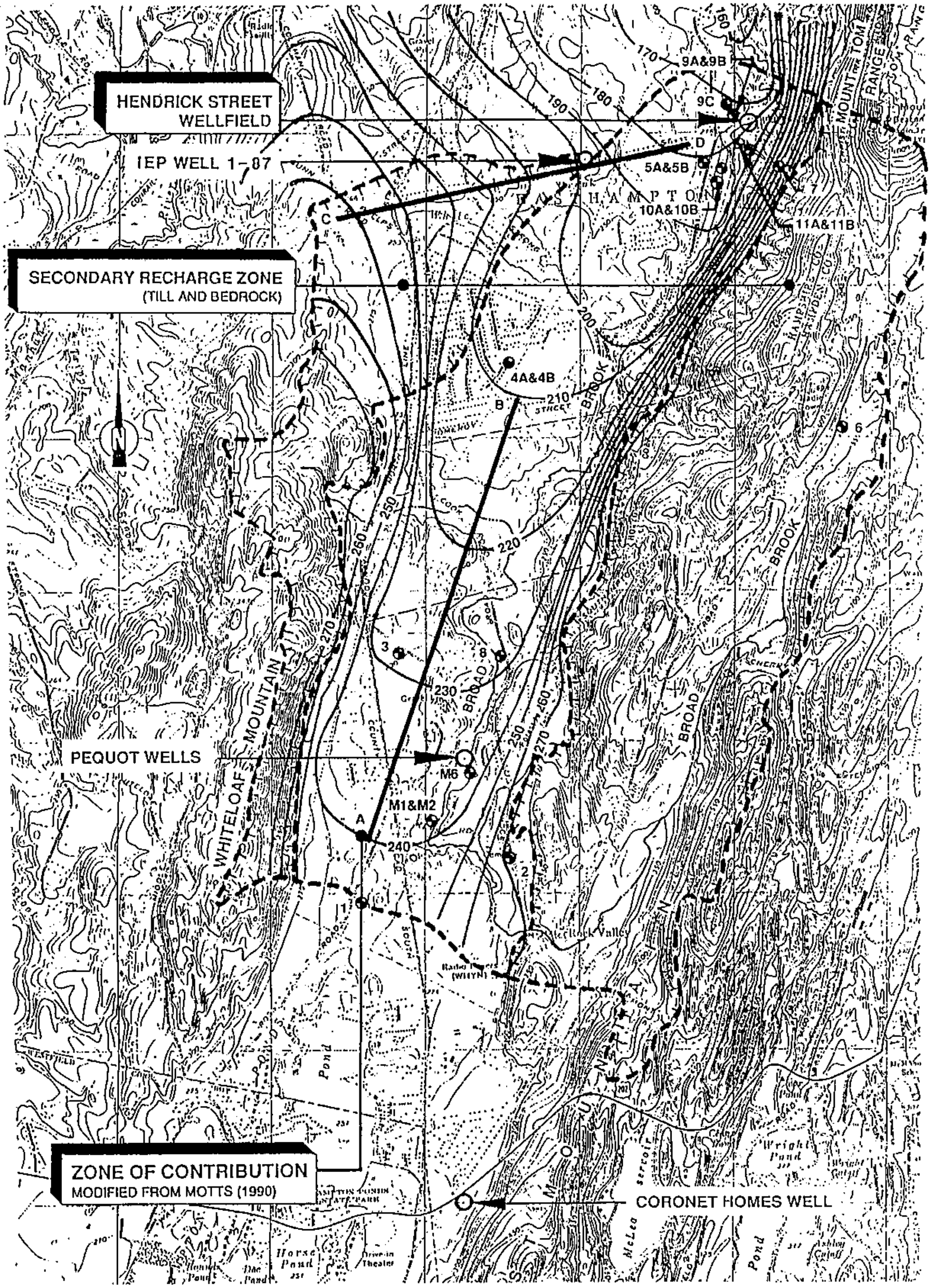
Groundwater Flow Direction

The measured depths to groundwater, as observed during the May 1991 Phase IIB sampling round, were used to estimate groundwater contours within the Hendrick Street zone of contribution. Due to the relative sparseness of groundwater data generated by the installation of the 16 Phase II wells, the groundwater contours shown in Figure 3.3 are estimated, and should be viewed as depicting general flow direction only. Existing surficial hydrogeologic data, such as stream elevations shown on the USGS map, were also used to assist in estimating the groundwater contours in the area.

In 1988, groundwater flow direction in the study area was to the north-northeast with a hydraulic gradient of 0.0042 (IEP, 1988). The data obtained from the groundwater monitoring wells installed as part of this investigation confirmed the groundwater flow direction and showed that the gradient varied across the aquifer. As shown in Figure 3.3, in the vicinity of MW-3 and MW-8, the hydraulic gradient (Gradient AB) was 0.0031, while in the vicinity of IEP Well 1-87, the gradient (Gradient CD) was 0.0117.

Contaminant Transport Theories

The Phase II groundwater monitoring results do not provide a clear understanding of the contaminant transport mechanism impacting the Hendrick Street Wellfield. The Phase IIA sampling program identified two monitoring wells with volatile organic chemical contamination. MW-4A, located in a residential neighborhood, detected low levels (2.3 ppb) of 1,1,1 - trichloroethane. MW-6, located along Broad Brook downgradient of the Rock Valley Patterns site but on the back side of the Mount Tom range from the Wellfield, detected low levels (14 ppb) of xylene. Neither of these results were duplicated during the Phase IIB sampling, wherein both wells showed no detectable volatile organic chemical contamination.



LEGEND

210 — Estimated Groundwater Contour

M6 — Monitoring Well

A — B — Groundwatergradient Line

Recharge Zone Boundary

0' — 2000'
Scale In Feet

Reference:

From the U.S.G.S. Topographic Map of the Mount Tom Quadrangle.

Figure 3.3

ESTIMATED GROUNDWATER CONTOURS

Town of Easthampton, Massachusetts

SEA Consultants Inc.
Engineers / Architects

The Phase IIB sampling program detected contamination at five well locations, MW-5A, MW-5B, MW-9A, MW-9B and MW-9C. The low levels of TCE contamination found at MW-5A (1.0 ppb) and MW-5B (0.5 ppb) are the first detectable observations of contamination at this location, as both wells showed no detectable contamination during the Phase IIA sampling round. These low levels of TCE contamination could reflect contamination in the soil, or contamination due to contaminated sampling equipment, or contamination introduced to the sample at the laboratory. Based on the low levels found, in conjunction with the lack of corroborative Phase IIA results, S E A feels that PhaseIIB results for MW-5A and MW-5B are inconclusive and that additional investigation is needed in the area to confirm the previous findings.

Based on the Phase II (IIA and IIB) groundwater monitoring results, the only potential source of TCE contamination is northwest of Hendrick Street Wellfield and could potentially be the past machinery cleaning operation at House No. 126, Hendrick St., as discussed earlier. There would appear to be an inconsistency in the data supporting the theory that House No. 126 is a potential source of the TCE contamination. The field data obtained from MW-9A and MW-9B, directly downgradient of House No. 126, showed TCE soil contamination fairly deep, approximately 44 feet deep, while none was found at the shallower depths. This would suggest a source further upgradient of House No. 126. The fact that TCE contamination was found at depth, 79 feet, upgradient of House No. 126 would also suggest an upgradient source.

Taking into account the known data, S E A has developed three different theories of contaminant transport which may account for the presence of TCE in the vicinity of the Hendrick Street Wellfield and the Pines Well. The three theories are discussed in descending order of likelihood and are named for sake of discussion; the "Lillipad Theory", the "Bedrock Fracture Theory", and the "Septic System Theory". The Lillipad Theory is advanced as a mechanism for House No. 126 to be the source, even given the upgradient TCE contamination. The Bedrock Fracture Theory takes into account the potential contamination introduced into the aquifer at Harvest Valley Patterns and the historical contamination of the Pequot Well. The Septic System Theory addresses the potential of an upgradient source, acknowledging that the area upgradient of House No. 126 is residential. The actual transport mechanism may be a combination of any of the above ranked theories.

Lillipad Theory

As indicated in the surficial geology and hydrogeology sections of this report, the area north of Plains Road, in which MW-9A, MW-9B and MW-9C are located, contains a confining layer composed of very fine sand and silt, with clay lenses interspersed over its varying thickness. The Lillipad Theory proposes that a contaminant release at the ground surface will slowly migrate down through the confining layer until it reaches a clay lens. Upon reaching the clay lens the contaminant will change its flow direction depending on the orientation and geometry of the clay lens, and thereby perhaps traveling "upgradient, downgradient, or laterally" with respect to localized groundwater flow before reaching the groundwater table. The overlapping clay layers at various depths generate a tortuous flow pattern of generally downward contaminant migration. Two modes of contaminant migration are then in joint process, the downward migration of contaminant flow vertically through different layers and the tortuous path of contaminant migration imposed by overlapping layers of clay behaving as "lillipads". Once it has reached the water table, the much-dispersed contamination will travel hydraulically downgradient in the groundwater resource. The benefit of these processes however is that contamination the Wellfield experiences is "averaged", with no excessive concentration spikes.

The implications of the Lillipad Theory are that the source of contamination, although able to be localized to a relatively small area, is impossible to pinpoint exactly without extensive work, and that many small shifting pockets of contamination over the clay lenses will continue to migrate downwards and remain difficult to locate and "track" over time.

Bedrock Fracture Theory

As indicated in the bedrock geology section of this report, the north-northeast to south-southwest trending Mount Tom fault occurs in the Holyoke Basalt and the Sugarloaf Arkose rock types. Both rock types are brittle and prone to fracture. The Mount Tom Fault most likely produced a lateral fracture system extending an unknown distance into the Broad Brook Basin. Precipitation enters as recharge onto the Mount Tom Range and infiltrates into any topsoil and/or the fracture system. Due to the elevation change between the Mount Tom Range and the Broad Brook Basin, a large potential head can be developed such that groundwater found in the bedrock fractures beneath the Broad Brook Basin can be pushed to recharge the aquifer from "below", wherever the potentiometric gradient is sufficient to drive the water upwards (at well fields, for example).

The implication of the Bedrock Fracture Theory is that the source of contamination can be anywhere within the Mount Tom Range which recharges the bedrock fracture system. This may make the tracing of the source difficult and expensive to locate. Since the flow into the aquifer from the bedrock fractures is induced into the aquifer by a pressure gradient, it is possible to induce contaminant flow by changing the pressure gradient within the aquifer, as in a groundwater supply pumping well. This can explain the contamination by TCE which occurred in the Pequot Wells during pumping prior to their shutdown in 1986 due to contaminant levels, although when the Pequot Wells (MW-M6) were sampled for this Investigation, no TCE was detected (under non-pumping conditions).

A primary reason that the Bedrock Fracture Theory is less likely than the Lillipad Theory is that the bedrock fractures would allow for a greater oscillation in contaminant concentrations, since the contaminant could travel, as free product, along the fracture system with little impact from dispersion. The Hendrick Street Wellfield has not experienced this oscillation in contaminant concentrations.

Septic System Theory

Prior to the homes to the south and southwest of the Hendrick Street Wellfield and the Pines Well being serviced by the town sewer system during the 1970's, their wastewater was discharged through septic systems. TCE was a common septic system degreaser in use at that time, and the low levels of TCE contamination monitored at the Wellfield could reflect an ambient condition generated by previous septic system use.

The implication of the Septic System Theory is that the source of contamination, which occurred over a specified area, can now appear as an ambient condition when observed at a point source location, such as the Wellfield. The TCE would have been introduced into the groundwater within a specific area, but no point source can be identified. This theory is the least likely as the monitoring wells located south of the Wellfield did not show any signs of TCE contamination except for the very low levels found at MW-5A and MW-5B.

Due to the prevalence of TCE uses in the past, it is possible that multiple sources of contamination could exist under any combination of the above mentioned theories.

Groundwater Flow Simulation

The Barnes Aquifer system currently has two existing numerical groundwater models. The two models used for the purpose of computer modeling were the U.S.G.S. MODFLOW model (IEP, 1988) and the AQUIFER (Motts, 1990) model. Both of these models have strengths and weaknesses which were reviewed in the Phase I Limited Site Investigation Report.

Following the work performed by S E A Consultants, Inc., an additional 16 borings were installed that contributed information about the subsurface geology. The additional borings support the evidence that the Barnes Aquifer is a complex aquifer system comprised of an upper, predominantly unconfined, aquifer south of Plain Street, and an upper unconfined aquifer and a lower confined aquifer north of Plain Street. Both models previously reviewed are inappropriately constructed to be used as an effective predictive tool for site specific areas. The MODFLOW model was appropriately constructed as a 3-dimensional 2-layer model but the input data used within the model, the model boundaries, and the inadequate finite-difference grid spacing preclude the use of this model as an accurate predictive tool without completely reconstructing the model. The AQUIFER model better dealt with the aquifer, but the AQUIFER model is still inappropriate for simulating actual site specific flows. The model generally describes the overall groundwater flow regime, but cannot model any specific conditions such as the confined/unconfined flow systems. AQUIFER defined an improved overall picture as compared to the MODFLOW model but is unable to match MODFLOW's ability for modeling specific complex aquifer flows. The additional data points generated by the Phase II field investigation, while increasing the general calibration of either model, would not contribute significantly to either model's predictive ability for the confined/unconfined aquifer system.

Neither the AQUIFER nor the MODFLOW model is able to be of assistance in determining location or site specific travel times and water quality trends for three predominant reasons. The first reason is the poorly understood nature of the source(s) of contamination. Since the source is not well defined at this time, it is impossible to estimate future contaminant concentrations. The further the contaminant is from the source, the higher in concentration the source is likely to be, since dispersion processes lessen its concentration as it reaches the wellfield. The second reason relates to the mode(s) of contaminant transport. Since multiple modes of contaminant transport are possible, each would have to be represented in the model. Groundwater contribution due to bedrock fracture flow to the overburden aquifer (currently a completely unknown quantity) would have to be estimated. The "Lillipad Theory" cannot be represented by AQUIFER, MODFLOW or any other the groundwater model currently available, since no groundwater numerical models are able to simulate non-saturated flow systems such as those which occur above the water table. The third reason relates to the existing grid distance between nodes (260 feet at the wellfield) used by either the MODFLOW or AQUIFER models. These grid distances do no allow the model enough "sensitivity" to determine the effects of a contaminant so potentially close to the wellfield, without a high probability of error.

To have a model which can best represent and model the specific groundwater flow regimes in the Barnes Aquifer, a new model would have to be constructed. It is recommended that the U.S.G.S. MODFLOW model be used with its multiple layers with the larger and denser finite-difference grid system which was set up for the AQUIFER model. Additional wells would also need to be installed to determine the geology in less well known and sensitive model areas within the Barnes Aquifer.

CHAPTER 4
GROUNDWATER REMEDIATION

Contaminant Duration

Both the extent of the contamination plume and the velocity at which it is travelling to or past the Hendrick Street Wellfield affect the duration of any proposed groundwater remediation approach. As discussed below, none of the contaminant transport theories, which are thought to possibly describe the plume characteristics, allows for a definitive determination of the duration of contaminant migration to the Hendrick Street Wellfield.

Lillipad Theory

The Lillipad Theory imposes an extended time frame on the duration of contaminant transport. Since the contaminant follows a long, slow, tortuous path, its transport time is estimated to be in the 10's of years range. The additional mode of transport of the contaminant travelling vertically through the various strata also reveals an extended time frame for contaminant transport, since the vertical conductivity through the very fine sand and silt with clay lenses is very low.

Bedrock Fracture Theory

The Bedrock Fracture Theory imposes an unknown time frame on the duration of contaminant transport, since it is impossible to quantify the amount of contamination present within the fracture system. The duration of contamination would also be affected by the pumping rate in that the decrease in overburden head would induce an increase in upward vertical flow through the bedrock fracture system.

Septic System Theory

The Septic System Theory also imposes an extended time frame on the duration of contaminant transport. The mode of transport is similar to that of the Lillipad Theory except that a broader area of contamination is potentially present to impact the Wellfield. The broader base of contamination indicates a greater mass of contaminant spread out over a greater area which can increase to a greater extent the time frame for contaminant migration to the Wellfield.

The only source of contamination reasonably well documented during the Phase II field investigation was almost directly north of the Hendrick Street Wellfield. The contamination, located in the vicinity of House No. 126, Hendrick Street, may be a combination of TCE, 1,1,1-trichloroethane and toluene. Based on S E A's understanding of the alleged activities at this site, beginning possibly as far back as the 1970's, the contamination occurred as intermittent releases to the ground over an extended period of time. Because of the depth to groundwater in the area, approximately 30 feet, it would appear that the contamination has infiltrated the vadose zone and continues to be flushed into the groundwater by any incident precipitation.

The theory that the contamination source is north of the Hendrick Street Wellfield is supported by the fact that TCE concentrations monitored at the Pines Well, located south of the Wellfield, have always been less than those levels found in the Wellfield. This variation in contaminant concentration suggests that the contamination source is north of the Wellfield. The fact that the contamination levels monitored at the Wellfield have been fairly constant and low over a seven year period, which would be typical of the contamination generated via the Lillipad Theory of contaminant transport, suggests that the source of contamination is a surface discharged source which is being slowly released to the groundwater.

The Lillipad Theory appears to best address the characteristics and historical data found at the Hendrick Street Wellfield. Therefore, assuming this is the contaminant transport mechanism at the Wellfield and also assuming the past activities at House No. 126, Hendrick Street, are the source of contamination, S E A has evaluated the duration of contamination which will impact the Wellfield. TCE is a slow moving contaminant due to its density and molecular size. It does not exhibit a strong affinity toward soil particles, so the duration of the TCE migration to the Wellfield will be primarily driven by the precipitation incident to the contaminant source and the speed at which the precipitation will flush the TCE from the vadose zone. It is estimated that, for purposes of evaluating wellhead treatment alternatives, and assuming source control measures are implemented at the House No. 126 site, any wellhead treatment will need to be in operation for at least a 10 year period. A 10 year duration has been used in the present worth analyses of the various alternatives evaluated during this Investigation.

Remediation Alternatives

As discussed in the following sections, there are three remediation alternatives available to the Town of Easthampton for bringing approximately 4 mgd of potable water back on-line to the Easthampton water supply system. These alternatives include source control, wellhead treatment and the development of alternative water supplies. There is a fourth alternative, the "no action" alternative, which is also discussed below.

Source Control

Source control is one alternative available to the Town for the remediation of the Hendrick Street water supply. By definition, source control is the identification, isolation or removal of contamination, prior to its leaving the site where the contamination has occurred. The implementation of source control requires the identification of the contaminant source(s). A groundwater monitoring program was completed to better define the potential source(s) of contamination entering the Hendrick Street Wellfield recharge area so that the applicability of source control could be evaluated.

The groundwater monitoring program results concluded that, other than the very low levels of TCE contamination found in MW-5A and MW-5B, TCE contamination was found only in Wells 9A, 9B and 9C. As discussed previously, these wells were installed to confirm the presence of TCE in the vicinity of an alleged machinery cleaning operation at House No. 126 Hendrick Street. The results of the groundwater analyses show that TCE contamination was found both upgradient and downgradient of this potential source of contamination. Therefore, additional investigation will be required to fully document the source(s) of TCE contamination in this vicinity.

Based on the analysis of the Well 9B (shallow) groundwater sample, there appears to be a potential contaminant source at House No. 126, Hendrick Street, and at this time, 126 Hendrick Street is the only site where source control would be applicable. The alleged machinery cleaning operation at this location consisted of washing down miscellaneous equipment with solvent, while the equipment was laying on the ground. Potentially applicable source control mechanisms include soil removal, soil vapor extraction and on-site groundwater extraction and treatment. These alternatives are evaluated below.

Soil Removal

The implementation of soil removal as a control mechanism will require that the extent, both horizontal and vertical, of the TCE contamination be determined. If the area of TCE contaminated soil is found to be fairly limited such that removal of the contaminated soil would not undermine the adjacent residential structures and would be cost-effective, then soil removal should be considered. Soil removal has the advantage of being the most direct source control mechanism.

Soil Vapor Extraction

Soil vapor extraction is an applicable control mechanism when the VOC contamination has percolated sufficiently deep into the ground so as to make soil removal impractical or uneconomical. Soil vapor extraction consists of the installation of small diameter wells throughout the contaminated area. The wells are used to introduce air into the subsurface strata as well as extract TCE contaminated vapor from the soil. The highly volatile nature of TCE lends itself very well to being removed, or flushed from the soil, by the repeated introduction of clean air and removal of contaminated vapor.

A typical soil gas extraction program located a House No. 126 would consist of four 6-inch diameter injection wells installed along the perimeter of the contaminated area and a fifth 6-inch diameter extraction well located in the center. A blower would be used to introduce clean air into the four perimeter injection wells and a vacuum pump would draw contaminated vapor out of the soil from the extraction well and into a carbon adsorption vessel for TCE removal prior to discharge to the atmosphere. To make the operation effective and eliminate the potential for short-circuited air flow, the entire contaminated area would be covered with plastic sheeting.

On-site Groundwater Treatment

In areas where the contamination extends down into the groundwater, a third source control alternative exists, consisting of installing on-site groundwater extraction wells, and pumping contaminated groundwater to an on-site treatment facility. The facility would then remove the TCE prior to discharging the treated groundwater back to the soil. The design of the "pump and treat" alternative would be based on containing the contaminated groundwater within the source site boundaries. This would stop "new" contaminated groundwater from reaching the Wellfield, while allowing the natural groundwater flow to flush the previously contaminated groundwater out of the aquifer.

Table 4.1 has been developed to summarize the advantages and disadvantages associated with the various source control alternatives. It is significant to note that, before any type of source control is implemented, additional field investigation must be completed to document that past operations at House No. 126, Hendrick Street, is the only source of VOC contamination in this immediate area and to also delineate the horizontal and vertical extent of the contamination found.

Wellhead Treatment

Treating the contaminated groundwater at the wellhead and prior to discharge into the Easthampton water distribution system is another alternative available to the Town. As the only documented contaminant, which exceeds its established MCL, is TCE, the wellhead treatment process alternatives being considered include air stripping and carbon adsorption. The evaluation of potential treatment processes has been screened down to these two alternatives based on documented research and analyses performed by others on similar contaminated water supplies which have shown these two treatment processes to be cost-effective in removing TCE contamination.

Table 4.1

Comparison of Source Control Alternatives

	Soil Removal	Soil Vapor Extraction	On-Site Groundwater Extraction and Treatment
APPLICABILITY	Used where high concentrations of contamination are close to surface.	Appropriate where volatile contamination is contained in vadose zone and groundwater is deep.	Appropriate where contamination cannot be removed by other means due to depth or concentration.
ADVANTAGES	Most direct and quickest source control method. Does not require any long term capital expenditure.	Less intrusive to area than soil removal. Effective method for removing deep vadose zone contamination.	Fewer wells required than soil gas removal. Effectively removes contaminated groundwater before reaching Hendrick Street Wellfield.
DISADVANTAGES	Very intrusive to residential neighborhood. Not appropriate where contamination has uniformly percolated down through the soil. Would require additional field testing to delineate contamination.	Requires installation of small diameter wells. Extracted contaminated vapor will require on-site vapor phase treatment. Typical installations have a 6 month to a year duration. Would require additional field testing to design extraction system. Would require plastic sheeting over entire area.	Requires installation of wells and on-site treatment facility. Requires discharge point for treated groundwater. Duration dependent on extraction rate.

As discussed earlier, for purposes of evaluation, it has been assumed that wellhead treatment would be required for a 10 year period. A sensitivity analysis was performed on the various treatment alternatives and it was determined that, for any treatment period up to 20 years, there was no significant change in how the alternatives compared to each other relative to present worth costs.

The cost analysis performed on the treatment alternatives included the installation and operation and maintenance (O&M) costs of a sodium hypochlorite chlorination system. DEP requires that chlorination be included in the treatment process for both air strippers and carbon adsorption facilities. The cost analysis did not include the installation and O&M costs associated with any corrosion control equipment. The wellhead treatment facility may need to incorporate a corrosion control process due to the EPA Lead and Copper Rule recently promulgated as an amendment to the Federal Safe Drinking Water Act. Corrosion control will be required at all drinking water sources unless a waiver is granted.

Air Stripping

Air stripping is a physical process whereby large quantities of air are passed through a cascading flow of contaminated water. The air flow is counter current to the water flow, with the water flow typically being introduced to the top of a cylindrical tower. The air, which is blown up through the cascading water, removes the TCE from the water and returns it to a vapor phase, due to the volatile nature of TCE. The air stripping tower, typically 6 to 12 feet in diameter and 8 to 30 feet high, is filled with synthetic packing material which improves the distribution of water flow within the tower while increasing the surface area over which the air can come into contact with the contaminated water. The water, collected at the bottom of the tower, is then disinfected and pumped into the distribution system.

The air stripping tower is typically located outside, with a building required to house the standby power generator, controls, the blower system, the chlorination equipment and the booster pumps needed to repump the treated water back into the system.

The contaminated vapor or off-gas must be treated prior to release to the atmosphere unless certain criteria are met, according to current DEP policy 88-01 (see Appendix E). DEP is currently reevaluating its policy on off-gas treatment and it is unclear at this time if off-gas treatment will be required as part of the wellhead treatment program. If required, vapor phase carbon adsorption typically is used as the off-gas treatment method of choice.

Dissolved iron and manganese testing was also performed on the groundwater samples in order to evaluate any adverse impacts the dissolved metals might have on the air stripper. Both iron and manganese can reduce the effectiveness of the air stripper operation by precipitating out onto the packing if the ambient concentrations are high enough. Previous operations have shown that if the dissolved concentration of iron or manganese exceeds approximately 1 milligram per liter (mg/l), then precipitation may occur, thereby causing fouling of the packing. The Phase II sampling determined that the iron and manganese levels in the groundwater are well below the 1 mg/l threshold and therefore no precipitation or fouling of the air stripper is anticipated.

Table 4.2 shows the costs associated with the installation and operation of an air stripper, equipped with off-gas treatment, capable of removing the TCE contamination to levels well below the Federal Drinking Water Standard of 5 ppb. Table 4.3 details the estimated installation and operation costs associated with the air stripper, if off-gas treatment is not required.

Carbon Adsorption

The second proven technology for removal of TCE from groundwater is carbon adsorption. In this process, the contaminated water is passed through a bed of activated carbon under pressure. The TCE has a higher affinity to the carbon than the water so the TCE adsorbs onto the carbon. When the carbon bed has reached its capacity for accepting TCE, the spent carbon is replaced with new carbon. Multiple carbon beds are utilized in the process so that a carbon bed can be removed from service for replacement while maintaining the treatment capacity through the installation.

TABLE 4.2

Estimated Air Stripper with Off-Gas Treatment Costs

CAPITAL COSTS:

12 foot Diameter Packed Air Stripper Tower	$ 125,000
Chlorine Equipment	$ 5,000
Control Building with Sanitary Facilities (5000 s.f.)	$ 375,000
Emergency Generator	$ 100,000
Booster Pumps	$ 45,000
12 foot Diameter Off-Gas Carbon Unit	$ 120,000
Duct Heater and Ductwork	$ 45,000
Subtotal	$ 815,000
Electrical Equipment (15% of Capital Subtotal)	$ 122,000
Instrumentation Equipment (10% of Capital Subtotal)	$ 82,000
Site Work (5% of Capital Subtotal)	$ 41,000
Total Capital Costs	$1,060,000[1]
Engineering and Contingencies (35% of Capital Costs)	$ 371,000
Total Initial Cost	$1,431,000

ANNUAL O & M COSTS[2]:

Maintenance	$ 14,000
Chemicals (Sodium Hypochlorite)	$ 20,000
Building (Electrical)	$ 5,000
Booster Pumping (Electrical)	$ 87,000
Air Blower (Electrical)	$ 3,000
Off-Gas Treatment Carbon Replacement	$ 8,000
Duct Heater/Dehumidifier (Electrical)	$ 7,000
Total O & M Costs	$ 144,000/yr.
Total Present Worth Cost[3]	$2,365,000

[1] Engineering News Record July 1991 Construction Cost Index = 4854
[2] Electrical costs based on an average rate of $0.06/kwhr.
[3] Assumes a 10 year project duration and an annual discount rate of 8.75%.

TABLE 4.3

Estimated Air Stripper without Off-Gas Treatment Costs

CAPITAL COSTS:	
12 foot Diameter Packed Air Stripper Tower	$ 125,000
Chlorine Equipment	$ 5,000
Control Building with Sanitary Facilities (4500 s.f.)	$ 338,000
Emergency Generator	$ 100,000
Booster Pumps	$ 45,000
Subtotal	$ 613,000
Electrical Equipment (15% of Capital Subtotal)	$ 92,000
Instrumentation Equipment (10% of Capital Subtotal)	$ 61,000
Site Work	$ 41,000
Total Capital Costs	$ 807,000[1]
Engineering and Contingencies (35% of Capital Costs)	$ 282,000
Total Initial Cost	$1,089,000
ANNUAL O & M COSTS[2]:	
Maintenance	$ 10,000
Chemicals (Sodium Hypochlorite)	$ 20,000
Building (Electrical)	$ 3,000
Booster Pumping (Electrical)	$ 87,000
Total O & M Costs	$ 120,000/yr.
Total Present Worth Cost[3]	$1,868,000

[1] Engineering News Record July 1991 Construction Cost Index = 4854
[2] Electrical costs based on an average rate of $0.06/kwhr.
[3] Assumes a 10 year project duration and an annual discount rate of 8.75%.

The carbon beds are typically 4 to 12 feet in diameter and 3 to 12 feet deep. The advantages of carbon over air stripping is that there is no contaminant release to the atmosphere. The disadvantage is that carbon replacement is expensive. Table 4.4 shows the estimated installation and operation costs associated with an activated carbon treatment facility sized for the Hendrick Street Wellfield flow and historical TCE contaminant levels.

Wellhead Treatment Summary

After comparing the present worth costs of the three wellhead treatment alternatives, in conjunction with each alternative being equally affective in removing TCE to well below drinking water standards, the air stripper alternative is the most cost-effective wellhead treatment alternative regardless of the need for off-gas treatment.

Alternative Water Supplies

An additional option that has been evaluated is the abandonment of the Hendrick Street Wellfield and the Pines Well and replacement with a new water supply developed in an uncontaminated area of Town. In evaluating this option, there are numerous issues which must be considered, including the cost of abandoning the existing water supply, the availability of suitable alternative and equivalent water supplies and the cost of developing and obtaining approval of any new water supply.

Abandonment of Existing Water Supply

The Hendrick Street Wellfield, with an estimated capacity of 3.5 mgd and the Pines Well, with an estimated 1 mgd capacity, account for approximately 51 percent of the Town's current available water supply. The Town of Easthampton relies heavily on the water from these two supplies to meet daily demands within the water system. The Town must have alternative water supplies available, approved and connected to the distribution system prior to the Hendrick Street Wellfield and Pines Well being removed from the water supply system, or "abandoned".

TABLE 4.4

Estimated Carbon Adsorption Costs

CAPITAL COSTS:

2 - Granular Activated Carbon Contactors	$ 400,000
Chlorine Equipment	$ 5,000
Emergency Generator	$ 60,000
Control Building with Sanitary Facilities (6000 s.f.)	$ 450,000
Subtotal	$ 915,000
Electrical Equipment (15% of Capital Subtotal)	$ 137,000
Instrumentation Equipment (15% of Capital Subtotal)	$ 137,000
Site Work (5% of Capital Subtotal)	$ 46,000
Total Capital Costs	$ 1,235,000[1]
Engineering and Contingencies (35% of Capital Costs)	$ 432,000
Total Initial Cost	$1,667,000

ANNUAL O & M COSTS[2]:

Maintenance	$ 17,000
Chemicals (Sodium Hypochlorite)	$ 20,000
Building (Electrical)	$ 5,000
Carbon Replacement (80,000 lbs./yr.)	$ 80,000
Total O & M Costs	$ 122,000
Total Present Worth Cost[3]	$2,459,000

[1] Engineering News Record July 1991 Construction Cost Index = 4854
[2] Electrical costs based on an average rate of $0.06/kwhr.
[3] Assumes a 10 year project duration and an annual discount rate of 8.75%.

The actual abandonment of the contaminated water supplies can occur via two different procedures. The least costly alterative to the Town would be the shutting down of the pumps at both locations and the isolation of the two pumping facilities from the distribution system. If these supplies were relegated to "emergency supply" status, DEP would require the Town to physically disconnect both supplies from the distribution system. The Town may chose to take the opportunity to inspect the pumps and perform any necessary maintenance at these facilities, based on the assumption that the TCE contamination will eventually pass by the two pumping facilities and both water sources will be useable at some late date.

The second option available to the Town, would consist of isolating both facilities from the distribution system and pumping the contaminated water to waste, similar to recent past practice. This would hasten the purging of the aquifer but would require continued operation and maintenance of both pumping facilities.

The cost of abandoning both water supplies, assuming they are both shut down with no pumping to waste, would be negligible as both facilities are fully depreciated and the Town is no longer financing any construction related bonds on either facility.

S E A has discussed the abandonment alternative with DEP officials who have expressed a concern over the potential abandonment of an approved 4.5 mgd water supply but who have also stated that by pursuing such an action, the Town would not be jeopardizing the eligibility of State funding for TCE contamination related costs incurred to date. It should be noted, however, that the Town is currently allowed to operate the Hendrick Street Wellfield and Pines Well only under emergency DEP approval and that DEP officials have expressed a concern over continuing to operate the contaminated water supplies during the period required to develop and obtain approval of alternative supplies.

Potential Sites of Alternative Water Supplies

There are numerous criteria which must be met in selecting alternative water supply sites. These include sufficient safe yield, acceptable water quality, ability to adequately protect the water supply from contamination and acceptable water supply development costs.

S E A has reviewed information supplied by the Town which outlined public land, school land and recreational areas. This mapping, in conjunction with existing groundwater favorability mapping, was used to highlight publicly owned or controlled areas within the Town which could possibly support adequate water supplies.

Based on a review of existing land use and subsurface information it appears that the two best sites located within the Town which might meet the criteria of an alternative water supply are the Nonotuck Park area and the New England Forestry Foundation area, as shown on Figure 4.1. It is important to state that this screening of potential sites is a preliminary screening only. There are numerous steps, such as extensive subsurface investigation, which must be completed before the actual potential of any site can be fully evaluated. The potential alternative sites are described below.

The Nonotuck Park area is an approximately 100 acre site located north of the Hendrick Street Wellfield. The surficial geologic mapping of the area shows the area to be favorable for water supply development and a potentially large enough area to support a 4 mgd capacity supply. The major concern with this site is that the site is located in the Barnes Aquifer and downgradient of the Hendrick Street Wellfield and may eventually encounter the same TCE contaminant plume currently affecting the Hendrick Street Wellfield. In 1987 the Town of Easthampton installed a test well on the Nonotuck Park site and found limited capacity due to excessive fine material clogging the well screen during the placement of the well screen. This lack of capacity, in conjunction with DEP's request that the Town not pursue further development of the Nonotuck Park water supply until the Hendrick Street contamination had been addressed, lead the Town to abandon the development of additional Nonotuck Park wells.

The second potential site is an approximate 70 acre New England Forestry Foundation site located in the extreme northwest corner of the Town. The groundwater favorability mapping shows a generally shallow aquifer in the area. The mapping shows the potential for a deep channel which

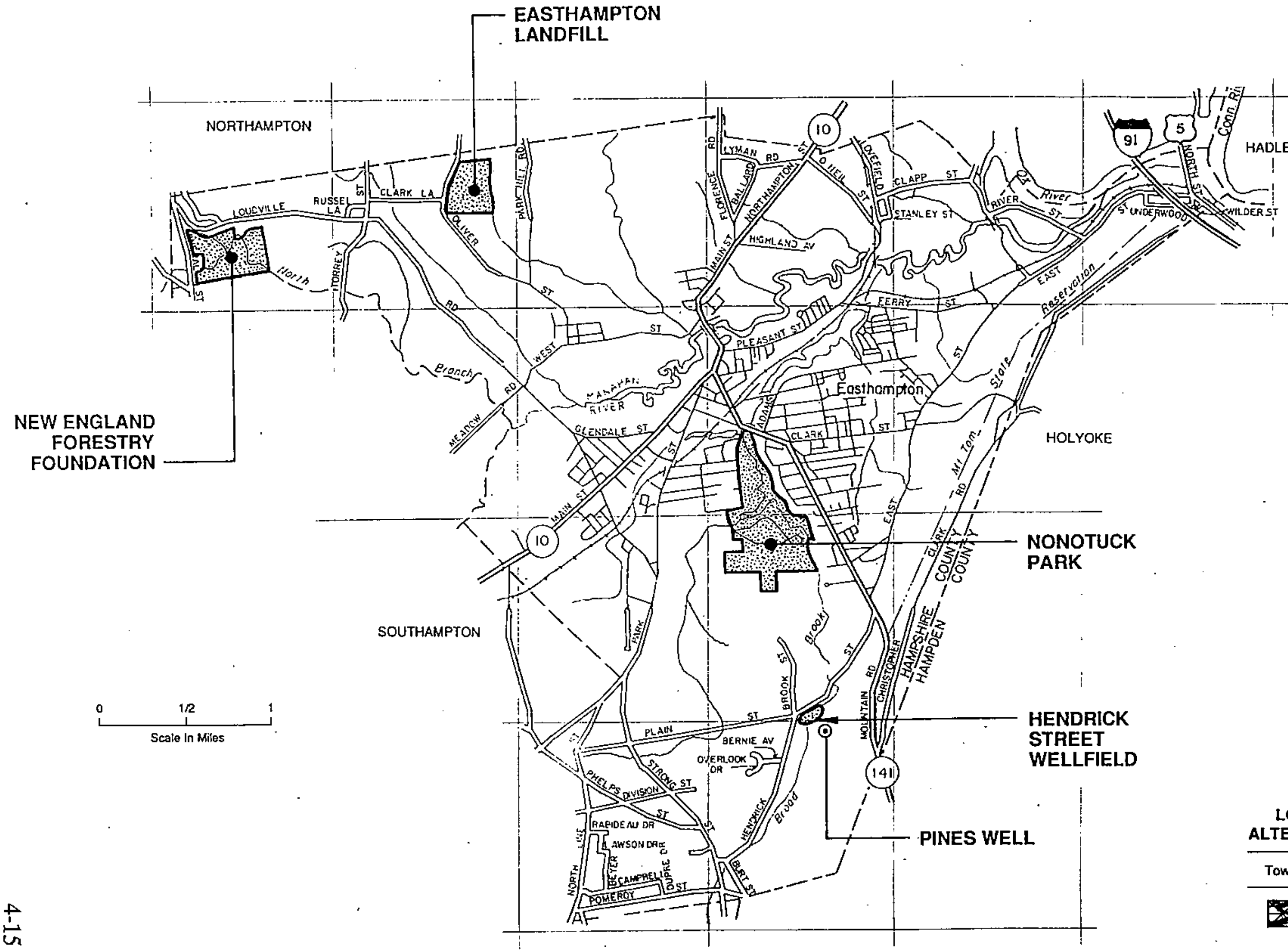


Figure 4.1

LOCATION OF POTENTIAL ALTERNATIVE WATER SUPPLIES

Town of Easthampton, Massachusetts

SEA Consultants Inc.
Engineers / Architects

might support the required level of groundwater extraction. This site is adjacent to the Town's 4 million gallon (mg) water supply storage tank so a water supply in this area would require minimal construction to connect to the water distribution system. It should be noted that locating the pumped water supply next to the storage tank is not an efficient location in terms of maintaining the water system's hydraulic gradient throughout the Town.

In 1985 a hydrogeologic study determined that the New England Forestry Foundation site could generate a substantial yield but that there was a potential that a documented contaminant plume created by the Easthampton Landfill, located east of the Foundation site, could contaminate the aquifer if a production well was developed in the area. Therefore, the Town decided to not develop the New England Forestry Foundation site at that time.

Therefore, based on a review of the sites most likely to support the development of a 4 mgd water supply, it would appear that the Town of Easthampton would have a difficult time in developing alternative water supplies to allow for the abandonment of the existing supply.

New Source Approval

The Massachusetts DEP requires that all proposed water supplies obtain a New Source Approval as detailed in DEP's "Guidelines and Policies for Public Water Systems". The new source approval process is a nine step procedure for obtaining DEP approval of any public drinking water supply in excess of 100,000 gallon per day (gpd). The approval process is phased to include exploration and preliminary testing, aquifer delineation and mapping, long-term aquifer pump testing to determine safe yield, and the preparation of a detailed hydrogeologic report.

Past experience with the new source approval process has shown the process to be a slow, deliberate process, requiring DEP review and approval at many intermediate checkpoints. Based on S E A's experience, it is estimated that the approval process period, from the start of initial groundwater exploration to obtaining DEP approval of the Source Final Report, takes an estimated 24 months.

Table 4.5 lists the various tasks which constitute the New Source Approval Process and each associated estimated range of costs to complete the task. Table 4.5 does not include the DEP permit application fees associated with the New Source Approval process. The Town, being a municipality, is exempt from the fees unless the Town desires DEP to adhere to a pre-established approval schedule. The "fee for schedule" process is relatively new and it is unclear at this time whether submitting the fees would be advantageous to the Town.

Development of Water Supplies

Once New Source Approval has been obtained, the next step in developing an alternative water supply would be the design and construction of the production wells, associated pumping stations and transmission mains. In order to estimate the cost of designing and constructing the required facilities the following assumptions have been made:

1. The new well(s) must have a total pumping capacity of 4 mgd.

2. A total of 4 wells will need to be installed to obtain the required capacity.

3. Each well will require a pump station and the construction of 1,000 feet of 12 inch diameter transmission main.

Based on these assumptions, Table 4.6 summarizes the estimated costs associated with developing and maintaining the new water supply.

No Action

Another option available to the Town is to proceed with the status quo and take no remedial action at the Hendrick Street Wellfield or Pines Well. DEP is currently allowing the Town to use the Pines Well on an as needed basis and the Hendrick Street Wellfield on an emergency basis only. As these

TABLE 4.5
SUMMARY OF NEW SOURCE APPROVAL TASKS

	TASK	ESTIMATED COST*
1.	Groundwater Exploration	$ 100,000 - $ 200,000
2.	Request for DEP Site Exam including Preparation of Bylaw Summary Form and Wellhead Protection Questionnaire	$ 10,000 - $ 20,000
3.	DEP Site Exam	$ 2,000
4.	Submittal of Pumping Test Proposal	$ 5,000 - $ 10,000
5.	Pumping Test Proposal Approval	$ 0
6.	Pumping Test Performance	$ 50,000 - $ 100,000
7.	Pumping Test Analysis	$ 40,000 - $ 80,000
8.	Submittal of Source Final Report	$ 5,000 - $ 10,000
9.	Source Final Report Approval	$ 0
	Total	$ 200,000 - $ 400,000**

* Based on an objective of developing 4 mgd at 1 or 2 separate sites. Costs do not include DEP permit application fees.

** $300,000 used in subsequent cost analyses.

TABLE 4.6
COSTS ASSOCIATED WITH DEVELOPING NEW WATER SUPPLY

	COST
New Source Approval Process	$ 300,000
Capital Cost	
4 Production Wells	$ 320,000
4 Pump Stations	$ 1,000,000
12-inch Transmission Main (4,000 feet)	$ 120,000
Capital Cost (Subtotal)	$ 1,440,000
Engineering and Contingencies (35% of Capital Cost)	$ 504,000
Total Initial Cost	$ 2,244,000
O&M Cost	
Operation (Power)	$ 80,000/yr.
Maintenance (2% of Capital Cost)	$ 29,000/yr.
Total O&M	$ 109,000/yr.
TOTAL PRESENT WORTH COST *	$ 2,951,000
* Based on 10 years, 8.75% discount rate	

sources constitute over fifty percent of the Town's current available water supply, and the Town's maximum daily water demands cannot be met without the Hendrick Street Wellfield on line, it is apparent that unless an equal alternative source is found, the Hendrick Street Wellfield must continue to be used.

The historical data on TCE contamination at the wellfield does not show any indication that the TCE concentration is decreasing with time and, to the contrary, shows an erratic increase in TCE concentration at both the Hendrick Street Wellfield and the Pines Well. Discussions with DEP officials have concluded that continued use of drinking water obtained from the Hendrick Street Wellfield which is contaminated with TCE in excess of the MCL, with or without the continued monitoring of contamination in the water, is unacceptable and would not be permitted. Therefore, the "no action" alternative is not viewed as a viable option to the Town and should be eliminated from further consideration.

APPENDIX A - Monitoring Well Boring Logs

LEGEND FOR S E A WELL LOGS

Project: *Well Log*	Project Number: *999Z*	*Boring No.* *WELL C*
Client: *ABC Incorporated*		Sheet No. *1* of *1*
Boring Depth (ft.): *15.0*	Elevation:	Driller:
Starting Date:		
Datum/Notes: *Elevation Datum+MSL /*		Ending Date:

Elev. (Feet)	Depth (Feet)	Lith-ology	Material Description	Well Detail	Comments	Penetration Resistance (Blows/Foot) 0 50 100
			Use for boring without observation or monitoring wells.		BLANK	
			Use for bentonite bottom seal.		BOTSEAL1	
			Use for grout bottom seal or grouted borehole.		BOTSEAL2	
			Use for soil bottom seal.		BOTSEAL3	
			Do not use		BOTSEAL4	
	5		Do not use.		BOTSEAL5	
			Same as BOTSEAL1.		BOTTPACK	
			Use for bentonite seal around riser pipe.		PACKPIPE	
			Use for sand backfill around riser pipe or silt trap.		PIPE	
	10		Same as PACKPIPE.		SEAL1	
			Use for grout around riser pipe.		SEAL2	
			Use for cement concrete around riser pipe.		SEAL3	
			Do not use.		SEAL4	
			Use for borehole cuttings around riser pipe.		SEAL5	
	15		Use for filter sand around well screen.		SLOTPIPE	

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started:	10/31/90	Boring Log
Ref. No.:	90072.1V	Date Finished:	11/1/90	B-1

Contractor/Driller: Soil Exploration Co.
Engineer/Geologist: Kosta Exarhoulakos
Casing Type/Size: 4-1/4 in. ID HSA
Sampler Type/Size: 1-3/8 in. Split Spoon
Weather:
Location: Pequot Road
Surface Elevation:

Groundwater Observations

Date	Depth	Elev.	Notes
11/1/90	40'		

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Stratum Description
			S-1	4"/24"	0.0-2.0	2	S-1 Medium-dense, tan, fine to coarse SAND and GRAVEL. Trace pebbles, cobbles.	TOPSOIL
						5		
1						9		
						14		
2								
3								
4			S-2	6"/24"	4.0-6.0	15	S-2 Dense, brown, medium to coarse SAND with fine GRAVEL and trace fine Sand.	4.0 SAND and GRAVEL
						22		
5						22		
						14		
6								
7								
8								
9			S-3	4"/24"	9.0-11.0	8	S-3 Medium-dense, brown, fine to medium SAND and GRAVEL with trace coarse Sand and Silt.	9.0 SAND and GRAVEL, trace Silt
						11		
10						12		
						11		
11								
12								
13								
14			S-4	2"/24"	14.0-16.0	10	S-4 Medium-dense, brown, fine to medium SAND with trace Silt and tan, coarse Sand and Gravel.	
						8		
15						8		
						9		
16								
17								
18								
19			S-5	8"/24"	19.0-21.0	6	S-5 Medium-dense, tan, medium to coarse SAND with fine SAND and GRAVEL. Trace	
						6		

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
Encountered GW at approximately 40 feet.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started:	10/31/90	Boring Log
Ref. No.:	90072.1V	Date Finished:	11/1/90	B-1

Contractor/Driller: **Soil Exploration Co.**
Engineer/Geologist: **Kosta Exarhoulakos**
Casing Type/Size: **4-1/4 in. ID HSA**
Sampler Type/Size: **1-3/8 in. Split Spoon**
Weather:
Location: **Pequot Road**
Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes
11/1/90	40		

Depth (ft)	Elev. (ft)	Sample PID (ppm)	Sample No.	Sample Pen /Rec.	Sample Depth (ft)	Sample Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
						8	Silt.			
						12				
21										
22										
23										
24									24.0	
			S-6	6"/24"	24.0-26.0	7	S-6 Medium-dense, tan, medium to coarse SAND with fine SAND and GRAVEL.		SAND and GRAVEL (fining downwards)	
25						8				
						9				
						11				
26										
27										
28										
29			S-7	10"/24"	29.0-31.0	7	S-7 Medium-dense, tan, medium to fine SAND. Trace coarse Sand and Gravel.			
						8				
30						9				
						11				
31										
32										
33										
34			S-8	8"/24"	34.0-36.0	12	S-8 Medium-dense, tan, medium SAND with coarse SAND, some fine Sand and Gravel.			
35						11				
						12				
						14				
36										
37										
38									39.0	
39			S-9	10"/24"	39.0-41.0	12	S-9 Medium-dense, tan, fine SAND inter-bedded with coarse Sand and Gravel.		SAND and GRAVEL	
						14				

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE
COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1.) Encountered GW at approximately 40 feet.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started:	10/31/90	Boring Log
Ref. No.:	90072.1V	Date Finished:	11/1/90	**B-1**

Contractor/Driller:	**Soil Exploration Co.**	Weather:	
Engineer/Geologist:	**Kosta Exarhoulakos**	Location:	**Pequot Road**
Casing Type/Size:	**4-1/4 in. ID HSA**		
Sampler Type/Size:	**1-3/8 in. Split Spoon**	Surface Elevation:	

Groundwater Observations			
Date	Depth	Elev.	Notes
11/1/90	40		

Depth (ft)	Elev. (ft)	Sample PID (ppm)	Sample No.	Sample Pen /Rec.	Sample Depth (ft)	Sample Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
						14				
41						11			41.0 Bottom of Boring at 41'.	
42										
43										
44			S-10	10"/24"	44.0-46.0	11	S-10 Interbedded medium-dense, medium to coarse SAND and GRAVEL (some pebbles and cobbles) and fine Sand with trace Silt.			
45						11				
						12				
46						11				
47										
48										
49			S-11	8"/24"	49.0-51.0	12	S-11 Medium-dense, medium to fine SAND, some coarse Sand with trace Silt.			
50						10				
						12				
51						11				
52										
53										
54			S-12	12"/24"	54.0-56.0	12	S-12 Tan, medium-dense, interbedded medium to fine SAND with trace Silt. Coarse SAND and GRAVEL.			
55						14				
						11				
56						17				
57										
58										
59			S-13	8"/24"	59.0-61.0	12	S-13 Dense, brown, fine SAND, trace medium Sand and Silt.			
						15				

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1.) Encountered GW at approximately 40 feet.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started:	10/31/90	Boring Log
Ref. No.:	90072.1V	Date Finished:	11/1/90	**B-1**

Contractor/Driller: **Soil Exploration Co.**
Engineer/Geologist: **Kosta Exarhoulakos**
Casing Type/Size: **4-1/4 in. ID HSA**
Sampler Type/Size: **1-3/8 in. Split Spoon**
Weather:
Location: **Pequot Road**
Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes
11/1/90	40		

Depth (ft)	Elev. (ft)	Sample PID (ppm)	Sample No.	Sample Pen /Rec.	Sample Depth (ft)	Sample Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
						15				
						17				
61										
62										
63										
64										
65										
66										
67										
68										
69										
70										
71										
72										
73										
74										
75										
76										
77										
78										
79										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE
COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1.) Encountered GW at approximately 40 feet.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started:	10/25/90	Boring Log
Ref. No.:	90072.1V	Date Finished:	10/29/90	B-2

Contractor/Driller:	Soil Exploration Co.	Weather:	
Engineer/Geologist:	Kosta Exarhoulakos	Location:	Keys & Rock Valley Road
Casing Type/Size:	6 in. ID HSA		
Sampler Type/Size:	1-3/8 in. Split Spoon	Surface Elevation:	

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Sample PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
			S-1		0.0-0.5	4	S-1 TOPSOIL		0.5 TOPSOIL	
1			S-1A		0.5-2.0	7	S-1A Brown, fine to coarse SAND.		SAND	
						6				
2						2				
3										
4			S-2	16"/24"	4.0-6.0	8	S-2 Medium-coarse, brown SAND, some fines.			
5						8				
						10				
6						13				
7									7.0 GRAVEL	
8										
9			S-3	12"/24"	9.0-11.0	7	S-3 Brown CLAY.		9.0 CLAY	
10						8				
						11				
11						11				
12										
13										
14			S-4	13"/24"	14.0-16.0	9	S-4 Brown CLAY.			
15						8				
						6				
16						9				
17										
18										
19			S-5		19.0-21.0	7	S-5 Brown CLAY with fine to medium SAND.			
						8				

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1. Encountered boulders at approximately 8'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 10/25/90 Date Finished: 10/29/90	Boring Log **B-2**
Ref. No.:	90072.1V		

Contractor/Driller:	Soil Exploration Co.	Weather:	
Engineer/Geologist:	Kosta Exarhoulakos	Location:	Keys & Rock Valley Road
Casing Type/Size:	6 in. ID HSA		
Sampler Type/Size:	1-3/8 in. Split Spoon	Surface Elevation:	

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Stratum Description
						24		
21						30		
22								
23								
24			S-6	10"/24"	24.0-26.0	28	S-6 Well compacted brown, fine SAND to coarse GRAVEL with trace Silty Clay (TILL).	24.0 Well compacted SAND and GRAVEL
25						31		
						47		
						40		
26								
27								
28								
29			S-7	10"/24"	29.0-31.0	16	S-7 Same as above.	
30						23		
						26		
						34		
31								
32								
33								
34			S-8		34.0-36.0	28	S-8 Same as above.	
35						43		
						41		
						37		
36								
37								
38								
39			S-9		39.0-41.0	16	S-9 Brown VARVE CLAY.	39.0 VARVE CLAY
						20		

GRANULAR SOILS BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

1. Encountered boulders at approximately 8'.

PROPORTIONS USED: trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started:	10/25/90	Boring Log
Ref. No.:	90072.1V	Date Finished:	10/29/90	B-2

Contractor/Driller: **Soil Exploration Co.**
Engineer/Geologist: **Kosta Exarhoulakos**
Casing Type/Size: **6 in. ID HSA**
Sampler Type/Size: **1-3/8 in. Split Spoon**
Weather:
Location: **Keys & Rock Valley Road**
Surface Elevation:

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Sample PID (ppm)	Sample No.	Sample Pen /Rec.	Sample Depth (ft)	Sample Blows /6"	Sample Description	Stratum Description
						19		
41						19		
42								
43								
44			S-10	24"/24"	44.0-46.0	8	S-10 Brown VARVE CLAY.	
						8		
45						16		
						13		
46								
47								
48								
49			S-11	24"/24"	49.0-51.0	7	S-11 Brown VARVE CLAY.	
						10		
50						14		
						15		
51								
52								
53								
54			S-12	18"/24"	54.0-56.0	6	S-12 Brown VARVE CLAY, trace Sand (some layers).	
						8		
55						8		
						9		
56								
57								58.0
58								SILT and CLAY with Sand and Gravel (TILL)
59			S-13	14"/24"	59.0-61.0	41	S-13 Brown SILT and CLAY with fine to coarse Sand and Gravel (TILL).	
						38		

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1. Encountered boulders at approximately 8'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project: **EASTHAMPTON TCE**
EASTHAMPTON, MA
Ref. No.: **90072.1V**

Date Started: **10/25/90**
Date Finished: **10/29/90**

Boring Log
B-2

Contractor/Driller: **Soil Exploration Co.**
Engineer/Geologist: **Kosta Exarhoulakos**
Casing Type/Size: **6 in. ID HSA**
Sampler Type/Size: **1-3/8 in. Split Spoon**

Weather:
Location: **Keys & Rock Valley Road**
Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Sample PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Stratum Description
						40		
						53		
61								
62								
								63.0
63			S-14	3"/24"	63.0-65.0	94	S-14 Brown, fine to medium grained	SANDSTONE
						61	SANDSTONE.	
64						97		
						111		
65								
66								
67								
68								
69			S-15	8"/24"	69.0-71.0	21	S-15 Brown, fine grained SANDSTONE with	
						25	Mica flecks.	
70						33		
						28		
71								
72								
73								
74			S-16		74.0-76.0	34	S-16 Brown, fine grained SANDSTONE.	
						41		
75						29		
						35		76.0
76								Bottom of Boring at 76'.
77								
78								
79								

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1. Encountered boulders at approximately 8'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 11/5/90 Date Finished: 11/6/90	Boring Log **B-3**
Ref. No.:	90072.1V		

Contractor/Driller: **Soil Exploration**
Engineer/Geologist: **Kosta Exarhoulakos**
Casing Type/Size:
Sampler Type/Size:
Weather:
Location: **S. County Road at Fir Lane**
Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes
11/5/90	49.0		

Depth (ft)	Elev. (ft)	Sample	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
									TOPSOIL	
1			S-1	10"/24"	1.0-3.0	4	S-1 TOPSOIL			
						7				
2						7				
						5				
3										
									4.0	
4			S-2	14"/24"	4.0-6.0	8	S-2 Brown, medium-coarse grained		SAND with GRAVEL	
						8	SAND with fine Sand and Gravel,		(some topsoil)	
5						10	some Topsoil.			
						10				
6										
7										
8										
9			S-3	12"/24"	9.0-11.0	10	S-3 Brown, medium-coarse grained			
						12	SAND with trace fine Sand and Gravel.			
10						12				
						15				
11										
12										
13									14.0	
14			S-4	8"/24"	14.0-16.0	9	S-4 Brown, fine to medium SAND.		SAND	
						10				
15						12				
						15				
16										
17										
18										
19			S-5		19.0-21.0	10	S-5 Brown, fine SAND.			
						14				

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 11/5/90 Date Finished: 11/6/90	Boring Log **B-3**
Ref. No.:	90072.1V		

Contractor/Driller:	Soil Exploration	Weather:			
Engineer/Geologist:	Kosta Exarhoulakos	Location:	S. County Road at Fir Lane		
Casing Type/Size:	4-1/4 in. ID HSA				
Sampler Type/Size:	1-3/8 in. Split Spoon	Surface Elevation:			

Groundwater Observations

Date	Depth	Elev.	Notes
11/5/90	49.0		

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
						16				
21						19				
22										
23										
24			S-6	7"/24"	24.0-26.0	6	S-6 Fine SAND.			
						9				
25						14				
						17				
26										
27										
28										
29			S-7	12"/24"	29.0-31.0	11	S-7 Brown, medium SAND.			
						16				
30						20				
						22				
31										
32										
33										
34			S-8	14"/24"	34.0-36.0	6	S-8 Brown, fine SAND.			
						11				
35						17				
						20				
36										
37										
38										
39			S-9	11"/24"	39.0-41.0	11	S-9 Brown, fine SAND.			
						21				

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE
COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 11/5/90 Date Finished: 11/6/90	Boring Log
Ref. No.:	90072.1V		B-3

Contractor/Driller: **Soil Exploration**
Engineer/Geologist: **Kosta Exarhoulakos**
Casing Type/Size: **4-1/4 in. ID HSA**
Sampler Type/Size: **1-3/8 in. Split Spoon**

Weather:
Location: **S. County Road at Fir Lane**
Surface Elevation:

Groundwater Observations

Date	Depth	Elev.	Notes
11/5/90	49.0		

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Stratum Description
						22		
41						18		
42								
43								
44			S-10	10"/24"	44.0-46.0	14	S-10 Dense, tan-brown, fine to coarse SAND with trace Gravel.	
45						18		
						26		
46						20		
47								
48								
49			S-11	0"/24"	49.0-51.0	12		
50						11		
						10		
51						12		
			S-11A	0"/24"	51.0-52.0			
52								
53								
54			S-12	8"/24"	54.0-56.0	16	S-12 Dense, red-brown, medium SAND with trace coarse Sand and occasional pebbles.	
55						20		
						22		
56						22		
57								
58								
59			S-13	0"/24"	59.0-61.0	16		
						17		

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started:	11/5/90	Boring Log
Ref. No.:	90072.1V	Date Finished:	11/6/90	**B-3**

Contractor/Driller:	Soil Exploration	Weather:	
Engineer/Geologist:	Kosta Exarhoulakos	Location:	S. County Road at Fir Lane
Casing Type/Size:	4-1/4 in. ID HSA		
Sampler Type/Size:	1-3/8 in. Split Spoon	Surface Elevation:	

Groundwater Observations

Date	Depth	Elev.	Notes
11/5/90	49.0		

Depth (ft)	Elev. (ft)	Sample PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
						20				
						15				
61			S-14	8"/24"	61.0-63.0	12	S-14 Dense, red-brown fine to medium SAND, trace Silt.			
						16				
62						23				
						20				
63										
64			S-15	8"/24"	64.0-66.0	15	S-15 Dense, red-brown SILT, fine SAND with trace Mica.			
						19				
65						22				
						23				
66										
67										
68										
69			S-16	8"/24"	69.0-71.0	20	S-16 Dense, tan-brown, SILTY FINE SAND with trace Mica.			
						23				
70						19				
						26				
71										
72										
73										
74			S-17	6"/24"	74.0-76.0	16	S-17 Dense, red-tan, very fine SANDY SILT.			
						26				
75						26				
						24				
76										
77										
78										
79			S-18	7"/24"	79.0-81.0	20	S-18 Dense, red-tan, fine SAND.			
						22				

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE
COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 11/5/90 Date Finished: 11/6/90	Boring Log
Ref. No.:	90072.1V		**B-3**

Contractor/Driller: **Soil Exploration**
Engineer/Geologist: **Kosta Exarhoulakos**
Casing Type/Size: **4-1/4 in. ID HSA**
Sampler Type/Size: **1-3/8 in. Split Spoon**

Weather:
Location: **S. County Road at Fir Lane**
Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes
11/5/90	49.0		

Depth (ft)	Elev. (ft)	Sample PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
						21				
81						26			81.0 Bottom of Boring at 81'.	
82										
83										
84										
85										
86										
87										
88										
89										
90										
91										
92										
93										
94										
95										
96										
97										
98										
99										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 11/5/90 Date Finished: 11/8/90	Boring Log
Ref. No.:	90072.1V		B-4A

Contractor/Driller: Soil Excavation Co. — Weather:

Engineer/Geologist: S.W. Porter — Location: Jones Road

Casing Type/Size: 4 in. Steel

Sampler Type/Size: 24 in. ID Split Spoon — Surface Elevation:

Groundwater Observations

Date	Depth	Elev.	Notes
11/6/90	30		
11/7/90	49.5		

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Stratum Description
			S-1	18"/24"	0.0-2.0	2	S-1 TOPSOIL, black-tan, organic	TOPSOIL
1						3	SILT, fine to medium SAND to 1.0'.	1.0
						3	Loose, red-tan, fine to medium SAND	SAND
2						3	to 2.0'.	
3								
4			S-2	16"/24"	4.0-6.0	8	S-2 Medium, light-red, fine to coarse	
5						8	SAND with trace Gravel.	
						11		
						15		6.0
6								SAND with GRAVEL
7								
8								
9			S-3	12"/24"	9.0-11.0	12	S-3 Medium, gray-red, fine to coarse	
						9	SAND with coarse Gravel layers.	
10						9		
						11		
11								
12								
13								
14			S-4	12"/24"	14.0-16.0	15	S-4 Dense, gray-red, fine to coarse	
						17	SAND with GRAVEL.	
15						18		
						18		16.0
16								SANDY SILT
17								
18								
19			S-5	14"/24"	19.0-21.0	27	S-5 Dense, red-tan SILT, fine to medium	
						21	SAND, trace coarse Sand.	

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1. VOC hit at 79.5'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started:	11/5/90	Boring Log
Ref. No.:	90072.1V	Date Finished:	11/8/90	**B-4**

Contractor/Driller: **Soil Excavation Co.**
Engineer/Geologist: **S.W. Porter**
Casing Type/Size: **4 in. Steel**
Sampler Type/Size: **24 in. ID Split Spoon**
Weather:
Location: **Jones Road**
Surface Elevation:

Groundwater Observations

Date	Depth	Elev.	Notes
11/6/90	30		
11/7/90	49.5		

Depth (ft)	Elev. (ft)	Sample PID (ppm)	Sample No.	Sample Pen /Rec.	Sample Depth (ft)	Sample Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
						21				
						24				
21										
22										
23									24.0	
24			S-6	10"/24"	24.0-26.0	20	S-6 Dense, layered 1/2 - 2".		Fine SAND	
						21	1.) Tan, fine SAND with medium to coarse			
25						27	SAND. 2.) Reddish-white, fine to medium			
						28	SAND.			
26										
27										
28										
29			S-7	8"/24"	29.0-31.0	10	S-7 Medium, reddish-white, fine to medium			
						11	SAND with trace coarse Sand.			
30						12				
						13				
31										
32										
33									Medium SAND trace Silt	
34			S-8	10"/24"	34.0-36.0	15	S-8 Medium, reddish-brown, medium to coarse			
						12	SAND with fine SAND and trace Silt.			
35						13				
						15				
36										
37										
38										
39										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE
COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1. VOC hit at 79.5'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started:	11/5/90	Boring Log
		Date Finished:	11/8/90	B-4
Ref. No.:	90072.1V			

Contractor/Driller:	Soil Excavation Co.	Weather:	
Engineer/Geologist:	S.W. Porter	Location:	Jones Road
Casing Type/Size:	4 in. Steel		
Sampler Type/Size:	24 in. ID Split Spoon	Surface Elevation:	

Groundwater Observations

Date	Depth	Elev.	Notes
11/6/90	30		
11/7/90	49.5		

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Stratum Description
			S-9	10"/24"	40.0-42.0	10	S-9 Medium, brownish-gray, fine to medium SAND.	
41						11		
						11		
						12		42.0
42								SILT and SAND trace Gravel
43								
44			S-10	10"/24"	44.0-46.0	13	S-10 Dense, reddish-tan SILT, fine to coarse SAND with trace Gravel.	
45						13		
						15		
						21		
46								
47								47.5
48								SAND
49			S-11	12"/24"	49.0-51.0	17	S-11 Dense, tan-brown, fine to medium SAND.	
50						16		
						15		
						23		
51								
52								52.0
								SAND trace Gravel
53								
54			S-12	7"/24"	54.0-56.0	17	S-12 Dense, red-tan, fine to coarse SAND with trace Gravel.	
55						18		
						16		
						20		
56								
57								
58								
59			S-13	12"/24"	59.0-61.0		S-13 Same as above.	

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1. VOC hit at 79.5'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started:	11/5/90	Boring Log
Ref. No.:	90072.1V	Date Finished:	11/8/90	B-4

Contractor/Driller: Soil Excavation Co.
Engineer/Geologist: S.W. Porter
Casing Type/Size: 4 in. Steel
Sampler Type/Size: 24 in. ID Split Spoon
Weather:
Location: Jones Road
Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes
11/6/90	30		
11/7/90	49.5		

Depth (ft)	Elev. (ft)	Sample PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
61										
62										
63										
64			S-14	8"/24"	64.0-66.0	21	S-14 Dense, red-brown, medium to coarse			
						22	SAND with fine SAND and trace Silt.			
65						22				
						25				
66										
67										
68										
69			S-15	7"/24"	69.0-71.0	16	S-15 Dense, red-tan, fine to medium			
						13	SAND with trace coarse SAND.			
70						17				
						17				
71										
72										
73										
74			S-16	0"/24"	74.0-76.0	16	S-16 Dense, red-tan, fine SAND with			
						16	some medium Sand.			
75						25				
						25				
76										
77										
78										
79			S-17	8"/24"	79.0-81.0	20	S-17 Same as above.			
						20				

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE
COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1. VOC hit at 79.5'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 11/5/90 Date Finished: 11/8/90	Boring Log **B-4**
Ref. No.:	90072.1V		

Contractor/Driller: **Soil Excavation Co.**
Engineer/Geologist: **S.W. Porter**
Casing Type/Size: **4 in. Steel**
Sampler Type/Size: **24 in. ID Split Spoon**
Weather:
Location: **Jones Road**
Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes
11/6/90	30		
11/7/90	49.5		

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
						20				
						20				
81										
82										
83										
84			S-18	12"/24"	84.0-86.0	26	S-18 Dense, red-tan, fine SAND with			
						25	some medium Sand.			
85						20				
						21				
86										
87										
88										
89			S-19	8"/24"	89.0-91.0	20	S-19 Dense, red-tan, fine to medium			
						21	SAND.			
90						30				
						35				
91										
92										
93										
94			S-20	12"/24"	94.0-96.0	15	S-20 Very dense, red-brown, very fine			
						16	SAND.			
95						20				
						35				
96										
97										
98										
99			S-21	16"/24"	99.0-101.0	16	S-21 Dense, red-brown, fine to medium			
						18	SAND.			

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1. VOC hit at 79.5'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started:	11/5/90	Boring Log
Ref. No.:	90072.1V	Date Finished:	11/8/90	B-4

Contractor/Driller: **Soil Excavation Co.**
Engineer/Geologist: **S.W. Porter**
Casing Type/Size: **4 in. Steel**
Sampler Type/Size: **24 in. ID Split Spoon**
Weather:
Location: **Jones Road**
Surface Elevation:

Groundwater Observations

Date	Depth	Elev.	Notes
11/6/90	30		
11/7/90	49.5		

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
						21				
						20			101.0	
101									Bottom of Boring at 101'.	
102										
103										
104										
105										
106										
107										
108										
109										
110										
111										
112										
113										
114										
115										
116										
117										
118										
119										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1. VOC hit at 79.5'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 11/3/90 Date Finished: 11/7/90	Boring Log **B-5A**
Ref. No.:	90072.1V		

Contractor/Driller: **Soil Exploration Co.** Weather:
Engineer/Geologist: **Kosta Exarhoulakos** Location: **Hendrick Street**
Casing Type/Size: **4-1/4 in. ID HSA**
Sampler Type/Size: **1-3/8 in. ID Split Spoon** Surface Elevation:

Groundwater Observations

Date	Depth	Elev.	Notes
11/7/90	30		
11/8/90	30		

Depth (ft)	Elev. (ft)	Sample PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Stratum Description
			S-1	18"/24"	0.0-2.0	5	S-1 Loose, fine to medium SAND	TOPSOIL
1						4	with pebbles and cobbles.	
						4		
						5		2.0
2								SAND trace Gravel
3								
4			S-2	6"/24"	4.0-6.0	10	S-2 Dense, dark-tan, medium to	
						12	coarse SAND, trace Gravel.	
5						16		
						27		
6								
7								
8								
9			S-3	10"/24"	9.0-11.0	4	S-3 Dense, dark-tan, medium to	SAND trace Silt
						11	fine SAND, trace Silt.	
10						16		
						17		
11								
12								
13								
14			S-4	12"/24"	14.0-16.0	12	S-4 Dense, dark-tan, fine SAND	
						12	with trace medium Sand and Silt.	
15						16		
						15		
16								
17								
18								19.0
19			S-5	6"/24"	19.0-21.0	14	S-5 Dense, brown, fine SAND and	SAND and SILT,
						20	SILT, trace Clay.	

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1.) GW encountered at approximately 30'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 11/3/90 Date Finished: 11/7/90	Boring Log **B-5A**
Ref. No.:	90072.1V		

Contractor/Driller:	Soil Exploration Co.	Weather:	
Engineer/Geologist:	Kosta Exarhoulakos	Location:	Hendrick Street
Casing Type/Size:	4-1/4 in. ID HSA		
Sampler Type/Size:	1-3/8 in. ID Split Spoon	Surface Elevation:	

Groundwater Observations

Date	Depth	Elev.	Notes
11/7/90	30		
11/8/90	30		

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Stratum Description
						19		trace Clay
21						22		
22								
23								
24			S-6	8"/24"	24.0-26.0	8	S-6 Medium-dense, brown SAND and	
						8	SILT. Trace Clay.	
25						12		
						16		
26								
27								
28								
29			S-7	10"/24"	29.0-31.0	7	S-7 Same as above.	
						11		
30						10		
						14		
31								
32								
33								34.0
34			S-8	10"/24"	34.0-36.0	8	S-8 Medium-dense, dark-tan, medium	SAND trace Silt
						9	to coarse SAND with some fines and	
35						9	trace Silt.	
						14		
36								
37								
38								39.0
39			S-9	14"/24"	39.0-41.0	8	S-9 Medium-dense, brown, fine SAND,	SAND and SILT
						7	trace medium Sand and Silt.	

NOTES:
1.) GW encountered at approximately 30'.

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 11/3/90 Date Finished: 11/7/90	Boring Log **B-5A**
Ref. No.:	90072.1V		

Contractor/Driller: **Soil Exploration Co.** Weather:
Engineer/Geologist: **Kosta Exarhoulakos** Location: **Hendrick Street**
Casing Type/Size: **4-1/4 in. ID HSA**
Sampler Type/Size: **1-3/8 in. ID Split Spoon** Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes
11/7/90	30		
11/8/90	30		

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Stratum Description
						7		
						14		
41								
42								
43								
44			S-10	12"/24"	44.0-46.0	4	S-10 Loose, brown, fine SAND, trace medium Sand and Silt.	
						4		
45						3		
						7		
46								
47								
48								49.0
49			S-11	10"/24"	49.0-51.0	11	S-11 Medium-dense, tan, coarse SAND with fine to medium Sand.	SAND
						12		
50						12		
						14		
51								
52								
53								
54			S-12	14"/24"	54.0-56.0	20	S-12 Very dense, brown, fine SAND, trace Silt.	SAND trace Silt
						18		
55						26		
						31		
56								
57								
58								
59			S-13	4"/24"	59.0-61.0	12	S-13 Medium-dense, brown, fine SAND.	SAND
						14		

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1.) GW encountered at approximately 30'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 11/3/90 Date Finished: 11/7/90	Boring Log
Ref. No.:	90072.1V		B-5A

Contractor/Driller: Soil Exploration Co.
Engineer/Geologist: Kosta Exarhoulakos
Casing Type/Size: 4-1/4 in. ID HSA
Sampler Type/Size: 1-3/8 in. ID Split Spoon
Weather:
Location: Hendrick Street
Surface Elevation:

Groundwater Observations

Date	Depth	Elev.	Notes
11/7/90	30		
11/8/90	30		

Depth (ft)	Elev. (ft)	Sample PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
						12				
61						15				
62										
63										
64			S-14	12"/24"	64.0-66.0	12	S-14 Medium-dense, dark-tan, medium SAND with some fine to coarse SAND.			
65						11				
						8				
66						4				
67										
68										
69			S-15	12"/24"	69.0-71.0	12	S-15 Dense, brown, fine SAND with trace Silt.		SAND trace Silt	
70						14				
						21				
71						23				
72										
73										
74			S-16	14"/24"	74.0-76.0	16	S-16 Very dense, dark-tan, medium to fine SAND, trace coarse Sand.			
75						28				
						37				
76						43				
77										
78										
79			S-17	12"/24"	79.0-81.0	16	S-17 Medium-dense to dense, dark-tan, coarse to medium SAND with			
						20				

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1.) GW encountered at approximately 30'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 11/3/90 Date Finished: 11/7/90	Boring Log
Ref. No.:	90072.1V		B-5A

Contractor/Driller: **Soil Exploration Co.**
Engineer/Geologist: **Kosta Exarhoulakos**
Casing Type/Size: **4-1/4 in. ID HSA**
Sampler Type/Size: **1-3/8 in. ID Split Spoon**
Weather:
Location: **Hendrick Street**
Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes
11/7/90	30		
11/8/90	30		

Depth (ft)	Elev. (ft)	Sample PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
						13	fine Sand.			
						17				
81										
82										
83										
84			S-18	14"/24"	84.0-86.0	10	S-18 Dense, tan, medium to coarse			
						16	SAND with some fine Sand.			
85						16				
						18				
86										
87										
88									89.0	
89			S-19	10"/24"	89.0-90.0	16	S-19 Tan, medium to coarse SAND		SAND with Gravel	
						17	with fine Gravel, trace fines.			
90			S-19A	8"/24"	90.0-91.0	34	S-19A Fine to coarse SAND with			
						46	pebbles and cobbles (TILL).			
91										
92										
93										
94			S-20	10"/24"	94.0-96.0	18	S-20 Very-dense, tan, medium to			
						21	coarse SAND. Some fine Sand,			
95						30	fine Gravel, to pebbles and			
						36	cobbles.			
96										
97										
98									99.0	
99			S-21	12"/24"	99.0-101.0	16	S-21 Dense, tan, coarse to		SAND	
						21	medium SAND, some fine Sand.			

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1.) GW encountered at approximately 30'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 11/3/90 Date Finished: 11/7/90	Boring Log
Ref. No.:	90072.1V		**B-5A**

Contractor/Driller: **Soil Exploration Co.**
Engineer/Geologist: **Kosta Exarhoulakos**
Casing Type/Size: **4-1/4 in. ID HSA**
Sampler Type/Size: **1-3/8 in. ID Split Spoon**
Weather:
Location: **Hendrick Street**
Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes
11/7/90	30		
11/8/90	30		

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
						19				
101						19				
102										
103										
104			S-22	16"/24"	104.0-106.0	23	S-22 Very-dense, brown, fine SAND; coarse SAND.		Alternating coarse SAND, approx. 2.5" thick	
105						31				
						46				
						40				
106										
107										
108										
109			S-23	12"/24"	109.0-111.0	28	S-23 Very-dense, brown, fine SAND, some medium Sand, coarse Sand.		Alternating coarse SAND, approx. 2" thick	
110						31				
						46				
						59			111.0	
111									Refusal at 111'.	
112										
113										
114										
115										
116										
117										
118										
119										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1.) GW encountered at approximately 30'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 11/7/90 Date Finished: 11/8/90	Boring Log **B-5B**
Ref. No.:	90072.1V		

Contractor/Driller: **Soil Exploration Co.**
Engineer/Geologist: **Kosta Exarhoulakos**
Casing Type/Size: **4-1/4 in. ID HSA**
Sampler Type/Size: **1-3/8 in. ID Split Spoon**

Weather:
Location: **Hendrick Street**
Surface Elevation:

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Sample PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%)
some (20-35%), and (35-50%)
with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 11/7/90 Date Finished: 11/8/90	Boring Log **B-5B**
Ref. No.:	90072.1V		

Contractor/Driller: **Soil Exploration Co.** Weather:
Engineer/Geologist: **Kosta Exarhoulakos** Location: **Hendrick Street**
Casing Type/Size: **4-1/4 in. ID HSA**
Sampler Type/Size: **1-3/8 in. ID Split Spoon** Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Sample PID (ppm)	Sample No.	Sample Pen /Rec.	Sample Depth (ft)	Sample Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
32										
33										
34										
35										
36										
37										
38										
39										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%)
some (20-35%), and (35-50%)
with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project: **EASTHAMPTON TCE** **EASTHAMPTON, MA** Ref. No.: **90072.1V**	Date Started: **11/7/90** Date Finished: **11/8/90**	Boring Log **B-5B**

Contractor/Driller: **Soil Exploration Co.**
Engineer/Geologist: **Kosta Exarhoulakos**
Casing Type/Size: **4-1/4 in. ID HSA**
Sampler Type/Size: **1-3/8 in. ID Split Spoon**
Weather:
Location: **Hendrick Street**
Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Sample PID (ppm)	Sample No.	Sample Pen /Rec.	Sample Depth (ft)	Sample Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
41										
42										
43										
44										
45										
46										
47										
48										
49										
50										
51										
52										
53										
54										
55										
56										
57										
58										
59										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE
COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 11/7/90 Date Finished: 11/8/90	Boring Log
Ref. No.:	90072.1V		**B-5B**

Contractor/Driller: **Soil Exploration Co.**
Engineer/Geologist: **Kosta Exarhoulakos**
Casing Type/Size: **4-1/4 in. ID HSA**
Sampler Type/Size: **1-3/8 in. ID Split Spoon**
Weather:
Location: **Hendrick Street**
Surface Elevation:

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Sample PID (ppm)	Sample No.	Sample Pen /Rec.	Sample Depth (ft)	Sample Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
									Bottom of Well at 60'.	
61										
62										
63										
64										
65										
66										
67										
68										
69										
70										
71										
72										
73										
74										
75										
76										
77										
78										
79										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

SEA

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started:	10/31/90	Boring Log
Ref. No.:	90072.1V	Date Finished:	11/1/90	B-7

Contractor/Driller: **Soil Exploration Co.**
Engineer/Geologist: **Kosta Exarhoulakos**
Casing Type/Size: **4 in. Steel**
Sampler Type/Size: **24 in. ID Split Spoon**
Weather:
Location: **1000' East of well house, approx. 20' above street**
Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes
11/1/90	15		

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Stratum Description
			S-1	6"/24"	0.0-2.0	WOH	S-1 Very loose, tan SILT, fine to medium SAND.	0.3 TOPSOIL
1						2		SAND
						2		
2						2		
3								SAND trace Gravel
4								
5			S-2	15"/24"	5.0-7.0	11	S-2 Medium, red-brown, fine to medium SAND.	
6						11		
						13		
						12		
7								
8								
9			S-3	6"/24"	9.0-11.0	13	S-3 Same as above.	
						15		
10						16		
						17		
11								
12								
13								SAND trace Gravel
14			S-4	7"/24"	14.0-16.0	12	S-4 Medium, red-brown, fine to coarse SAND with trace Silt, occasional Gravel.	
						13		
15						13		
						13		
16								
17								17.5
18			S-5	5"/24"	18.0-20.0	12	S-5 Medium, red-brown, fine SAND and SILT with trace Mica.	SAND and SILT
						13		
19						13		
						14		

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE
COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1.) Boring is approx. 20' above stream level.
2.) Stream elev. at approx. 20'.
3.) Samples near saturation a 29'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 10/31/90 Date Finished: 11/1/90	Boring Log **B-7**
Ref. No.:	90072.1V		

Contractor/Driller:	Soil Exploration Co.	Weather:	
Engineer/Geologist:	Kosta Exarhoulakos	Location:	1000' East of well house, approx. 20' above street
Casing Type/Size:	4 in. Steel		
Sampler Type/Size:	24 in. ID Split Spoon	Surface Elevation:	

Groundwater Observations

Date	Depth	Elev.	Notes
11/1/90	15		

Depth (ft)	Elev. (ft)	Sample PID (ppm)	Sample No.	Sample Pen /Rec.	Sample Depth (ft)	Sample Blows /6"	Sample Description	Stratum Description
21								
22								
23								
24			S-6	4"/24"	24.0-26.0	12	S-6 Same as above.	
						13		
25						13		
						13		
26								
27								
28								29.0
29			S-7	12"/24'	29.0-31.0	4	S-7 Stiff, tan, very fine, Sandy SILT with thin micaceous laminae.	SANDY SILT
						5		
30						6		
						6		
31								
32								
33								
34			S-8	12"/24'	34.0-36.0	5	S-8 Very stiff, red-tan, fine, Sandy SILT with Clayey SILT.	
						4		
35						5		
						11		
36								37.0
37								SANDY SILTY CLAY
38								
39			S-9		39.0-41.0		S-9 Stiff, tan, fine, Sandy, Silty CLAY.	

GRANULAR SOILS BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1.) Boring is approx. 20' above stream level.
2.) Stream elev. at approx. 20'.
3.) Samples near saturation a 29'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started:	10/31/90	Boring Log
Ref. No.:	90072.1V	Date Finished:	11/1/90	B-7

Contractor/Driller: **Soil Exploration Co.**
Engineer/Geologist: **Kosta Exarhoulakos**
Casing Type/Size: **4 in. Steel**
Sampler Type/Size: **24 in. ID Split Spoon**

Weather:
Location: **1000' East of well house, approx. 20' above street**
Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes
11/1/90	15		

Depth (ft)	Elev. (ft)	Sample PID (ppm)	Sample No.	Sample Pen /Rec.	Sample Depth (ft)	Sample Blows /6"	Sample Description	Stratum Description
41								
42								42.0 SANDY CLAYEY SILT
43								
44			S-10	14"/24"	44.0-46.0	10 / 13 / 16 / 27	S-10 Dense, red-brown, Silty CLAY, fine to coarse SAND with GRAVEL and pebbles.	44.5 SAND with GRAVEL
45								
46								
47			S-11	10"/24"	47.0-48.3	48 / 41 / 100/3	S-11 Very dense, red-tan, medium to coarse SAND with fine SAND and 1" layers of red-tan, fine, Sandy SILT.	
48								48.2
49								Casing Refusal at 47.5'. Spoon Refusal at 48.25'.
50								
51								
52								
53								
54								
55								
56								
57								
58								
59								

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1.) Boring is approx. 20' above stream level.
2.) Stream elev. at approx. 20'.
3.) Samples near saturation a 29'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started:	11/2/90	Boring Log
Ref. No.:	90072.1V	Date Finished:	11/2/90	B-8

Contractor/Driller:	Soil Exploration Co.	Weather:		
Engineer/Geologist:	Kosta Exarhoulakos	Location:	So. Co. Road and Cook Road	
Casing Type/Size:	4 in. ID HSA			
Sampler Type/Size:	1-3/8 in. ID Split Spoon	Surface Elevation:		

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Sample PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Stratum Description
			S-1	10"/24"	0.0-2.0	1	S-1 Black-brown, Silty, fine SAND.	0.3 TOPSOIL
1						2		ALLUVIUM: SAND
						1		
2						2		
3								
4								
5			S-2	18"/24"	5.0-7.0	4	S-2 ALLUVIUM: Very loose, tan-brown, Silty, fine to medium SAND with trace coarse SAND.	5.0 ALLUVIUM: SAND with GRAVEL
6						7		
						3		
7						7		
8								
9			S-3	8"/24"	9.0-11.0	10	S-3 ALLUVIUM: Medium, red-tan, gravelly, fine to coarse SAND and trace Silt.	9.0 ALLUVIUM: SAND with trace Silt
10						8		
						8		
11						12		
12								
13								
14			S-4	0"/24"	14.0-16.0	13	S-4 ALLUVIUM: Same appearance, pebbley and cobbley.	
15						7		
						6		
16						6		
17								
18								18.0 SANDY SILT
19			S-5	0"/24"	19.0-21.0	5	S-5 Medium, red-brown, fine, Sandy SILT.	
						6		

GRANULAR SOILS BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not Included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 11/2/90 Date Finished: 11/2/90	Boring Log
Ref. No.:	90072.1V		B-8

Contractor/Driller: Soil Exploration Co.
Engineer/Geologist: Kosta Exarhoulakos
Casing Type/Size: 4 in. ID HSA
Sampler Type/Size: 1-3/8 in. ID Split Spoon
Weather:
Location: So. Co. Road and Cook Road
Surface Elevation:

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Sample PID (ppm)	Sample No.	Sample Pen /Rec.	Sample Depth (ft)	Sample Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
						7				
21						6				
22										
23									24.0	
24			S-6	0"/24"	24.0-26.0	5	S-6 Same as above.		Sample attempt: 24 to 26', No Recovery Bottom of Boring at 24'.	
25						4				
						3				
26						4				
27										
28										
29										
30										
31										
32										
33										
34										
35										
36										
37										
38										
39										

GRANULAR SOILS BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project: EASTHAMPTON TCE EASTHAMPTON, MA Ref. No.: 90072.1V	Date Started: 4/3/91 Date Finished: 4/8/91	Boring Log **B-9A**

Contractor/Driller: **Soil Exploration Co.**
Engineer/Geologist: **Kosta Exarhoulakos**
Casing Type/Size: **4 in. ID HSA**
Sampler Type/Size: **1-3/8 in. ID Split Spoon**
Weather:
Location: **126 Hendrick Street**
Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Stratum Description
								TOPSOIL
								1.0
1								SAND
2								
3								
4			S-1	1.2'/2'	4.0-6.0	21	S-1 Very dense, brown, very,	
						24	very fine SAND to fine SAND.	
5						28		
						30		
6								
7								
8								
9			S-2	1.4'/2'	9.0-11.0	21	S-2 Dense, brown, fine SAND,	SAND
						18	trace very fine Sand and med-	
10						17	ium Sand.	
						19		
11								
12								
13								
14			S-3	1.5'/2'	14.0-16.0	20	S-3 Very dense, brown, fine	
						25	SAND, trace medium Sand.	
15						23		
						28		
16								
17								
18								
19			S-4	.3'/2'	19.0-21.0	18	S-4 Medium dense, brown, fine	
						17	to medium SAND.	

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 4/3/91 Date Finished: 4/8/91	Boring Log
Ref. No.:	90072.1V		**B-9A**

Contractor/Driller: **Soil Exploration Co.**
Engineer/Geologist: **Kosta Exarhoulakos**
Casing Type/Size: **4 in. ID HSA**
Sampler Type/Size: **1-3/8 in. ID Split Spoon**
Weather:
Location: **126 Hendrick Street**
Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Sample PID (ppm)	Sample No.	Sample Pen /Rec.	Sample Depth (ft)	Sample Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
						18				
						22				
21										
22										
23										
24			S-5	.5'/2'	24.0-26.0	20	S-5 Medium dense, brown, fine			
						17	SAND, trace medium to coarse			
25						14	SAND.		SAND	
						12				
26										
27										
28										
29			S-6	.9'/2'	29.0-31.0	12	S-6 Medium dense, brown, fine			
						12	SAND, trace very fine Sand and			
30						11	medium Sand.			
						11				
31										
32										
33										
34			S-7		34.0-36.0	9	S-7 Medium dense, brown, fine			
						8	SAND (wash water only). No			
35						6	Sample.			
						6				
36										
37										
38										
39			S-8	.9'/2'	39.0-41.0	10	S-8 Loose to medium dense, brown,			
						8	medium to fine SAND, trace coarse			

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 4/3/91 Date Finished: 4/8/91	Boring Log
Ref. No.:	90072.1V		**B-9A**

Contractor/Driller: **Soil Exploration Co.** Weather:
Engineer/Geologist: **Kosta Exarhoulakos** Location: **126 Hendrick Street**
Casing Type/Size: **4 in. ID HSA**
Sampler Type/Size: **1-3/8 in. ID Split Spoon** Surface Elevation:

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Sample PID (ppm)	Sample No.	Sample Pen /Rec.	Sample Depth (ft)	Sample Blows /6"	Sample Description	Stratum Description
						5	Sand.	
41						6		
42								
43								
44			S-9	.7'/2'	44.0-46.0	8	S-9 Medium dense, brown, medium to	
45						10	fine SAND.	
						10		
46						13		SAND
47								
48								
49			S-10	.9'/2'	49.0-51.0	16	S-10 Medium dense, brown, fine SAND,	
50						17	trace very fine Sand.	
						17		
51						20		
52								
53								
54			S-11	.6'/2'	54.0-56.0	10	S-11 Medium dense, brown, medium to	
55						11	coarse SAND, some fine Sand.	
						10		
56						12		
57								
58								59.0
59			S-12		59.0-61.0	12	S-12 Loose, brown, coarse SAND and	SAND, GRAVEL and
						7	GRAVEL and COBBLES, some fine to	

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE
COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project: EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 4/3/91	Boring Log
Ref. No.: 90072.1V	Date Finished: 4/8/91	B-9A

Contractor/Driller: Soil Exploration Co.
Engineer/Geologist: Kosta Exarhoulakos
Casing Type/Size: 4 in. ID HSA
Sampler Type/Size: 1-3/8 in. ID Split Spoon

Weather:
Location: 126 Hendrick Street
Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Stratum Description
						4	medium Sand.	COBBLES
						5		
61								
62								
63								
64			S-13	.3'/2'	64.0-66.0	10	S-13 Medium dense, brown, coarse	
						9	GRAVEL, COBBLES, some coarse Sand,	
65						7	trace medium to fine Sand.	
						8		
66								
67								
68								69.0
69			S-14		69.0-71.0	9	S-14 Medium dense, brown SAND, trace	SAND
						9	fine to medium Sand.	
70						12		
						15		
71								
72								
73								
74			S-15	.4'/2'	74.0-76.0	13	S-15 Dense, brown, coarse to medium	
						16	SAND and some fine Sand.	
75						20		
						18		
76								
77								
78								79.0
79			S-16	.1'/2'	79.0-81.0	11	S-16 Dense, brown, fine to coarse	GRAVEL
						19	GRAVEL (anything else fell out).	

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE
COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 4/3/91 Date Finished: 4/8/91	Boring Log
Ref. No.:	90072.1V		**B-9A**

Contractor/Driller: **Soil Exploration Co.**
Engineer/Geologist: **Kosta Exarhoulakos**
Casing Type/Size: **4 in. ID HSA**
Sampler Type/Size: **1-3/8 in. ID Split Spoon**
Weather:
Location: **126 Hendrick Street**
Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Sample PID (ppm)	Sample No.	Sample Pen /Rec.	Sample Depth (ft)	Blows /6"	Sample Description	Stratum Description
						20		
81						21		
82								
83								84.0
84			S-17		84.0-86.0	8 9 10 8	S-17 Medium dense, brown, medium to coarse SAND and GRAVEL, trace fines, (wash water only).	SAND and GRAVEL
85								
86								
87								
88								
89			S-18	.2'/2'	89.0-91.0	7 5 3 3	S-18 Very loose, brown, medium to coarse SAND and GRAVEL with trace to some fine Sand (last 6": seemed to be a hole.)	
90								
91								
92								
93								94.0
94			S-19	.6'/2'	94.0-96.0	16 20 24 22	S-19 Dense, brown, fine to coarse SAND, trace coarse Sand.	SAND
95								
96								
97								
98								
99			S-20		99.0-101.0	18 18	S-20 Dense, brown, medium SAND, trace fine to coarse Sand.	

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started:	4/3/91	Boring Log
Ref. No.:	90072.1V	Date Finished:	4/8/91	B-9A

Contractor/Driller:	Soil Exploration Co.	Weather:	
Engineer/Geologist:	Kosta Exarhoulakos	Location:	126 Hendrick Street
Casing Type/Size:	4 in. ID HSA		
Sampler Type/Size:	1-3/8 in. ID Split Spoon	Surface Elevation:	

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Sample PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Stratum Description
						25		
						29		
101								
102								SAND
103								
104			S-21	.4'/2'	104.0-106.0	24	S-21 Dense, brown, coarse SAND, some medium Sand, trace fine Sand.	
						29		
105						34		
						33		
106								
107								
108								
109			S-22		109.0-111.0	26	S-22 Dense, brown, medium to coarse SAND, some fine Sand. (Wash water only).	
						27		
110						26		
						18		
111								
112								
113								114.0
114			S-23		114.0-116.0	11	S-23 Medium dense, brown, (first one empty) coarse to medium SAND and GRAVEL, some fine Sand.	SAND and GRAVEL
						7		
115						9		
						12		
116								
117								
118								
119			S-24	1.1'/2'	119.0-121.0	25	S-24 Very dense, brown, coarse SAND and GRAVEL with cobbles, trace fine to	
						29		

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE
COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 4/3/91 Date Finished: 4/8/91	Boring Log
Ref. No.:	90072.1V		**B-9A**

Contractor/Driller: Soil Exploration Co.
Engineer/Geologist: Kosta Exarhoulakos
Casing Type/Size: 4 in. ID HSA
Sampler Type/Size: 1-3/8 in. ID Split Spoon
Weather:
Location: 126 Hendrick Street
Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Sample PID (ppm)	Sample No.	Sample Pen /Rec.	Sample Depth (ft)	Sample Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
						25	medium Sand.			
						26				
121										
122									SAND and GRAVEL	
123										
									124.0	
124			S-25				S-25 Drove casing but couldn't obtain Spoon Sample. Sand kept blowing back into casing. (Wash water was coarse to fine SAND and GRAVEL - possibly TILL).		Bottom of Boring at 124'.	
125										
126										
127										
128										
129										
130										
131										
132										
133										
134										
135										
136										
137										
138										
139										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 4/8/91 Date Finished: 4/8/91	Boring Log **B-9B**
Ref. No.:	90072.1V		

Contractor/Driller:	Soil Exploration Co.	Weather:	
Engineer/Geologist:	Kosta Exarhoulakos	Location:	
Casing Type/Size:	4 in. ID HSA		
Sampler Type/Size:	1-3/8 in. Split Spoon	Surface Elevation:	

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Sample PID (ppm)	Sample No.	Sample Pen /Rec.	Sample Depth (ft)	Sample Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
1										
2										
3										
4									SAND	
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 4/8/91 Date Finished: 4/8/91	Boring Log **B-9B**
Ref. No.:	90072.1V		

Contractor/Driller:	Soil Exploration Co.	Weather:	
Engineer/Geologist:	Kosta Exarhoulakos	Location:	
Casing Type/Size:	4 in. ID HSA		
Sampler Type/Size:	1-3/8 in. Split Spoon	Surface Elevation:	

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Sample PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
21										
22										
23										
24										
25										
26										
27									SAND	
28										
29										
30										
31										
32										
33										
34										
35										
36										
37										
38										
39										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE
COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started:	4/8/91	Boring Log
Ref. No.:	90072.1V	Date Finished:	4/8/91	**B-9B**

Contractor/Driller: **Soil Exploration Co.**
Engineer/Geologist: **Kosta Exarhoulakos**
Casing Type/Size: **4 in. ID HSA**
Sampler Type/Size: **1-3/8 in. Split Spoon**
Weather:
Location:
Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Sample PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
41										
42										
43										
44			S-1	1.2'/2'	44.0-46.0	7	S-1 Dense, brown, medium to fine			
						10	SAND, some coarse Sand.			
45						12				
						20				
46										
47										
48										
49			S-2		49.0-51.0	8	S-2 Medium dense, brown, medium			
						12	to coarse SAND, some fine Sand.			
50						8	(Wash water only).			
						6			51.0	
51									Bottom of Boring at 51'.	
52										
53										
54										
55										
56										
57										
58										
59										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 4/24/91 Date Finished: 4/29/91	Boring Log **B-9C**
Ref. No.:	90072.1V		

Contractor/Driller: **Soil Exploration Co.**
Engineer/Geologist: **Kosta Exarhoulakos**
Casing Type/Size: **4 in. ID HSA**
Sampler Type/Size: **1-3/8 in. ID Split Spoon**
Weather:
Location: **Approx. 13 Brook Street**
Surface Elevation:

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
1										
2										
3										
4			S-1	1.1'/2'	4.0-6.0	17	S-1 Medium dense, brown, fine		SAND	
						14	to medium SAND.			
5						14				
						13				
6										
7										
8										
9			S-2	2.2'/2'	9.0-11.0	5	S-2 Medium dense, grey-brown,		SAND trace Clay	
						5	SILT to fine SAND, trace Clay.			
10						5				
						7				
11										
12										
13										
14			S-3	1'/2'	14.0-16.0	15	S-3 Dense, brown, fine to med-		SAND	
						16	ium SAND, trace coarse Sand.			
15						17				
						21				
16										
17										
18										
19			S-4	.8'/2'	19.0-21.0	16	S-4 Medium dense, brown, fine		SAND trace Silt	
						12	SAND, trace Silt and medium			

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 4/24/91 Date Finished: 4/29/91	Boring Log
Ref. No.:	90072.1V		B-9C

Contractor/Driller: Soil Exploration Co.
Engineer/Geologist: Kosta Exarhoulakos
Casing Type/Size: 4 in. ID HSA
Sampler Type/Size: 1-3/8 in. ID Split Spoon

Weather:
Location: Approx. 13 Brook Street
Surface Elevation:

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Sample PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
						13	Sand.			
						16				
21										
22										
23									24.0	
24			S-5	1.15'/2	24.0-26.0	9	S-5 Dense, brown, very fine SAND		SAND and SILT	
						13	and SILT.			
25						15				
						17				
26										
27										
28										
29			S-6	1.6'/2'	29.0-31.0	4	S-6 Dense, brown, very fine SAND			
						8	and SILT, trace Clay?			
30						14				
						21				
31										
32										
33									34.0	
34			S-7		34.0-36.0	9	S-7 Medium dense, brown, fine SAND		SAND	
						11	(wash water only).			
35						13				
						15				
36										
37										
38									39.0	
39			S-8		39.0-41.0	8	S-8 Medium dense, brown, (empty on		SAND, SILT and CLAY	
						9	first and repounded) very fine SAND,			

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 4/24/91 Date Finished: 4/29/91	Boring Log
Ref. No.:	90072.1V		**B-9C**

Contractor/Driller: Soil Exploration Co.
Engineer/Geologist: Kosta Exarhoulakos
Casing Type/Size: 4 in. ID HSA
Sampler Type/Size: 1-3/8 in. ID Split Spoon
Weather:
Location: Approx. 13 Brook Street
Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Sample PID (ppm)	Sample No.	Sample Pen /Rec.	Sample Depth (ft)	Sample Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
						10	SILT and CLAY.			
41						11				
42										
43									44.0	
44			S-9		44.0-46.0	12	S-9 Dense, brown, fine SAND and SILT		SAND and SILT	
						17	(wash water only).			
45						20				
						27				
46										
47										
48									49.0	
49			S-10	1.2'/2'	49.0-51.0	10	S-10 Dense, brown, very fine SAND.		SAND	
						17				
50						21				
						25				
51										
52										
53										
54			S-11		54.0-56.0	11	S-11 Dense, brown, very fine SAND			
						15	(wash water only).			
55						21				
						24				
56										
57										
58										
59			S-12	.2'/2'	59.0-61.0	18	S-12 Dense, brown, very fine SAND,		SAND trace Silt	
						21	trace Silt.			

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 4/24/91 Date Finished: 4/29/91	Boring Log
Ref. No.:	90072.1V		B-9C

Contractor/Driller:	Soil Exploration Co.	Weather:	
Engineer/Geologist:	Kosta Exarhoulakos	Location:	Approx. 13 Brook Street
Casing Type/Size:	4 in. ID HSA		
Sampler Type/Size:	1-3/8 in. ID Split Spoon	Surface Elevation:	

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	Sample PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
						24				
						21				
61										
62										
63										
64			S-13		64.0-66.0	12	S-13 Very dense, very fine SAND, trace Silt.		SAND trace Silt	
						18				
65						26				
						36				
66										
67										
68									69.0	
69			S-14	1.9'/2'	69.0-71.0	9	S-14 Dense, brown, very fine SAND and SILT, trace Clay.		SAND and SILT, trace Clay	
						13				
70						19				
						27				
71										
72										
73									74.0	
74			S-15	1.2'/2'	74.0-76.0	17	S-15 Dense, brown, fine to coarse Sand, trace very fine Sand.		SAND	
						20				
75						21				
						26				
76										
77										
78										
79			S-16	.9'/2'	79.0-81.0	20	S-16 Very dense, brown, very fine to medium SAND.			
						22				

GRANULAR SOILS

BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS

BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started:	4/24/91	Boring Log
Ref. No.:	90072.1V	Date Finished:	4/29/91	**B-9C**

Contractor/Driller: **Soil Exploration Co.**
Engineer/Geologist: **Kosta Exarhoulakos**
Casing Type/Size: **4 in. ID HSA**
Sampler Type/Size: **1-3/8 in. ID Split Spoon**
Weather:
Location: **Approx. 13 Brook Street**
Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
						24				
						27				
81										
82										
83										
84			S-17	.9'/2'	84.0-86.0	17	S-17 Dense, brown, interbedded, fine to coarse SAND.			
						20				
85						19				
						23				
86										
87										
88										
89			S-18	.8'/2'	89.0-91.0	30	S-18 Very dense, brown, fine to medium SAND, trace coarse Sand.			
						37				
90						38				
						45				
91										
92										
93										
94			S-19	1.3'/2'	94.0-96.0	22	S-19 Very dense, brown, very fine to fine SAND, trace Silt.		SAND trace Silt	
						27				
95						30				
						30				
96										
97										
98										
99			S-20	.5'/2'	99.0-101.0	18	S-20 Medium dense, brown, medium to coarse SAND, trace fine SAND and		SAND trace Gravel	
						18				

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 4/24/91 Date Finished: 4/29/91	Boring Log
Ref. No.:	90072.1V		B-9C

Contractor/Driller: Soil Exploration Co.
Engineer/Geologist: Kosta Exarhoulakos
Casing Type/Size: 4 in. ID HSA
Sampler Type/Size: 1-3/8 in. ID Split Spoon
Weather:
Location: Approx. 13 Brook Street
Surface Elevation:

Groundwater Observations

Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
						10	GRAVEL.			
						15				
101										
102										
103										
104			S-21	.5'/2'	104.0-106.0	15	S-21 Dense, brown, coarse to medium			
						13	SAND, trace fine Sand and Gravel.			
105						18				
						18				
106										
107										
108										
109			S-22	.6'/2'	109.0-111.0	19	S-22 Very dense, brown, coarse to			
						19	medium SAND, trace fine Sand and			
110						26	Gravel.			
						27				
111										
112										
113									114.0	
114			S-23	.8'/2'	114.0-116.0	21	S-23 Very dense, brown, fine to		SAND and SILT	
						26	medium SAND with coarse SAND			
115						28	interbedded, very fine SAND and			
						35	SILT.			
116										
117										
118									119.0	
119			S-24	.65'/2'	119.0-121.0	29	S-24 Very dense, brown, medium to		SAND and GRAVEL	
						33	coarse SAND and GRAVEL, trace fine			

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started:	4/24/91	Boring Log
Ref. No.:	90072.1V	Date Finished:	4/29/91	B-9C

Contractor/Driller: Soil Exploration Co.
Engineer/Geologist: Kosta Exarhoulakos
Casing Type/Size: 4 in. ID HSA
Sampler Type/Size: 1-3/8 in. ID Split Spoon

Weather:
Location: Approx. 13 Brook Street
Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
						34	SAND. (Tip of spoon appears to be			
						30	in Till).		121.0	
121									Bottom of Boring at 121'.	
122										
123										
124										
125										
126										
127										
128										
129										
130										
131										
132										
133										
134										
135										
136										
137										
138										
139										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 3/27/91 Date Finished: 3/29/91	Boring Log
Ref. No.:	90072.1V		B-10A

Contractor/Driller:	Soil Exploration Co.	Weather:	
Engineer/Geologist:	Kosta Exarhoulakos	Location:	Tautznik
Casing Type/Size:	4 in. ID HSA		
Sampler Type/Size:	1-3/8 in. ID Split Spoon	Surface Elevation:	

Groundwater Observations

Date	Depth	Elev.	Notes
3/29/91	11.75		

Depth (ft)	Elev. (ft)	Sample PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
							Brown, fine SAND and GRAVEL to cobble size.		SAND and GRAVEL	
1										
2										
3										
4			S-1	1.1'/2'	4.0-6.0	7	S-1 Medium dense, brown, fine to coarse SAND and GRAVEL to cobble size.			
5						8 6 7				
6										
7										
8										
9			S-2	.2'/2'	9.0-11.0	9	S-2 Medium dense, brown, fine to coarse SAND and GRAVEL to cobble size.			
10						10 11 18				
11									SAND and GRAVEL	
12										
13									14.0	
14			S-3	.8'/2'	14.0-16.0	6	S-3 Loose, brown, medium SAND with some fine Sand and trace coarse Sand and fine Gravel.		SAND	
15						6 5 5				
16										
17										
18										
19			S-4	1.6'/2'	19.0-21.0	6 4	S-4 Medium dense, brown, fine to medium SAND with trace very fine,			

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1.) 0'-11' appears to be overburden for grading purposes.
2.) Encountered GW at 11.75'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 3/27/91 Date Finished: 3/29/91	Boring Log **B-10A**
Ref. No.:	90072.1V		

Contractor/Driller: **Soil Exploration Co.**
Engineer/Geologist: **Kosta Exarhoulakos**
Casing Type/Size: **4 in. ID HSA**
Sampler Type/Size: **1-3/8 in. ID Split Spoon**

Weather:
Location: **Tautznik**
Surface Elevation:

Groundwater Observations

Date	Depth	Elev.	Notes
3/29/91	11.75		

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Stratum Description
						6	coarse Sand.	
21						7		
22								SAND
23								
24			S-5	1'/2'	24.0-26.0	9	S-5 Medium dense, brown, medium	
25						7	SAND with some fine to coarse SAND.	
						9		
26						11		
27								
28								
29			S-6	.3'/2'	29.0-31.0	6	S-6 Loose, brown, very fine and fine	
30						5	SAND, trace medium Sand.	
						6		
31						3		
32								
33								34.0
34			S-7		34.0-36.0	13	S-7 Dense, brown, coarse SAND and	SAND and GRAVEL
35						13	fine GRAVEL with trace fine to medium	
						14	Sand.	
36						20		
37								
38								
39			S-8		39.0-41.0	18	S-8 Dense, brown, very coarse SAND	
						21	and GRAVEL with cobbles.	

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1.) 0'-11' appears to be overburden for grading purposes.
2.) Encountered GW at 11.75'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started:	3/27/91	Boring Log
		Date Finished:	3/29/91	**B-10A**
Ref. No.:	90072.1V			

Contractor/Driller:	Soil Exploration Co.	Weather:	
Engineer/Geologist:	Kosta Exarhoulakos	Location:	Tautznik
Casing Type/Size:	4 in. ID HSA		
Sampler Type/Size:	1-3/8 in. ID Split Spoon	Surface Elevation:	

Groundwater Observations

Date	Depth	Elev.	Notes
3/29/91	11.75		

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Stratum Description
						20		SAND and GRAVEL
41						21		
42								
43								
44			S-9	.1'/2'	44.0-46.0	13	S-9 Medium dense, brown, very coarse SAND and GRAVEL.	
45						14		
						14		
46						14		
47								
48								
49			S-10	.6'/2'	49.0-51.0	8	S-10 Medium dense, brown, medium to coarse SAND and GRAVEL with some fine Sand.	
50						6		
						6		
51						9		
52								
53								54.0
54			S-11	1.2'/2'	54.0-56.0	8	S-11 Medium dense, brown, very fine SAND.	SAND
55						7		
						6		
56						8		
57								
58								
59			S-12	1.05'/2	59.0-61.0	7	S-12 Medium dense, brown, very fine to medium SAND.	
						5		

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1.) 0'-11' appears to be overburden for grading purposes.
2.) Encountered GW at 11.75'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 3/27/91 Date Finished: 3/29/91	Boring Log
Ref. No.:	90072.1V		**B-10A**

Contractor/Driller: **Soil Exploration Co.**
Engineer/Geologist: **Kosta Exarhoulakos**
Casing Type/Size: **4 in. ID HSA**
Sampler Type/Size: **1-3/8 in. ID Split Spoon**
Weather:
Location: **Tautznik**
Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes
3/29/91	11.75		

Depth (ft)	Elev. (ft)	Sample PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Stratum Description
						4		
						9		
61								
62								
63								
64			S-13	.8'/2'	64.0-66.0	7	S-13 Medium dense, brown, medium to coarse SAND with trace to some fine Sand.	SAND
						7		
65						7		
						5		
66								
67								
68								
69			S-14	1'/2'	69.0-71.0	16	S-14 Dense, brown, fine to medium SAND.	
						15		
70						20		
						30		
71								
72								
73								
74			S-15	0'/2'	74.0-76.0	12	S-15 Very dense, brown, fine to medium SAND (wash water only).	
						15		
75						20		
						34		
76								
77								
78								
79			S-16	1.1'/2'	79.0-81.0	12	S-16 Very dense, brown, medium to coarse SAND with some fine to medium Sand layers.	
						18		

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1.) 0'-11' appears to be overburden for grading purposes.
2.) Encountered GW at 11.75'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 3/27/91 Date Finished: 3/29/91	Boring Log
Ref. No.:	90072.1V		**B-10A**

Contractor/Driller: **Soil Exploration Co.**
Engineer/Geologist: **Kosta Exarhoulakos**
Casing Type/Size: **4 in. ID HSA**
Sampler Type/Size: **1-3/8 in. ID Split Spoon**
Weather:
Location: **Tautznik**
Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes
3/29/91	11.75		

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
						29				
						33			81.0	
81									Refusal at 81'.	
82										
83										
84										
85										
86										
87										
88										
89										
90										
91										
92										
93										
94										
95										
96										
97										
98										
99										

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1.) 0'-11' appears to be overburden for grading purposes.
2.) Encountered GW at 11.75'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

SEA
S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 4/1/91 Date Finished: 4/2/91	Boring Log **B-10B**
Ref. No.:	90072.1V		

Contractor/Driller: **Soil Exploration Co.** Weather:
Engineer/Geologist: **Kosta Exarhoulakos** Location: **Tautznik**
Casing Type/Size: **4 in. ID HSA**
Sampler Type/Size: **1-3/8 in. ID Split Spoon** Surface Elevation:

Groundwater Observations

Date	Depth	Elev.	Notes
4/2/91	13.45		

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Stratum Description
0							TOPSOIL - Fine SAND.	TOPSOIL
1								1.0 SAND
4			S-1	.9'/2'	4.0-6.0	6	S-1 Very dense, brown, fine	4.0 SAND and GRAVEL
						8	SAND over medium to coarse	
5						29	SAND and GRAVEL.	
						36		
9			S-2	.8'/2'	9.0-11.0	17	S-2 Dense, brown, fine to	9.0 SAND
						16	medium SAND.	
10						15		
						16		
14			S-3	.6'/2'	14.0-16.0	7	S-3 Medium dense to loose,	
						7	brown, fine to medium SAND.	
15						6		SAND
						5		
19			S-4	.9'/2'	19.0-21.0	10	S-4 Medium dense, brown, fine	
						10	to medium SAND, trace very fine	

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1.) Encountered GW at 13.45'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 4/1/91 Date Finished: 4/2/91	Boring Log
Ref. No.:	90072.1V		**B-10B**

Contractor/Driller: **Soil Exploration Co.** Weather:
Engineer/Geologist: **Kosta Exarhoulakos** Location: **Tautznik**
Casing Type/Size: **4 in. ID HSA**
Sampler Type/Size: **1-3/8 in. ID Split Spoon** Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes
4/2/91	13.45		

Depth (ft)	Elev. (ft)	Sample PID (ppm)	Sample No.	Sample Pen /Rec.	Sample Depth (ft)	Sample Blows /6"	Sample Description	Symbol	Stratum Description	Well Log
						8	Sand.			
						8				
21									SAND	
22										
23										
24			S-5	.7'/2'	24.0-26.0	7	S-5 Medium dense, brown, medium			
						6	to fine SAND.			
25						7				
						7				
26										
27										
28										
29			S-6	.8'/2'	29.0-31.0	10	S-6 Medium dense, brown, medium			
						13	SAND with some fine Sand.			
30						13				
						12				
31										
32										
33									34.0	
34			S-7	1.2'/2'	34.0-36.0	3	S-7 Medium dense, brown, fine to		SAND, trace Silt	
						4	medium SAND with trace Silt and		and Clay	
35						6	Clay.			
						13				
36										
37										
38										
39			S-8	1.1'/2'	39.0-41.0	6	S-8 Medium dense, brown, some red,		SAND, some Silt	
						7	fine SAND, trace medium SAND with		trace Clay	

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1.) Encountered GW at 13.45'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started:	4/1/91	Boring Log
Ref. No.:	90072.1V	Date Finished:	4/2/91	**B-10B**

Contractor/Driller: **Soil Exploration Co.** Weather:
Engineer/Geologist: **Kosta Exarhoulakos** Location: **Tautznik**
Casing Type/Size: **4 in. ID HSA**
Sampler Type/Size: **1-3/8 in. ID Split Spoon** Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes
4/2/91	13.45		

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Stratum Description
						6	some Silt and trace Clay.	
						7		
41								
42								
43								
44			S-9	1'/2'	44.0-46.0	12	S-9 Medium dense to dense, fine	
						14	SAND with some medium Sand and	
45						15	some Silt layers.	
						16		
46								
47								SAND, trace to some Silt
48								
49			S-10	1.4'/2'	49.0-51.0	8	S-10 Dense, brown, fine SAND, trace	
						5	to some Silt.	
50						13		
						21		
51								
52								
53								54.0
54			S-11		54.0-56.0	13	S-11 Dense, brown, fine SAND and	SAND and SILT
						10	SILT, trace medium Sand.	
55						16		
						19		
56								
57								
58								59.0
59			S-12	1.6'/2'	59.0-61.0	12	S-12 Dense, brown, fine to medium	SAND
						16	SAND, some coarse Sand.	

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1.) Encountered GW at 13.45'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started:	4/1/91	Boring Log
Ref. No.:	90072.1V	Date Finished:	4/2/91	B-10B

Contractor/Driller: Soil Exploration Co. Weather:
Engineer/Geologist: Kosta Exarhoulakos Location: Tautznik
Casing Type/Size: 4 in. ID HSA
Sampler Type/Size: 1-3/8 in. ID Split Spoon Surface Elevation:

Groundwater Observations

Date	Depth	Elev.	Notes
4/2/91	13.45		

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Stratum Description
						21		
						22		
61								
62								
63								
64			S-13	.7'/2'	64.0-66.0	6	S-13 Medium dense, brown, fine to medium SAND, trace coarse Sand.	
						8		
65						10		
						9		
66								
67								
68								
69			S-14		69.0-71.0	11	S-14 Dense, brown, coarse to medium SAND, trace Gravel, some fine Sand.	SAND trace Gravel
						14		
70						18		
						21		
71								
72								
73								
74			S-15	1.3'/2'	74.0-76.0	38	S-15 Very dense, brown, fine to coarse SAND.	SAND
						33		
75						37		
						64		
76								
77								
78								79.0
79			S-16	1.7'/2'	79.0-81.0	56	S-16 Very dense, brown, fine to coarse SAND and GRAVEL.	SAND and GRAVEL
						59		

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1.) Encountered GW at 13.45'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 4/1/91 Date Finished: 4/2/91	Boring Log
Ref. No.:	90072.1V		**B-10B**

Contractor/Driller: **Soil Exploration Co.** Weather:

Engineer/Geologist: **Kosta Exarhoulakos** Location: **Tautznik**

Casing Type/Size: **4 in. ID HSA**

Sampler Type/Size: **1-3/8 in. ID Split Spoon** Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes
4/2/91	13.45		

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Stratum Description
						67		
						68		
81								
82								
83								
84					84.0-85.0	76	No Sample.	
						120		85.0
85								Refusal at 85'.
86								
87								
88								
89								
90								
91								
92								
93								
94								
95								
96								
97								
98								
99								

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1.) Encountered GW at 13.45'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 3/25/91 Date Finished: 3/27/91	Boring Log
Ref. No.:	90072.1V		**B-11A**

Contractor/Driller: Soil Exploration Co.
Engineer/Geologist: Kosta Exarhoulakos
Casing Type/Size: 4 in. ID HSA
Sampler Type/Size: 1-3/8 in. ID Split Spoon
Weather:
Location: Pines Well
Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes
3/27/91	10.32		

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Stratum Description
							TOPSOIL	TOPSOIL
1								1.5
2								SAND some Gravel
3								
4			S-1	9"/24"	4.0-6.0	14	S-1 Medium, brown SAND, some	
						14	coarse Sand and Gravel, small	
5						23	cobbles, trace fine Sand.	
						26		
6								
7								
8								
9			S-2	8"/24"	9.0-11.0	7	S-2 Medium dense, brown, fine	SAND, trace Gravel
						5	to coarse SAND with trace fine	and Silt
10						8	Gravel and Silt.	
						8		
11								
12								
13								14.0
14			S-3	6"/24"	14.0-16.0	8	S-3 Medium dense, brown, fine	SAND over SAND
						4	SAND over coarse SAND and	and GRAVEL
15						4	GRAVEL.	
						7		
16								
17								
18								19.0
19			S-4		19.0-21.0	7	S-4 Dense, brown SAND (wash	SAND
						7	water fines only). No Sample	

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1.) Encountered GW at 10.32'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 3/25/91 Date Finished: 3/27/91	Boring Log
Ref. No.:	90072.1V		**B-11A**

Contractor/Driller: **Soil Exploration Co.**
Engineer/Geologist: **Kosta Exarhoulakos**
Casing Type/Size: **4 in. ID HSA**
Sampler Type/Size: **1-3/8 in. ID Split Spoon**
Weather:
Location: **Pines Well**
Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes
3/27/91	10.32		

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Stratum Description
						13		
						18		21.0
21								SAND and SILT
22								
23								
24			S-5	1.5'/2'	24.0-26.0	14	S-5 Medium dense, brown, very fine SAND and SILT.	
						9		
25						9		
						16		
26								
27								SAND and SILT
28								
29			S-6	1.1'/2'	29.0-31.0	10	S-6 Medium dense to dense, brown, very fine SAND and SILT.	
						13		
30						15		
						18		
31								
32								
33								34.0
34			S-7	1.1'/2'	34.0-36.0	9	S-7 Medium dense, brown, fine SAND, trace medium to coarse Sand.	SAND
						8		
35						7		
						9		
36								
37								
38								39.0
39			S-8	.9'/2'	39.0-41.0	8	S-8 Medium dense, brown, fine to medium SAND interbedded with	SAND interbedded with
						11		

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1.) Encountered GW at 10.32'.

PROPROTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started:	3/25/91	Boring Log
Ref. No.:	90072.1V	Date Finished:	3/27/91	B-11A

Contractor/Driller: **Soil Exploration Co.** Weather:
Engineer/Geologist: **Kosta Exarhoulakos** Location: **Pines Well**
Casing Type/Size: **4 in. ID HSA**
Sampler Type/Size: **1-3/8 in. ID Split Spoon** Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes
3/27/91	10.32		

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Stratum Description
						10	coarse SAND and GRAVEL.	Sand and Gravel
41						14		
42								
43								44.0
44			S-9	1.6'/2'	44.0-46.0	9	S-9 Medium dense, brown, very	SAND with SILT,
						8	fine SAND with SILT and trace	trace Gravel
45						9	gravel.	
						14		
46								
47								
48								
49			S-10	.9'/2'	49.0-51.0	11	S-10 Medium dense, brown, very	SAND with SILT
						11	fine SAND with SILT and some	
50						11	medium Sand.	
						11		
51								
52								
53								
54			S-11	1.1'/2'	54.0-56.0	16	S-11 Dense, brown, very fine SAND	SAND and SILT
						17	and SILT, grading to coarse Sand	
55						20	and back to very fine Sand.	
						28		56.0
56								SAND
57								
58								
59			S-12		59.0-61.0	9	S-12 Medium dense, brown, fine	
						7	SAND - some coarse. (Wash water	

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1.) Encountered GW at 10.32'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 3/25/91	Boring Log
Ref. No.:	90072.1V	Date Finished: 3/27/91	B-11A

Contractor/Driller: Soil Exploration Co. Weather:
Engineer/Geologist: Kosta Exarhoulakos Location: Pines Well
Casing Type/Size: 4 in. ID HSA
Sampler Type/Size: 1-3/8 in. ID Split Spoon Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes
3/27/91	10.32		

Depth (ft)	Elev. (ft)	PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Stratum Description
						10	only - No Sample).	
						13		
61								
62								
63								
64			S-13		64.0-66.0	5	S-13 Medium dense, brown, fine SAND,	SAND
						5	trace coarse Sand (wash sample only).	
65						6		
						8		
66								
67								
68								
69			S-14	1.6'/2'	69.0-71.0	15	S-14 Very dense, brown, fine to	
						26	medium SAND, some coarse Sand.	
70						29		
						25		
71								
72								
73								74.0
74			S-15	1.1'/2'	74.0-76.0	20	S-15 Dense, brown, fine to coarse	SAND and GRAVEL
						15	SAND to very coarse SAND and fine	
75						15	GRAVEL.	
						19		
76								
77								
78								79.0
79			S-16	.9'/2'	79.0-81.0	6	S-16 Very dense, brown, medium to	SAND
						7	coarse SAND, some fine (heavy	

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1.) Encountered GW at 10.32'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

Project:	EASTHAMPTON TCE EASTHAMPTON, MA	Date Started: 3/25/91 Date Finished: 3/27/91	Boring Log **B-11A**
Ref. No.:	90072.1V		

Contractor/Driller: Soil Exploration Co.
Engineer/Geologist: Kosta Exarhoulakos
Casing Type/Size: 4 in. ID HSA
Sampler Type/Size: 1-3/8 in. ID Split Spoon

Weather:
Location: Pines Well
Surface Elevation:

Groundwater Observations			
Date	Depth	Elev.	Notes
3/27/91	10.32		

Depth (ft)	Elev. (ft)	Sample PID (ppm)	No.	Pen /Rec.	Depth (ft)	Blows /6"	Sample Description	Stratum Description
						22	coarse SAND in wash water).	
						41		
81								
82								
83								84.0
84			S-17	2'/2'	84.0-86.0	8	S-17 Dense, brown, interbedded, very fine SAND with very coarse SAND and GRAVEL.	SAND with GRAVEL
						11		
85						13		
						18		
86								
87								
88								89.0
89			S-18	1'/2'	89.0-91.0	10	S-18 Dense, brown, very fine SAND with fine to coarse SAND.	SAND
						10		
90						16		
						20		
91								
92								
93								94.0
94			S-19		94.0-96.0	14	S-19 Dense, brown, fine SAND over Till and Bedrock (Sandstone).	SAND over TILL and BEDROCK
						22		
95						65		
						115		96.0
96								Bottom of Boring at 96'.
97								
98								
99								

GRANULAR SOILS	
BLOWS/FT.	DENSITY
0-4	V.LOOSE
4-10	LOOSE
10-30	M.DENSE
30-50	DENSE
>50	V.DENSE

COHESIVE SOILS	
BLOWS/FT.	DENSITY
<2	V.SOFT
2-4	SOFT
4-8	M.STIFF
8-15	STIFF
15-30	V.STIFF
>30	HARD

NOTES:
1.) Encountered GW at 10.32'.

PROPORTIONS USED:
trace (0-10%), little (10-20%) some (20-35%), and (35-50%) with (Amount of component not included)

S E A Consultants, Inc.
Engineers/Architects

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(508) 840-0391

SOIL EXPLORATION CORPORATION

Geotechnical Drilling and Groundwater Monitor Wells

5 Monson Place
Milford, NH 03055
(603) 672-2135

Client SEA CONSULTANTS INC. Date 11/09/90 Job No. 90-354 F

Location EASTHAMPTON, SOUTHAMPTON, AND HOLYOKE, MASSACHUSETTS

BORING NO. B-1(MW-1) Ground Elev. Date Start 10/31/90 Date Complete 11/01/90 Drilling Foreman J.C. Eng./Hydrol. Geologist C.B.

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
	1	0'0"- 2'0"	2-5-9-14	4"/24"			TOPSOIL
						0'6"	Medium dense, dry, tan, FINE TO COARSE SAND AND GRAVEL, trace pebbles-cobbles.
5	2	4'0"- 6'0"	15-22-22-14	6"		4'0"	Dense, dry, brown, MEDIUM COARSE SAND, with fine gravel and trace fine sand.
10	3	9'0"-11'0"	8-11-12-11	4"		9'0"	Medium dense, dry, brown, FINE AND MEDIUM SAND AND GRAVEL with trace coarse sand and silt.
						13'0"	Medium dense, dry, brown, FINE TO MEDIUM SAND, with trace silt, and with tan coarse sand and gravel.
15	4	14'0"-16'0"	10-8-8-9				
20	5	19'0"-21'0"	6-8-8				
25	6	24'0"-26'0"	7-8-9-11				
30	7	29'0"- 31'0"	7-8-9-11				
35	8	34'0"-36'0"	12-11-12-14				
40	9	39'0"-41'0"	12-14-14-11				

Type of Boring Casing Size: Hollow Stem Auger Size:

Proportion Percentages
Trace 0 to 10%
Some 10 to 40%
And 40 to 50%

Granular Soils (blows per ft.)
0 to 4 Very Loose
4 to 10 Loose
10 to 30 Medium Dense
30 to 50 Dense
Over 50 Very Dense

Cohesive Soils (blows per ft.)
0 to 2 Very Soft
2 to 4 Soft
4 to 8 Medium Stiff
8 to 15 Stiff
15 to 30 Very Stiff
Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long × 2" O.D. × 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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Client SEA CONSULTANTS INC. Date 11/09/90 Job No. 90-354 F

Location EASTHAMPTON, SOUTHAMPTON, AND HOLYOKE, MASSACHUSETTS

BORING NO. B-1 (MW-1) Ground Elev. Date Start 10/31/90 Date Complete 11/01/90 Drilling Foreman J.C. Eng./Hydrol. Geologist C.B.

Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
					41'0"	Interbedded, medium dense, wet, MEDIUM TO COARSE SAND AND GRAVEL, some cobbles and pebbles, and fine sand with trace silt.
10	44'0"-46'0"	11-11-12-11				
					48'0"	Medium dense, wet, MEDIUM TO FINE SAND, some coarse sand and trace silt.
11	49'0"-51'0"	12-10-12-11				
12	54'0"-56'0"	12-14-11-17			54'0"	Tan, medium dense, wet, interbedded MEDIUM TO FINE SAND, with trace silt, coarse sand and gravel.
					58'0"	Dense, brown, wet, FINE SAND, trace medium sand and silt.
13	59'0"-61'0"	12-15-15-17				
					61'0"	End of boring at 61'0" Water level at 40'0" upon completion.

Type of Boring Casing Size: - Hollow Stem Auger Size:

Proportion Percentages
Trace 0 to 10%
Some 10 to 40%
And 40 to 50%

Granular Soils (blows per ft.)
0 to 4 Very Loose
4 to 10 Loose
10 to 30 Medium Dense
30 to 50 Dense
Over 50 Very Dense

Cohesive Soils (blows per ft.)
0 to 2 Very Soft
2 to 4 Soft
4 to 8 Medium Stiff
8 to 15 Stiff
15 to 30 Very Stiff
Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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(603) 672-2135

Client	SEA CONSULTANTS INC.	Date 11/09/90	Job No. 90-354 F
Location	EASTHAMPTON, SOUTHAMPTON, AND HOLYOKE, MASSACHUSETTS		

BORING NO.	Ground Elev.	Date Start	Date Complete	Drilling Foreman	Eng./Hydrol. Geologist
B-2 (MW-2)		11/ /90	11/ /90	J.C.	C.B.

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
	1	0'0"- 0'6"	4				TOPSOIL
	1A	0'6"- 2'0"	7-6-2			0'6"	Brown, FINE TO COARSE SAND, medium dense, dry, trace gravel and cobbles.
5	2	4'0"- 6'0"	8-8-10-13	16			
10	3	9'0"- 11'0"	7-8-11-11	12		9'0"	Stiff, moist, brown, CLAY, trace fine sand.
15	4	14'0"-16'0"	7-8-6-9	13			
20	5	19'0"-21'0"	7-8-24-30				
25	6	24'0"-26'0"	28-31-47-40	10		24'0"	Very dense, dry to moist, brown, FINE SAND, trace inorganic silt and clay.
30	7	29'0"-31'0"	16-23-26-34				
35	8	34'0"-36'0"	28-43-41-32				
40	9	39'0"-41'0"	16-20-14-19			39'0"	Stiff, wet, brown, VARVED CLAY.

Type of Boring   Casing Size: Hollow Stem Auger Size:

Proportion Percentages	Granular Soils (blows per ft.)	Cohesive Soils (blows per ft.)
Trace 0 to 10% Some 10 to 40% And 40 to 50%	0 to 4 Very Loose 4 to 10 Loose 10 to 30 Medium Dense 30 to 50 Dense Over 50 Very Dense	0 to 2 Very Soft 2 to 4 Soft 4 to 8 Medium Stiff 8 to 15 Stiff 15 to 30 Very Stiff Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long × 2" O.D. × 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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Client SEA CONSULTANTS INC. Date 11/09/90 Job No. 90-354 F

Location EASTHAMPTON, SOUTHAMPTON, AND HOLYOKE, MASSACHUSETTS

BORING NO. B-2 (MW-2) Ground Elev. Date Start 11/ /90 Date Complete 11/ /90 Drilling Foreman J.C. Eng./Hydrol. Geologist C.B.

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
5	10	44'0"-46'0"	8-8-10-13	24			Stiff, wet, brown, VARVED CLAY.
10	11	49'0"-51'0"	7-10-14-15				
15	12	54'0"-56'0"	6-8-8-9	18			
						58'0"	
20	13	59'0"-61'0"	41-38-40-53	14			Hard, wet, brown, SILT AND CLAY, with fine to coarse sand and gravel, (till.)
25	14	63'0"-65'0"	94-61-97-111	3			Very dense, brown, FINE TO MEDIUM GRAIN AND SAND STONE.
30	15	69'0"-71'0"	21-25-33-28				
35	16	74'0"-76'0"	34-41-29-35				
						76'0"	End of boring at 76'0" Water level at 40'0" upon completion.
40							

Type of Boring Casing Size: Hollow Stem Auger Size:

Proportion Percentages	Granular Soils (blows per ft.)	Cohesive Soils (blows per ft.)
Trace 0 to 10% Some 10 to 40% And 40 to 50%	0 to 4 Very Loose 4 to 10 Loose 10 to 30 Medium Dense 30 to 50 Dense Over 50 Very Dense	0 to 2 Very Soft 2 to 4 Soft 4 to 8 Medium Stiff 8 to 15 Stiff 15 to 30 Very Stiff Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long × 2" O.D. × 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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Client SEA CONSULTANTS INC. Date 11/09/90 Job No. 90-354 F

Location EASTHAMPTON, SOUTHAMPTON, AND HOLYOKE, MASSACHUSETTS

BORING NO. B-3(MW-3) Ground Elev. Date Start 11/ /90 Date Complete 11/ /90 Drilling Foreman J.C. Eng./Hydrol. Geologist C.B.

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
	1	0'0"- 0'6"	4				TOPSOIL
	1A	0'6"- 2'0"	7-7-5	10		0'6"	
5	2	4'0"- 6'0"	8-8-10-10	14			Medium dense,dry, brown, MEDIUM TO COARSE GRAINED SAND, with fine sand and gravel.
10	3	9'0"-11'0"	10-12-12-15	12			
15	4	14'0"-16'0"	9-10-12-15	8		14'0"	
20	5	19'0"-21'0"	10-14-16-19				
25	6	24'0"-26'0"	6-9-14-17	7			Medium dense, dry, brown, FINE TO MEDIUM SAND.
30	7	29'0"-31'0"	11-16-20-22	12			
35	8	34'0"-36'0"	6-11-17-20	14			
40	9	39'0"-41'0"	11-21-22-18	11			

Type of Boring Casing Size: Hollow Stem Auger Size:

Proportion Percentages	Granular Soils (blows per ft.)		Cohesive Soils (blows per ft.)	
Trace 0 to 10%	0 to 4 Very Loose	30 to 50 Dense	0 to 2 Very Soft	8 to 15 Stiff
Some 10 to 40%	4 to 10 Loose	Over 50 Very Dense	2 to 4 Soft	15 to 30 Very Stiff
And 40 to 50%	10 to 30 Medium Dense		4 to 8 Medium Stiff	Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

148 Pioneer Dr.
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SOIL EXPLORATION CORPORATION

Geotechnical Drilling and Groundwater Monitor Wells

5 Monson Place
Milford, NH 03055
(603) 672-2135

Client SEA CONSULTANTS INC. Date 11/09/90 Job No. 90-354 F

Location EASTHAMPTON, SOUTHAMPTON, AND HOLYOKE, MASSACHUSETTS

BORING NO. B-3 (MW-3) Ground Elev. Date Start 10/29/90 Date Complete 10/30/90 Drilling Foreman J.C. Eng./Hydrol. Geologist C.B.

DEPTH	Sample Data					Soil and/or bedrock strata descriptions	
	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
							Medium dense, dry, brown, FINE TO MEDIUM SAND.
5	10	44'0"-46'0"	14-18-28-20	10/24		44'0"	
10	11	49'0"-51'0"	12-11-10-12	0/24			
15	12	54'0" 56'0"	16-20-20-22				Dense, moist to wet, FINE TO MEDIUM BROWN SAND, trace inorganic silt and fine gravel.
20	13	59'0"-61'0"	16-17-20-15	8"			
25	15	64'0"-66'0"	15-19-22-25	8"			
30	16	69'0"-71'0"	20-23-19-24	8"			
35	17	74'0"-76'0"	16-26-26-24				
40	18	79'0" 81'0"	20-22-21-26	7"		80'0"	End of boring at 80'0"

Type of Boring Casing Size: Hollow Stem Auger Size:

Proportion Percentages	Granular Soils (blows per ft.)	Cohesive Soils (blows per ft.)
Trace 0 to 10% Some 10 to 40% And 40 to 50%	0 to 4 Very Loose 4 to 10 Loose 10 to 30 Medium Dense 30 to 50 Dense Over 50 Very Dense	0 to 2 Very Soft 2 to 4 Soft 4 to 8 Medium Stiff 8 to 15 Stiff 15 to 30 Very Stiff Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long × 2" O.D. × 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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Client SEA CONSULTANTS INC. Date 11/09/90 Job No. 90-354 F

Location EASTHAMPTON, SOUTHAMPTON, AND HOLYOKE, MASSACHUSETTS

BORING NO. B-4 (MW-4A) Ground Elev. Date Start 11/05/90 Date Complete 11/08/90 Drilling Foreman G.J. Eng./Hydrol. Geologist C.B.

DEPTH	Sample Data: Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Soil and/or bedrock strata descriptions: Visual Identification of Soil and/or Rock Strata
	1	0'0"- 1'0"	2-3				TOPSOIL
	1A	1'0"- 2'0"	3-3			1'0"	SUBSOIL
						3'0"	
5	2	4'0"- 6'0"	8-8-11-5				
10	3	9'0"- 11'0"	12-9-9-11				
15	4	14'0"-16'0"	15-17-18-18				
20	5	19'0"-21'0"	27-21-21-24				Medium dense to very dense, dry to wet, FINE TO MEDIUM SAND, some coarse sand, trace inorganic silt, trace cobbles.
25	6	24'0"-26'0"	20-21-27-28				
30	7	29'0"-31'0"	10-11-12-13				
35	8	34'0"-36'0"	15-12-13-15				
40	9	39'0"-41'0"	10-11-11-12				

Type of Boring Casing Size: 4" Hollow Stem Auger Size:

Proportion Percentages
Trace 0 to 10%
Some 10 to 40%
And 40 to 50%

Granular Soils (blows per ft.)
0 to 4 Very Loose
4 to 10 Loose
10 to 30 Medium Dense
30 to 50 Dense
Over 50 Very Dense

Cohesive Soils (blows per ft.)
0 to 2 Very Soft
2 to 4 Soft
4 to 8 Medium Stiff
8 to 15 Stiff
15 to 30 Very Stiff
Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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Client SEA CONSULTANTS INC. Date 11/09/90 Job No. 90-354 F

Location EASTHAMPTON, SOUTHAMPTON, AND HOLYOKE, MASSACHUSETTS

BORING NO. B-4(MW-4A) Ground Elev. Date Start 11/05/90 Date Complete 11/08/90 Drilling Foreman G.J. Eng./Hydrol. Geologist C.B.

Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
18	84'0"-86'0"	26-25-20-21				Medium dense to very dense, dry to wet, FINE TO MEDIUM SAND, some coarse sand, trace inorganic silt, trace cobbles.
19	89'0"-91'0"	20-21-30-35				
20	94'0"-96'0"	15-16-20-35				
21	99'0"-101'0"	16-18-21-20			99'0"	Deense to very dense, wet, FINE TO MEDIUM SAND, some coarse sand, trace inorganic silt.
22	104'0"-106'0"	17-20-23-27				
23	108'0"-110'0"	17-21-22-30				
					110'0"	End of boring at 110'0" Set well point at 109'6" Water level at 109'6"upon completion

Type of Boring Casing Size: 4" Hollow Stem Auger Size:

Proportion Percentages	Granular Soils (blows per ft.)	Cohesive Soils (blows per ft.)
Trace 0 to 10% Some 10 to 40% And 40 to 50%	0 to 4 Very Loose 4 to 10 Loose 10 to 30 Medium Dense 30 to 50 Dense Over 50 Very Dense	0 to 2 Very Soft 2 to 4 Soft 4 to 8 Medium Stiff 8 to 15 Stiff 15 to 30 Very Stiff Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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Client SEA CONSULTANTS INC. Date 11/09/90 Job No. 90-354 F

Location EASTHAMPTON, SOUTHAMPTON, AND HOLYOKE, MASSACHUSETTS

BORING NO. B-4 (MW-4A) Ground Elev. Date Start 11/05/90 Date Complete 11/08/90 Drilling Foreman G.J. Eng./Hydrol. Geologist C.B.

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
45	10	44'0"-46'0"	13-13-15-21				
50	11	49'0'-51'0"	17-16-15-23				
55	12	54'0"-56'0"	17-18-16-20				
60	13	59'0"-61'0"					Medium dense to very dense, dry to wet, FINE TO MEDIUM SAND, some coarse sand, trace inorganic silt, trace cobbles.
65	14	64'0"-66'0"	21-22-22-25				
70	15	69'0"-71'0"	16-13-17-17				
75	16	74'0"-76'0"	16-16-25-25				
80	17	79'0"-81'0"	20-20-20-20				

Type of Boring Casing Size: 4" Hollow Stem Auger Size:

Proportion Percentages
Trace 0 to 10%
Some 10 to 40%
And 40 to 50%

Granular Soils (blows per ft.)
0 to 4 Very Loose
4 to 10 Loose
10 to 30 Medium Dense
30 to 50 Dense
Over 50 Very Dense

Cohesive Soils (blows per ft.)
0 to 2 Very Soft
2 to 4 Soft
4 to 8 Medium Stiff
8 to 15 Stiff
15 to 30 Very Stiff
Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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Client SEA CONSULTANTS INC. Date 11/09/90 Job No. 90-354 F

Location EASTHAMPTON, SOUTHAMPTON, AND HOLYOKE, MASSACHUSETTS

BORING NO. B-4S (MW-4B) Ground Elev. Date Start 11/08/90 Date Complete 11/09/90 Drilling Foreman G.J. Eng./Hydrol. Geologist C.B.

DEPTH	Sample Data: Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
5							
10							
15							
20							FINE TO MEDIUM SAND, trace coarse sand, trace inorganic silt.
25							
30							
35							
40							

Type of Boring Casing Size: Hollow Stem Auger Size:

Proportion Percentages	Granular Soils (blows per ft.)	Cohesive Soils (blows per ft.)
Trace 0 to 10% Some 10 to 40% And 40 to 50%	0 to 4 Very Loose 4 to 10 Loose 10 to 30 Medium Dense 30 to 50 Dense Over 50 Very Dense	0 to 2 Very Soft 2 to 4 Soft 4 to 8 Medium Stiff 8 to 15 Stiff 15 to 30 Very Stiff Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long × 2" O.D. × 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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Client SEA CONSULTANTS INC. Date 11/09/90 Job No. 90-354 F

Location EASTHAMPTON, SOUTHAMPTON, AND HOLYOKE, MASSACHUSETTS

BORING NO. B-4S (MW-4B) Ground Elev. Date Start 11/08/90 Date Complete 11/09/90 Drilling Foreman G.J. Eng./Hydrol. Geologist C.B.

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
45							
50							FINE TO MEDIUM SAND, trace coarse sand, trace inorganic silt.
55							
60						60'0"	End of boring at 60'0" Set well point at 60'0" Water level at 60'0" upon completion
65							
70							
75							NOTE: No samples required.
80							

Type of Boring Casing Size: 4¼" Hollow Stem Auger Size:

Proportion Percentages	Granular Soils (blows per ft.)	Cohesive Soils (blows per ft.)
Trace 0 to 10% Some 10 to 40% And 40 to 50%	0 to 4 Very Loose 4 to 10 Loose 10 to 30 Medium Dense 30 to 50 Dense Over 50 Very Dense	0 to 2 Very Soft 2 to 4 Soft 4 to 8 Medium Stiff 8 to 15 Stiff 15 to 30 Very Stiff Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long × 2" O.D. × 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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Client SEA CONSULTANTS INC. Date 11/09/90 Job No. 90-354 F

Location EASTHAMPTON, SOUTHAMPTON, AND HOLYOKE, MASSACHUSETTS

BORING NO. B-5 (MW-5A) Ground Elev. Date Start 11/ /90 Date Complete 11/ /90 Drilling Foreman J.C. Eng./Hydrol. Geologist C.B.

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
	1	0'0"- 2'0"	5-4-4-5	18/24"			TOPSOIL
						0'6"	Loose, dry, FINE TO MEDIUM SAND, some fine gravel.
5	2	4'0"- 6'0"	10-12-16-27	6"			
						8'0"	
10	3	9'0"-11'0"	4-11-16-17	10"			
15	4	14'0"-16'0"	12-12-16-15				Dense, dry, dark tan, MEDIUM TO FINE SAND, trace inorganic silt.
20	5	19'0"-21'0"	14-20-19-22	6"			
25	6	24'0"-26'0"	8-8-12-16	8"		24'0"	Medium dense, dry, brown, SAND AND SILT, trace clay.
30	7	29'0"-31'0"	7-11-10-14	10"			
35	8	34'0"-36'0"	8-9-9-14	10"		34'0"	Medium dense, moist to wet, dark tan MEDIUM TO COARSE SAND with some fine sand and trace silt.
40	9	39'0"-41'0"	8-7-7-14	14"			

Type of Boring Casing Size: Hollow Stem Auger Size:

Proportion Percentages	Granular Soils (blows per ft.)		Cohesive Soils (blows per ft.)	
Trace 0 to 10%	0 to 4 Very Loose	30 to 50 Dense	0 to 2 Very Soft	8 to 15 Stiff
Some 10 to 40%	4 to 10 Loose	Over 50 Very Dense	2 to 4 Soft	15 to 30 Very Stiff
And 40 to 50%	10 to 30 Medium Dense		4 to 8 Medium Stiff	Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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Client SEA CONSULTANTS INC. Date 11/09/90 Job No. 90-354 F

Location EASTHAMPTON, SOUTHAMPTON, AND HOLYOKE, MASSACHUSETTS

BORING NO. B-5 (MW-5A) Ground Elev. Date Start 11/ /90 Date Complete 11/ /90 Drilling Foreman J.C. Eng./Hydrol. Geologist C.B.

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
5	10	44'0"-46'0"	4-4-3-7	12"			
10	11	49'0"-51'0"	11-12-12-14	10"			
15	12	54'0"-56'0"	20-18-26-31	14"			
							Medium dense, moist to wet, dark tan, MEDIUM TO COARSE SAND with some fine sand and trace silt.
20	13	59'0"-61'0"	12-14-2-15	4"			
25	14	64'0"-66'0"	12-11-8-4	12"			
30	15	69'0"-71'0"	12-14-21-23	12"			
35	16	74'0"-76'0"	16-28-37-43	14"			
40	17	79'0"-81'0"	17	12"			

Type of Boring Casing Size: Hollow Stem Auger Size:

Proportion Percentages
Trace 0 to 10%
Some 10 to 40%
And 40 to 50%

Granular Soils (blows per ft.)
0 to 4 Very Loose
4 to 10 Loose
10 to 30 Medium Dense
30 to 50 Dense
Over 50 Very Dense

Cohesive Soils (blows per ft.)
0 to 2 Very Soft
2 to 4 Soft
4 to 8 Medium Stiff
8 to 15 Stiff
15 to 30 Very Stiff
Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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Client SEA CONSULTANTS INC. Date 11/09/90 Job No. 90-354 F

Location EASTHAMPTON, SOUTHAMPTON, AND HOLYOKE, MASSACHUSETTS

BORING NO. B-5 (MW-5A) Ground Elev. Date Start 11/ /90 Date Complete 11/ /90 Drilling Foreman J.C. Eng./Hydrol. Geologist C.B.

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
5	18	84'0"-86'0"	10-16-16-18	14"			Medium dense, moist to wet, dark tan, MEDIUM TO COARSE SAND, with some fine sand and trace silt.
10	19	89'0"-90'0"	16-17	10"		89'0"	Very dense, wet, tan, FINE TO COARSE SAND, travel, cobbles and inorganic silt.
	19A	90'0"-91'0"	34-36	8"			
15	20	94'0"-96'0"	18-21-30-36	10"			
20	21	99'0"-101'0"	16-21-19-19	12"		99'0"	Very dense, wet, FINE TO COARSE SAND, trace inorganic silt.
25	22	104'0"-106'0'	23-31-46-40	16"			
30	23	109'0"-111'0'	28-31-46-59	12"			
						111'0"	End of boring at 111'0"
35							
40							

Type of Boring Casing Size: Hollow Stem Auger Size:

Proportion Percentages
Trace 0 to 10%
Some 10 to 40%
And 40 to 50%

Granular Soils (blows per ft.)
0 to 4 Very Loose
4 to 10 Loose
10 to 30 Medium Dense
30 to 50 Dense
Over 50 Very Dense

Cohesive Soils (blows per ft.)
0 to 2 Very Soft
2 to 4 Soft
4 to 8 Medium Stiff
8 to 15 Stiff
15 to 30 Very Stiff
Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long × 2" O.D. × 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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Client SEA CONSULTANTS INC. Date 11/09/90 Job No. 90-354 F

Location EASTHAMPTON, SOUTHAMPTON, AND HOLYOKE, MASSACHUSETTS

BORING NO. B-7 (MW-7) Ground Elev. Date Start 10/31/90 Date Complete 11/01/90 Drilling Foreman G.J. Eng./Hydrol. Geologist C.B.

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
	1	0'0"-0'6"	1				TOPSOIL
	1A	0'6"-2'0"	2-2-2			0'6"	SUBSOIL
						3'0"	
5	2	5'0"-7'0"	11-11-13-12				
10	3	9'0"-11'0"	13-15-16-17				
15	4	14'0"-16'0"	12-13-13-13				
20	5	19'0"-21'0"	12-13-13-14				Dry to wet, medium dense, FINE TO MEDIUM SAND, some coarse sand, trace cobbles.
25	6	24'0"-26'0"	12-12-13-13				
30	7	29'0"-31'0"	4-5-6-6				
35	8	34'0"-36'0"	5-4-5-11				
40	9	39'0"-41'0"	4-3-6-6			40'0"	

Type of Boring Casing Size: 4" Hollow Stem Auger Size:

Proportion Percentages	Granular Soils (blows per ft.)	Cohesive Soils (blows per ft.)
Trace 0 to 10% Some 10 to 40% And 40 to 50%	0 to 4 Very Loose 4 to 10 Loose 10 to 30 Medium Dense 30 to 50 Dense Over 50 Very Dense	0 to 2 Very Soft 2 to 4 Soft 4 to 8 Medium Stiff 8 to 15 Stiff 15 to 30 Very Stiff Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long × 2" O.D. × 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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Client SEA CONSULTANTS INC. Date 11/09/90 Job No. 90-354 F

Location EASTHAMPTON, SOUTHAMPTON, AND HOLYOKE, MASSACHUSETTS

BORING NO. B-7 (MW-7) Ground Elev. Date Start 10/31/90 Date Complete 11/01/90 Drilling Foreman G.J. Eng./Hydrol. Geologist C.B.

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
							Wet, medium stiff, yellow, CLAY, trace inorganic silt.
45	10	44'0"-44'6"	10				
	10A	44'6"-45'3"	51-120/3"			44'6"	Very dense, wet, FINE TO COARSE SAND, some fine to coarse gravel, trace inorganic silt, some cobbles.
	11	48'0"-48'3"	120/3"			48'3"	Refusal at 48'3" with hollow stem auger. Set well point at 27'0" Water level at 15'0" upon completion
50							
55							
60							
65							
70							
75							
80							

Type of Boring Casing Size: 4" Hollow Stem Auger Size:

Proportion Percentages	Granular Soils (blows per ft.)	Cohesive Soils (blows per ft.)
Trace 0 to 10% Some 10 to 40% And 40 to 50%	0 to 4 Very Loose 4 to 10 Loose 10 to 30 Medium Dense 30 to 50 Dense Over 50 Very Dense	0 to 2 Very Soft 2 to 4 Soft 4 to 8 Medium Stiff 8 to 15 Stiff 15 to 30 Very Stiff Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

Sheet # ____ of ____

148 Pioneer Dr.
Leominster, MA 01453
(508) 840-0391

SOIL EXPLORATION CORPORATION

Geotechnical Drilling and Groundwater Monitor Wells

5 Monson Place
Milford, NH 03055
(603) 672-2135

Client SEA CONSULTANTS INC. Date 11/09/90 Job No. 90-354 F

Location EASTHAMPTON, SOUTHAMPTON, AND HOLYOKE, MASSACHUSETTS

BORING NO. B-8 (MW-8) Ground Elev. Date Start 11/02/90 Date Complete 11/02/90 Drilling Foreman G.J. Eng./Hydrol. Geologist C.B.

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
	1	0'0"-1'0"	1-2				TOPSOIL
	1A	1'0"- 2'0"	1-2			1'0"	SUBSOIL
						3'0"	
5	2	5'0"- 7'0"	4-7-3-7				
10	3	9'0"-11'0"	10-8-8-12				Damp to wet, medium dense, FINE TO MEDIUM SAND, trace coarse sand, trace cobbles.
15	4	14'0'-16'0"	13-7-6-6				
20	5	19'0"-21'0"	5-7-6-7				
25						24'0"	End of boring at 24'0" Set well point at 21'0" Water level at 5'0" upon completion
30							
35							
40							

Type of Boring Casing Size: Hollow Stem Auger Size:

Proportion Percentages
Trace 0 to 10%
Some 10 to 40%
And 40 to 50%

Granular Soils (blows per ft.)
0 to 4 Very Loose
4 to 10 Loose
10 to 30 Medium Dense
30 to 50 Dense
Over 50 Very Dense

Cohesive Soils (blows per ft.)
0 to 2 Very Soft
2 to 4 Soft
4 to 8 Medium Stiff
8 to 15 Stiff
15 to 30 Very Stiff
Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long × 2" O.D. × 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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SOIL EXPLORATION CORPORATION

Geotechnical Drilling and Groundwater Monitor Wells

5 Monson Place
Milford, NH 03055
(603) 672-2135

Client S E A Consultants | Date 04/09/91 | Job No. 91-0119

Location Hendrick Street, Easthampton, Massachusetts

BORING NO. 9-A (MW-9A) | Ground Elev. | Date Start 04/08/91 | Date Complete 04/08/91 | Drilling Foreman S.B. | Eng./Hydrol. Geologist

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
5	1	4'0"- 6'0"	21-24-28-30				
10	2	9'0"-11'0"	21-18-17-19				
15	3	14'0"-16'0"	20-25-23-28				
20	4	19'0"-21'0"	18-17-18-22				Dense, dry to wet, FINE TO COARSE SAND AND SILT.
25	5	24'0"-26'0"	20-17-14-12				
30	6	29'0"-31'0"	12-12-11-11				
35	7	34'0"-36'0"	9-8-6-6				
40	8	39'0"-41'0"	10-8-5-6				

Type of Boring | Casing Size: 4" | Hollow Stem Auger Size:

Proportion Percentages
Trace 0 to 10%
Some 10 to 40%
And 40 to 50%

Granular Soils (blows per ft.)
0 to 4 Very Loose
4 to 10 Loose
10 to 30 Medium Dense
30 to 50 Dense
Over 50 Very Dense

Cohesive Soils (blows per ft.)
0 to 2 Very Soft
2 to 4 Soft
4 to 8 Medium Stiff
8 to 15 Stiff
15 to 30 Very Stiff
Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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Geotechnical Drilling and Groundwater Monitor Wells

5 Monson Place
Milford, NH 03055
(603) 672-2135

Client S E A Consultants   Date 04/09/91   Job No. 91-0119

Location Hendrick Street, Easthampton, Massachusetts

BORING NO. 9-A (MW-9A)   Ground Elev.   Date Start 04/08/91   Date Complete 04/08/91   Drilling Foreman S.B.   Eng./Hydrol. Geologist

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
45	9	44'0"-46'0"	8-10-10-13				
50	10	49'0"-51'0"	16-17-17-20				
55	11	54'0"-56'0"	10-11-10-12				
60	12	59'0"-61'0"	12-7-4-5				Dense, dry to wet, FINE TO COARSE SAND AND SILT.
65	13	64'0"-66'0"	10-9-7-8				
70	14	69'0"-71'0"	9-9-12-15				
75	15	74'0"-76'0"	13-16-20-18				
80	16	79'0"-81'0"	11-19-20-21				

Type of Boring   Casing Size: 4"   Hollow Stem Auger Size:

Proportion Percentages
Trace 0 to 10%
Some 10 to 40%
And 40 to 50%

Granular Soils (blows per ft.)
0 to 4 Very Loose
4 to 10 Loose
10 to 30 Medium Dense
30 to 50 Dense
Over 50 Very Dense

Cohesive Soils (blows per ft.)
0 to 2 Very Soft
2 to 4 Soft
4 to 8 Medium Stiff
8 to 15 Stiff
15 to 30 Very Stiff
Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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(603) 672-2135

Client S E A Consultants Date 04/09/91 Job No. 91-0119

Location Hendrick Street, Easthampton, Massachusetts

BORING NO. 9-A (MW-9A) Ground Elev. Date Start 04/08/91 Date Complete 04/08/91 Drilling Foreman S.B. Eng./Hydrol. Geologist

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
85	17	84'0"-86'0"	8-9-10-8				
90	18	89'0"-91'0"	7-5-3-1				
95	19	94'0"-96'0"	16-20-24-22				
100	20	99'0"-101'0"	18-18-25-29				Dense, dry to wet, FINE TO COARSE SAND AND SILT.
105	21	104'0"-106'0"	24-29-34-33				
110	22	109'0"-111'0"	26-27-26-18				
115	23	114'0"-116'0"	11-7-9-12				
120	24	119'0"-121'0"	25-29-25-26				

Type of Boring Casing Size: 4" Hollow Stem Auger Size:

Proportion Percentages
Trace 0 to 10%
Some 10 to 40%
And 40 to 50%

Granular Soils (blows per ft.)
0 to 4 Very Loose
4 to 10 Loose
10 to 30 Medium Dense
30 to 50 Dense
Over 50 Very Dense

Cohesive Soils (blows per ft.)
0 to 2 Very Soft
2 to 4 Soft
4 to 8 Medium Stiff
8 to 15 Stiff
15 to 30 Very Stiff
Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long × 2" O.D. × 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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(603) 672-2135

Client S E A Consultants | Date 04/09/91 | Job No. 91-0119

Location Hendrick Street, Easthampton, Massachusetts

BORING NO. 9-A (MW-9A) | Ground Elev. | Date Start 04/08/91 | Date Complete 04/08/91 | Drilling Foreman S.B. | Eng./Hydrol. Geologist

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
							Dense, dry to wet, FINE TO COARSE SAND AND SILT.
125						124'0"	End of boring at 124'0" Set well point at 119'0" Water level at 31'0" upon completion
130							
135							
140							
145							
150							
155							
160							

Type of Boring | Casing Size: 4" | Hollow Stem Auger Size:

Proportion Percentages
Trace 0 to 10%
Some 10 to 40%
And 40 to 50%

Granular Soils (blows per ft.)
0 to 4 Very Loose
4 to 10 Loose
10 to 30 Medium Dense
30 to 50 Dense
Over 50 Very Dense

Cohesive Soils (blows per ft.)
0 to 2 Very Soft
2 to 4 Soft
4 to 8 Medium Stiff
8 to 15 Stiff
15 to 30 Very Stiff
Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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Client S E A Consultants — Date 04/09/91 — Job No. 91-0119

Location Hendrick Street, Easthampton, Massachusetts

BORING NO. 9-B (MW-9B) — Ground Elev. — Date Start 04/08/91 — Date Complete 04/08/91 — Drilling Foreman S.B. — Eng./Hydrol. Geologist

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
0–40							Medium dense, FINE TO COARSE SAND AND SILT.

Type of Boring — Casing Size: 4" — Hollow Stem Auger Size:

Proportion Percentages	Granular Soils (blows per ft.)	Cohesive Soils (blows per ft.)
Trace 0 to 10%	0 to 4 Very Loose	0 to 2 Very Soft
Some 10 to 40%	4 to 10 Loose	2 to 4 Soft
And 40 to 50%	10 to 30 Medium Dense	4 to 8 Medium Stiff
	30 to 50 Dense	8 to 15 Stiff
	Over 50 Very Dense	15 to 30 Very Stiff
		Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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Milford, NH 03055
(603) 672-2135

Client S E A Consultants | Date 04/09/91 | Job No. 91-0119

Location Hendrick Street, Easthampton, Massachusetts

BORING NO. 9-B (MW-9B) | Ground Elev. | Date Start 04/08/91 | Date Complete 04/08/91 | Drilling Foreman S.B. | Eng./Hydrol. Geologist

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
45							Medium dense, FINE TO COARSE SAND AND SILT.
50							
55						55'0"	End of boring at 55'0" Set well point at 55'0" Water level at 31'0" upon completion
60							
65							
70							
75							
80							

Type of Boring | Casing Size: 4" | Hollow Stem Auger Size:

Proportion Percentages
Trace 0 to 10%
Some 10 to 40%
And 40 to 50%

Granular Soils (blows per ft.)
0 to 4 Very Loose
4 to 10 Loose
10 to 30 Medium Dense
30 to 50 Dense
Over 50 Very Dense

Cohesive Soils (blows per ft.)
0 to 2 Very Soft
2 to 4 Soft
4 to 8 Medium Stiff
8 to 15 Stiff
15 to 30 Very Stiff
Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long × 2" O.D. × 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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SOIL EXPLORATION CORPORATION

Geotechnical Drilling and Groundwater Monitor Wells

5 Monson Place
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(603) 672-2135

Client S E A Consultants — Date 04/29/91 — Job No. 91-0119A

Location Hendrick Street, Easthampton, Massachusetts

BORING NO. MW-9C — Ground Elev. — Date Start 04/24/91 — Date Complete 04/29/91 — Drilling Foreman M.C. — Eng./Hydrol. Geologist

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
5	1	4'0"- 6'0"	17-14-14-13				Medium dense, dry, brown, FINE TO MEDIUM SAND, trace inorganic silt.
10	2	9'0"-11'0"	5-5-5-7			8'0"	Medium dense, dry, brown, FINE SAND, some inorganic silt, trace clay.
15	3	14'0"-15'0"	15-16-17-21			14'0"	Dense, dry, FINE TO MEDIUM SNAD, Trace inorganic silt, trace coarse sand.
20	4	19'0"-21'0"	16-12-13-16			18'0"	Medium dense to dense, dry to wet, VERY FINE TO FINE SAND, some inorganic silt, trace clay.
25	5	24'0"-26'0"	9-13-15-17				
30	6	29'0"-31'0"	4-8-14-21				
35	7	34'0"-36'0"	9-11-13-15				
40	8	39'0"-41'0"	8-9-10-11				

Type of Boring — Casing Size: — Hollow Stem Auger Size:

Proportion Percentages	Granular Soils (blows per ft.)	Cohesive Soils (blows per ft.)
Trace 0 to 10%	0 to 4 Very Loose; 30 to 50 Dense	0 to 2 Very Soft; 8 to 15 Stiff
Some 10 to 40%	4 to 10 Loose; Over 50 Very Dense	2 to 4 Soft; 15 to 30 Very Stiff
And 40 to 50%	10 to 30 Medium Dense	4 to 8 Medium Stiff; Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long × 2" O.D. × 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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5 Monson Place
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(603) 672-2135

Client S E A Consultants | Date 04/29/91 | Job No. 91-0119A

Location Hendrick Street, Easthampton, Massachusetts

BORING NO. MW-9C | Ground Elev. | Date Start 04/24/91 | Date Complete 04/29/91 | Drilling Foreman M.C. | Eng./Hydrol. Geologist

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
45	9	44'0"-46'0"	12-17-20-27				Medium dense to dense, dry to wet, VERY FINE TO FINE SAND, some inorganic silt, trace clay.
50	10	49'0"-51'0"	10-17-21-25				
55	11	54'0"-56'0"	11-15-21-24				
60	12	59'0"-61'0"	18-21-24-21				
						63'0"	Very dense, wet, brown to gray, VERY FINE TO FINE SAND, some inorganic silt, trace coarse sand, trace clay lenses.
65	13	64'0"-66'0"	12-18-26-36				
70	14	69'0"- 71'0"	9-13-19-27				
75	15	74'0"-76'0"	17-20-21-26				
80	16	79'0"-81'0"	20-22-24-27				

Type of Boring   Casing Size: Hollow Stem Auger Size:

Proportion Percentages	Granular Soils (blows per ft.)	Cohesive Soils (blows per ft.)
Trace 0 to 10% Some 10 to 40% And 40 to 50%	0 to 4 Very Loose 4 to 10 Loose 10 to 30 Medium Dense 30 to 50 Dense Over 50 Very Dense	0 to 2 Very Soft 2 to 4 Soft 4 to 8 Medium Stiff 8 to 15 Stiff 15 to 30 Very Stiff Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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(603) 672-2135

Client S E A Consultants — Date 04/29/91 — Job No. 91-0119A

Location Hendrick Street, Easthampton, Massachusetts

BORING NO. MW-9C — Ground Elev. — Date Start 04/24/91 — Date Complete 04/29/91 — Drilling Foreman M.C. — Eng./Hydrol. Geologist

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
85	17	84'0"-86'0"	17-20-19-23				
90	18	89'0"-91'0"	30-37-38-45				
95	19	94'0"-96'0"	22-27-30-30				
100	20	99'0"-101'0"	18-18-10-15				Very dense, wet, brown to gray, VERY FINE TO FINE SAND, some inorganic silt, trace coarse sand, trace clay lenses.
105	20	104'0"-106'0"	15-13-18-18				
110	22	109'0"-111'0"	19-19-26-27				
115	23	114'0"-116'0"	21-26-28-25				
120	24	119'0"-120'0"	29-33-34-30				

Type of Boring — Casing Size: — Hollow Stem Auger Size:

Proportion Percentages
Trace 0 to 10%
Some 10 to 40%
And 40 to 50%

Granular Soils (blows per ft.)
0 to 4 Very Loose
4 to 10 Loose
10 to 30 Medium Dense
30 to 50 Dense
Over 50 Very Dense

Cohesive Soils (blows per ft.)
0 to 2 Very Soft
2 to 4 Soft
4 to 8 Medium Stiff
8 to 15 Stiff
15 to 30 Very Stiff
Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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(603) 672-2135

Client S E A Consultants | Date 04/29/91 | Job No. 91-0119A

Location Hendrick Street, Easthampton, Massachusetts

BORING NO. MW-9C | Ground Elev. | Date Start 04/24/91 | Date Complete 04/29/91 | Drilling Foreman M.C. | Eng./Hydrol. Geologist

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
						121'0"	End 4" casing hole at 121'0" Set well point at 119'0" Water level at 45'0" upon completion
125							
130							
135							
140							
145							
150							
155							
160							

Type of Boring | Casing Size: | Hollow Stem Auger Size:

Proportion Percentages	Granular Soils (blows per ft.)		Cohesive Soils (blows per ft.)	
Trace 0 to 10%	0 to 4 Very Loose	30 to 50 Dense	0 to 2 Very Soft	8 to 15 Stiff
Some 10 to 40%	4 to 10 Loose	Over 50 Very Dense	2 to 4 Soft	15 to 30 Very Stiff
And 40 to 50%	10 to 30 Medium Dense		4 to 8 Medium Stiff	Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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5 Monson Place
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Client S E A Consultants   Date 04/09/91   Job No. 91-0119

Location Hendrick Street, Easthampton, Massachusetts

BORING NO. 10-A (MW-10A)   Ground Elev.   Date Start 03/28/91   Date Complete 03/29/91   Drilling Foreman S.B.   Eng./Hydrol. Geologist

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
5	1	4'0"- 6'0"	7-8-6-7				
10	2	9'0"-11'0"	9-10-11-18				
15	3	14'0"-16'0"	6-6-5-5				
20	4	19'0"-21'0"	6-4-6-7				Loose to dense, dry to wet, FINE TO COARSE SAND AND SILT.
25	5	24'- 26'0"	9-7-9-11				
30	6	29'0"-31'0"	6-5-6-3				
35	7	34'0"-36'0"	13-13-14-20				
40	8	39'0"-41'0"	18-21-20-21				

Type of Boring   Casing Size: 4"   Hollow Stem Auger Size:

Proportion Percentages
Trace 0 to 10%
Some 10 to 40%
And 40 to 50%

Granular Soils (blows per ft.)
0 to 4 Very Loose
4 to 10 Loose
10 to 30 Medium Dense
30 to 50 Dense
Over 50 Very Dense

Cohesive Soils (blows per ft.)
0 to 2 Very Soft
2 to 4 Soft
4 to 8 Medium Stiff
8 to 15 Stiff
15 to 30 Very Stiff
Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long × 2" O.D. × 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

148 Pioneer Dr.
Leominster, MA 01453
(508) 840-0391

SOIL EXPLORATION CORPORATION

Geotechnical Drilling and Groundwater Monitor Wells

5 Monson Place
Milford, NH 03055
(603) 672-2135

Client S E A Consultants | Date 04/09/91 | Job No. 91-0119

Location Hendrick Street, Easthampton, Massachusetts

BORING NO. 10-A (MW-10A) | Ground Elev. | Date Start 03/28/91 | Date Complete 03/29/91 | Drilling Foreman S.B. | Eng./Hydrol. Geologist

DEPTH	Sample Data					Soil and/or bedrock strata descriptions	
	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
45	9	44'0"-46'0"	13-14-14-14				
50	10	49'0"-51'0"	8-6-6-9				
55	11	54'0" 56'0"	8-7-6-8				Loose to dense, dry to wet, FINE TO COARSE SAND AND SILT.
60	12	59'0"-61'0"	7-5-4-4				
65	13	64'0"-66'0"	7-7-7-5				
70	14	69'0"-71'0"	10-15-20-30				
75	15	74'0"-76'0"	12-25-20-34				
80	16	79'0"-81'0"	12-18-29-33				

Type of Boring Casing Size: 4" Hollow Stem Auger Size:

Proportion Percentages	Granular Soils (blows per ft.)	Cohesive Soils (blows per ft.)
Trace 0 to 10%	0 to 4 Very Loose	0 to 2 Very Soft
Some 10 to 40%	4 to 10 Loose	2 to 4 Soft
And 40 to 50%	10 to 30 Medium Dense	4 to 8 Medium Stiff
	30 to 50 Dense	8 to 15 Stiff
	Over 50 Very Dense	15 to 30 Very Stiff
		Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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5 Monson Place
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(603) 672-2135

Client S E A Consultants — Date 04/09/91 — Job No. 91-0119

Location Hendrick Street, Easthampton, Massachusetts

BORING NO. 10-A (MW-10A) — Ground Elev. — Date Start 03/28/91 — Date Complete 03/29/91 — Drilling Foreman S.B. — Eng./Hydrol. Geologist

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
						81'0"	Refusal at 81'0" with 4" casing. End of boring at 81'0" Set well point at 81'0" Water level at 11'0" upon completion
85							
90							
95							
100							
105							
110							
115							
120							

Type of Boring — Casing Size: 4" — Hollow Stem Auger Size:

Proportion Percentages	Granular Soils (blows per ft.)	Cohesive Soils (blows per ft.)
Trace 0 to 10% Some 10 to 40% And 40 to 50%	0 to 4 Very Loose 4 to 10 Loose 10 to 30 Medium Dense 30 to 50 Dense Over 50 Very Dense	0 to 2 Very Soft 2 to 4 Soft 4 to 8 Medium Stiff 8 to 15 Stiff 15 to 30 Very Stiff Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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SOIL EXPLORATION CORPORATION
Geotechnical Drilling and Groundwater Monitor Wells

5 Monson Place
Milford, NH 03055
(603) 672-2135

Client S E A Consultants   Date 04/09/91   Job No. 91-0119

Location Hendrick Street, Easthampton, Massachusetts

BORING NO. 10-B (MW-10B)   Ground Elev.   Date Start 04/08/91   Date Complete 04/08/91   Drilling Foreman   S.B Eng./Hydrol. Geologist

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
5	1	4'0"- 6'0"	6-8-29-36				
10	2	9'0"-11'0"	11-16-15-17				
15	3	14'0"-16'0"	7-7-6-5				
20	4	19'0"-21'0"	10-10-8-8				Dense to very dense, dry to wet, FINE TO COARSE SAND AND SILT.
25	5	24'0"-26'0"	7-6-7-7				
30	6	29'0"-31'0"	10-13-13-12				
35	7	34'0"-36'0"	3-4-6-13				
40	8	39'0"-41'0"	6-7-5-7				

Type of Boring   Casing Size: 4"   Hollow Stem Auger Size:

Proportion Percentages
Trace 0 to 10%
Some 10 to 40%
And 40 to 50%

Granular Soils (blows per ft.)
0 to 4 Very Loose
4 to 10 Loose
10 to 30 Medium Dense
30 to 50 Dense
Over 50 Very Dense

Cohesive Soils (blows per ft.)
0 to 2 Very Soft
2 to 4 Soft
4 to 8 Medium Stiff
8 to 15 Stiff
15 to 30 Very Stiff
Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long × 2" O.D. × 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

Sheet # __-__ of __-__

148 Pioneer Dr.
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(508) 840-0391

SOIL EXPLORATION CORPORATION
Geotechnical Drilling and Groundwater Monitor Wells

5 Monson Place
Milford, NH 03055
(603) 672-2135

Client S E A Consultants Date 04/09/91 Job No. 91-0119

Location Hendrick Street, Easthampton, Massachusetts

BORING NO. 10-B (MW-10B) Ground Elev. Date Start 04/08/91 Date Complete 04/08/91 Drilling Foreman S.B. Eng./Hydrol. Geologist

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
45	9	44'0"-46'0"	12-14-15-16				
50	10	49'0"-51'0"	8-5-13-21				
55	11	54'0"-56'0"	13-10-16-19				
60	12	59'0"-61'0"	12-16-21-22				Dense to very dense, dry to wet, FINE TO COARSE SAND AND SILT.
65	13	64'0"-66'0"	6-8-10-9				
70	14	69'0"-71'0"	11-14-18-21				
75	15	74'0"-76'0"	38-33-37-64				
80	16	79'0"-81'0"	56-59-67-68				

Type of Boring Casing Size: 4" Hollow Stem Auger Size:

Proportion Percentages	Granular Soils (blows per ft.)	Cohesive Soils (blows per ft.)
Trace 0 to 10% Some 10 to 40% And 40 to 50%	0 to 4 Very Loose 4 to 10 Loose 10 to 30 Medium Dense 30 to 50 Dense Over 50 Very Dense	0 to 2 Very Soft 2 to 4 Soft 4 to 8 Medium Stiff 8 to 15 Stiff 15 to 30 Very Stiff Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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(603) 672-2135

Client S E A Consultants Date 04/09/91 Job No. 91-0119

Location Hendrick Street, Easthampton, Massachusetts

BORING NO. 10-B (MW-10B) Ground Elev. Date Start 04/08/91 Date Complete 04/08/91 Drilling Foreman S.B. Eng./Hydrol. Geologist

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
							Dense to very dense, dry to wet, FINE TO COARSE SAND AND SILT.
85	17	84'0"-85'0"	76-120/6"			85'0"	
							End of boring at 85'0" Set well point at 84'0" Water level at 15'0" upon completion
90							
95							
100							
105							
110							
115							
120							

Type of Boring Casing Size: 4" Hollow Stem Auger Size:

Proportion Percentages	Granular Soils (blows per ft.)		Cohesive Soils (blows per ft.)	
Trace 0 to 10%	0 to 4 Very Loose	30 to 50 Dense	0 to 2 Very Soft	8 to 15 Stiff
Some 10 to 40%	4 to 10 Loose	Over 50 Very Dense	2 to 4 Soft	15 to 30 Very Stiff
And 40 to 50%	10 to 30 Medium Dense		4 to 8 Medium Stiff	Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless otherwise noted.

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Milford, NH 03055
(603) 672-2135

Client S E A Consultants — Date 04/09/91 — Job No. 91-0119

Location Hendrick Street, Easthampton, Massachusetts

BORING NO. 11A (MW 11A) — Ground Elev. — Date Start 03/25/91 — Date Complete 03/27/91 — Drilling Foreman S.B. — Eng./Hydrol. Geologist

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
5	1	4'0"- 6'0"	14-14-23-26				
10	2	9'0"-11'0"	7-5-8-8				
15	3	14'0"-16'0"	8-4-4-7				
20	4	19'0"-21'0"	3-3-13-18				Loose to very dense, dry to wet, FINE TO COARSE SAND AND SILT.
25	5	24'- 26'0"	14-9-9-16				
30	6	29'0"-31'0"	10-13-15-18				
35	7	34'0"-36'0"	9-11-12-14				
40	8	39'0"-41'0"	8-11-10-14				

Type of Boring — Casing Size: 4" — Hollow Stem Auger Size:

Proportion Percentages
Trace 0 to 10%
Some 10 to 40%
And 40 to 50%

Granular Soils (blows per ft.)
0 to 4 Very Loose
4 to 10 Loose
10 to 30 Medium Dense
30 to 50 Dense
Over 50 Very Dense

Cohesive Soils (blows per ft.)
0 to 2 Very Soft
2 to 4 Soft
4 to 8 Medium Stiff
8 to 15 Stiff
15 to 30 Very Stiff
Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless otherwise noted.

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(603) 672-2135

Client S E A Consultants | Date 04/09/91 | Job No. 91-0119

Location Hendrick Street, Easthampton, Massachusetts

BORING NO. 11-A (MW-11A) | Ground Elev. | Date Start 03/25/91 | Date Complete 03/27/91 | Drilling Foreman S.B. | Eng./Hydrol. Geologist

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
45	9	44'0"-46'0"	9-8-9-14				
50	10	49'0"-51'0"	11-11-11-11				
55	11	54'0"-56'0"	16-17-20-20				Loose to very dense, dry to wet, FINE TO COARSE SAND AND SILT.
60	12	59'0"-61'0"	9-7-10-13				
65	13	64'0"-66'0"	5-5-6-8				
70	14	69'0"-71'0"	15-26-29-25				
75	15	74'0"-76'0"	20-15-15-19				
80	16	79'0"-81'0"	6-7-22-11				

Type of Boring | Casing Size: 4" | Hollow Stem Auger Size:

Proportion Percentages	Granular Soils (blows per ft.)	Cohesive Soils (blows per ft.)
Trace 0 to 10%	0 to 4 Very Loose	0 to 2 Very Soft
Some 10 to 40%	4 to 10 Loose	2 to 4 Soft
And 40 to 50%	10 to 30 Medium Dense	4 to 8 Medium Stiff
	30 to 50 Dense	8 to 15 Stiff
	Over 50 Very Dense	15 to 30 Very Stiff
		Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long × 2" O.D. × 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

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SOIL EXPLORATION CORPORATION

Geotechnical Drilling and Groundwater Monitor Wells

5 Monson Place
Milford, NH 03055
(603) 672-2135

Client S E A Consultants | Date 04/09/91 | Job No. 91-0119

Location Hendrick Street, Easthampton, Massachusetts

BORING NO. 11-A (MW-11A) | Ground Elev. | Date Start 03/25/91 | Date Complete 03/27/91 | Drilling Foreman S.B. | Eng./Hydrol. Geologist

DEPTH	Sample No.	Sample Depth (ft.)	Blows 6" Penetration	Rec. Inches	Casing Blows Per ft.	Strata Change Depth	Visual Identification of Soil and/or Rock Strata
85	17	84'0"-86'0"	8-11-13-18				Loose to very dense, dry to wet, FINE TO COARSE SAND AND SILT.
90	18	89'0"-91'0"	10-10-16-20				
95	19	94'0"-96'0"	14-22-65-120				
						96'0"	End of boring at 96'0" Set well point at 96'0" Water level at 4'0" upon completion
100							
105							
110							
115							
120							

Type of Boring | Casing Size: 4" | Hollow Stem Auger Size:

Proportion Percentages
Trace 0 to 10%
Some 10 to 40%
And 40 to 50%

Granular Soils (blows per ft.)
0 to 4 Very Loose
4 to 10 Loose
10 to 30 Medium Dense
30 to 50 Dense
Over 50 Very Dense

Cohesive Soils (blows per ft.)
0 to 2 Very Soft
2 to 4 Soft
4 to 8 Medium Stiff
8 to 15 Stiff
15 to 30 Very Stiff
Over 30 Hard

Standard penetration test (SPT) = 140# hammer falling 30"
Blows are per 6" taken with an 18" long x 2" O.D. x 1 3/8" I.D. split spoon sampler unless otherwise noted.

The terms and percentages used to describe soil and or rock are based on visual identification of the retrieved samples. ■ Moisture content indicated may be affected by time of year and water added during the drilling process. ■ Water levels indicated may vary with seasonal fluctuation and the degree of soil saturation when the boring was taken. ■ The stratification lines represent the approximate boundaries between soil types, the actual transitions may be gradual. ■

APPENDIX B - Phase IIA Chemical Analyses Reports

DECEMBER 1990
WATER SAMPLES
PHASE IIA WELLS

ALPHA ANALYTICAL LABORATORIES

Eight Walkup Drive
Westborough, Massachusetts 01581-1019
(508) 898-9220

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320

CERTIFICATE OF ANALYSIS

Client: SEA Consultants, Inc.

Address: 485 Massachusetts Avenue
Cambridge, MA 02139

Attn: Craig Blake

Client Designation: Project# E. Hampton

Laboratory Job Number: 906556

Invoice Number: 17699

Date Received: 12/06/90

Date Reported: 12/20/90

Delivery Method: EST

ALPHA SAMPLE NUMBER	CLIENT IDENTIFICATION	SAMPLE LOCATION
906556.1	#1 (MW-1)	N/A
906556.2	#6 (MW-6)	N/A
906556.2D	#6 (Duplicate)	N/A
906556.3	M1 (MW-M1)	N/A
906556.3S	M1 (Spike Recovery)	N/A
906556.4	M2 (MW-M2)	N/A
906556.5	Equipment Blank	N/A
906556.6	Trip blank	N/A

Authorized by: Scott McLean
Scott McLean - Laboratory Director

cp

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320

Laboratory Sample Number: 906556.1 **Date Received:** 12/06/90

Sample Matrix: Water **Date Reported:** 12/20/90

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One plastic bottle & three VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Volatile Organics ***	ND	ug/L	**	14	524.2	----	12/19/90
Soluble Metals							
Iron	0.06	mg/L	0.01	1	6010	12/06/90	12/10/90
Manganese	0.09	mg/L	0.01	1	6010	12/06/90	12/10/90

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320

Laboratory Sample Number: 906556.2 **Date Received:** 12/06/90

Sample Matrix: Water **Date Reported:** 12/20/90

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One plastic bottle & three VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Volatile Organics ***							
Xylenes	14	ug/L	**	14	524.2	----	12/19/90
Soluble Metals							
Iron	0.73	mg/L	0.01	1	6010	12/06/90	12/10/90
Manganese	4.89	mg/L	0.01	1	6010	12/06/90	12/10/90

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086   NH 198958-A   CT PH-0574   NY 11148   NC 320

Laboratory Sample Number: 906556.2D   **Date Received:** 12/06/90

Sample Matrix: Water   **Date Reported:** 12/20/90

Condition of Samples: Satisfactory   **Field Prep:** None

Number & Type of Containers: One plastic bottle & three VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	SAMPLE RESULT	DUPLICATE RESULT	%RPD
Volatile Organics ***			
Xylenes	14	13	7.4
Soluble Metals			
Iron	0.73	0.82	12
Manganese	4.89	5.17	6

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320

Laboratory Sample Number: 906556.3 **Date Received:** 12/06/90

Sample Matrix: Water **Date Reported:** 12/20/90

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One plastic bottle & three VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Volatile Organics ***	ND	ug/L	**	14	524.2	----	12/20/90
Soluble Metals							
Iron	0.04	mg/L	0.01	1	6010	12/06/90	12/10/90
Manganese	0.10	mg/L	0.01	1	6010	12/06/90	12/10/90

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320

Laboratory Sample Number: 906556.3S **Date Received:** 12/06/90

Sample Matrix: Water **Date Reported:** 12/20/90

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One plastic bottle & three VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	%RECOVERY
Soluble Metals	
Iron	92%
Manganese	102%

COMMENTS: * Complete list of References found in Addendum I

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320

Laboratory Sample Number: 906556.4 **Date Received:** 12/06/90

Sample Matrix: Water **Date Reported:** 12/20/90

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One plastic bottle & three VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Volatile Organics ***	ND	ug/L	**	14	524.2	----	12/20/90
Soluble Metals							
Iron	0.14	mg/L	0.01	1	6010	12/06/90	12/10/90
Manganese	0.06	mg/L	0.01	1	6010	12/06/90	12/10/90

COMMENTS:
* Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320

Laboratory Sample Number: 906556.5 **Date Received:** 12/06/90

Sample Matrix: Water **Date Reported:** 12/20/90

Condition of Samples: Satisfactory **Field Prep:** Metals were field filtered and preserved

Number & Type of Containers: One plastic bottle & three VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Volatile Organics ***							
Chloroform	39	ug/L	**	14	524.2	----	12/19/90
Bromodichloromethane	4.7	ug/L	**	14	524.2	----	12/19/90
Soluble Metals							
Iron	0.16	mg/L	0.01	1	6010	12/06/90	12/10/90
Manganese	0.01	mg/L	0.01	1	6010	12/06/90	12/10/90

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320

Laboratory Sample Number: 906556.6

Date Received: 12/06/90

Sample Matrix: Water

Date Reported: 12/20/90

Condition of Samples: Satisfactory

Field Prep: Metals were field filtered and preserved

Number & Type of Containers: One plastic bottle & three VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Volatile Organics ***	ND	ug/L	**	14	524.2	----	12/20/90
Soluble Metals							
Iron	0.02	mg/L	0.01	1	6010	12/06/90	12/10/90
Manganese	ND	mg/L	0.01	1	6010	12/06/90	12/10/90

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABS
VOLATILE ORGANICS ANALYSIS by GC/MS
METHOD 524.2

Alpha Job Number: 906556 Date Reported: 12/20/90
Alpha Sample Number(s): 906556.1-.6
Method Detection Limit: See Below

COMPOUNDS	
Methylene chloride	0.9 ug/L
1,1-Dichloroethane	1.6 ug/L
Chloroform	0.5 ug/L
Carbon tetrachloride	0.5 ug/L
1,2-Dichloropropane	2.0 ug/L
Dibromochloromethane	1.0 ug/L
1,1,2-Trichloroethane	1.7 ug/L
2-Chloroethylvinyl ether	3.3 ug/L
Tetrachloroethene	0.5 ug/L
Chlorobenzene	2.0 ug/L
Trichlorofluoromethane	1.7 ug/L
1,2-Dichloroethane	0.5 ug/L
1,1,1-Trichloroethane	0.5 ug/L
Bromodichloromethane	0.7 ug/L
trans-1,3-Dichloropropene	1.7 ug/L
cis-1,3-Dichloropropene	1.7 ug/L
Bromoform	1.6 ug/L
1,1,2,2-Tetrachloroethane	2.3 ug/L
Benzene	0.5 ug/L
Toluene	2.0 ug/L
Ethyl benzene	2.4 ug/L
Xylenes	3.3 ug/L
Chloromethane	2.7 ug/L
Bromomethane	2.3 ug/L
Vinyl chloride	0.5 ug/L
Chloroethane	2.5 ug/L
1,1-Dichloroethene	0.5 ug/L
Trans-1,2-dichloroethene	0.5 ug/L
Cis-1,2-dichloroethene	0.5 ug/L
Trichloroethene	0.5 ug/L
1,2-Dichlorobenzene	0.5 ug/L
1,3-Dichlorobenzene	0.5 ug/L
1,4-Dichlorobenzene	0.5 ug/L
Acetone	33.4 ug/L
Carbon disulfide	6.7 ug/L
2-Butanone	10.0 ug/L
Vinyl acetate	10.0 ug/L
4-Methyl-2-pentanone	6.7 ug/L
2-Hexanone	6.7 ug/L
Styrene	3.3 ug/L
o-Xylene	3.3 ug/L

ALPHA ANALYTICAL LABS
VOLATILE ORGANICS ANALYSIS by GC/MS
METHOD 524.2
CONTINUED

Alpha Job Number: 906556 Date Reported: 12/20/90
Alpha Sample Number(s): 906556.1-.6
Method Detection Limit: See Below

COMPOUNDS	
1,1-Dichloropropene	10.0 ug/L
2,2-Dichloropropane	10.0 ug/L
1,1,1,2-Tetrachloroethane	10.0 ug/L
1,2,3-Trichloropropane	10.0 ug/L
Bromochloromethane	10.0 ug/L
n-Butylbenzene	10.0 ug/L
Dichlorodifluoromethane	10.0 ug/L
Hexachlorobutadiene	10.0 ug/L
Isopropylbenzene	10.0 ug/L
p-Isopropyltoluene	10.0 ug/L
Naphthalene	10.0 ug/L
n-Propylbenzene	10.0 ug/L
Sec-butylbenzene	10.0 ug/L
Tert-butylbenzene	10.0 ug/L
1,2,3-Trichlorobenzene	10.0 ug/L
1,2,4-Trichlorobenzene	10.0 ug/L
1,2,4-Trimethylbenzene	10.0 ug/L
1,3,5-Trimethylbenzene	10.0 ug/L
Bromobenzene	10.0 ug/L
o-Chlorotoluene	10.0 ug/L
p-Chlorotoluene	10.0 ug/L
Dibromomethane	10.0 ug/L
1,2-Dibromoethane	10.0 ug/L
1,2-Dibromo-3-chloropropane	10.0 ug/L
1,3-Dichloropropane	10.0 ug/L

ALPHA ANALYTICAL LABORATORIES

ACCEPTABLE MATRIX SPIKE RECOVERY LIMITS

FOR INORGANICS

PARAMETER GROUP	WATER	SOIL
Metals	75-125 %	60-140 %
Wet Chemistry	70-130 %	N/A

ALPHA ANALYTICAL LABORATORIES

RELATIVE PERCENT DIFFERENCE

CRITERIA FOR DUPLICATE ANALYSIS

PARAMETER GROUP	WATER	SOIL
Organics:		
Volatile Organics	30 %	30 %
Acid/Base/Neutrals	40 %	40 %
Pesticides/PCB's	40 %	40 %
Inorganics:		
Metals	20 %	30 %
Wet Chemistry	30 %	30 %

ALPHA ANALYTICAL LABS
ADDENDUM I
REFERENCES

1. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. EPA SW-846. 1986.

2. Standard Methods for Examination of Water and Waste Water. APHA-AWWA-WPCF. 16th Edition. 1985.

3. Standard Methods for Examination of Water and Waste Water. APHA-AWWA-WPCF. 17th Edition. 1989.

4. Methods for Chemical Analysis of Water and Wastes. EPA 600/4-82-055. 1983.

5. Oil Spill Identification System. CG-D-52-77 U. S. Coast Guard. 1977.

6. Methods for Organic Chemical Analysis of Municipal and Industrial Waste Water. EPA 600/4-82-057. 1982.

7. U. S. Department of Health, Education, and Welfare, National Institute of Occupational Safety and Health. D. G. Taylor, [Manual of Analytical Methods, 2nd Ed., DHEW (NIOSH) Pub. No. 77-237A, 1977.]

8. Handbook of Analytical Quality Control in Water and Wastewater Laboratories. EPA 600/4-79-019. March 1979.

9. The United States Pharmacopeia. The National Formulary. USP 20th Edition. Formulary 15th Edition. 1980.

10. Choosing Cost-Effective QA/QC (Quality Assurance/Quality Control) Programs for Chemical Analysis. PB85-241461. U. S. Department of Commerce, National Technical Information Service. August 1985.

11. Manual of Analytical Quality Control for Pesticides in Human and Environmental Media. PB 261 019. EPA 600/1-76-017. February 1975.

12. Annual Book of ASTM Standards. Sections 0, 3, 4, 5, 6, 8, 9, 11, and 14. American Society for Testing and Materials 1986.

13. Federal Register, part II. 40 CFR, part 261, et al, pp. 29686-26998. June 29, 1990

14. Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water. Available from USEPA, Cincinnati, 26 West Martin Luther King Drive, Cincinnati, Ohio, 45268.

15. Interim Methods for the Determination of Asbestiform Minerals in Bulk Insulation Samples, Research Triangle Institute, June 1980. Asbestos Containing Materials in School Buildings: A Guidance Document, March 1979, USEPA Document C00090, parts 1 & 2.

16. Interim Methods for the Determination of Asbestos in Bulk Insulation Samples (EPA-600/M4-82-020).

17. "Prescribed Procedures for Measurement of Radioactivity in Drinking Water," Publication EPA-600/4-80-032, U. S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, August 1980.

18. "Clean Harbors Radiological Environmental Analytical Procedures," Clean Harbors Analytical Services, Braintree, MA, October 1985.

19. H. M. Prichard and T. F. Gesell, "Rapid Measurement of RN-222 Concentrations in Water with a Commercial Liquid Scintillation Counter", Health Physics, Volume 33, 1977, pp. 577-581.

20. "Handbook for Analytical Quality Control in Water and Wastewater Laboratories", March 1979, EPA 600/4-79-019.

21. Analysis of PCB's in Transformer Fluid and Waste Oil. EPA 600/4-81-045. 1981.

22. Klute, A. 1986, "Methods of Soil Analysis, Part 1", Methods 15-2.2 and 15-5.1. American Society of Agronomy, Madison, WI.

23. Exhibit No. 1. Petroleum Oils by Gas Chromatography. Alley, Young & Baumartner, Inc., Consulting Engineers, P.O. Box 2036, Brentwood, TN 37024.

DECEMBER 1990
WATER SAMPLES

ALPHA ANALYTICAL LABORATORIES

Eight Walkup Drive
Westborough, Massachusetts 01581-1019
(508) 898-9220

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320

CERTIFICATE OF ANALYSIS

Client: SEA Consultants, Inc.

Address: 485 Massachusetts Avenue
Cambridge, MA 02139

Attn: C. Blake

Client Designation: Job# 90072.1

Laboratory Job Number: 906495

Invoice Number: 17590

Date Received: 12/03/90

Date Reported: 12/17/90

Delivery Method: EST

ALPHA SAMPLE NUMBER	CLIENT IDENTIFICATION	SAMPLE LOCATION
906495.1	Well #2	N/A
906495.2	Well #4D (MW-4A)	N/A
906495.2D	Well #4D (Duplicate)	N/A
906495.3	Well #5S (MW-5B)	N/A
906495.3S	Well #5S (Spike Recovery)	N/A
906495.4	Well #M6 (MW-M6)	N/A
906495.5	Well #8	N/A
906495.6	Well #5D (MW-5A)	N/A
906495.7	Equipment Blank	N/A
906495.8	Trip blank	N/A

Authorized by: Scott McLean
Scott McLean - Laboratory Director

cp

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086   NH 198958-A   CT PH-0574   NY 11148   NC 320

Laboratory Sample Number: 906495.1   **Date Received:** 12/03/90

Sample Matrix: Water   **Date Reported:** 12/17/90

Condition of Samples: Satisfactory   **Field Prep:** Metals were Field Filtered and Preserved

Number & Type of Containers: One plastic bottle & three VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Soluble Metals							
Iron	0.05	mg/L	0.01	1	6010	----	12/07/90
Manganese	0.47	mg/L	0.01	1	6010	----	12/07/90
Volatile Organics ***	ND	ug/L	**	14	524.2	----	12/15/90

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320

Laboratory Sample Number: 906495.2 **Date Received:** 12/03/90

Sample Matrix: Water **Date Reported:** 12/17/90

Condition of Samples: Satisfactory **Field Prep:** Metals were Field Filtered and Preserved

Number & Type of Containers: One plastic bottle & three VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Soluble Metals							
Iron	0.02	mg/L	0.01	1	6010	----	12/07/90
Manganese	0.05	mg/L	0.01	1	6010	----	12/07/90
Volatile Organics ***							
1,1,1-Trichloroethane	2.3	ug/L	**	14	524.2	----	12/15/90

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320

Laboratory Sample Number: 906495.2D **Date Received:** 12/03/90

Sample Matrix: Water **Date Reported:** 12/17/90

Condition of Samples: Satisfactory **Field Prep:** Metals were Field Filtered and Preserved

Number & Type of Containers: One plastic bottle & three VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	SAMPLE RESULT	DUPLICATE RESULT	%RPD
Soluble Metals			
Iron	0.02	0.03	40
Manganese	0.05	0.05	0
Volatile Organics ***			
1,1,1-Trichloroethane	2.3	2.4	4.3

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320

Laboratory Sample Number: 906495.3 **Date Received:** 12/03/90

Sample Matrix: Water **Date Reported:** 12/17/90

Condition of Samples: Satisfactory **Field Prep:** Metals were Field Filtered and Preserved

Number & Type of Containers: One plastic bottle & three VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Soluble Metals							
Iron	0.08	mg/L	0.01	1	6010	----	12/07/90
Manganese	0.02	mg/L	0.01	1	6010	----	12/07/90
Volatile Organics ***	ND	ug/L	**	14	524.2	----	12/15/90

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086   NH 198958-A   CT PH-0574   NY 11148   NC 320

Laboratory Sample Number: 906495.3S

Date Received: 12/03/90

Sample Matrix: Water

Date Reported: 12/17/90

Condition of Samples: Satisfactory

Field Prep: Metals were Field Filtered and Preserved

Number & Type of Containers: One plastic bottle

Analysis Requested: Analysis as Listed Below

PARAMETER	%RECOVERY
Soluble Metals	
Iron	84%
Manganese	100%

COMMENTS: * Complete list of References found in Addendum I

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320

Laboratory Sample Number: 906495.4 **Date Received:** 12/03/90

Sample Matrix: Water **Date Reported:** 12/17/90

Condition of Samples: Satisfactory **Field Prep:** Metals were Field Filtered and Preserved

Number & Type of Containers: One plastic bottle & three VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Soluble Metals							
Iron	0.87	mg/L	0.01	1	6010	----	12/07/90
Manganese	0.06	mg/L	0.01	1	6010	----	12/07/90
Volatile Organics ***	ND	ug/L	**	14	524.2	----	12/15/90

COMMENTS: * Complete list of References found in Addendum I

** A list of volatile organics analyzed for and their detection limits accompanies this report.

*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320

Laboratory Sample Number: 906495.5 **Date Received:** 12/03/90

Sample Matrix: Water **Date Reported:** 12/17/90

Condition of Samples: Satisfactory **Field Prep:** Metals were Field Filtered and Preserved

Number & Type of Containers: One plastic bottle & three VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Soluble Metals							
Iron	0.04	mg/L	0.01	1	6010	----	12/07/90
Manganese	0.16	mg/L	0.01	1	6010	----	12/07/90
Volatile Organics ***	ND	ug/L	**	14	524.2	----	12/15/90

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320

Laboratory Sample Number: 906495.6 **Date Received:** 12/03/90

Sample Matrix: Water **Date Reported:** 12/17/90

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One plastic bottle & three VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Soluble Metals							
Iron	0.01	mg/L	0.01	1	6010	12/03/90	12/07/90
Manganese	ND	mg/L	0.01	1	6010	12/03/90	12/07/90
Volatile Organics ***	ND	ug/L	**	14	524.2	----	12/16/90

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320

Laboratory Sample Number: 906495.7 **Date Received:** 12/03/90

Sample Matrix: Water **Date Reported:** 12/17/90

Condition of Samples: Satisfactory **Field Prep:** Metals were Field Filtered and Preserved

Number & Type of Containers: One plastic bottle & three VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL	REF*	METHOD	DATES	
						EXT/PREP	ANALYSIS
Soluble Metals							
Iron	0.03	mg/L	0.01	1	6010	----	12/07/90
Manganese	ND	mg/L	0.01	1	6010	----	12/07/90
Volatile Organics ***	ND	ug/L	**	14	524.2	----	12/16/90

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320

Laboratory Sample Number: 906495.8 **Date Received:** 12/03/90

Sample Matrix: Water **Date Reported:** 12/17/90

Condition of Samples: Satisfactory **Field Prep:** Metals were Field Filtered and Preserved

Number & Type of Containers: One plastic bottle & one VOA vial

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Soluble Metals							
Iron	0.03	mg/L	0.01	1	6010	----	12/07/90
Manganese	ND	mg/L	0.01	1	6010	----	12/07/90
Volatile Organics ***	ND	ug/L	**	14	524.2	----	12/15/90

COMMENTS:
* Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABS
VOLATILE ORGANICS ANALYSIS by GC/MS
METHOD 524.2

Alpha Job Number: 906495 Date Reported: 12/17/90
Alpha Sample Number(s): 906495.1-.8
Method Detection Limit: See Below

COMPOUNDS	
Methylene chloride	0.9 ug/L
1,1-Dichloroethane	1.6 ug/L
Chloroform	0.5 ug/L
Carbon tetrachloride	0.5 ug/L
1,2-Dichloropropane	2.0 ug/L
Dibromochloromethane	1.0 ug/L
1,1,2-Trichloroethane	1.7 ug/L
2-Chloroethylvinyl ether	3.3 ug/L
Tetrachloroethene	0.5 ug/L
Chlorobenzene	2.0 ug/L
Trichlorofluoromethane	1.7 ug/L
1,2-Dichloroethane	0.5 ug/L
1,1,1-Trichloroethane	0.5 ug/L
Bromodichloromethane	0.7 ug/L
trans-1,3-Dichloropropene	1.7 ug/L
cis-1,3-Dichloropropene	1.7 ug/L
Bromoform	1.6 ug/L
1,1,2,2-Tetrachloroethane	2.3 ug/L
Benzene	0.5 ug/L
Toluene	2.0 ug/L
Ethyl benzene	2.4 ug/L
Xylenes	3.3 ug/L
Chloromethane	2.7 ug/L
Bromomethane	2.3 ug/L
Vinyl chloride	0.5 ug/L
Chloroethane	2.5 ug/L
1,1-Dichloroethene	0.5 ug/L
Trans-1,2-dichloroethene	0.5 ug/L
Cis-1,2-dichloroethene	0.5 ug/L
Trichloroethene	0.5 ug/L
1,2-Dichlorobenzene	0.5 ug/L
1,3-Dichlorobenzene	0.5 ug/L
1,4-Dichlorobenzene	0.5 ug/L
Acetone	33.4 ug/L
Carbon disulfide	6.7 ug/L
2-Butanone	10.0 ug/L
Vinyl acetate	10.0 ug/L
4-Methyl-2-pentanone	6.7 ug/L
2-Hexanone	6.7 ug/L
Styrene	3.3 ug/L
o-Xylene	3.3 ug/L

ALPHA ANALYTICAL LABS
VOLATILE ORGANICS ANALYSIS by GC/MS
METHOD 524.2
CONTINUED

Alpha Job Number: 906495 Date Reported: 12/17/90
Alpha Sample Number(s): 906495.1-.8
Method Detection Limit: See Below

COMPOUNDS	
1,1-Dichloropropene	10.0 ug/L
2,2-Dichloropropane	10.0 ug/L
1,1,1,2-Tetrachloroethane	10.0 ug/L
1,2,3-Trichloropropane	10.0 ug/L
Bromochloromethane	10.0 ug/L
n-Butylbenzene	10.0 ug/L
Dichlorodifluoromethane	10.0 ug/L
Hexachlorobutadiene	10.0 ug/L
Isopropylbenzene	10.0 ug/L
p-Isopropyltoluene	10.0 ug/L
Naphthalene	10.0 ug/L
n-Propylbenzene	10.0 ug/L
Sec-butylbenzene	10.0 ug/L
Tert-butylbenzene	10.0 ug/L
1,2,3-Trichlorobenzene	10.0 ug/L
1,2,4-Trichlorobenzene	10.0 ug/L
1,2,4-Trimethylbenzene	10.0 ug/L
1,3,5-Trimethylbenzene	10.0 ug/L
Bromobenzene	10.0 ug/L
o-Chlorotoluene	10.0 ug/L
p-Chlorotoluene	10.0 ug/L
Dibromomethane	10.0 ug/L
1,2-Dibromoethane	10.0 ug/L
1,2-Dibromo-3-chloropropane	10.0 ug/L
1,3-Dichloropropane	10.0 ug/L

ALPHA ANALYTICAL LABS
ADDENDUM I
REFERENCES

1. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. EPA SW-846. 1986.

2. Standard Methods for Examination of Water and Waste Water. APHA-AWWA-WPCF. 16th Edition. 1985.

3. Standard Methods for Examination of Water and Waste Water. APHA-AWWA-WPCF. 17th Edition. 1989.

4. Methods for Chemical Analysis of Water and Wastes. EPA 600/4-82-055. 1983.

5. Oil Spill Identification System. CG-D-52-77 U. S. Coast Guard. 1977.

6. Methods for Organic Chemical Analysis of Municipal and Industrial Waste Water. EPA 600/4-82-057. 1982.

7. U. S. Department of Health, Education, and Welfare, National Institute of Occupational Safety and Health. D. G. Taylor, [Manual of Analytical Methods, 2nd Ed., DHEW (NIOSH) Pub. No. 77-237A, 1977.]

8. Handbook of Analytical Quality Control in Water and Wastewater Laboratories. EPA 600/4-79-019. March 1979.

9. The United States Pharmacopeia. The National Formulary. USP 20th Edition. Formulary 15th Edition. 1980.

10. Choosing Cost-Effective QA/QC (Quality Assurance/Quality Control) Programs for Chemical Analysis. PB85-241461. U. S. Department of Commerce, National Technical Information Service. August 1985.

11. Manual of Analytical Quality Control for Pesticides in Human and Environmental Media. PB 261 019. EPA 600/1-76-017. February 1975.

12. Annual Book of ASTM Standards. Sections 0, 3, 4, 5, 6, 8, 9, 11, and 14. American Society for Testing and Materials 1986.

13. Federal Register, part II. 40 CFR, part 261, et al, pp. 29686-26998. June, 1990.

14. Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water. Available from USEPA, Cincinnati, 26 West Martin Luther King Drive, Cincinnati, Ohio, 45268.

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16. Interim Methods for the Determination of Asbestos in Bulk Insulation Samples (EPA-600/M4-82-020).

17. "Prescribed Procedures for Measurement of Radioactivity in Drinking Water," Publication EPA-600/4-80-032, U. S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, August 1980.

18. "Clean Harbors Radiological Environmental Analytical Procedures," Clean Harbors Analytical Services, Braintree, MA, October 1985.

19. H. M. Prichard and T. F. Gesell, "Rapid Measurement of RN-222 Concentrations in Water with a Commercial Liquid Scintillation Counter", Health Physics, Volume 33, 1977, pp. 577-581.

20. "Handbook for Analytical Quality Control in Water and Wastewater Laboratories", March 1979, EPA 600/4-79-019.

21. Analysis of PCB's in Transformer Fluid and Waste Oil. EPA 600/4-81-045. 1981.

22. Klute, A. 1986, "Methods of Soil Analysis, Part 1", Methods 15-2.2 and 15-5.1. American Society of Agronomy, Madison, WI.

23. Exhibit No. 1. Petroleum Oils by Gas Chromatography. Alley, Young & Baumartner, Inc., Consulting Engineers, P.O. Box 2036, Brentwood, TN 37024.

ALPHA ANALYTICAL LABORATORIES

RELATIVE PERCENT DIFFERENCE

CRITERIA FOR DUPLICATE ANALYSIS

PARAMETER GROUP	WATER	SOIL
Organics:		
Volatile Organics	30 %	30 %
Acid/Base/Neutrals	40 %	40 %
Pesticides/PCB's	40 %	40 %
Inorganics:		
Metals	20 %	30 %
Wet Chemistry	30 %	30 %

ALPHA ANALYTICAL LABORATORIES

ACCEPTABLE MATRIX SPIKE RECOVERY LIMITS

FOR INORGANICS

PARAMETER GROUP	WATER	SOIL
Metals	75-125 %	60-140 %
Wet Chemistry	70-130 %	N/A

SOIL TESTS

MW-1
MW-2
MW-3
MW-4A
MW-4B
MW-5A
MW-5B
MW-7
MW-8

ALPHA ANALYTICAL LABORATORIES

Eight Walkup Drive
Westborough, Massachusetts 01581-1019
(508) 898-9220

MA 086 NH 198958-A CT PH-0574

NY 11148 NC 320

CERTIFICATE OF ANALYSIS

Client: SEA Consultants

Address: 485 Massachusetts Avenue
Cambridge, MA 02139

Attn: Kosta Exarhoulakos

Client Designation: Project# 90072.1V

Laboratory Job Number: 906147

Invoice Number: 17241

Date Received: 11/14/90

Date Reported: 11/28/90

Delivery Method: Alpha Courier

ALPHA SAMPLE NUMBER	CLIENT IDENTIFICATION	SAMPLE LOCATION
906147.1	B-1	Easthampton
906147.2	B-2	Easthampton
906147.2D	B-2 (duplicate)	Easthampton
906147.3	B-3	Easthampton
906147.3S	B-3 (spike recovery)	Easthampton
906147.4	B-4D (MW-4A)	Easthampton
906147.5	B-4S (MW-4B)	Easthampton
906147.6	B-5D (MW-5A)	Easthampton
906147.7	B-5S (MW-5B)	Easthampton
906147.8	B-7	Easthampton
906147.9	B-8	Easthampton

Authorized by: Scott McLean
Scott McLean - Laboratory Director

mar

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574

NY 11148 NC 320

Laboratory Sample Number: 906147.1 **Date Received:** 11/14/90

Sample Matrix: Soil (results on a dry weight basis) **Date Reported:** 11/28/90

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One glass jar

Analysis Requested: Analysis as listed below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Total Solids	87	%	0.1	3	2540B	----	11/23/90
Total Petroleum Hydrocarbons	ND	mg/Kg	40	3	5520CDF	11/22/90	11/23/90
Volatile Organics ***	ND	ug/Kg	**	1	8260	11/16/90	11/22/90

Volatile Organics	% Surrogate Recovery
1,2-Dichloroethane-d4	100%
Toluene-d8	107%
4-Bromofluorobenzene	86%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompany this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574

NY 11148 NC 320

Laboratory Sample Number: 906147.2 **Date Received:** 11/14/90

Sample Matrix: Soil (results on a dry weight basis) **Date Reported:** 11/28/90

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One glass jar

Analysis Requested: Analysis as listed below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Total Solids	82	%	0.1	3	2540B	----	11/23/90
Total Petroleum Hydrocarbons	ND	mg/Kg	40	3	5520CDF	11/22/90	11/23/90
Volatile Organics ***	ND	ug/Kg	**	1	8260	11/16/90	11/22/90

Volatile Organics	% Surrogate Recovery
1,2-Dichloroethane-d4	100%
Toluene-d8	113%
4-Bromofluorobenzene	95%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompany this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574

NY 11148 NC 320

Laboratory Sample Number: 906147.2D **Date Received:** 11/14/90

Sample Matrix: Soil (results on a dry weight basis) **Date Reported:** 11/28/90

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One glass jar

Analysis Requested: Total Petroleum Hydrocarbons (IR)

PARAMETER	SAMPLE RESULT	DUPLICATE RESULT	% RPD
Total Petroleum Hydrocarbons	ND	ND	NC

NC - Non calculable RPD

COMMENTS: * Complete list of References found in Addendum I

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574

NY 11148 NC 320

Laboratory Sample Number: 906147.3 **Date Received:** 11/14/90

Sample Matrix: Soil (results on a dry weight basis) **Date Reported:** 11/28/90

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One glass jar

Analysis Requested: Analysis as listed below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Total Solids	86	%	0.1	3	2540B	----	11/23/90
Total Petroleum Hydrocarbons	ND	mg/Kg	40	3	5520CDF	11/22/90	11/23/90
Volatile Organics ***	ND	ug/Kg	**	1	8260	11/16/90	11/22/90

Volatile Organics	% Surrogate Recovery
1,2-Dichloroethane-d4	103%
Toluene-d8	105%
4-Bromofluorobenzene	101%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompany this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574

NY 11148 NC 320

Laboratory Sample Number: 906147.3S **Date Received:** 11/14/90

Sample Matrix: Soil (results on a dry weight basis) **Date Reported:** 11/28/90

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One glass jar

Analysis Requested: Total Petroleum Hydrocarbons (IR)

PARAMETER	% RECOVERY
Total Petroleum Hydrocarbons	92%

COMMENTS: * Complete list of References found in Addendum I

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574

NY 11148 NC 320

Laboratory Sample Number: 906147.4 **Date Received:** 11/14/90

Sample Matrix: Soil (results on a dry weight basis) **Date Reported:** 11/28/90

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One glass jar

Analysis Requested: Analysis as listed below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Total Solids	85	%	0.1	3	2540B	----	11/23/90
Total Petroleum Hydrocarbons	ND	mg/Kg	40	3	5520CDF	11/22/90	11/23/90
Volatile Organics ***	ND	ug/Kg	**	1	8260	11/16/90	11/22/90

Volatile Organics	% Surrogate Recovery
1,2-Dichloroethane-d4	89%
Toluene-d8	100%
4-Bromofluorobenzene	123%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompany this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574

NY 11148 NC 320

Laboratory Sample Number: 906147.5 **Date Received:** 11/14/90

Sample Matrix: Soil (results on a dry weight basis) **Date Reported:** 11/28/90

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One glass jar

Analysis Requested: Analysis as listed below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Total Solids	86	%	0.1	3	2540B	----	11/23/90
Total Petroleum Hydrocarbons	ND	mg/Kg	40	3	5520CDF	11/22/90	11/23/90
Volatile Organics ***	ND	ug/Kg	**	1	8260	11/16/90	11/22/90

Volatile Organics	% Surrogate Recovery
1,2-Dichloroethane-d4	95%
Toluene-d8	103%
4-Bromofluorobenzene	122%

COMMENTS:
* Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompany this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574

NY 11148 NC 320

Laboratory Sample Number: 906147.6 **Date Received:** 11/14/90

Sample Matrix: Soil (results on a dry weight basis) **Date Reported:** 11/28/90

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One glass jar

Analysis Requested: Analysis as listed below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Total Solids	87	%	0.1	3	2540B	----	11/23/90
Total Petroleum Hydrocarbons	ND	mg/Kg	40	3	5520CDF	11/22/90	11/23/90
Volatile Organics ***	ND	ug/Kg	**	1	8260	11/16/90	11/22/90

Volatile Organics	% Surrogate Recovery
1,2-Dichloroethane-d4	97%
Toluene-d8	105%
4-Bromofluorobenzene	85%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompany this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574

NY 11148 NC 320

Laboratory Sample Number: 906147.7 **Date Received:** 11/14/90

Sample Matrix: Soil (results on a dry weight basis) **Date Reported:** 11/28/90

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One glass jar

Analysis Requested: Analysis as listed below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Total Solids	83	%	0.1	3	2540B	----	11/23/90
Total Petroleum Hydrocarbons	ND	mg/Kg	40	3	5520CDF	11/22/90	11/23/90
Volatile Organics ***	ND	ug/Kg	**	1	8260	11/16/90	11/22/90

Volatile Organics	% Surrogate Recovery
1,2-Dichloroethane-d4	96%
Toluene-d8	108%
4-Bromofluorobenzene	95%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompany this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574

NY 11148 NC 320

Laboratory Sample Number: 906147.8 **Date Received:** 11/14/90

Sample Matrix: Soil (results on a dry weight basis) **Date Reported:** 11/28/90

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One glass jar

Analysis Requested: Analysis as listed below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Total Solids	83	%	0.1	3	2540B	----	11/23/90
Total Petroleum Hydrocarbons	ND	mg/Kg	40	3	5520CDF	11/22/90	11/23/90
Volatile Organics ***	ND	ug/Kg	**	1	8260	11/16/90	11/22/90

Volatile Organics	% Surrogate Recovery
1,2-Dichloroethane-d4	97%
Toluene-d8	105%
4-Bromofluorobenzene	86%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompany this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574

NY 11148 NC 320

Laboratory Sample Number: 906147.9 **Date Received:** 11/14/90

Sample Matrix: Soil (results on a dry weight basis) **Date Reported:** 11/28/90

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One glass jar

Analysis Requested: Analysis as listed below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Total Solids	87	%	0.1	3	2540B	----	11/23/90
Total Petroleum Hydrocarbons	ND	mg/Kg	40	3	5520CDF	11/22/90	11/23/90
Volatile Organics ***	ND	ug/Kg	**	1	8260	11/16/90	11/23/90

Volatile Organics	% Surrogate Recovery
1,2-Dichloroethane-d4	117%
Toluene-d8	97%
4-Bromofluorobenzene	110%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompany this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABS
VOLATILE ORGANICS ANALYSIS by GC/MS
METHOD 8260

Alpha Job Number: 906147 Date Reported: 11/28/90
Alpha Sample Number(s): 6147.1 - .9
Method Detection Limit: stated below

COMPOUNDS	
Methylene chloride	140 ug/Kg
1,1-Dichloroethane	235 ug/Kg
Chloroform	80 ug/Kg
Carbon tetrachloride	140 ug/Kg
1,2-Dichloropropane	300 ug/Kg
Dibromochloromethane	155 ug/Kg
1,1,2-Trichloroethane	250 ug/Kg
2-Chloroethylvinyl ether	500 ug/Kg
Tetrachloroethene	205 ug/Kg
Chlorobenzene	300 ug/Kg
Trichlorofluoromethane	250 ug/Kg
1,2-Dichloroethane	140 ug/Kg
1,1,1-Trichloroethane	190 ug/Kg
Bromodichloromethane	110 ug/Kg
trans-1,3-Dichloropropene	250 ug/Kg
cis-1,3-Dichloropropene	250 ug/Kg
Bromoform	235 ug/Kg
1,1,2,2-Tetrachloroethane	345 ug/Kg
Benzene	300 ug/Kg
Toluene	300 ug/Kg
Ethyl benzene	360 ug/Kg
Xylenes	500 ug/Kg
Chloromethane	400 ug/Kg
Bromomethane	350 ug/Kg
Vinyl chloride	325 ug/Kg
Chloroethane	375 ug/Kg
1,1-Dichloroethene	140 ug/Kg
Trans-1,2-dichloroethene	80 ug/Kg
Cis-1,2-dichloroethene	80 ug/Kg
Trichloroethene	95 ug/Kg
Dibromomethane	235 ug/Kg
1,4-Dichloro-2-butane	500 ug/Kg
Ethanol	5,000 ug/Kg
Iodomethane	325 ug/Kg
1,2,3-Trichloropropane	300 ug/kg
Styrene	500 ug/Kg
Dichlorodifluoromethane	5,000 ug/Kg
Acetone	5,000 ug/Kg
Carbon disulfide	1,000 ug/Kg
2-Butanone	1,500 ug/Kg
Vinyl acetate	1,500 ug/Kg
4-Methyl-2-pentanone	1,000 ug/Kg
2-Hexanone	1,000 ug/Kg
1,2-Dichlorobenzene	500 ug/Kg
1,3-Dichlorobenzene	500 ug/Kg
1,4-Dichlorobenzene	500 ug/Kg

ALPHA ANALYTICAL LABORATORIES

ACCEPTABLE SURROGATE SPIKE RECOVERY LIMITS

FRACTION	SURROGATE COMPOUND	LOW/MEDIUM WATER	LOW/MEDIUM SOIL/SEDIMENT
VOA	Toluene-d_8	88-110 %	81-117 %
VOA	4-Bromofluorobenzene	86-115 %	74-121 %
VOA	1,2-Dichloroethane-d_4	76-114 %	70-121 %
BNA	Nitrobenzene-d_5	35-114 %	23-120 %
BNA	2-Fluorobiphenyl	43-116 %	30-115 %
BNA	p-Terphenyl-d_{14}	33-141 %	18-137 %
BNA	Phenol-d_5	10-94 %	24-113 %
BNA	2-Fluorophenol	21-100 %	25-121 %
BNA	2,4,6-Tribromophenol	10-123 %	19-122 %
Pest.	Dibutylchlorendate	24-154 %	20-150 %

ALPHA ANALYTICAL LABORATORIES

ACCEPTABLE MATRIX SPIKE RECOVERY LIMITS

FOR INORGANICS

PARAMETER GROUP	WATER	SOIL
Metals	75-125 %	60-140 %
Wet Chemistry	70-130 %	N/A

ALPHA ANALYTICAL LABORATORIES

RELATIVE PERCENT DIFFERENCE

CRITERIA FOR DUPLICATE ANALYSIS

PARAMETER GROUP	WATER	SOIL
Organics:		
Volatile Organics	30 %	30 %
Acid/Base/Neutrals	40 %	40 %
Pesticides/PCB's	40 %	40 %
Inorganics:		
Metals	20 %	30 %
Wet Chemistry	30 %	30 %

ALPHA ANALYTICAL LABS
ADDENDUM I
REFERENCES

1. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. EPA SW-846. 1986.

2. Standard Methods for Examination of Water and Waste Water. APHA-AWWA-WPCF. 16th Edition. 1985.

3. Standard Methods for Examination of Water and Waste Water. APHA-AWWA-WPCF. 17th Edition. 1989.

4. Methods for Chemical Analysis of Water and Wastes. EPA 600/4-82-055. 1983.

5. Oil Spill Identification System. CG-D-52-77 U. S. Coast Guard. 1977.

6. Methods for Organic Chemical Analysis of Municipal and Industrial Waste Water. EPA 600/4-82-057. 1982.

7. U. S. Department of Health, Education, and Welfare, National Institute of Occupational Safety and Health. D. G. Taylor, [Manual of Analytical Methods, 2nd Ed., DHEW (NIOSH) Pub. No. 77-237A, 1977.]

8. Handbook of Analytical Quality Control in Water and Wastewater Laboratories. EPA 600/4-79-019. March 1979.

9. The United States Pharmacopeia. The National Formulary. USP 20th Edition. Formulary 15th Edition. 1980.

10. Choosing Cost-Effective QA/QC (Quality Assurance/Quality Control) Programs for Chemical Analysis. PB85-241461. U. S. Department of Commerce, National Technical Information Service. August 1985.

11. Manual of Analytical Quality Control for Pesticides in Human and Environmental Media. PB 261 019. EPA 600/1-76-017. February 1975.

12. Annual Book of ASTM Standards. Sections 0, 3, 4, 5, 6, 8, 9, 11, and 14. American Society for Testing and Materials 1986.

13. Federal Register, part II. 40 CFR, part 261, et al, pp. 11798-11877. March 29, 1990.

14. Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water. Available from USEPA, Cincinnati, 26 West Martin Luther King Drive, Cincinnati, Ohio, 45268.

15. Interim Methods for the Determination of Asbestiform Minerals in Bulk Insulation Samples, Research Triangle Institute, June 1980. Asbestos Containing Materials in School Buildings: A Guidance Document, March 1979, USEPA Document C00090, parts 1 & 2.

16. Interim Methods for the Determination of Asbestos in Bulk Insulation Samples (EPA-600/M4-82-020).

17. "Prescribed Procedures for Measurement of Radioactivity in Drinking Water," Publication EPA-600/4-80-032, U. S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, August 1980.

18. "Clean Harbors Radiological Environmental Analytical Procedures," Clean Harbors Analytical Services, Braintree, MA, October 1985.

19. H. M. Prichard and T. F. Gesell, "Rapid Measurement of RN-222 Concentrations in Water with a Commercial Liquid Scintillation Counter", Health Physics, Volume 33, 1977, pp. 577-581.

20. "Handbook for Analytical Quality Control in Water and Wastewater Laboratories", March 1979, EPA 600/4-79-019.

21. Analysis of PCB's in Transformer Fluid and Waste Oil. EPA 600/4-81-045. 1981.

22. Klute, A. 1986, "Methods of Soil Analysis, Part 1", Methods 15-2.2 and 15-5.1. American Society of Agronomy, Madison, WI.

23. Exhibit No. 1. Petroleum Oils by Gas Chromatography. Alley Young & Baumartner, Inc., Consulting Engineers, PO Box 2036, Brentwood, TN 37024.

CHAIN OF CUSTODY RECORD

S E A Consultants Inc.
Engineers/ Architects
Cambridge, MA. S. Portland, ME. Wethersfield, CT.

Project: EASTHAMPTON TCE
Client: EASTHAMPTON
Location: EASTHAMPTON
Project No: 90072.IV

SAMPLE IDENTIFICATION AND ANALYSIS

S E A Sample I.D. No.	Lab. I.D. No.	No. of Containers	Sample Location	Sample Type	Date	Time	Analysis Required
90072.IV		1	B-1	Soil	10/30	10 AM	VOC Analysis #8240 & TPH by IR
"		1	B-2	"	10/26	2PM	"
"		1	B-3	"	11/6	10 AM	"
"		1	B-4D	"	11/7	2:30 PM	"
"		1	B-4S	"	11/8	12 NOON	"
"		1	B-5D	"	11/6	3 PM	"
"		1	B-5S	"	11/8	NOON	"
"		1	B-7	"	10/31	1:30	"
"		1	B-8	"	11/2	11 AM	"
							"

COMMENTS:

CHAIN OF CUSTODY CHRONICLE :

COLLECTED BY :

1 NAME: KOSTA EXARHOULAKOS COMPANY: SEA
SIGNATURE: Kosta [signature] DATE: 11/14/90 TIME: 9:35 AM

CUSTODY TRANSFERRED TO :

2 NAME: W. T. GOWARD COMPANY: alpha
SIGNATURE: W. T Goward DATE: 11/14/90 TIME: 4 35 PM

CUSTODY TRANSFERRED TO :

3 NAME: COMPANY:
SIGNATURE: DATE: TIME:

RECIEVED IN LABORATORY BY :

4 NAME: COMPANY:
SIGNATURE: DATE: TIME:

NOTE: Original remains with sample containers

PHASE II A
DRILLING WATER
TESTS

ALPHA ANALYTICAL LABORATORIES

Eight Walkup Drive
Westborough, Massachusetts 01581-1019
(508) 898-9220

MA 086 NH 198958-A CT PH-0574

NY 11148 NC 320

CERTIFICATE OF ANALYSIS

Client: SEA Consultants

Address: 485 Massachusetts Avenue
Cambridge, MA 02139

Attn: Craig Blake

Client Designation: Job# 90072.1V

Laboratory Job Number: 905961

Invoice Number: 17062

Date Received: 11/05/90

Date Reported: 11/19/90

Delivery Method: Alpha Courier

ALPHA SAMPLE NUMBER	CLIENT IDENTIFICATION	SAMPLE LOCATION
905961.1	RIG #1	N/A
905961.2	RIG #26	N/A
905961.2D	RIG #26 (duplicate)	N/A
905961.3	RIG #29	N/A
905961.3S	RIG #29 (spike recovery)	N/A
905961.4	Trip Blank	N/A

Authorized by: Scott McLean
Scott McLean - Laboratory Director

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ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574

NY 11148 NC 320

Laboratory Sample Number: 905961.1 **Date Received:** 11/05/90

Sample Matrix: Water **Date Reported:** 11/19/90

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One glass bottle and two VOA vials

Analysis Requested: Total Petroleum Hydrocarbons (IR) and Volatile Organics

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Total Petroleum Hydrocarbons	ND	mg/L	0.5	3	5520CDF	11/16/90	11/17/90
Volatile Organics ***	ND	ug/L	**	14	524.2	----	11/18/90

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompany this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574

NY 11148 NC 320

Laboratory Sample Number: 905961.2 **Date Received:** 11/05/90

Sample Matrix: Water **Date Reported:** 11/19/90

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One glass bottle and two VOA vials

Analysis Requested: Total Petroleum Hydrocarbons (IR) and Volatile Organics

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	ANALYSIS
Total Petroleum Hydrocarbons	ND	mg/L	0.5	3	5520CDF	11/16/90	11/17/90
Volatile Organics ***	ND	ug/L	**	14	524.2	----	11/18/90

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompany this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574

NY 11148 NC 320

Laboratory Sample Number: 905961.2D **Date Received:** 11/05/90

Sample Matrix: Water **Date Reported:** 11/19/90

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One glass bottle and two VOA vials

Analysis Requested: Total Petroleum Hydrocarbons (IR)

PARAMETER	SAMPLE RESULT	DUPLICATE RESULT	% RPD
Total Petroleum Hydrocarbons	ND	ND	NC

NC - Non calculable RPD

COMMENTS: * Complete list of References found in Addendum I

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574

NY 11148 NC 320

Laboratory Sample Number: 905961.3 **Date Received:** 11/05/90

Sample Matrix: Water **Date Reported:** 11/19/90

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One glass bottle and two VOA vials

Analysis Requested: Total Petroleum Hydrocarbons (IR) and Volatile Organics

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	ANALYSIS
Total Petroleum Hydrocarbons	ND	mg/L	0.5	3	5520CDF	11/16/90	11/17/90
Volatile Organics ***	ND	ug/L	**	14	524.2	----	11/18/90

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompany this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574

NY 11148 NC 320

Laboratory Sample Number: 905961.3S **Date Received:** 11/05/90

Sample Matrix: Water **Date Reported:** 11/19/90

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One glass bottle and two VOA vials

Analysis Requested: Total Petroleum Hydrocarbons (IR)

PARAMETER	% RECOVERY
Total Petroleum Hydrocarbons	98%

COMMENTS: * Complete list of References found in Addendum I

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574

NY 11148 NC 320

Laboratory Sample Number: 905961.4 **Date Received:** 11/05/90

Sample Matrix: Water **Date Reported:** 11/19/90

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One VOA vial

Analysis Requested: Volatile Organics

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Volatile Organics ***	ND	ug/L	**	14	524.2	----	11/18/90

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompany this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABS
VOLATILE ORGANICS ANALYSIS by GC/MS
METHOD 524.2

Alpha Job Number: 905961 Date Reported: 11/19/90
Alpha Sample Number(s): 5961.1 - .4
Method Detection Limit: stated below

COMPOUNDS	
Methylene chloride	0.9 ug/L
1,1-Dichloroethane	1.3 ug/L
Chloroform	0.5 ug/L
Carbon tetrachloride	0.5 ug/L
1,2-Dichloropropane	0.5 ug/L
Dibromochloromethane	0.5 ug/L
1,1,2-Trichloroethane	0.5 ug/L
Tetrachloroethene	0.5 ug/L
Chlorobenzene	1.0 ug/L
Trichlorofluoromethane	1.4 ug/L
1,2-Dichloroethane	0.5 ug/L
1,1,1-Trichloroethane	0.5 ug/L
Bromodichloromethane	0.5 ug/L
trans-1,3-Dichloropropene	1.1 ug/L
cis-1,3-Dichloropropene	1.0 ug/L
Bromoform	0.7 ug/L
1,1,2,2-Tetrachloroethane	0.7 ug/L
Benzene	0.5 ug/L
Toluene	0.9 ug/L
Ethyl benzene	1.3 ug/L
Xylenes	3.3 ug/L
Chloromethane	2.2 ug/L
Bromomethane	0.9 ug/L
Vinyl chloride	0.5 ug/L
Chloroethane	1.2 ug/L
1,1-Dichloroethene	0.5 ug/L
Trans-1,2-dichloroethene	0.5 ug/L
Cis-1,2-dichloroethene	0.5 ug/L
Trichloroethene	0.5 ug/L
1,2-Dichlorobenzene	0.5 ug/L
1,3-Dichlorobenzene	0.5 ug/L
1,4-Dichlorobenzene	0.5 ug/L
Styrene	1.0 ug/L
o-Xylene	1.0 ug/L
1,1-Dichloropropene	1.1 ug/L
2,2-Dichloropropane	1.6 ug/L
1,1,1,2-Tetrachloroethane	0.8 ug/L
1,2,3-Trichloropropane	0.9 ug/L
Bromochloromethane	0.8 ug/L
n-Butylbenzene	2.5 ug/L

ALPHA ANALYTICAL LABS
VOLATILE ORGANICS ANALYSIS by GC/MS
METHOD 524.2
CONTINUED

Alpha Job Number: 905961 Date Reported: 11/19/90
Alpha Sample Number(s): 5961.1 - .4
Method Detection Limit: stated below

COMPOUNDS

Dichlorodifluoromethane	1.7 ug/L
Hexachlorobutadiene	4.1 ug/L
Isopropylbenzene	1.5 ug/L
p-Isopropyltoluene	1.7 ug/L
Naphthalene	1.8 ug/L
n-Propylbenzene	1.3 ug/L
Sec-butylbenzene	2.1 ug/L
Tert-butylbenzene	1.5 ug/L
1,2,3-Trichlorobenzene	3.0 ug/L
1,2,4-Trichlorobenzene	3.0 ug/L
1,2,4-Trimethylbenzene	1.3 ug/L
1,3,5-Trimethylbenzene	1.5 ug/L
Bromobenzene	0.9 ug/L
o-Chlorotoluene	1.3 ug/L
p-Chlorotoluene	1.3 ug/L
Dibromomethane	0.5 ug/L
1,2-Dibromoethane	0.6 ug/L
1,2-Dibromo-3-chloropropane	1.1 ug/L
1,3-Dichloropropane	0.7 ug/L
Methyl tert butyl ether	5.0 ug/L
Iodomethane	-- ug/L
Ethanol	-- ug/L
Ethyl methacrylate	-- ug/L
Acrolien	-- ug/L
Acrylonitrile	-- ug/L
Acetone	-- ug/L

ALPHA ANALYTICAL LABORATORIES

ACCEPTABLE MATRIX SPIKE RECOVERY LIMITS

FOR INORGANICS

PARAMETER GROUP	WATER	SOIL
Metals	75-125 %	60-140 %
Wet Chemistry	70-130 %	N/A

ALPHA ANALYTICAL LABORATORIES

RELATIVE PERCENT DIFFERENCE

CRITERIA FOR DUPLICATE ANALYSIS

PARAMETER GROUP	WATER	SOIL
Organics:		
Volatile Organics	30 %	30 %
Acid/Base/Neutrals	40 %	40 %
Pesticides/PCB's	40 %	40 %
Inorganics:		
Metals	20 %	30 %
Wet Chemistry	30 %	30 %

ALPHA ANALYTICAL LABS
ADDENDUM I
REFERENCES

1. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. EPA SW-846. 1986.

2. Standard Methods for Examination of Water and Waste Water. APHA-AWWA-WPCF. 16th Edition. 1985.

3. Standard Methods for Examination of Water and Waste Water. APHA-AWWA-WPCF. 17th Edition. 1989.

4. Methods for Chemical Analysis of Water and Wastes. EPA 600/4-82-055. 1983.

5. Oil Spill Identification System. CG-D-52-77 U. S. Coast Guard. 1977.

6. Methods for Organic Chemical Analysis of Municipal and Industrial Waste Water. EPA 600/4-82-057. 1982.

7. U. S. Department of Health, Education, and Welfare, National Institute of Occupational Safety and Health. D. G. Taylor, [Manual of Analytical Methods, 2nd Ed., DHEW (NIOSH) Pub. No. 77-237A, 1977.]

8. Handbook of Analytical Quality Control in Water and Wastewater Laboratories. EPA 600/4-79-019. March 1979.

9. The United States Pharmacopeia. The National Formulary. USP 20th Edition. Formulary 15th Edition. 1980.

10. Choosing Cost-Effective QA/QC (Quality Assurance/Quality Control) Programs for Chemical Analysis. PB85-241461. U. S. Department of Commerce, National Technical Information Service. August 1985.

11. Manual of Analytical Quality Control for Pesticides in Human and Environmental Media. PB 261 019. EPA 600/1-76-017. February 1975.

12. Annual Book of ASTM Standards. Sections 0, 3, 4, 5, 6, 8, 9, 11, and 14. American Society for Testing and Materials 1986.

13. Federal Register, part II. 40 CFR, part 261, et al, pp. 11798-11877. March 29, 1990.

14. Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water. Available from USEPA, Cincinnati, 26 West Martin Luther King Drive, Cincinnati, Ohio, 45268.

15. Interim Methods for the Determination of Asbestiform Minerals in Bulk Insulation Samples, Research Triangle Institute, June 1980. Asbestos Containing Materials in School Buildings: A Guidance Document, March 1979, USEPA Document C00090, parts 1 & 2.

16. Interim Methods for the Determination of Asbestos in Bulk Insulation Samples (EPA-600/M4-82-020).

17. "Prescribed Procedures for Measurement of Radioactivity in Drinking Water," Publication EPA-600/4-80-032, U. S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, August 1980.

18. "Clean Harbors Radiological Environmental Analytical Procedures," Clean Harbors Analytical Services, Braintree, MA, October 1985.

19. H. M. Prichard and T. F. Gesell, "Rapid Measurement of RN-222 Concentrations in Water with a Commercial Liquid Scintillation Counter", Health Physics, Volume 33, 1977, pp. 577-581.

20. "Handbook for Analytical Quality Control in Water and Wastewater Laboratories", March 1979, EPA 600/4-79-019.

21. Analysis of PCB's in Transformer Fluid and Waste Oil. EPA 600/4-81-045. 1981.

22. Klute, A. 1986, "Methods of Soil Analysis, Part 1", Methods 15-2.2 and 15-5.1. American Society of Agronomy, Madison, WI.

23. Exhibit No. 1. Petroleum Oils by Gas Chromatography. Alley Young & Baumartner, Inc., Consulting Engineers, PO Box 2036, Brentwood, TN 37024.

PHASE II A
DRILLING WATER
MALONEY WELL
(24 HR. TURNAROUND)

ALPHA ANALYTICAL LABORATORIES

Eight Walkup Drive
Westborough, Massachusetts 01581-1019
(508) 898-9220

MA 086 NH 198958-A CT PH-0574 NY 11148

CERTIFICATE OF ANALYSIS

Client: SEA Consultants, Inc.

Address: 485 Massachusetts Avenue
Cambridge, MA 02139

Attn: Craig Blake

Client Designation: N/A

Laboratory Job Number: 905799

Invoice Number: 90481

Date Received: 10/29/90

Date Reported: 10/30/90

Delivery Method: Alpha Courier

ALPHA SAMPLE NUMBER	CLIENT IDENTIFICATION	SAMPLE LOCATION
905799.1	90072.1V	N/A
905799.2	Trip blank	N/A

Authorized by: Scott McLean
Scott McLean - Laboratory Director

cp

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148

Laboratory Sample Number: 905799.1 **Date Received:** 10/29/90

Sample Matrix: Water **Date Reported:** 10/30/90

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: Four VOA vials and two glass bottles

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	ANALYSIS
Volatile Organics ***	ND	ug/L	**	14	524.2	----	10/30/90
Total Hydrocarbons	ND	mg/L	0.5	3	5520-CDF	10/29/90	10/30/90

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 **NH 198958-A** **CT PH-0574** NY 11148

Laboratory Sample Number: 905799.2 **Date Received:** 10/29/90

Sample Matrix: Water **Date Reported:** 10/30/90

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One VOA vial

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Volatile Organics ***	ND	ug/L	**	14	524.2	----	10/30/90

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABS
VOLATILE ORGANICS ANALYSIS by GC/MS
METHOD 524.2

Alpha Job Number: 905799 Date Reported: 10/30/90
Alpha Sample Number(s): 905799.1-.2
Method Detection Limit: See Below

COMPOUNDS	
Methylene chloride	0.9 ug/L
1,1-Dichloroethane	1.6 ug/L
Chloroform	0.5 ug/L
Carbon tetrachloride	0.5 ug/L
1,2-Dichloropropane	2.0 ug/L
Dibromochloromethane	1.0 ug/L
1,1,2-Trichloroethane	1.7 ug/L
2-Chloroethylvinyl ether	3.3 ug/L
Tetrachloroethene	0.5 ug/L
Chlorobenzene	2.0 ug/L
Trichlorofluoromethane	1.7 ug/L
1,2-Dichloroethane	0.5 ug/L
1,1,1-Trichloroethane	0.5 ug/L
Bromodichloromethane	0.7 ug/L
trans-1,3-Dichloropropene	1.7 ug/L
cis-1,3-Dichloropropene	1.7 ug/L
Bromoform	1.6 ug/L
1,1,2,2-Tetrachloroethane	2.3 ug/L
Benzene	0.5 ug/L
Toluene	2.0 ug/L
Ethyl benzene	2.4 ug/L
Xylenes	3.3 ug/L
Chloromethane	2.7 ug/L
Bromomethane	2.3 ug/L
Vinyl chloride	0.5 ug/L
Chloroethane	2.5 ug/L
1,1-Dichloroethene	0.5 ug/L
Trans-1,2-dichloroethene	0.5 ug/L
Cis-1,2-dichloroethene	0.5 ug/L
Trichloroethene	0.5 ug/L
1,2-Dichlorobenzene	0.5 ug/L
1,3-Dichlorobenzene	0.5 ug/L
1,4-Dichlorobenzene	0.5 ug/L
Acetone	33.4 ug/L
Carbon disulfide	6.7 ug/L
2-Butanone	10.0 ug/L
Vinyl acetate	10.0 ug/L
4-Methyl-2-pentanone	6.7 ug/L
2-Hexanone	6.7 ug/L
Styrene	3.3 ug/L
o-Xylene	3.3 ug/L

ALPHA ANALYTICAL LABS
VOLATILE ORGANICS ANALYSIS by GC/MS
METHOD 524.2
CONTINUED

Alpha Job Number: 905799 Date Reported: 10/30/90
Alpha Sample Number(s): 905799.1-.2
Method Detection Limit: See Below

COMPOUNDS	
1,1-Dichloropropene	10.0 ug/L
2,2-Dichloropropane	10.0 ug/L
1,1,1,2-Tetrachloroethane	10.0 ug/L
1,2,3-Trichloropropane	10.0 ug/L
Bromochloromethane	10.0 ug/L
n-Butylbenzene	10.0 ug/L
Dichlorodifluoromethane	10.0 ug/L
Hexachlorobutadiene	10.0 ug/L
Isopropylbenzene	10.0 ug/L
p-Isopropyltoluene	10.0 ug/L
Naphthalene	10.0 ug/L
n-Propylbenzene	10.0 ug/L
Sec-butylbenzene	10.0 ug/L
Tert-butylbenzene	10.0 ug/L
1,2,3-Trichlorobenzene	10.0 ug/L
1,2,4-Trichlorobenzene	10.0 ug/L
1,2,4-Trimethylbenzene	10.0 ug/L
1,3,5-Trimethylbenzene	10.0 ug/L
Bromobenzene	10.0 ug/L
o-Chlorotoluene	10.0 ug/L
p-Chlorotoluene	10.0 ug/L
Dibromomethane	10.0 ug/L
1,2-Dibromoethane	10.0 ug/L
1,2-Dibromo-3-chloropropane	10.0 ug/L
1,3-Dichloropropane	10.0 ug/L

ALPHA ANALYTICAL LABS
ADDENDUM I
REFERENCES

1. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. EPA SW-846. 1986.

2. Standard Methods for Examination of Water and Waste Water. APHA-AWWA-WPCF. 16th Edition. 1985.

3. Standard Methods for Examination of Water and Waste Water. APHA-AWWA-WPCF. 17th Edition. 1989.

4. Methods for Chemical Analysis of Water and Wastes. EPA 600/4-82-055. 1983.

5. Oil Spill Identification System. CG-D-52-77 U. S. Coast Guard. 1977.

6. Methods for Organic Chemical Analysis of Municipal and Industrial Waste Water. EPA 600/4-82-057. 1982.

7. U. S. Department of Health, Education, and Welfare, National Institute of Occupational Safety and Health. D. G. Taylor, [Manual of Analytical Methods, 2nd Ed., DHEW (NIOSH) Pub. No. 77-237A, 1977.]

8. Handbook of Analytical Quality Control in Water and Wastewater Laboratories. EPA 600/4-79-019. March 1979.

9. The United States Pharmacopeia. The National Formulary. USP 20th Edition. Formulary 15th Edition. 1980.

10. Choosing Cost-Effective QA/QC (Quality Assurance/Quality Control) Programs for Chemical Analysis. PB85-241461. U. S. Department of Commerce, National Technical Information Service. August 1985.

11. Manual of Analytical Quality Control for Pesticides in Human and Environmental Media. PB 261 019. EPA 600/1-76-017. February 1975.

12. Annual Book of ASTM Standards. Sections 0, 3, 4, 5, 6, 8, 9, 11, and 14. American Society for Testing and Materials 1986.

13. Federal Register, part II. 40 CFR, part 261, et al, pp. 11798-11877. March 29, 1990.

14. Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water. Available from USEPA, Cincinnati, 26 West Martin Luther King Drive, Cincinnati, Ohio, 45268.

15. Interim Methods for the Determination of Asbestiform Minerals in Bulk Insulation Samples, Research Triangle Institute, June 1980. Asbestos Containing Materials in School Buildings: A Guidance Document, March 1979, USEPA Document C00090, parts 1 & 2.

16. Interim Methods for the Determination of Asbestos in Bulk Insulation Samples (EPA-600/M4-82-020).

17. "Prescribed Procedures for Measurement of Radioactivity in Drinking Water," Publication EPA-600/4-80-032, U. S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, August 1980.

18. "Clean Harbors Radiological Environmental Analytical Procedures," Clean Harbors Analytical Services, Braintree, MA, October 1985.

19. H. M. Prichard and T. F. Gesell, "Rapid Measurement of RN-222 Concentrations in Water with a Commercial Liquid Scintillation Counter", Health Physics, Volume 33, 1977, pp. 577-581.

20. "Handbook for Analytical Quality Control in Water and Wastewater Laboratories", March 1979, EPA 600/4-79-019.

21. Analysis of PCB's in Transformer Fluid and Waste Oil. EPA 600/4-81-045. 1981.

22. Klute, A. 1986, "Methods of Soil Analysis, Part 1", Methods 15-2.2 and 15-5.1. American Society of Agronomy, Madison, WI.

23. Exhibit No. 1. Petroleum Oils by Gas Chromatography. Alley Young & Baumartner, Inc., Consulting Engineers, PO Box 2036, Brentwood, TN 37024.

EST
ENVIRONMENTAL
SAMPLING
TECHNOLOGY

■ 14 Grant Street ■ Framingham, MA 01701 ■ (508) 620-0002

SAMPLING REPORT

Client: **SEA Consultants, Inc.**
485 Massachusetts Avenue
Cambridge, MA 02139
(617) 497-7800
Contact: Craig E. Blake, P.E.

Sampling Program

EST Sampling Technicians: John E. Carlin
Patrick A. Falla

Project: Hendrick Street Wellfield Study

SEA Project No.: 90072.1

Dates of Sampling: December 3, 1990
December 5, 1990

Laboratory: Alpha Analytical Labs
8 Walkup Drive
Westborough, MA 01581
(508) 898-9220
Contact: Jim Roth

Survey Discussion

EST technicians collected samples from thirteen 2" monitoring wells on-site, ten on December 3 and the remaining wells on December 5. Static water level was recorded for each well prior to purging. Three well volumes were purged from each well prior to sample collection, and measurements of pH, temperature and conductivity were recorded. Results are shown in Table 1.

Samples were split into appropriately preserved containers provided by the lab, including equipment blanks for each day of sampling (trip blanks were provided by the lab). Samples were placed on blue ice for transport to the lab, along with associated Chain of Custody documentation.

Table 1

FIELD MEASUREMENTS
SEA CONSULTANTS, INC.

HENDRICK STREET WELLFIELD STUDY

Well ID	Sample Date	Well Depth (feet)	Water Level (feet)	pH	Temperature (°C)	Specific Conduct (mhos)
1	12/5/90	59.73	40.94	7.01	7.5	109
2	12/3/90	17.73	10.05	6.63	8.9	90
3*						
4S* (4B)						
4D (4A)	12/3/90	110.32	71.67	6.92	6.5	170
5S (5B)	12/3/90	62.36	32.27	7.31	8.5	130
5D (5A)	12/3/90	101.15	32.32	7.13	8.0	140
6	12/3/90	5.00	1.68	6.77	5.0	650
7*						
8	12/3/90	21.15	8.38	6.5	10.5	410
M1	12/5/90	90.30	2.59	6.96	7.2	90
M2	12/5/90	17.94	1.92	7.02	5.5	45
M6	12/3/90	83.05	5.63	6.81	7.5	120

* No sample attainable.

APPENDIX C - Phase IIB Chemical Analyses Reports

MAY & JUNE 1991
WATER SAMPLES

PHASE IIB WELLS
PHASE II A WELLS

TOTAL IRON & MANGANESE
SEE 7/5/91 REPORT
FOR SOLUABLE

ALPHA ANALYTICAL LABORATORIES

Eight Walkup Drive
Westborough, Massachusetts 01581-1019
(508) 898-9220

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

CERTIFICATE OF ANALYSIS

Client: SEA Consultants, Inc.

Address: 485 Massachusetts Avenue
Cambridge, MA 02139

Attn: Erin Healy

Client Designation: Project Holyoke/
S. Hampton Wells

Laboratory Job Number: 913169

Invoice Number: 21465

Date Received: 05/23/91

Date Reported: 06/06/91

Delivery Method: EST

ALPHA SAMPLE NUMBER	CLIENT IDENTIFICATION	SAMPLE LOCATION
913169.1	MW-9C	Brook Street
913169.2	MW-11A	Brook Street
913169.2D	MW-11A (Duplicate)	Brook Street
913169.3	MW-6	Brook Street
913169.3S	MW-6 (Spike Recovery)	Brook Street
913169.4	MW-8	Brook Street
913169.5	MW-M6	Brook Street
913169.6	MW-2	Brook Street
913169.7	MW-1	Brook Street

Authorized by: [signature]
Scott McLean - Laboratory Director

cp

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 913169.1 Date Received: 05/23/91

Sample Matrix: Water Date Reported: 06/06/91

Condition of Samples: Satisfactory Field Prep: None

Number & Type of Containers: One plastic bottle & two VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Total Metals Preparation	--	--	--	1	3050	05/28/91	--------
Iron	132	mg/L	0.01	1	6010	----	05/29/91
Manganese	3.58	mg/L	0.01	1	6010	----	05/29/91
Volatile Organics ***							
Trichloroethene	5.7	ug/L	**	14	524.2	----	06/05/91

Volatile Organics	%Surrogate Recovery
1,2-Dichloroethane-d4	86%
Toluene-d8	87%
4-Bromofluorobenzene	89%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 913169.2 **Date Received:** 05/23/91

Sample Matrix: Water **Date Reported:** 06/06/91

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One plastic bottle & two VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Total Metals Preparation	--	--	--	1	3050	05/28/91	--------
Iron	50.7	mg/L	0.01	1	6010	----	05/29/91
Manganese	6.05	mg/L	0.01	1	6010	----	05/29/91
Volatile Organics ***	ND	ug/L	**	14	524.2	----	06/05/91

Volatile Organics	%Surrogate Recovery
1,2-Dichloroethane-d4	88%
Toluene-d8	117%
4-Bromofluorobenzene	104%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 913169.2D

Date Received: 05/23/91

Sample Matrix: Water

Date Reported: 06/06/91

Condition of Samples: Satisfactory

Field Prep: None

Number & Type of Containers: One plastic bottle & two VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	SAMPLE RESULT	DUPLICATE RESULT	%RPD
Total Metals			
Iron	50.7	47.5	7
Manganese	6.05	6.09	1

COMMENTS: * Complete list of References found in Addendum I

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 913169.3 **Date Received:** 05/23/91

Sample Matrix: Water **Date Reported:** 06/06/91

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One plastic bottle & two VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Total Metals Preparation	--	--	--	1	3050	05/28/91	--------
Iron	22.1	mg/L	0.01	1	6010	----	05/29/91
Manganese	0.25	mg/L	0.01	1	6010	----	05/29/91
Volatile Organics ***	ND	ug/L	**	14	524.2	----	06/05/91

Volatile Organics	%Surrogate Recovery
1,2-Dichloroethane-d4	100%
Toluene-d8	112%
4-Bromofluorobenzene	103%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 913169.3S **Date Received:** 05/23/91

Sample Matrix: Water **Date Reported:** 06/06/91

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One plastic bottle & two VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	%RECOVERY
Total Manganese	101%

COMMENTS: * Complete list of References found in Addendum I

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 913169.4 **Date Received:** 05/23/91

Sample Matrix: Water **Date Reported:** 06/06/91

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One plastic bottle & two VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Total Metals Preparation	--	--	--	1	3050	05/28/91	---------
Iron	202	mg/L	0.01	1	6010	----	05/29/91
Manganese	1.72	mg/L	0.01	1	6010	----	05/29/91
Volatile Organics ***	ND	ug/L	**	14	524.2	----	06/05/91

Volatile Organics	%Surrogate Recovery
1,2-Dichloroethane-d4	87%
Toluene-d8	110%
4-Bromofluorobenzene	104%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086   NH 198958-A   CT PH-0574   NY 11148   NC 320   SC 88006

Laboratory Sample Number: 913169.5   **Date Received:** 05/23/91

Sample Matrix: Water   **Date Reported:** 06/06/91

Condition of Samples: Satisfactory   **Field Prep:** None

Number & Type of Containers: One plastic bottle & two VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Total Metals Preparation	--	--	--	1	3050	05/28/91	--------
Iron	37.9	mg/L	0.01	1	6010	----	05/29/91
Manganese	3.06	mg/L	0.01	1	6010	----	05/29/91
Volatile Organics ***	ND	ug/L	**	14	524.2	----	06/06/91

Volatile Organics	%Surrogate Recovery
1,2-Dichloroethane-d4	86%
Toluene-d8	93%
4-Bromofluorobenzene	106%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 913169.6 **Date Received:** 05/23/91

Sample Matrix: Water **Date Reported:** 06/06/91

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One plastic bottle & two VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Total Metals Preparation	--	--	--	1	3050	05/28/91	--------
Iron	47.8	mg/L	0.01	1	6010	----	05/29/91
Manganese	1.44	mg/L	0.01	1	6010	----	05/29/91
Volatile Organics ***	ND	ug/L	**	14	524.2	----	06/06/91

Volatile Organics	%Surrogate Recovery
1,2-Dichloroethane-d4	91%
Toluene-d8	95%
4-Bromofluorobenzene	99%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 913169.7 **Date Received:** 05/23/91

Sample Matrix: Water **Date Reported:** 06/06/91

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One plastic bottle & two VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Total Metals Preparation	--	--	--	1	3050	05/28/91	--------
Iron	32.7	mg/L	0.01	1	6010	----	05/29/91
Manganese	2.57	mg/L	0.01	1	6010	----	05/29/91
Volatile Organics ***	ND	ug/L	**	14	524.2	----	06/06/91

Volatile Organics	%Surrogate Recovery
1,2-Dichloroethane-d4	113%
Toluene-d8	93%
4-Bromofluorobenzene	99%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABS
VOLATILE ORGANICS ANALYSIS by GC/MS
METHOD 524.2

Alpha Job Number: 913169 Date Reported: 6/6/91
Alpha Sample Number(s): 913169.1-.7
Method Detection Limit: Stated Below

COMPOUNDS	
Methylene chloride	0.9 ug/L
1,1-Dichloroethane	1.6 ug/L
Chloroform	0.5 ug/L
Carbon tetrachloride	0.5 ug/L
1,2-Dichloropropane	2.0 ug/L
Dibromochloromethane	1.0 ug/L
1,1,2-Trichloroethane	1.7 ug/L
2-Chloroethylvinyl ether	3.3 ug/L
Tetrachloroethene	0.5 ug/L
Chlorobenzene	2.0 ug/L
Trichlorofluoromethane	1.7 ug/L
1,2-Dichloroethane	0.5 ug/L
1,1,1-Trichloroethane	0.5 ug/L
Bromodichloromethane	0.7 ug/L
trans-1,3-Dichloropropene	1.7 ug/L
cis-1,3-Dichloropropene	1.7 ug/L
Bromoform	1.6 ug/L
1,1,2,2-Tetrachloroethane	2.3 ug/L
Benzene	0.5 ug/L
Toluene	2.0 ug/L
Ethyl benzene	2.4 ug/L
Xylenes	3.3 ug/L
Chloromethane	2.7 ug/L
Bromomethane	2.3 ug/L
Vinyl chloride	0.5 ug/L
Chloroethane	2.5 ug/L
1,1-Dichloroethene	0.5 ug/L
Trans-1,2-dichloroethene	0.5 ug/L
Cis-1,2-dichloroethene	0.5 ug/L
Trichloroethene	0.5 ug/L
1,2-Dichlorobenzene	0.5 ug/L
1,3-Dichlorobenzene	0.5 ug/L
1,4-Dichlorobenzene	0.5 ug/L
Acetone	33.4 ug/L
Carbon disulfide	6.7 ug/L
2-Butanone	10.0 ug/L
Vinyl acetate	10.0 ug/L
4-Methyl-2-pentanone	6.7 ug/L
2-Hexanone	6.7 ug/L
Styrene	3.3 ug/L
o-Xylene	3.3 ug/L

ALPHA ANALYTICAL LABS
VOLATILE ORGANICS ANALYSIS by GC/MS
METHOD 524.2
CONTINUED (Page 2 of 2)

Alpha Job Number: 913169 Date Reported: 6/6/91
Alpha Sample Number(s): 913169.1-.7
Method Detection Limit: Stated Below

COMPOUNDS	
1,1-Dichloropropene	10.0 ug/L
2,2-Dichloropropane	10.0 ug/L
1,1,1,2-Tetrachloroethane	10.0 ug/L
1,2,3-Trichloropropane	10.0 ug/L
Bromochloromethane	10.0 ug/L
n-Butylbenzene	10.0 ug/L
Dichlorodifluoromethane	10.0 ug/L
Hexachlorobutadiene	10.0 ug/L
Isopropylbenzene	10.0 ug/L
p-Isopropyltoluene	10.0 ug/L
Naphthalene	10.0 ug/L
n-Propylbenzene	10.0 ug/L
Sec-butylbenzene	10.0 ug/L
Tert-butylbenzene	10.0 ug/L
1,2,3-Trichlorobenzene	10.0 ug/L
1,2,4-Trichlorobenzene	10.0 ug/L
1,2,4-Trimethylbenzene	10.0 ug/L
1,3,5-Trimethylbenzene	10.0 ug/L
Bromobenzene	10.0 ug/L
o-Chlorotoluene	10.0 ug/L
p-Chlorotoluene	10.0 ug/L
Dibromomethane	10.0 ug/L
1,2-Dibromoethane	10.0 ug/L
1,2-Dibromo-3-chloropropane	10.0 ug/L
1,3-Dichloropropane	10.0 ug/L

ALPHA ANALYTICAL LABORATORIES

RELATIVE PERCENT DIFFERENCE

CRITERIA FOR DUPLICATE ANALYSIS

PARAMETER GROUP	WATER	SOIL
Organics:		
Volatile Organics	30 %	30 %
Acid/Base/Neutrals	40 %	40 %
Pesticides/PCB's	40 %	40 %
Inorganics:		
Metals	20 %	30 %
Wet Chemistry	30 %	30 %

ALPHA ANALYTICAL LABORATORIES

ACCEPTABLE MATRIX SPIKE RECOVERY LIMITS

FOR INORGANICS

PARAMETER GROUP	WATER	SOIL
Metals	75-125 %	60-140 %
Wet Chemistry	70-130 %	N/A

ALPHA ANALYTICAL LABORATORIES

ACCEPTABLE SURROGATE SPIKE RECOVERY LIMITS

FRACTION	SURROGATE COMPOUND	LOW/MEDIUM WATER	LOW/MEDIUM SOIL/SEDIMENT
VOA	Toluene-d_8	88-110 %	81-117 %
VOA	4-Bromofluorobenzene	86-115 %	74-121 %
VOA	1,2-Dichloroethane-d_4	76-114 %	70-121 %
BNA	Nitrobenzene-d_5	35-114 %	23-120 %
BNA	2-Fluorobiphenyl	43-116 %	30-115 %
BNA	p-Terphenyl-d_{14}	33-141 %	18-137 %
BNA	Phenol-d_5	10-94 %	24-113 %
BNA	2-Fluorophenol	21-100 %	25-121 %
BNA	2,4,6-Tribromophenol	10-123 %	19-122 %
Pest.	Dibutylchlorendate	24-154 %	20-150 %

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574

NY 11148 NC 320

Laboratory Sample Number: 906147.4 **Date Received:** 11/14/90

Sample Matrix: Soil (results on a dry weight basis) **Date Reported:** 11/28/90

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One glass jar

Analysis Requested: Analysis as listed below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Total Solids	85	%	0.1	3	2540B	----	11/23/90
Total Petroleum Hydrocarbons	ND	mg/Kg	40	3	5520CDF	11/22/90	11/23/90
Volatile Organics ***	ND	ug/Kg	**	1	8260	11/16/90	11/22/90

Volatile Organics	% Surrogate Recovery
1,2-Dichloroethane-d4	89%
Toluene-d8	100%
4-Bromofluorobenzene	123%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompany this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABS
ADDENDUM I
REFERENCES

1. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. EPA SW-846. 1986.

2. Standard Methods for Examination of Water and Waste Water. APHA-AWWA-WPCF. 16th Edition. 1985.

3. Standard Methods for Examination of Water and Waste Water. APHA-AWWA-WPCF. 17th Edition. 1989.

4. Methods for Chemical Analysis of Water and Wastes. EPA 600/4-82-055. 1983.

5. Oil Spill Identification System. CG-D-52-77 U. S. Coast Guard. 1977.

6. Methods for Organic Chemical Analysis of Municipal and Industrial Waste Water. EPA 600/4-82-057. 1982.

7. U. S. Department of Health & Human Services, National Institute of Occupational Safety and Health. Peter M. Eller, NIOSH Manual of Analytical Methods, Third Edition, 1984.

8. Handbook of Analytical Quality Control in Water and Wastewater Laboratories. EPA 600/4-79-019. March 1979.

9. The United States Pharmacopeia. The National Formulary. USP 20th Edition. Formulary 15th Edition. 1980.

10. Choosing Cost-Effective QA/QC (Quality Assurance/Quality Control) Programs for Chemical Analysis. PB85-241461. U. S. Department of Commerce, National Technical Information Service. August 1985.

11. Manual of Analytical Quality Control for Pesticides in Human and Environmental Media. PB 261 019. EPA 600/1-76-017. February 1975.

12. Annual Book of ASTM Standards. Sections 0, 3, 4, 5, 6, 8, 9, 11, and 14. American Society for Testing and Materials 1986.

13. 40 CFR Part 261, App. II. Method 1311 Toxicity Characteristic Leaching Procedure (TCLP). July 1, 1990 Edition.

14. Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water. Available from USEPA, Cincinnati, 26 West Martin Luther King Drive, Cincinnati, Ohio, 45268.

15. Interim Methods for the Determination of Asbestiform Minerals in Bulk Insulation Samples, Research Triangle Institute, June 1980. Asbestos Containing Materials in School Buildings: A Guidance Document, March 1979, USEPA Document C00090, parts 1 & 2.

16. Interim Methods for the Determination of Asbestos in Bulk Insulation Samples (EPA-600/M4-82-020).

17. "Prescribed Procedures for Measurement of Radioactivity in Drinking Water," Publication EPA-600/4-80-032, U. S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, August 1980.

18. "Clean Harbors Radiological Environmental Analytical Procedures," Clean Harbors Analytical Services, Braintree, MA, October 1985.

19. H. M. Prichard and T. F. Gesell, "Rapid Measurement of RN-222 Concentrations in Water with a Commercial Liquid Scintillation Counter", Health Physics, Volume 33, 1977, pp. 577-581.

20. "Handbook for Analytical Quality Control in Water and Wastewater Laboratories", March 1979, EPA 600/4-79-019.

21. Analysis of PCB's in Transformer Fluid and Waste Oil. EPA 600/4-81-045. 1981.

22. Klute, A. 1986, "Methods of Soil Analysis, Part 1", Methods 15-2.2 and 15-5.1. American Society of Agronomy, Madison, WI.

23. Exhibit No. 1. Petroleum Oils by Gas Chromatography. Alley, Young & Baumartner, Inc., Consulting Engineers, P.O. Box 2036, Brentwood, TN 37024.

24. Principal Organic Hazardous Constituents and Products of Incomplete Combustion Screening Protocol. Southern Research Institute, October 1989.

REFERENCES

1. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. EPA SW-846. 1986.

2. Standard Methods for Examination of Water and Waste Water. APHA-AWWA-WPCF. 16th Edition. 1985.

3. Standard Methods for Examination of Water and Waste Water. APHA-AWWA-WPCF. 17th Edition. 1989.

4. Methods for Chemical Analysis of Water and Wastes. EPA 600/4-82-055. 1983.

5. Oil Spill Identification System. CG-D-52-77 U. S. Coast Guard. 1977.

6. Methods for Organic Chemical Analysis of Municipal and Industrial Waste Water. EPA 600/4-82-057. 1982.

7. U. S. Department of Health & Human Services, National Institute of Occupational Safety and Health. Peter M. Eller, NIOSH Manual of Analytical Methods, Third Edition, 1984.

8. Handbook of Analytical Quality Control in Water and Wastewater Laboratories. EPA 600/4-79-019. March 1979.

9. The United States Pharmacopeia. The National Formulary. USP 20th Edition. Formulary 15th Edition. 1980.

10. Choosing Cost-Effective QA/QC (Quality Assurance/Quality Control) Programs for Chemical Analysis. PB85-241461. U. S. Department of Commerce, National Technical Information Service. August 1985.

11. Manual of Analytical Quality Control for Pesticides in Human and Environmental Media. PB 261 019. EPA 600/1-76-017. February 1975.

12. Annual Book of ASTM Standards. Sections 0, 3, 4, 5, 6, 8, 9, 11, and 14. American Society for Testing and Materials 1986.

13. 40 CFR Part 261, App. II. Method 1311 Toxicity Characteristic Leaching Procedure (TCLP). July 1, 1990 Edition.

14. Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water. Available from USEPA, Cincinnati, 26 West Martin Luther King Drive, Cincinnati, Ohio, 45268.

15. Interim Methods for the Determination of Asbestiform Minerals in Bulk Insulation Samples, Research Triangle Institute, June 1980. Asbestos Containing Materials in School Buildings: A Guidance Document, March 1979, USEPA Document C00090, parts 1 & 2.

16. Interim Methods for the Determination of Asbestos in Bulk Insulation Samples (EPA-600/M4-82-020).

17. "Prescribed Procedures for Measurement of Radioactivity in Drinking Water," Publication EPA-600/4-80-032, U. S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, August 1980.

18. "Clean Harbors Radiological Environmental Analytical Procedures," Clean Harbors Analytical Services, Braintree, MA, October 1985.

19. H. M. Prichard and T. F. Gesell, "Rapid Measurement of RN-222 Concentrations in Water with a Commercial Liquid Scintillation Counter", Health Physics, Volume 33, 1977, pp. 577-581.

20. "Handbook for Analytical Quality Control in Water and Wastewater Laboratories", March 1979, EPA 600/4-79-019.

21. Analysis of PCB's in Transformer Fluid and Waste Oil. EPA 600/4-81-045. 1981.

22. Klute, A. 1986, "Methods of Soil Analysis, Part 1", Methods 15-2.2 and 15-5.1. American Society of Agronomy, Madison, WI.

23. Exhibit No. 1. Petroleum Oils by Gas Chromatography. Alley, Young & Baumartner, Inc., Consulting Engineers, P.O. Box 2036, Brentwood, TN 37024.

24. Principal Organic Hazardous Constituents and Products of Incomplete Combustion Screening Protocol. Southern Research Institute, October 1989.

EST
ENVIRONMENTAL
SAMPLING
TECHNOLOGY

■ 14 Grant Street ■ Framingham, MA 01701 ■ (508) 620-0002

Special Instructions: page 1 of 2

CHAIN OF CUSTODY RECORD

Contact

Client Job #

Site Name: Holyoke / S. Hampton Wells : SEA

Delivered To:

Client Job #	Location/Sample Identification	Matrix Type	# /Type of Container	Date/Time Sample Taken	Analysis
SEA	mw-9C Brook St.	H_2O	1 p	5/22 1158	T Fe Mn
	" "		2 V	" "	526
	mw 11A		1 p	5/22 - 1205	T Fe, Mn
	"		2 V	" "	526
	mw 6		1 p	" - 13:45	T Fe, Mn
	"		2 V	" "	526
	mw 8		1 p	" 1408	T Fe, Mn
	"		2 V	" "	526
	mw - m6		1 p	" 1455	T Fe, Mn
	"		2 V	"	526
	mw - 2		1 p	" 1615	T Fe, Mn
			2 V	"	526

Relinquished By (Site) [signature]

Received By (EST)
1. Joe Watkins
2.

Received By (Lab) [signature] 5/23 10:10

CONTAINER CODE
P - Plastic
G - Glass
AG - Amber Glass
V - VOA Vial
S - Soil Jar

MATRIX CODE
W - Water
L - Liquid
S - Soil
SL - Sludge
O - Other

EST
ENVIRONMENTAL
SAMPLING
TECHNOLOGY

■ 14 Grant Street ■ Framingham, MA 01701 ■ (508) 620-0002

Special Instructions:
(page 2 of 2)

CHAIN OF CUSTODY RECORD

Contact

Client Job #	Site Name:				
	Delivered To:				
	Location/Sample Identification	Matrix Type	# /Type of Container	Date/Time Sample Taken	Analysis
SEA	RW1	H_2O	1 P	5/22 1655	T Fe, Mn
"	"	"	2 V	" "	526

Relinquished By (Site)
[signature]

Received By (EST)
1. Joe Watkins
2.

Received By (Lab)
[signature]
5/23 10:10

CONTAINER CODE
P - Plastic
G - Glass
AG - Amber Glass
V - VOA Vial
S - Soil Jar

MATRIX CODE
W - Water
L - Liquid
S - Soil
SL - Sludge
O - Other

ALPHA ANALYTICAL LABORATORIES

Eight Walkup Drive
Westborough, Massachusetts 01581-1019
(508) 898-9220

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

CERTIFICATE OF ANALYSIS

Client: SEA Consultants, Inc.

Address: 485 Massachusetts Avenue

Cambridge, MA 02139

Attn: Erin Healy

Client Designation: N/A

Laboratory Job Number: 913138

Invoice Number: 21457

Date Received: 05/22/91

Date Reported: 06/05/91

Delivery Method: EST

ALPHA SAMPLE NUMBER	CLIENT IDENTIFICATION	SAMPLE LOCATION
913138.1	MW-9A	Easthampton
913138.2	MW-5S (MW-5B)	Easthampton
913138.3	MW-5D (MW-5A)	Easthampton
913138.4	MW-10A	Easthampton
913138.5	MW-10B	Easthampton
913138.6	MW-4D (MW-4A)	Easthampton

Authorized by: Scott McLean
Scott McLean - Laboratory Director

cp

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 913138.1 **Date Received:** 05/22/91

Sample Matrix: Liquid **Date Reported:** 06/05/91

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One plastic bottle & two VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Total Metals Preparation	--	--	--	1	3050	05/28/91	--------
Iron	2.13	mg/L	0.01	1	6010	----	05/29/91
Manganese	ND	mg/L	0.01	1	6010	----	05/29/91
Volatile Organics ***							
Trichloroethene	12	ug/L	**	14	524.2	----	06/05/91

Volatile Organics	%Surrogate Recovery
1,2-Dichloroethane-d4	87%
Toluene-d8	88%
4-Bromofluorobenzene	106%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 913138.2 **Date Received:** 05/22/91

Sample Matrix: Liquid **Date Reported:** 06/05/91

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One plastic bottle & two VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Total Metals Preparation	--	--	--	1	3050	05/28/91	--------
Iron	17.8	mg/L	0.01	1	6010	----	05/29/91
Manganese	0.76	mg/L	0.01	1	6010	----	05/29/91
Volatile Organics ***							
Trichloroethene	0.5	ug/L	**	14	524.2	----	06/05/91

Volatile Organics	%Surrogate Recovery
1,2-Dichloroethane-d4	87%
Toluene-d8	88%
4-Bromofluorobenzene	98%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 913138.2D **Date Received:** 05/22/91

Sample Matrix: Liquid **Date Reported:** 06/05/91

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One plastic bottle & two VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	SAMPLE RESULT	DUPLICATE RESULT	%RPD
Total Metals			
Iron	17.8	19.1	7
Manganese	0.76	0.80	5

COMMENTS: * Complete list of References found in Addendum I

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 913138.3 **Date Received:** 05/22/91

Sample Matrix: Liquid **Date Reported:** 06/05/91

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One plastic bottle & two VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Total Metals Preparation	--	--	--	1	3050	05/28/91	--------
Iron	16.1	mg/L	0.01	1	6010	----	05/29/91
Manganese	0.27	mg/L	0.01	1	6010	----	05/29/91
Volatile Organics ***							
Trichloroethene	1.0	ug/L	**	14	524.2	----	06/05/91

Volatile Organics	%Surrogate Recovery
1,2-Dichloroethane-d4	93%
Toluene-d8	91%
4-Bromofluorobenzene	104%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 913138.4 **Date Received:** 05/22/91

Sample Matrix: Liquid **Date Reported:** 06/05/91

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One plastic bottle & two VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Total Metals Preparation	--	--	--	1	3050	05/28/91	--------
Iron	45.8	mg/L	0.01	1	6010	----	05/29/91
Manganese	1.50	mg/L	0.01	1	6010	----	05/29/91
Volatile Organics ***	ND	ug/L	**	14	524.2	----	06/05/91

Volatile Organics	%Surrogate Recovery
1,2-Dichloroethane-d4	90%
Toluene-d8	88%
4-Bromofluorobenzene	104%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086   NH 198958-A   CT PH-0574   NY 11148   NC 320   SC 88006

Laboratory Sample Number: 913138.5   **Date Received:** 05/22/91

Sample Matrix: Liquid   **Date Reported:** 06/05/91

Condition of Samples: Satisfactory   **Field Prep:** None

Number & Type of Containers: One plastic bottle & two VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Total Metals Preparation	--	--	--	1	3050	05/28/91	--------
Iron	24.1	mg/L	0.01	1	6010	----	05/29/91
Manganese	1.43	mg/L	0.01	1	6010	----	05/29/91
Volatile Organics ***	ND	ug/L	**	14	524.2	----	06/05/91

Volatile Organics	%Surrogate Recovery
1,2-Dichloroethane-d4	91%
Toluene-d8	79%
4-Bromofluorobenzene	103%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086   NH 198958-A   CT PH-0574   NY 11148   NC 320   SC 88006

Laboratory Sample Number: 913138.6 **Date Received:** 05/22/91

Sample Matrix: Liquid **Date Reported:** 06/05/91

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One plastic bottle & two VOA vials

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Total Metals Preparation	--	--	--	1	3050	05/28/91	--------
Iron	32.3	mg/L	0.01	1	6010	----	05/29/91
Manganese	1.68	mg/L	0.01	1	6010	----	05/29/91
Volatile Organics ***	ND	ug/L	**	14	524.2	----	06/05/91

Volatile Organics	%Surrogate Recovery
1,2-Dichloroethane-d4	89%
Toluene-d8	89%
4-Bromofluorobenzene	102%

COMMENTS:
* Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 913138.7 **Date Received:** 05/22/91

Sample Matrix: Liquid **Date Reported:** 06/05/91

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One VOA vial

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Volatile Organics ***	ND	ug/L	**	14	524.2	----	06/05/91

Volatile Organics	%Surrogate Recovery
1,2-Dichloroethane-d4	82%
Toluene-d8	87%
4-Bromofluorobenzene	105%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABS
VOLATILE ORGANICS ANALYSIS by GC/MS
METHOD 524.2

Alpha Job Number: 913138 Date Reported: 6/5/91
Alpha Sample Number(s): 913138.1-.7
Method Detection Limit: Stated Below

COMPOUNDS	
Methylene chloride	0.9 ug/L
1,1-Dichloroethane	1.6 ug/L
Chloroform	0.5 ug/L
Carbon tetrachloride	0.5 ug/L
1,2-Dichloropropane	2.0 ug/L
Dibromochloromethane	1.0 ug/L
1,1,2-Trichloroethane	1.7 ug/L
2-Chloroethylvinyl ether	3.3 ug/L
Tetrachloroethene	0.5 ug/L
Chlorobenzene	2.0 ug/L
Trichlorofluoromethane	1.7 ug/L
1,2-Dichloroethane	0.5 ug/L
1,1,1-Trichloroethane	0.5 ug/L
Bromodichloromethane	0.7 ug/L
trans-1,3-Dichloropropene	1.7 ug/L
cis-1,3-Dichloropropene	1.7 ug/L
Bromoform	1.6 ug/L
1,1,2,2-Tetrachloroethane	2.3 ug/L
Benzene	0.5 ug/L
Toluene	2.0 ug/L
Ethyl benzene	2.4 ug/L
Xylenes	3.3 ug/L
Chloromethane	2.7 ug/L
Bromomethane	2.3 ug/L
Vinyl chloride	0.5 ug/L
Chloroethane	2.5 ug/L
1,1-Dichloroethene	0.5 ug/L
Trans-1,2-dichloroethene	0.5 ug/L
Cis-1,2-dichloroethene	0.5 ug/L
Trichloroethene	0.5 ug/L
1,2-Dichlorobenzene	0.5 ug/L
1,3-Dichlorobenzene	0.5 ug/L
1,4-Dichlorobenzene	0.5 ug/L
Acetone	33.4 ug/L
Carbon disulfide	6.7 ug/L
2-Butanone	10.0 ug/L
Vinyl acetate	10.0 ug/L
4-Methyl-2-pentanone	6.7 ug/L
2-Hexanone	6.7 ug/L
Styrene	3.3 ug/L
o-Xylene	3.3 ug/L

ALPHA ANALYTICAL LABS
VOLATILE ORGANICS ANALYSIS by GC/MS
METHOD 524.2
CONTINUED (Page 2 of 2)

Alpha Job Number: 913138 Date Reported: 6/5/91
Alpha Sample Number(s): 913138.1-.7
Method Detection Limit: Stated Below

COMPOUNDS

1,1-Dichloropropene	10.0 ug/L
2,2-Dichloropropane	10.0 ug/L
1,1,1,2-Tetrachloroethane	10.0 ug/L
1,2,3-Trichloropropane	10.0 ug/L
Bromochloromethane	10.0 ug/L
n-Butylbenzene	10.0 ug/L
Dichlorodifluoromethane	10.0 ug/L
Hexachlorobutadiene	10.0 ug/L
Isopropylbenzene	10.0 ug/L
p-Isopropyltoluene	10.0 ug/L
Naphthalene	10.0 ug/L
n-Propylbenzene	10.0 ug/L
Sec-butylbenzene	10.0 ug/L
Tert-butylbenzene	10.0 ug/L
1,2,3-Trichlorobenzene	10.0 ug/L
1,2,4-Trichlorobenzene	10.0 ug/L
1,2,4-Trimethylbenzene	10.0 ug/L
1,3,5-Trimethylbenzene	10.0 ug/L
Bromobenzene	10.0 ug/L
o-Chlorotoluene	10.0 ug/L
p-Chlorotoluene	10.0 ug/L
Dibromomethane	10.0 ug/L
1,2-Dibromoethane	10.0 ug/L
1,2-Dibromo-3-chloropropane	10.0 ug/L
1,3-Dichloropropane	10.0 ug/L

ALPHA ANALYTICAL LABS
ADDENDUM I
REFERENCES

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24. Principal Organic Hazardous Constituents and Products of Incomplete Combustion Screening Protocol. Southern Research Institute, October 1989.

ALPHA ANALYTICAL LABORATORIES

RELATIVE PERCENT DIFFERENCE

CRITERIA FOR DUPLICATE ANALYSIS

PARAMETER GROUP	WATER	SOIL
Organics:		
Volatile Organics	30 %	30 %
Acid/Base/Neutrals	40 %	40 %
Pesticides/PCB's	40 %	40 %
Inorganics:		
Metals	20 %	30 %
Wet Chemistry	30 %	30 %

ALPHA ANALYTICAL LABORATORIES

ACCEPTABLE MATRIX SPIKE RECOVERY LIMITS

FOR INORGANICS

PARAMETER GROUP	WATER	SOIL
Metals	75-125 %	60-140 %
Wet Chemistry	70-130 %	N/A

ALPHA ANALYTICAL LABORATORIES

ACCEPTABLE SURROGATE SPIKE RECOVERY LIMITS

FRACTION	SURROGATE COMPOUND	LOW/MEDIUM WATER	LOW/MEDIUM SOIL/SEDIMENT
VOA	Toluene-d_8	88-110 %	81-117 %
VOA	4-Bromofluorobenzene	86-115 %	74-121 %
VOA	1,2-Dichloroethane-d_4	76-114 %	70-121 %
BNA	Nitrobenzene-d_5	35-114 %	23-120 %
BNA	2-Fluorobiphenyl	43-116 %	30-115 %
BNA	p-Terphenyl-d_{14}	33-141 %	18-137 %
BNA	Phenol-d_5	10-94 %	24-113 %
BNA	2-Fluorophenol	21-100 %	25-121 %
BNA	2,4,6-Tribromophenol	10-123 %	19-122 %
Pest.	Dibutylchlorendate	24-154 %	20-150 %

EST ENVIRONMENTAL SAMPLING TECHNOLOGY

■ 14 Grant Street ■ Framingham, MA 01701 ■ (508) 620-0002

Special Instructions:

CHAIN OF CUSTODY RECORD

Contact

Client Job #	Site Name:				
	Delivered To:				
	Location/Sample Identification	**Matrix Type**	**# /Type of Container**	**Date/Time Sample Taken**	**Analysis**
SEA	East Hampton MW 9-A	H_2O	1 p	5/21/91 12:50	T, Fe, Mn
"	" MW - 9-A	"	2 V	" "	~~524~~ 524
"	MW - 5-S (5B)	"	1 p	" 13:56	T, Fe, Mn
"	" "		2 V	" "	524
"	MW - 5D (5A)	"	1 p	" 15:10	T, Fe, Mn
"	" "	"	2 V	" "	524
"	MW - 10A	"	1 p	" 16:44	T, Fe, Mn
"	" "	"	2 V	" "	524.
"	MW - 10B	"	1 p	" 17:48	T, Fe, Mn
"	" "	"	2 V	" "	524.
"	MW 4-~~D~~ (4A)	"	1 p	" 1930	T, Fe, Mn
	"	"	2 V	" "	524

Relinquished By (Site)
John O'Brien

Received By (EST)
1. ____________________
2. ____________________

Received By (Lab)
C. Pignatello

CONTAINER CODE
P - Plastic
G - Glass
AG - Amber Glass
V - VOA Vial
S - Soil Jar

MATRIX CODE
W - Water
L - Liquid
S - Soil
SL - Sludge
O - Other

ALPHA ANALYTICAL LABORATORIES

Eight Walkup Drive
Westborough, Massachusetts 01581-1019
(508) 898-9220

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

CERTIFICATE OF ANALYSIS

Client:	SEA Consultants, Inc.	Laboratory Job Number:	913905
Address:	485 Massachusetts Avenue	Invoice Number:	22271
	Cambridge, MA 02139	Date Received:	06/21/91
Attn:	Craig Blake	Date Reported:	07/05/91
Client Designation:	Project Easthampton Well	Delivery Method:	EST

ALPHA SAMPLE NUMBER	CLIENT IDENTIFICATION	SAMPLE LOCATION
913905.1	MW1	N/A
913905.2	MW2	N/A
913905.2D	MW2 (Duplicate)	N/A
913905.3	~~MW4B~~ (MW-4A)	N/A
913905.3S	MW-4A ~~MW4B~~ (Spike Recovery)	N/A
913905.4	MW6	N/A
913905.5	MW8	N/A
913905.6	MW9C	N/A
913905.7	MW9A	N/A
913905.8	MW5~~B~~A	N/A
913905.9	MW10A	N/A
913905.10	MW10B	N/A
913905.11	MW11A	N/A
913905.12	MW5~~A~~B	N/A
913905.12D	MW5~~A~~B (Duplicate)	N/A

Authorized by: James R. Roth
James R. Roth - Laboratory Manager

cp

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 913905.1

Date Received: 06/21/91

Sample Matrix: Water

Date Reported: 07/05/91

Condition of Samples: Satisfactory

Field Prep: Metals were field filtered and preserved.

Number & Type of Containers: One plastic cube

Analysis Requested: Analysis as listed below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Soluble Metals							
Iron	0.05	mg/L	0.01	1	6010	----	07/01/91
Manganese	ND	mg/L	0.01	1	6010	----	07/01/91

COMMENTS: * Complete list of References found in Addendum I

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 913905.2

Date Received: 06/21/91

Sample Matrix: Water

Date Reported: 07/05/91

Condition of Samples: Satisfactory

Field Prep: Metals were field filtered and preserved

Number & Type of Containers: One plastic cube

Analysis Requested: Analysis as listed below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Soluble Metals							
Iron	0.08	mg/L	0.01	1	6010	----	07/01/91
Manganese	ND	mg/L	0.01	1	6010	----	07/01/91

COMMENTS: * Complete list of References found in Addendum I

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 913905.2D

Date Received: 06/21/91

Sample Matrix: Water

Date Reported: 07/05/91

Condition of Samples: Satisfactory

Field Prep: Metals were field filtered and preserved

Number & Type of Containers: One plastic cube

Analysis Requested: Analysis as listed below

PARAMETER	SAMPLE RESULT	DUPLICATE RESULT	%RPD
Soluble Metals			
Iron	0.08	0.10	22
Manganese	ND	ND	NC

NC = Non calculable RPD

COMMENTS: * Complete list of References found in Addendum I

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 913905.3

Date Received: 06/21/91

Sample Matrix: Water

Date Reported: 07/05/91

Condition of Samples: Satisfactory

Field Prep: Metals were field filtered and preserved

Number & Type of Containers: One plastic cube

Analysis Requested: Analysis as listed below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Soluble Metals							
Iron	ND	mg/L	0.01	1	6010	----	07/01/91
Manganese	ND	mg/L	0.01	1	6010	----	07/01/91

COMMENTS: * Complete list of References found in Addendum I

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086   NH 198958-A   CT PH-0574   NY 11148   NC 320   SC 88006

Laboratory Sample Number: 913905.3S   **Date Received:** 06/21/91

Sample Matrix: Water   **Date Reported:** 07/05/91

Condition of Samples: Satisfactory   **Field Prep:** Metals were field filtered and preserved

Number & Type of Containers: One plastic cube

Analysis Requested: Analysis as listed below

PARAMETER	%RECOVERY
Soluble Metals	
Iron	103%
Manganese	100%

COMMENTS: * Complete list of References found in Addendum I

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 913905.4 **Date Received:** 06/21/91

Sample Matrix: Water **Date Reported:** 07/05/91

Condition of Samples: Satisfactory **Field Prep:** Metals were field filtered and preserved

Number & Type of Containers: One plastic cube

Analysis Requested: Analysis as listed below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Soluble Metals							
Iron	0.17	mg/L	0.01	1	6010	----	07/01/91
Manganese	0.57	mg/L	0.01	1	6010	----	07/01/91

COMMENTS: * Complete list of References found in Addendum I

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 913905.5

Date Received: 06/21/91

Sample Matrix: Water

Date Reported: 07/05/91

Condition of Samples: Satisfactory

Field Prep: Metals were field filtered and preserved

Number & Type of Containers: One plastic cube

Analysis Requested: Analysis as listed below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Soluble Metals							
Iron	0.10	mg/L	0.01	1	6010	----	07/01/91
Manganese	0.03	mg/L	0.01	1	6010	----	07/01/91

COMMENTS: * Complete list of References found in Addendum I

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 913905.6

Date Received: 06/21/91

Sample Matrix: Water

Date Reported: 07/05/91

Condition of Samples: Satisfactory

Field Prep: Metals were field filtered and preserved

Number & Type of Containers: One plastic cube

Analysis Requested: Analysis as listed below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Soluble Metals							
Iron	ND	mg/L	0.01	1	6010	----	07/01/91
Manganese	ND	mg/L	0.01	1	6010	----	07/01/91

COMMENTS: * Complete list of References found in Addendum I

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 913905.7

Date Received: 06/21/91

Sample Matrix: Water

Date Reported: 07/05/91

Condition of Samples: Satisfactory

Field Prep: Metals were field filtered and preserved

Number & Type of Containers: One plastic cube

Analysis Requested: Analysis as listed below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Soluble Metals							
Iron	0.34	mg/L	0.01	1	6010	----	07/01/91
Manganese	ND	mg/L	0.01	1	6010	----	07/01/91

COMMENTS: * Complete list of References found in Addendum I

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 913905.8

Date Received: 06/21/91

Sample Matrix: Water

Date Reported: 07/05/91

Condition of Samples: Satisfactory

Field Prep: Metals were field filtered and preserved

Number & Type of Containers: One plastic cube

Analysis Requested: Analysis as listed below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Soluble Metals							
Iron	0.08	mg/L	0.01	1	6010	----	07/01/91
Manganese	ND	mg/L	0.01	1	6010	----	07/01/91

COMMENTS: * Complete list of References found in Addendum I

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 913905.9 **Date Received:** 06/21/91

Sample Matrix: Water **Date Reported:** 07/05/91

Condition of Samples: Satisfactory **Field Prep:** Metals were field filtered and preserved.

Number & Type of Containers: One plastic cube

Analysis Requested: Analysis as listed below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Soluble Metals							
Iron	0.03	mg/L	0.01	1	6010	----	07/01/91
Manganese	ND	mg/L	0.01	1	6010	----	07/01/91

COMMENTS: * Complete list of References found in Addendum I

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 913905.10 **Date Received:** 06/21/91

Sample Matrix: Water **Date Reported:** 07/05/91

Condition of Samples: Satisfactory **Field Prep:** Metals were field filtered and preserved

Number & Type of Containers: One plastic cube

Analysis Requested: Analysis as listed below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Soluble Metals							
Iron	0.03	mg/L	0.01	1	6010	----	07/01/91
Manganese	ND	mg/L	0.01	1	6010	----	07/01/91

COMMENTS: * Complete list of References found in Addendum I

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086   NH 198958-A   CT PH-0574   NY 11148   NC 320   SC 88006

Laboratory Sample Number: 913905.11

Date Received: 06/21/91

Sample Matrix: Water

Date Reported: 07/05/91

Condition of Samples: Satisfactory

Field Prep: Metals were field filtered and preserved

Number & Type of Containers: One plastic cube

Analysis Requested: Analysis as listed below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Soluble Metals							
Iron	ND	mg/L	0.01	1	6010	----	07/01/91
Manganese	ND	mg/L	0.01	1	6010	----	07/01/91

COMMENTS: * Complete list of References found in Addendum I

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 913905.12

Date Received: 06/21/91

Sample Matrix: Water

Date Reported: 07/05/91

Condition of Samples: Satisfactory

Field Prep: Metals were field filtered and preserved

Number & Type of Containers: One plastic cube

Analysis Requested: Analysis as listed below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Soluble Metals							
Iron	0.04	mg/L	0.01	1	6010	----	07/01/91
Manganese	ND	mg/L	0.01	1	6010	----	07/01/91

COMMENTS: * Complete list of References found in Addendum I

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086   NH 198958-A   CT PH-0574   NY 11148   NC 320   SC 88006

Laboratory Sample Number: 913905.12D

Date Received: 06/21/91

Sample Matrix: Water

Date Reported: 07/05/91

Condition of Samples: Satisfactory

Field Prep: Metals were field filtered and preserved

Number & Type of Containers: One plastic cube

Analysis Requested: Analysis as listed below

PARAMETER	SAMPLE RESULT	DUPLICATE RESULT	%RPD
Soluble Metals			
Iron	0.04	0.05	22
Manganese	ND	ND	NC

COMMENTS: * Complete list of References found in Addendum I

ALPHA ANALYTICAL LABORATORIES

ACCEPTABLE MATRIX SPIKE RECOVERY LIMITS

FOR INORGANICS

PARAMETER GROUP	WATER	SOIL
Metals	75-125 %	60-140 %
Wet Chemistry	70-130 %	N/A

ALPHA ANALYTICAL LABORATORIES

RELATIVE PERCENT DIFFERENCE

CRITERIA FOR DUPLICATE ANALYSIS

PARAMETER GROUP	WATER	SOIL
Organics:		
Volatile Organics	30 %	30 %
Acid/Base/Neutrals	40 %	40 %
Pesticides/PCB's	40 %	40 %
Inorganics:		
Metals	20 %	30 %
Wet Chemistry	30 %	30 %

REFERENCES

1. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. EPA SW-846. 1986.

2. Standard Methods for Examination of Water and Waste Water. APHA-AWWA-WPCF. 16th Edition. 1985.

3. Standard Methods for Examination of Water and Waste Water. APHA-AWWA-WPCF. 17th Edition. 1989.

4. Methods for Chemical Analysis of Water and Wastes. EPA 600/4-82-055. 1983.

5. Oil Spill Identification System. CG-D-52-77 U. S. Coast Guard. 1977.

6. Methods for Organic Chemical Analysis of Municipal and Industrial Waste Water. EPA 600/4-82-057. 1982.

7. U. S. Department of Health & Human Services, National Institute of Occupational Safety and Health. Peter M. Eller, NIOSH Manual of Analytical Methods, Third Edition, 1984.

8. Handbook of Analytical Quality Control in Water and Wastewater Laboratories. EPA 600/4-79-019. March 1979.

9. The United States Pharmacopeia. The National Formulary. USP 20th Edition. Formulary 15th Edition. 1980.

10. Choosing Cost-Effective QA/QC (Quality Assurance/Quality Control) Programs for Chemical Analysis. PB85-241461. U. S. Department of Commerce, National Technical Information Service. August 1985.

11. Manual of Analytical Quality Control for Pesticides in Human and Environmental Media. PB 261 019. EPA 600/1-76-017. February 1975.

12. Annual Book of ASTM Standards. Sections 0, 3, 4, 5, 6, 8, 9, 11, and 14. American Society for Testing and Materials 1986.

13. 40 CFR Part 261, App. II. Method 1311 Toxicity Characteristic Leaching Procedure (TCLP). July 1, 1990 Edition.

14. Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water. Available from USEPA, Cincinnati, 26 West Martin Luther King Drive, Cincinnati, Ohio, 45268.

15. Interim Methods for the Determination of Asbestiform Minerals in Bulk Insulation Samples, Research Triangle Institute, June 1980. Asbestos Containing Materials in School Buildings: A Guidance Document, March 1979, USEPA Document C00090, parts 1 & 2.

16. Interim Methods for the Determination of Asbestos in Bulk Insulation Samples (EPA-600/M4-82-020).

17. "Prescribed Procedures for Measurement of Radioactivity in Drinking Water," Publication EPA-600/4-80-032, U. S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, August 1980.

18. "Clean Harbors Radiological Environmental Analytical Procedures," Clean Harbors Analytical Services, Braintree, MA, October 1985.

19. H. M. Prichard and T. F. Gesell, "Rapid Measurement of RN-222 Concentrations in Water with a Commercial Liquid Scintillation Counter", Health Physics, Volume 33, 1977, pp. 577-581.

20. "Handbook for Analytical Quality Control in Water and Wastewater Laboratories", March 1979, EPA 600/4-79-019.

21. Analysis of PCB's in Transformer Fluid and Waste Oil. EPA 600/4-81-045. 1981.

22. Klute, A. 1986, "Methods of Soil Analysis, Part 1", Methods 15-2.2 and 15-5.1. American Society of Agronomy, Madison, WI.

23. Exhibit No. 1. Petroleum Oils by Gas Chromatography. Alley, Young & Baumartner, Inc., Consulting Engineers, P.O. Box 2036, Brentwood, TN 37024.

24. Principal Organic Hazardous Constituents and Products of Incomplete Combustion Screening Protocol. Southern Research Institute, October 1989.

EST
ENVIRONMENTAL SAMPLING TECHNOLOGY

■ 14 Grant Street ■ Framingham, MA 01701 ■ (508) 620-0002

Special Instructions:

CHAIN OF CUSTODY RECORD

Contact: Craig Blake / SEA; Jim Roth

Client Job #

Site Name: Easthampton Well Field Study

Delivered To: Alpha Analytical Labs, Walkup Dr, Westboro

Location/Sample Identification	Matrix Type	# /Type of Container	Date/Time Sample Taken	Analysis
MW 1	W	1 P (HNO_3)	6/21/91 09^30 am	Sol Fe, MN
MW 2	W	1 P (HNO_3)	6/20/91 1550	
MW 4 ~~B~~ A	W	1 P (HNO_3)	6/20/91 1400	
MW 6	W	1 P (HNO_3)	6/20/91 1510	
MW 8	W	1 P (HNO_3)	6/20/91 0700	
MW 9C	W	1 P (HNO_3)	6/21/91 0920	
MW 9 A	W	1 P (HNO_3)	6/20/91 0700	
MW 5 ~~B~~ A	W	1 P (HNO_3)	6/20/91 0900	
MW 10A	W	1 P (HNO_3)	6/20/91 1110	
MW 10B	W	1 P (HNO_3)	6/20/91 1130	
MW 11 A	W	1 P (HNO_3)	6/20/91 1300	
MW 5 ~~A~~ B	W	1 P (HNO_3)	6/20/91 0800	

Relinquished By (Site)

Received By (EST)
1. ____________
2. ____________

Received By (Lab)
6/21 4:45

CONTAINER CODE
P - Plastic
G - Glass
AG - Amber Glass
V - VOA Vial
S - Soil Jar

MATRIX CODE
W - Water
L - Liquid
S - Soil
SL - Sludge
O - Other

ALPHA ANALYTICAL LABORATORIES

Eight Walkup Drive
Westborough, Massachusetts 01581-1019
(508) 898-9220

MA 086 NH 198958-A NC 320 SC 88006 CT PH-0574 NY 11148

CERTIFICATE OF ANALYSIS

Client: SEA Consultants, Inc. **Laboratory Job Number:** 913978

Address: 485 Massachusetts Avenue **Invoice Number:** 22405

Cambridge, MA 02139 **Date Received:** 06/25/91

Attn: Don Maggioli **Date Reported:** 07/09/91

Client Designation: N/A **Delivery Method:** EST

ALPHA SAMPLE NUMBER	CLIENT IDENTIFICATION	SAMPLE LOCATION
913978.1	MW-9B	Easthampton

Authorized by: Scott McLean
Scott McLean - Laboratory Director

seh

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A NC 320 SC 88006 CT PH-0574 NY 11148

Laboratory Sample Number: 913978.1 **Date Received:** 06/25/91

Sample Matrix: Liquid **Date Reported:** 07/09/91

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One plastic cube and two VOA vials

Analysis Requested: Volatile Organics and Soluble Metals as listed below

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Volatile Organics ***							
1,1,1-Trichloroethane	1.8	ug/L	**	14	524.2	----	07/09/91
Toluene	2.7	ug/L	**	14	524.2	----	07/09/91
Trichloroethene	7.2	ug/L	**	14	524.2	----	07/09/91
Soluble Metals							
Iron	ND	ug/L	0.01	1	6010	06/25/91	07/03/91
Manganese	0.01	ug/L	0.01	1	6010	06/25/91	07/03/91

Volatile Organics	%Surrogate Recovery
1,2-Dichloroethane-d4	88%
Toluene-d8	84%
4-Bromofluorobenzene	103%

COMMENTS: * Complete list of References found in Addendum I

** A list of volatile organics analyzed for and their detection limits accompany this report.

*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABS
VOLATILE ORGANICS ANALYSIS by GC/MS
METHOD 524.2

Alpha Job Number: 913978 Date Reported: 07/09/91
Alpha Sample Number(s): 913978.1
Method Detection Limit: Stated below

COMPOUNDS	
Methylene chloride	0.9 ug/L
1,1-Dichloroethane	1.6 ug/L
Chloroform	0.5 ug/L
Carbon tetrachloride	0.5 ug/L
1,2-Dichloropropane	2.0 ug/L
Dibromochloromethane	1.0 ug/L
1,1,2-Trichloroethane	1.7 ug/L
2-Chloroethylvinyl ether	3.3 ug/L
Tetrachloroethene	0.5 ug/L
Chlorobenzene	2.0 ug/L
Trichlorofluoromethane	1.7 ug/L
1,2-Dichloroethane	0.5 ug/L
1,1,1-Trichloroethane	0.5 ug/L
Bromodichloromethane	0.7 ug/L
trans-1,3-Dichloropropene	1.7 ug/L
cis-1,3-Dichloropropene	1.7 ug/L
Bromoform	1.6 ug/L
1,1,2,2-Tetrachloroethane	2.3 ug/L
Benzene	0.5 ug/L
Toluene	2.0 ug/L
Ethyl benzene	2.4 ug/L
Xylenes	3.3 ug/L
Chloromethane	2.7 ug/L
Bromomethane	2.3 ug/L
Vinyl chloride	0.5 ug/L
Chloroethane	2.5 ug/L
1,1-Dichloroethene	0.5 ug/L
Trans-1,2-dichloroethene	0.5 ug/L
Cis-1,2-dichloroethene	0.5 ug/L
Trichloroethene	0.5 ug/L
1,2-Dichlorobenzene	0.5 ug/L
1,3-Dichlorobenzene	0.5 ug/L
1,4-Dichlorobenzene	0.5 ug/L
Acetone	33.4 ug/L
Carbon disulfide	6.7 ug/L
2-Butanone	10.0 ug/L
Vinyl acetate	10.0 ug/L
4-Methyl-2-pentanone	6.7 ug/L
2-Hexanone	6.7 ug/L
Styrene	3.3 ug/L
o-Xylene	3.3 ug/L

ALPHA ANALYTICAL LABS
VOLATILE ORGANICS ANALYSIS by GC/MS
METHOD 524.2
CONTINUED (Page 2 of 2)

Alpha Job Number: 913978 Date Reported: 07/09/91
Alpha Sample Number(s): 913978.1
Method Detection Limit: Stated below

COMPOUNDS	
1,1-Dichloropropene	10.0 ug/L
2,2-Dichloropropane	10.0 ug/L
1,1,1,2-Tetrachloroethane	10.0 ug/L
1,2,3-Trichloropropane	10.0 ug/L
Bromochloromethane	10.0 ug/L
n-Butylbenzene	10.0 ug/L
Dichlorodifluoromethane	10.0 ug/L
Hexachlorobutadiene	10.0 ug/L
Isopropylbenzene	10.0 ug/L
p-Isopropyltoluene	10.0 ug/L
Naphthalene	10.0 ug/L
n-Propylbenzene	10.0 ug/L
Sec-butylbenzene	10.0 ug/L
Tert-butylbenzene	10.0 ug/L
1,2,3-Trichlorobenzene	10.0 ug/L
1,2,4-Trichlorobenzene	10.0 ug/L
1,2,4-Trimethylbenzene	10.0 ug/L
1,3,5-Trimethylbenzene	10.0 ug/L
Bromobenzene	10.0 ug/L
o-Chlorotoluene	10.0 ug/L
p-Chlorotoluene	10.0 ug/L
Dibromomethane	10.0 ug/L
1,2-Dibromoethane	10.0 ug/L
1,2-Dibromo-3-chloropropane	10.0 ug/L
1,3-Dichloropropane	10.0 ug/L

ALPHA ANALYTICAL LABS
ADDENDUM I
REFERENCES

1. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. EPA SW-846. 1986.

2. Standard Methods for Examination of Water and Waste Water. APHA-AWWA-WPCF. 16th Edition. 1985.

3. Standard Methods for Examination of Water and Waste Water. APHA-AWWA-WPCF. 17th Edition. 1989.

4. Methods for Chemical Analysis of Water and Wastes. EPA 600/4-82-055. 1983.

5. Oil Spill Identification System. CG-D-52-77 U. S. Coast Guard. 1977.

6. Methods for Organic Chemical Analysis of Municipal and Industrial Waste Water. EPA 600/4-82-057. 1982.

7. U. S. Department of Health & Human Services, National Institute of Occupational Safety and Health. Peter M. Eller, NIOSH Manual of Analytical Methods, Third Edition, 1984.

8. Handbook of Analytical Quality Control in Water and Wastewater Laboratories. EPA 600/4-79-019. March 1979.

9. The United States Pharmacopeia. The National Formulary. USP 20th Edition. Formulary 15th Edition. 1980.

10. Choosing Cost-Effective QA/QC (Quality Assurance/Quality Control) Programs for Chemical Analysis. PB85-241461. U. S. Department of Commerce, National Technical Information Service. August 1985.

11. Manual of Analytical Quality Control for Pesticides in Human and Environmental Media. PB 261 019. EPA 600/1-76-017. February 1975.

12. Annual Book of ASTM Standards. Sections 0, 3, 4, 5, 6, 8, 9, 11, and 14. American Society for Testing and Materials 1986.

13. 40 CFR Part 261, App. II. Method 1311 Toxicity Characteristic Leaching Procedure (TCLP). July 1, 1990 Edition.

14. Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water. Available from USEPA, Cincinnati, 26 West Martin Luther King Drive, Cincinnati, Ohio, 45268.

15. Interim Methods for the Determination of Asbestiform Minerals in Bulk Insulation Samples, Research Triangle Institute, June 1980. Asbestos Containing Materials in School Buildings: A Guidance Document, March 1979, USEPA Document C00090, parts 1 & 2.

16. Interim Methods for the Determination of Asbestos in Bulk Insulation Samples (EPA-600/M4-82-020).

17. "Prescribed Procedures for Measurement of Radioactivity in Drinking Water," Publication EPA-600/4-80-032, U. S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, August 1980.

18. "Clean Harbors Radiological Environmental Analytical Procedures," Clean Harbors Analytical Services, Braintree, MA, October 1985.

19. H. M. Prichard and T. F. Gesell, "Rapid Measurement of RN-222 Concentrations in Water with a Commercial Liquid Scintillation Counter", Health Physics, Volume 33, 1977, pp. 577-581.

20. "Handbook for Analytical Quality Control in Water and Wastewater Laboratories", March 1979, EPA 600/4-79-019.

21. Analysis of PCB's in Transformer Fluid and Waste Oil. EPA 600/4-81-045. 1981.

22. Klute, A. 1986, "Methods of Soil Analysis, Part 1", Methods 15-2.2 and 15-5.1. American Society of Agronomy, Madison, WI.

23. Exhibit No. 1. Petroleum Oils by Gas Chromatography. Alley, Young & Baumartner, Inc., Consulting Engineers, P.O. Box 2036, Brentwood, TN 37024.

24. Principal Organic Hazardous Constituents and Products of Incomplete Combustion Screening Protocol. Southern Research Institute, October 1989.

25. Official Methods of Analysis, AOAC, 14th Edition, 1984.

EST
ENVIRONMENTAL SAMPLING TECHNOLOGY
14 Grant Street ■ Framingham, MA 01701 ■ (508) 620-0002

Special Instructions:

CHAIN OF CUSTODY RECORD

Contact: Craig Blake

Client Job #

Site Name: Easthampton, Wellfield Study (SEA)

Delivered To: Alpha Analytical, Walk up Rd, Westboro, MA

Location/Sample Identification	Matrix Type	# /Type of Container	Date/Time Sample Taken	Analysis
~~3A-4-8A~~ + MW9B	W	2V (HCL)	6/25 3[15] pm	524
		1 P	6/25 3[15] pm	Sol Fe, MN

Relinquished By (Site)

Received By (EST)
1. [signature] 6/25 3[15]
2.

Received By (Lab) [signature]

CONTAINER CODE
- P - Plastic
- G - Glass
- AG - Amber Glass
- V - VOA Vial
- S - Soil Jar

MATRIX CODE
- W - Water
- L - Liquid
- S - Soil
- SL - Sludge
- O - Other

SOIL SAMPLES

MW-9A
MW-9B
MW-10A
MW-10B
MW-11A

ALPHA ANALYTICAL LABORATORIES

Eight Walkup Drive
Westborough, Massachusetts 01581-1019
(508) 898-9220

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320

CERTIFICATE OF ANALYSIS

Client: SEA Consultants, Inc.

Address: 485 Massachusetts Avenue
Cambridge, MA 02139

Attn: Kosta Exarhoulakos

Client Designation: Project #90072.1V

Laboratory Job Number: 912139

Invoice Number: 20384

Date Received: 04/10/91

Date Reported: 04/23/91

Delivery Method: Alpha Courier

ALPHA SAMPLE NUMBER	CLIENT IDENTIFICATION	SAMPLE LOCATION
912139.1	9A-10	Easthampton, MA
912139.2	9A-14	Easthampton, MA
912139.2D	9A-14 (duplicate)	Easthampton, MA
912139.3	9A-18	Easthampton, MA
912139.3S	9A-18 (spike)	Easthampton, MA
912139.4	9A-24	Easthampton, MA
912139.5	9B-1	Easthampton, MA
912139.6	10A-14	Easthampton, MA
912139.7	10B-16	Easthampton, MA
912139.8	11A-16	Easthampton, MA

Authorized by: Scott McLean
Scott McLean - Laboratory Director

cp

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320

Laboratory Sample Number: 912139.1 **Date Received:** 04/10/91

Sample Matrix: Soil (results on a dry weight basis) **Date Reported:** 04/23/91

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One glass jar

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Volatile Organics***	ND	ug/Kg	**	1	8260	04/10/91	04/21/91
Total Petroleum Hydrocarbons	ND	mg/Kg	40	3	5520CDF	04/15/91	04/16/91
Total Solids	83	%	0.1	3	2540B	----	04/16/91

Volatile Organics	% Surrogate Recovery
1,2-Dichloroethane-d4	97%
Toluene-d8	99%
4-Bromofluorobenzene	102%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompany this report.
*** All compounds were below the detection limit except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086   NH 198958-A   CT PH-0574   NY 11148   NC 320

Laboratory Sample Number: 912139.2   **Date Received:** 04/10/91

Sample Matrix: Soil (results on a dry weight basis)   **Date Reported:** 04/23/91

Condition of Samples: Satisfactory   **Field Prep:** None

Number & Type of Containers: One glass jar

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Volatile Organics***	ND	ug/Kg	**	1	8260	04/10/91	04/22/91
Total Petroleum Hydrocarbons	ND	mg/Kg	40	3	5520CDF	04/15/91	04/16/91
Total Solids	86	%	0.1	3	2540B	----	04/16/91

Volatile Organics	% Surrogate Recovery
1,2-Dichloroethane-d4	103%
Toluene-d8	100%
4-Bromofluorobenzene	102%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompany this report.
*** All compounds were below the detection limit except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086   NH 198958-A   CT PH-0574   NY 11148   NC 320

Laboratory Sample Number: 912139.2D   **Date Received:** 04/10/91

Sample Matrix: Soil (results on a dry weight basis)   **Date Reported:** 04/23/91

Condition of Samples: Satisfactory   **Field Prep:** None

Number & Type of Containers: One glass jar

Analysis Requested: Analysis as Listed Below

PARAMETER	SAMPLE RESULT	DUPLICATE RESULT	% RPD
Total Petroleum Hydrocarbons	ND	ND	NC
Volatile Organics	ND	ND	NC

NC = Non calculable RPD

COMMENTS: * Complete list of References found in Addendum I

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320

Laboratory Sample Number: 912139.3 **Date Received:** 04/10/91

Sample Matrix: Soil (results on a dry weight basis) **Date Reported:** 04/23/91

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One glass jar

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Volatile Organics***	ND	ug/Kg	**	1	8260	04/10/91	04/22/91
Total Petroleum Hydrocarbons	ND	mg/Kg	40	3	5520CDF	04/15/91	04/16/91
Total Solids	81	%	0.1	3	2540B	----	04/16/91

Volatile Organics	% Surrogate Recovery
1,2-Dichloroethane-d4	93%
Toluene-d8	99%
4-Bromofluorobenzene	93%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompany this report.
*** All compounds were below the detection limit except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320

Laboratory Sample Number: 912139.3S

Date Received: 04/10/91

Sample Matrix: Soil (results on a dry weight basis)

Date Reported: 04/23/91

Condition of Samples: Satisfactory

Field Prep: None

Number & Type of Containers: One glass jar

Analysis Requested: Analysis as Listed Below

PARAMETER	% SPIKE RECOVERY
Total Petroleum Hydrocarbons	96%
Volatile Organics	
1,1-Dichloroethene	82%
Trichloroethene	93%
Chlorobenzene	99%
Toluene	98%
Benzene	88%

COMMENTS: * Complete list of References found in Addendum I

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320

Laboratory Sample Number: 912139.4 **Date Received:** 04/10/91

Sample Matrix: Soil (results on a dry weight basis) **Date Reported:** 04/23/91

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One glass jar

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL	REF*	METHOD	DATES EXT/PREP	ANALYSIS
Volatile Organics***	ND	ug/Kg	**	1	8260	04/10/91	04/23/91
Total Petroleum Hydrocarbons	ND	mg/Kg	40	3	5520CDF	04/15/91	04/16/91
Total Solids	90	%	0.1	3	2540B	----	04/16/91

Volatile Organics	% Surrogate Recovery
1,2-Dichloroethane-d4	89%
Toluene-d8	99%
4-Bromofluorobenzene	88%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompany this report.
*** All compounds were below the detection limit except those listed above.

<u>ALPHA ANALYTICAL LABORATORIES</u>
<u>CERTIFICATE OF ANALYSIS</u>

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320

Laboratory Sample Number: 912139.5 Date Received: 04/10/91

Sample Matrix: Soil (results on a dry weight basis) Date Reported: 04/23/91

Condition of Samples: Satisfactory Field Prep: None

Number & Type of Containers: One glass jar

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Volatile Organics***	ND	ug/Kg	**	1	8260	04/10/91	04/23/91
Total Petroleum Hydrocarbons	ND	mg/Kg	40	3	5520CDF	04/15/91	04/16/91
Total Solids	84	%	0.1	3	2540B	----	04/16/91

Volatile Organics	% Surrogate Recovery
1,2-Dichloroethane-d4	88%
Toluene-d8	97%
4-Bromofluorobenzene	89%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompany this report.
*** All compounds were below the detection limit except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320

Laboratory Sample Number: 912139.6 **Date Received:** 04/10/91

Sample Matrix: Soil (results on a dry weight basis) **Date Reported:** 04/23/91

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One glass jar

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Volatile Organics***	ND	ug/Kg	**	1	8260	04/10/91	04/23/91
Total Petroleum Hydrocarbons	ND	mg/Kg	40	3	5520CDF	04/15/91	04/16/91
Total Solids	86	%	0.1	3	2540B	----	04/16/91

Volatile Organics	% Surrogate Recovery
1,2-Dichloroethane-d4	91%
Toluene-d8	96%
4-Bromofluorobenzene	87%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompany this report.
*** All compounds were below the detection limit except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320

Laboratory Sample Number: 912139.7 **Date Received:** 04/10/91

Sample Matrix: Soil (results on a dry weight basis) **Date Reported:** 04/23/91

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One glass jar

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Volatile Organics***	ND	ug/Kg	**	1	8260	04/10/91	04/23/91
Total Petroleum Hydrocarbons	ND	mg/Kg	40	3	5520CDF	04/15/91	04/16/91
Total Solids	89	%	0.1	3	2540B	----	04/16/91

Volatile Organics	% Surrogate Recovery
1,2-Dichloroethane-d4	90%
Toluene-d8	98%
4-Bromofluorobenzene	93%

COMMENTS:
* Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompany this report.
*** All compounds were below the detection limit except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320

Laboratory Sample Number: 912139.8 **Date Received:** 04/10/91

Sample Matrix: Soil (results on a dry weight basis) **Date Reported:** 04/23/91

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One glass jar

Analysis Requested: Analysis as Listed Below

PARAMETER	RESULT	UNITS	MDL	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Volatile Organics***	ND	ug/Kg	**	1	8260	04/10/91	04/22/91
Total Petroleum Hydrocarbons	ND	mg/Kg	40	3	5520CDF	04/15/91	04/16/91
Total Solids	86	%	0.1	3	2540B	----	04/16/91

Volatile Organics	% Surrogate Recovery
1,2-Dichloroethane-d4	97%
Toluene-d8	99%
4-Bromofluorobenzene	101%

COMMENTS:
* Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompany this report.
*** All compounds were below the detection limit except those listed above.

ALPHA ANALYTICAL LABS
VOLATILE ORGANICS ANALYSIS by GC/MS
METHOD 8260

Alpha Job Number: 912139 Date Reported: 4/23/91
Alpha Sample Number(s): 912139.1-.9
Method Detection Limit: Stated below

COMPOUNDS	
Methylene chloride	250 ug/Kg
1,1-Dichloroethane	75 ug/Kg
Chloroform	75 ug/Kg
Carbon tetrachloride	50 ug/Kg
1,2-Dichloropropane	175 ug/Kg
Dibromochloromethane	50 ug/Kg
1,1,2-Trichloroethane	75 ug/Kg
2-Chloroethylvinyl ether	-- ug/Kg
Tetrachloroethene	75 ug/Kg
Chlorobenzene	175 ug/Kg
Trichlorofluoromethane	250 ug/Kg
1,2-Dichloroethane	75 ug/Kg
1,1,1-Trichloroethane	50 ug/Kg
Bromodichloromethane	50 ug/Kg
Trans-1,3-Dichloropropene	75 ug/Kg
Cis-1,3-Dichloropropene	50 ug/Kg
Bromoform	50 ug/Kg
1,1,2,2-Tetrachloroethane	50 ug/Kg
Benzene	50 ug/Kg
Toluene	75 ug/Kg
Ethyl benzene	50 ug/Kg
Xylenes	50 ug/Kg
Chloromethane	500 ug/Kg
Bromomethane	100 ug/Kg
Vinyl chloride	175 ug/Kg
Chloroethane	500 ug/Kg
1,1-Dichloroethene	75 ug/Kg
Trans-1,2-dichloroethene	75 ug/Kg
Cis-1,2-dichloroethene	50 ug/Kg
Trichloroethene	50 ug/Kg
Dibromomethane	500 ug/Kg
1,4-Dichloro-2-butane	500 ug/Kg
Ethanol	-- ug/Kg
Iodomethane	-- ug/Kg
1,2,3-Trichloropropane	500 ug/Kg
Dichlorodifluoromethane	500 ug/Kg
Acetone	500 ug/Kg
Carbon disulfide	500 ug/Kg
2-Butanone	225 ug/Kg
Vinyl acetate	500 ug/Kg
4-Methyl-2-pentanone	500 ug/Kg
2-Hexanone	500 ug/Kg

ALPHA ANALYTICAL LABS
VOLATILE ORGANICS ANALYSIS by GC/MS
METHOD 8260

Alpha Job Number: 912139 Date Reported: 4/23/91
Alpha Sample Number(s): 912139.1-.9
Method Detection Limit: Stated below

COMPOUNDS	
Styrene	50 ug/Kg
Ethyl methacrylate	-- ug/Kg
Acrolein	-- ug/Kg
Acrylonitrile	-- ug/Kg
Methyl tert butyl ether	500 ug/Kg
1,2-Dichlorobenzene	500 ug/Kg
1,3-Dichlorobenzene	500 ug/Kg
1,4-Dichlorobenzene	500 ug/Kg

ALPHA ANALYTICAL LABS
ADDENDUM I
REFERENCES

1. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. EPA SW-846. 1986.

2. Standard Methods for Examination of Water and Waste Water. APHA-AWWA-WPCF. 16th Edition. 1985.

3. Standard Methods for Examination of Water and Waste Water. APHA-AWWA-WPCF. 17th Edition. 1989.

4. Methods for Chemical Analysis of Water and Wastes. EPA 600/4-82-055. 1983.

5. Oil Spill Identification System. CG-D-52-77 U. S. Coast Guard. 1977.

6. Methods for Organic Chemical Analysis of Municipal and Industrial Waste Water. EPA 600/4-82-057. 1982.

7. U. S. Department of Health & Human Services, National Institute of Occupational Safety and Health. Peter M. Eller, NIOSH Manual of Analytical Methods, Third Edition, 1984.

8. Handbook of Analytical Quality Control in Water and Wastewater Laboratories. EPA 600/4-79-019. March 1979.

9. The United States Pharmacopeia. The National Formulary. USP 20th Edition. Formulary 15th Edition. 1980.

10. Choosing Cost-Effective QA/QC (Quality Assurance/Quality Control) Programs for Chemical Analysis. PB85-241461. U. S. Department of Commerce, National Technical Information Service. August 1985.

11. Manual of Analytical Quality Control for Pesticides in Human and Environmental Media. PB 261 019. EPA 600/1-76-017. February 1975.

12. Annual Book of ASTM Standards. Sections 0, 3, 4, 5, 6, 8, 9, 11, and 14. American Society for Testing and Materials 1986.

13. 40 CFR Part 261, App. II. Method 1311 Toxicity Characteristic Leaching Procedure (TCLP). July 1, 1990 Edition.

14. Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water. Available from USEPA, Cincinnati, 26 West Martin Luther King Drive, Cincinnati, Ohio, 45268.

15. Interim Methods for the Determination of Asbestiform Minerals in Bulk Insulation Samples, Research Triangle Institute, June 1980. Asbestos Containing Materials in School Buildings: A Guidance Document, March 1979, USEPA Document C00090, parts 1 & 2.

16. Interim Methods for the Determination of Asbestos in Bulk Insulation Samples (EPA-600/M4-82-020).

17. "Prescribed Procedures for Measurement of Radioactivity in Drinking Water," Publication EPA-600/4-80-032, U. S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, August 1980.

18. "Clean Harbors Radiological Environmental Analytical Procedures," Clean Harbors Analytical Services, Braintree, MA, October 1985.

19. H. M. Prichard and T. F. Gesell, "Rapid Measurement of RN-222 Concentrations in Water with a Commercial Liquid Scintillation Counter", Health Physics, Volume 33, 1977, pp. 577-581.

20. "Handbook for Analytical Quality Control in Water and Wastewater Laboratories", March 1979, EPA 600/4-79-019.

21. Analysis of PCB's in Transformer Fluid and Waste Oil. EPA 600/4-81-045. 1981.

22. Klute, A. 1986, "Methods of Soil Analysis, Part 1", Methods 15-2.2 and 15-5.1. American Society of Agronomy, Madison, WI.

23. Exhibit No. 1. Petroleum Oils by Gas Chromatography. Alley, Young & Baumartner, Inc., Consulting Engineers, P.O. Box 2036, Brentwood, TN 37024.

24. Principal Organic Hazardous Constituents and Products of Incomplete Combustion Screening Protocol. Southern Research Institute, October 1989.

ALPHA ANALYTICAL LABORATORIES

ACCEPTABLE MATRIX SPIKE RECOVERY LIMITS

FOR INORGANICS

PARAMETER GROUP	WATER	SOIL
Metals	75-125 %	60-140 %
Wet Chemistry	70-130 %	N/A

ALPHA ANALYTICAL LABORATORIES

ACCEPTABLE MATRIX SPIKE RECOVERY LIMITS

FOR ORGANICS

FRACTION	MATRIX SPIKE COMPOUND	WATER	SOIL/SEDIMENT
VOA	1,1-Dichloroethene	61-145 %	59-172 %
VOA	Trichloroethene	71-120 %	62-137 %
VOA	Chlorobenzene	75-130 %	60-133 %
VOA	Toluene	76-125 %	59-139 %
VOA	Benzene	76-127 %	66-142 %
BN	1,2,4-Trichlorobenzene	39-98 %	38-107 %
BN	Acenaphthene	46-118 %	31-137 %
BN	2,4-Dinitrotoluene	24-96 %	28-89 %
BN	Di-n-butyl phthalate	11-117 %	29-135 %
BN	Pyrene	26-127 %	35-142 %
BN	N-nitros-di-n-propylamine	41-116 %	41-126 %
BN	1,4-Dichlorobenzene	36-97 %	28-104 %
Acid	Pentachlorophenol	9-103 %	17-109 %
Acid	Phenol	12-89 %	26-90 %
Acid	2-Chlorophenol	27-123 %	25-102 %
Acid	4-Chloro-3-methylphenol	23-97 %	26-103 %
Acid	4-Nitrophenol	10-80 %	11-114 %
Pest.	Lindane	56-123 %	46-127 %
Pest.	Heptachlor	40-131 %	35-130 %
Pest.	Aldrin	40-120 %	34-132 %
Pest.	Dieldrin	52-126 %	31-134 %
Pest.	Endrin	56-121 %	42-139 %
Pest.	4,4'-DDT	38-127 %	23-134 %

ALPHA ANALYTICAL LABORATORIES

RELATIVE PERCENT DIFFERENCE

CRITERIA FOR DUPLICATE ANALYSIS

PARAMETER GROUP	WATER	SOIL
Organics:		
Volatile Organics	30 %	30 %
Acid/Base/Neutrals	40 %	40 %
Pesticides/PCB's	40 %	40 %
Inorganics:		
Metals	20 %	30 %
Wet Chemistry	30 %	30 %

CHAIN OF CUSTODY RECORD

S E A Consultants Inc.
Engineers/ Architects
Cambridge, MA. S. Portland, ME. Wethersfield, CT.

Project: Easthampton - TCE
Client: Easthampton
Location: Easthampton, MA
Project No: 90072.1V

SAMPLE IDENTIFICATION AND ANALYSIS

S E A Sample I.D. No.	Lab. I.D. No.	No. of Containers	Sample Location	Sample Type	Date	Time	Analysis Required
90072.1V	.	1	9A-10	Soil	4/3/91	2 PM	VOC #8240 and TPH by IR
		1	9A-14	"	4/4/91	9 AM	"
		1	9A-18	"	4/4/91	noon	"
		1	9A-24	"	4/5/91	1 PM	"
		1	9B-1	"	4/8/91	1 PM	"
		1	10A-14	"	3/28/91	2 PM	"
		1	10B-16	"	4/2/91	10 AM	"
		1	11A-16	"	3/27/91	11 AM	"

COMMENTS:

CHAIN OF CUSTODY CHRONICLE :

COLLECTED BY :

1 NAME : KOSTA EXARHOULAKOS COMPANY : SEA
SIGNATURE : Kosta [signature] DATE : 4/9/91 TIME : 2 PM

CUSTODY TRANSFERRED TO :

2 NAME : W. T. GOWARD COMPANY : AIDIA
SIGNATURE : W. T. Goward DATE : 4/10/91 TIME : 11 20 AM

CUSTODY TRANSFERRED TO :

3 NAME : COMPANY :
SIGNATURE : DATE : TIME :

RECIEVED IN LABORATORY BY :

4 NAME : B. Marcotte COMPANY : Aidia
SIGNATURE : B. Marcotte DATE : 4/10/91 TIME : 12:00

NOTE: Original remains with sample containers

MW-9C
SOIL SAMPLE

ALPHA ANALYTICAL LABORATORIES

Eight Walkup Drive
Westborough, Massachusetts 01581-1019
(508) 898-9220

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

CERTIFICATE OF ANALYSIS

Client: SEA Consultants

Address: 485 Massachusetts Avenue
Cambridge, MA 02139

Attn: Kosta Exarhoulakos

Client Designation: Project #90072.1V

Laboratory Job Number: 912656

Invoice Number: 20957

Date Received: 05/01/91

Date Reported: 05/15/91

Delivery Method: Alpha courier

ALPHA SAMPLE NUMBER	CLIENT IDENTIFICATION	SAMPLE LOCATION
912656.1	90072.1V	9C-23

Authorized by: [signature]
Scott McLean - Laboratory Director

kmg

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 912656.1 Date Received: 05/01/91

Sample Matrix: Soil (results are reported on a dry weight basis) Date Reported: 05/15/91

Condition of Samples: Satisfactory Field Prep: None

Number & Type of Containers: One glass jar

Analysis Requested: Total Petroleum Hydrocarbons, Volatile Organics and Total Solids

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	ANALYSIS
Total Petroleum Hydrocarbons	66	mg/Kg	40	3	5520CDF	05/08/91	05/09/91
Volatile Organics ***	ND	ug/Kg	**	1	8260	05/02/91	05/14/91
Total Solids	86	%	0.1	3	2540B	----	05/09/91

Volatile Organics	% Surrogate Recovery
1,2-Dichloroethane-d4	104%
Toluene-d8	100%
4-Bromofluorobenzene	91%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABS
VOLATILE ORGANICS ANALYSIS by GC/MS
METHOD 8260

Alpha Job Number: 912656 Date Reported: 05/15/91
Alpha Sample Number(s): 912656.1
Method Detection Limit: See below

COMPOUNDS

Methylene chloride	250 ug/Kg
1,1-Dichloroethane	75 ug/Kg
Chloroform	75 ug/Kg
Carbon tetrachloride	50 ug/Kg
1,2-Dichloropropane	175 ug/Kg
Dibromochloromethane	50 ug/Kg
1,1,2-Trichloroethane	75 ug/Kg
2-Chloroethylvinyl ether	500 ug/Kg
Tetrachloroethene	75 ug/Kg
Chlorobenzene	175 ug/Kg
Trichlorofluoromethane	250 ug/Kg
1,2-Dichloroethane	75 ug/Kg
1,1,1-Trichloroethane	50 ug/Kg
Bromodichloromethane	50 ug/Kg
Trans-1,3-Dichloropropene	75 ug/Kg
Cis-1,3-Dichloropropene	50 ug/Kg
Bromoform	50 ug/Kg
1,1,2,2-Tetrachloroethane	50 ug/Kg
Benzene	50 ug/Kg
Toluene	75 ug/Kg
Ethyl benzene	50 ug/Kg
Xylenes	50 ug/Kg
Chloromethane	500 ug/Kg
Bromomethane	100 ug/Kg
Vinyl chloride	175 ug/Kg
Chloroethane	500 ug/Kg
1,1-Dichloroethene	75 ug/Kg
Trans-1,2-dichloroethene	75 ug/Kg
Cis-1,2-dichloroethene	50 ug/Kg
Trichloroethene	50 ug/Kg
Dibromomethane	500 ug/Kg
1,4-Dichloro-2-butane	500 ug/Kg
Ethanol	-- ug/Kg
Iodomethane	-- ug/Kg
1,2,3-Trichloropropane	500 ug/Kg
Dichlorodifluoromethane	500 ug/Kg
Acetone	500 ug/Kg
Carbon disulfide	500 ug/Kg
2-Butanone	225 ug/Kg
Vinyl acetate	500 ug/Kg
4-Methyl-2-pentanone	500 ug/Kg
2-Hexanone	500 ug/Kg

ALPHA ANALYTICAL LABS
VOLATILE ORGANICS ANALYSIS by GC/MS
METHOD 8260

Alpha Job Number: 912656 Date Reported: 05/15/91
Alpha Sample Number(s): 912656.1
Method Detection Limit: See below

COMPOUNDS

Styrene	50 ug/Kg
Ethyl methacrylate	-- ug/Kg
Acrolein	-- ug/Kg
Acrylonitrile	-- ug/Kg
Methyl tert butyl ether	500 ug/Kg
1,2-Dichlorobenzene	500 ug/Kg
1,3-Dichlorobenzene	500 ug/Kg
1,4-Dichlorobenzene	500 ug/Kg

ALPHA ANALYTICAL LABORATORIES

ACCEPTABLE SURROGATE SPIKE RECOVERY LIMITS

FRACTION	SURROGATE COMPOUND	LOW/MEDIUM WATER	LOW/MEDIUM SOIL/SEDIMENT
VOA	Toluene-d_8	88-110 %	81-117 %
VOA	4-Bromofluorobenzene	86-115 %	74-121 %
VOA	1,2-Dichloroethane-d_4	76-114 %	70-121 %
BNA	Nitrobenzene-d_5	35-114 %	23-120 %
BNA	2-Fluorobiphenyl	43-116 %	30-115 %
BNA	p-Terphenyl-d_{14}	33-141 %	18-137 %
BNA	Phenol-d_5	10-94 %	24-113 %
BNA	2-Fluorophenol	21-100 %	25-121 %
BNA	2,4,6-Tribromophenol	10-123 %	19-122 %
Pest.	Dibutylchlorendate	24-154 %	20-150 %

ALPHA ANALYTICAL LABS
ADDENDUM I
REFERENCES

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1. Test Methods for Evaluating Solid Waste: Physical/Chemical Methods. EPA SW-846. 1986.

2. Standard Methods for Examination of Water and Waste Water. APHA-AWWA-WPCF. 16th Edition. 1985.

3. Standard Methods for Examination of Water and Waste Water. APHA-AWWA-WPCF. 17th Edition. 1989.

4. Methods for Chemical Analysis of Water and Wastes. EPA 600/4-82-055. 1983.

5. Oil Spill Identification System. CG-D-52-77 U. S. Coast Guard. 1977.

6. Methods for Organic Chemical Analysis of Municipal and Industrial Waste Water. EPA 600/4-82-057. 1982.

7. U. S. Department of Health & Human Services, National Institute of Occupational Safety and Health. Peter M. Eller, NIOSH Manual of Analytical Methods, Third Edition, 1984.

8. Handbook of Analytical Quality Control in Water and Wastewater Laboratories. EPA 600/4-79-019. March 1979.

9. The United States Pharmacopeia. The National Formulary. USP 20th Edition. Formulary 15th Edition. 1980.

10. Choosing Cost-Effective QA/QC (Quality Assurance/Quality Control) Programs for Chemical Analysis. PB85-241461. U. S. Department of Commerce, National Technical Information Service. August 1985.

11. Manual of Analytical Quality Control for Pesticides in Human and Environmental Media. PB 261 019. EPA 600/1-76-017. February 1975.

12. Annual Book of ASTM Standards. Sections 0, 3, 4, 5, 6, 8, 9, 11, and 14. American Society for Testing and Materials 1986.

13. 40 CFR Part 261, App. II. Method 1311 Toxicity Characteristic Leaching Procedure (TCLP). July 1, 1990 Edition.

14. Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water. Available from USEPA, Cincinnati, 26 West Martin Luther King Drive, Cincinnati, Ohio, 45268.

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15. Interim Methods for the Determination of Asbestiform Minerals in Bulk Insulation Samples, Research Triangle Institute, June 1980. Asbestos Containing Materials in School Buildings: A Guidance Document, March 1979, USEPA Document C00090, parts 1 & 2.

16. Interim Methods for the Determination of Asbestos in Bulk Insulation Samples (EPA-600/M4-82-020).

17. "Prescribed Procedures for Measurement of Radioactivity in Drinking Water," Publication EPA-600/4-80-032, U. S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, August 1980.

18. "Clean Harbors Radiological Environmental Analytical Procedures," Clean Harbors Analytical Services, Braintree, MA, October 1985.

19. H. M. Prichard and T. F. Gesell, "Rapid Measurement of RN-222 Concentrations in Water with a Commercial Liquid Scintillation Counter", Health Physics, Volume 33, 1977, pp. 577-581.

20. "Handbook for Analytical Quality Control in Water and Wastewater Laboratories", March 1979, EPA 600/4-79-019.

21. Analysis of PCB's in Transformer Fluid and Waste Oil. EPA 600/4-81-045. 1981.

22. Klute, A. 1986, "Methods of Soil Analysis, Part 1", Methods 15-2.2 and 15-5.1. American Society of Agronomy, Madison, WI.

23. Exhibit No. 1. Petroleum Oils by Gas Chromatography. Alley, Young & Baumartner, Inc., Consulting Engineers, P.O. Box 2036, Brentwood, TN 37024.

24. Principal Organic Hazardous Constituents and Products of Incomplete Combustion Screening Protocol. Southern Research Institute, October 1989.

CHAIN OF CUSTODY RECORD

S E A Consultants Inc.
Engineers/ Architects
Cambridge, MA. S. Portland, ME. Wethersfield, CT.

Project: Easthampton - TCE
Client: Easthampton
Location: Easthampton, MA
Project No: 90072.IV

SAMPLE IDENTIFICATION AND ANALYSIS

S E A Sample I.D. No.	Lab. I.D. No.	No. of Containers	Sample Location	Sample Type	Date	Time	Analysis Required
90072 IV	·	1	9C - 23	Soil	4/26/91	3 PM	VOC #8240, + TPH by IR

COMMENTS:

CHAIN OF CUSTODY CHRONICLE :

COLLECTED BY :

1 NAME: Kosta Exarhoulakos COMPANY: SEA
SIGNATURE: Kosta Ex[illegible] DATE: 5/1/91 TIME: 10:30 PM

CUSTODY TRANSFERRED TO :

3 NAME: COMPANY:
SIGNATURE: DATE: TIME:

CUSTODY TRANSFERRED TO :

2 NAME: Scott Stenstrom COMPANY: Alpha Analytical
SIGNATURE: [illegible] DATE: 5-1-91 TIME: 4:00

RECIEVED IN LABORATORY BY :

4 NAME: B. Maywalth COMPANY: Alpha
SIGNATURE: B. Maywalth DATE: 5/1/91 TIME: 5:00

NOTE: Original remains with sample containers

WATER BUFFALO TESTS
FOR PHASE II WELLS

ALPHA ANALYTICAL LABORATORIES

Eight Walkup Drive
Westborough, Massachusetts 01581-1019
(508) 898-9220

MA 086   NH 198958-A   CT PH-0574   NY 11148   NC 320   SC 88006

CERTIFICATE OF ANALYSIS

Client: SEA Consultants

Address: 485 Massachusetts Avenue
Cambridge, MA 02139

Attn: Kosta Exarhoulakos

Client Designation: N/A

Laboratory Job Number: 911750

Invoice Number: 20022

Date Received: 03/26/91

Date Reported: 04/09/91

Delivery Method: Alpha Courier

ALPHA SAMPLE NUMBER	CLIENT IDENTIFICATION	SAMPLE LOCATION
911750.1	90072.1V	Easthampton Water Dept.
911750.2	Tripblank	Easthampton Water Dept.

Authorized by: [signature]
Scott McLean - Laboratory Director

kmg

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086   NH 198958-A   CT PH-0574   NY 11148   NC 320   SC 88006

Laboratory Sample Number: 911750.1   Date Received: 03/26/91

Sample Matrix: Water   Date Reported: 04/09/91

Condition of Samples: Satisfactory   Field Prep: None

Number & Type of Containers: Two glass bottles and two VOA vials

Analysis Requested: Total Petroleum Hydrocarbons and Volatile Organics

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Total Petroleum Hydrocarbons	ND	mg/L	0.5	3	5520CDF	03/28/91	03/29/91
Volatile Organics ***	ND	ug/L	**	14	524.2	----	04/06/91

Volatile Organics	% Surrogate Recovery
1,2-Dichloroethane-d4	110%
Toluene-d8	109%
4-Bromofluorobenzene	114%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABORATORIES
CERTIFICATE OF ANALYSIS

MA 086 NH 198958-A CT PH-0574 NY 11148 NC 320 SC 88006

Laboratory Sample Number: 911750.2 **Date Received:** 03/26/91

Sample Matrix: Water **Date Reported:** 04/09/91

Condition of Samples: Satisfactory **Field Prep:** None

Number & Type of Containers: One VOA vial

Analysis Requested: Volatile Organics

PARAMETER	RESULT	UNITS	MDL**	REF*	METHOD	DATES EXT/PREP	DATES ANALYSIS
Volatile Organics ***	ND	ug/L	**	14	524.2	----	04/06/91

Volatile Organics	% Surrogate Recovery
1,2-Dichloroethane-d4	108%
Toluene-d8	105%
4-Bromofluorobenzene	105%

COMMENTS: * Complete list of References found in Addendum I
** A list of volatile organics analyzed for and their detection limits accompanies this report.
*** All compounds were below the detection limits except those listed above.

ALPHA ANALYTICAL LABS
VOLATILE ORGANICS ANALYSIS by GC/MS
METHOD 524.2

Alpha Job Number: 911750 Date Reported: 04/09/91
Alpha Sample Number(s): 911750.1 & .2
Method Detection Limit: See below

COMPOUNDS	
Methylene chloride	0.9 ug/L
1,1-Dichloroethane	1.6 ug/L
Chloroform	0.5 ug/L
Carbon tetrachloride	0.5 ug/L
1,2-Dichloropropane	2.0 ug/L
Dibromochloromethane	1.0 ug/L
1,1,2-Trichloroethane	1.7 ug/L
2-Chloroethylvinyl ether	3.3 ug/L
Tetrachloroethene	0.5 ug/L
Chlorobenzene	2.0 ug/L
Trichlorofluoromethane	1.7 ug/L
1,2-Dichloroethane	0.5 ug/L
1,1,1-Trichloroethane	0.5 ug/L
Bromodichloromethane	0.7 ug/L
trans-1,3-Dichloropropene	1.7 ug/L
cis-1,3-Dichloropropene	1.7 ug/L
Bromoform	1.6 ug/L
1,1,2,2-Tetrachloroethane	2.3 ug/L
Benzene	0.5 ug/L
Toluene	2.0 ug/L
Ethyl benzene	2.4 ug/L
Xylenes	3.3 ug/L
Chloromethane	2.7 ug/L
Bromomethane	2.3 ug/L
Vinyl chloride	0.5 ug/L
Chloroethane	2.5 ug/L
1,1-Dichloroethene	0.5 ug/L
Trans-1,2-dichloroethene	0.5 ug/L
Cis-1,2-dichloroethene	0.5 ug/L
Trichloroethene	0.5 ug/L
1,2-Dichlorobenzene	0.5 ug/L
1,3-Dichlorobenzene	0.5 ug/L
1,4-Dichlorobenzene	0.5 ug/L
Acetone	33.4 ug/L
Carbon disulfide	6.7 ug/L
2-Butanone	10.0 ug/L
Vinyl acetate	10.0 ug/L
4-Methyl-2-pentanone	6.7 ug/L
2-Hexanone	6.7 ug/L
Styrene	3.3 ug/L
o-Xylene	3.3 ug/L

ALPHA ANALYTICAL LABS
VOLATILE ORGANICS ANALYSIS by GC/MS
METHOD 524.2
CONTINUED (Page 2 of 2)

Alpha Job Number: 911750 Date Reported: 04/09/91
Alpha Sample Number(s): 911750.1 & .2
Method Detection Limit: See below

COMPOUNDS

1,1-Dichloropropene	10.0 ug/L
2,2-Dichloropropane	10.0 ug/L
1,1,1,2-Tetrachloroethane	10.0 ug/L
1,2,3-Trichloropropane	10.0 ug/L
Bromochloromethane	10.0 ug/L
n-Butylbenzene	10.0 ug/L
Dichlorodifluoromethane	10.0 ug/L
Hexachlorobutadiene	10.0 ug/L
Isopropylbenzene	10.0 ug/L
p-Isopropyltoluene	10.0 ug/L
Naphthalene	10.0 ug/L
n-Propylbenzene	10.0 ug/L
Sec-butylbenzene	10.0 ug/L
Tert-butylbenzene	10.0 ug/L
1,2,3-Trichlorobenzene	10.0 ug/L
1,2,4-Trichlorobenzene	10.0 ug/L
1,2,4-Trimethylbenzene	10.0 ug/L
1,3,5-Trimethylbenzene	10.0 ug/L
Bromobenzene	10.0 ug/L
o-Chlorotoluene	10.0 ug/L
p-Chlorotoluene	10.0 ug/L
Dibromomethane	10.0 ug/L
1,2-Dibromoethane	10.0 ug/L
1,2-Dibromo-3-chloropropane	10.0 ug/L
1,3-Dichloropropane	10.0 ug/L

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ALPHA ANALYTICAL LABS
ADDENDUM I
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13. 40 CFR Part 261, App. II. Method 1311 Toxicity Characteristic Leaching Procedure (TCLP). July 1, 1990 Edition.

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ALPHA ANALYTICAL LABORATORIES

ACCEPTABLE SURROGATE SPIKE RECOVERY LIMITS

FRACTION	SURROGATE COMPOUND	LOW/MEDIUM WATER	LOW/MEDIUM SOIL/SEDIMENT
VOA	Toluene-d_8	88-110 %	81-117 %
VOA	4-Bromofluorobenzene	86-115 %	74-121 %
VOA	1,2-Dichloroethane-d_4	76-114 %	70-121 %
BNA	Nitrobenzene-d_5	35-114 %	23-120 %
BNA	2-Fluorobiphenyl	43-116 %	30-115 %
BNA	p-Terphenyl-d_{14}	33-141 %	18-137 %
BNA	Phenol-d_5	10-94 %	24-113 %
BNA	2-Fluorophenol	21-100 %	25-121 %
BNA	2,4,6-Tribromophenol	10-123 %	19-122 %
Pest.	Dibutylchlorendate	24-154 %	20-150 %

EST
ENVIRONMENTAL
SAMPLING
TECHNOLOGY

■ 14 Grant Street ■ Framingham, MA 01701 ■ (508) 620-0002

Client: SEA Consultants
Site: Easthampton, MA

EST Technicians: Patrick Falla, John O'Brien
Sampling Date: May 21-22, 1991

Well ID	Well Depth (feet)	SWL (feet)	Temperature (°C)	pH	Spec. Conduct. (umhos)
MW1	60.13	39.64	13.1	6.41	100
MW2	17.56	9.35	13.9	5.98	55
MW4~~B~~ A	112.55	70.60	13.9	6.13	180
MW5~~A~~ B	62.11	31.45	12.0	6.78	195
MW5~~B~~ A	101.82	31.45	12.1	6.91	150
MW6	4.85	2.25	13.9	6.09	765
MW8	20.85	8.20	12.5	6.98	25
MW9A	118.00	32.50	13.4	6.90	156
MW9B	Well not located.				
MW9C	121.36	37.48	13.9	6.77	155
MW10A	84.44	11.56	12.6	6.63	190
MW10B	84.51	13.27	13.6	6.91	170
MW11A	95.60	9.21	12.5	6.74	120

Well depth for MW9B is 53.58', measurement taken on June 25, 1991

EST
ENVIRONMENTAL SAMPLING TECHNOLOGY

■ 14 Grant Street ■ Framingham, MA 01701 ■ (508) 620-0002

Client: **SEA Consultants, Inc.**
Site: Easthampton, MA
EST Technicians: Patrick A. Falla, John O'Brien, John Carlin
Sampling Date: June 20-21, 1991, June 25, 1991

TABLE 1

Well ID	SWL (ft)	pH (s.u.)	Specific Conductance (μmhos)	Temp. (°C)
MW1	39.66	6.10	109	13.2
MW2	9.37	5.50	56	14.5
MW4~~B~~A	70.61	6.30	190	14.0
MW5~~A~~B	31.46	6.75	200	12.3
MW5~~B~~A	31.45	6.74	155	12.0
MW6	2.24	6.48	775	14.2
MW8	8.20	7.01	25	13.0
MW9A	32.51	6.98	158	14.8
MW9B	32.97	6.09	162	14.8
MW9C	37.49	6.80	154	14.6
MW10A	11.59	6.59	185	12.3
MW10B	13.29	6.90	167	14.3
MW11A	9.24	6.70	118	12.7

All wells 2" diameter. Three well volumes were purged prior to sample collection. Samples were field filtered to .45 micron. Samples were delivered to Alpha Analytical Labs in Westboro, MA.

APPENDIX D - Summary of Field Gas Chromatograph Soil Headspace Analyses

Summary of Field Gas Chromatograph
Soil Headspace Analyses
Soil Boring TCE Concentration (ppb)

Sampling Interval Depth (Feet)	Soil Boring						
	MW-1	MW-2	MW-3	MW-4A	MW-5A	MW-7	MW-8
0-2	<1	†	<1	ND	ND	ND	<1
4-6	ND	ND	<1	ND	ND	<1	<1
9-11	<1	<1	<1	ND	ND	ND	<1
14-16	ND	1	<1	ND	<1	<1	<1*
19-21	<1	<1	<1	ND	ND	ND	
24-26	ND	ND	<1	ND	ND	ND	
29-31	ND	ND	<1	ND	ND	ND	
34-36	ND	ND	<1	ND	ND	ND	
39-41	ND	ND	ND	ND	<1	ND	
44-46	ND	ND	<1	ND	ND	<1	
47-49	†	†	†	†	†	<1*	
49-51	ND	ND	†	ND	ND		
54-56	ND	ND	<1	ND	ND		
59-61	ND*	ND	†	ND	ND		
61-63		†	ND	†	†		
64-66		ND	ND	ND	ND		
69-71		ND	<1	ND	ND		
74-76		ND*	ND	†	ND		
79-81			<1	ND	ND		
84-86				ND	ND		
89-91				ND	ND		
94-96				ND*	ND		
99-101					ND		
104-106					ND		
109-111					ND*		

Notes:

1. ND = None Detected.
2. * = Deepest sampling interval of soil boring.
3. † = Interval Not Sampled.
4. Soil headspace analyses were not performed at MW-4B, MW-5B, and MW-9B as each was a shallow boring/well of a well couplet.
5. MW-6 was a hand driven wellpoint and no soil samples were taken.

Summary of Field Gas Chromatograph
Soil Headspace Analyses
Soil Boring TCE Concentration (ppb)

Sampling Interval Depth (Feet)	Soil Boring				
	MW-9A	MW-9C	MW-10A	MW-10B	MW-11A
4-6	<1	<1	2	<1	<1
9-11	<1	ND	2	<1	ND
14-16	<1	ND	2.2	ND	ND
19-21	<1	ND	<1	ND	†
24-26	<1	ND	ND	ND	ND
29-31	<1	ND	2	ND	ND
34-36	†	†	1.2	ND	ND
39-41	<1	ND	1.8	ND	ND
44-46	1.0	†	1.8	ND	ND
49-51	1.9	ND	1.8	†	ND
54-56	<1	†	1.8	ND	ND
59-61	<1	ND	1.8	ND	†
64-66	<1	ND	1.6	ND	†
69-71	<1	ND	1.8	ND	ND
74-76	<1	ND	†	1.3	ND
79-81	<1	1.2	<1*	<1*	ND
84-86	†	ND			ND
89-91	<1	1.1			<1
94-96	<1	ND			ND*
99-101	<1	1.3			
104-106	1.4	1.7			
109-111	<1	2.9			
114-116	5.7	4.0			
119-121	8.4*	1.6*			

Notes:

1. ND = None Detected.
2. * = Deepest sampling interval of soil boring.
3. † = Interval Not Sampled.
4. Soil headspace analyses were not performed at MW-4B, MW-5B, and MW-9B as each was a shallow boring/well of a well couplet.
5. MW-6 was a hand driven wellpoint and no soil samples were taken.

APPENDIX E - DEP TCE Air Stripper Policy (88-01)

Daniel S. Greenbaum
COMMISSIONER

The Commonwealth of Massachusetts

Executive Office of Environmental Affairs
Department of Environmental Quality Engineering
Division of Water Supply
One Winter Street, Boston, Mass. 02108

DWS Policy 88-01
DAQC Policy
Date: 1/06/89

Division of Water Supply Policy 88-01
Division of Air Quality Control Policy

Trichloroethylene (TCE) Air Stripper Policy

This policy is adopted jointly by the Division of Air Quality Control (DAQC) and the Division of Water Supply (DWS) to limit the impact of trichloroethylene (TCE) in the atmosphere due to the removal of that compound from public water supplies. It is based upon calculations of air emissions developed by DAQC. It establishes criteria for water supply treatment facility parameters that can allow a TCE air stripper without specific air pollution controls to be approved under 310 CMR 7.02.

This policy may be superseded when new technologies become available, when facility parameters differ significantly, when costs change significantly, or when an air regulation is adopted to regulate these new sources.

POLICY

Air strippers without specific air pollution controls to remove TCE during water treatment will be approved when the following criteria have been met.

1. The treatment plant and wells have a minimum 400 foot zone of protection around the stack; no terrain or building in the 400 foot zone extends higher than the emission point, and
2. The air stripper tower (packed or spray) height is no less than thirty (30) feet, and
3. Treatment technologies other than air stripping have also been considered by the supplier and found to be less effective or unreasonably expensive, and
4. The stack flow rate for a spray tower is equal to or greater than 7 cubic feet per second, and for a packed tower, equal to or greater than 43 cubic feet per second, and
5. The minimum temperature of the water being treated is no less than 42 degrees F, and

DWS Policy 88-01
DAQC Policy
Date: 1/06/89

6. Emissions of TCE will not exceed 0.013 grams per second from a spray tower air stripper and 0.033 grams per second from a packed tower air stripper, as calculated by the following formula:

$$\frac{Q(\text{Max. CFS}) \times C(\text{Max. TCE of water being treated in mg/l}) \times 28.32}{1{,}000} \leq \text{gm/sec}$$

DWS and DAQC will review this policy twelve months from its effective date.

Procedure

1. The public water supplier will evaluate the design for conformity with the criteria above and submit a summary of the relevant facts and calculations to the DWS regional Section Chief.
2. DWS regional staff will review the summary and if all criteria are met, will approve the use and installation of the air stripper; if not, the package will be forwarded to the DAQC regional Section Chief.
3. DWS regional Section Chief will forward a copy of the summary and the letter of approval to the DAQC regional Section Chief.

Approved: 1/06/89

Bruce K. Maillet
Bruce K. Maillet
Director
Division of Air Quality Control

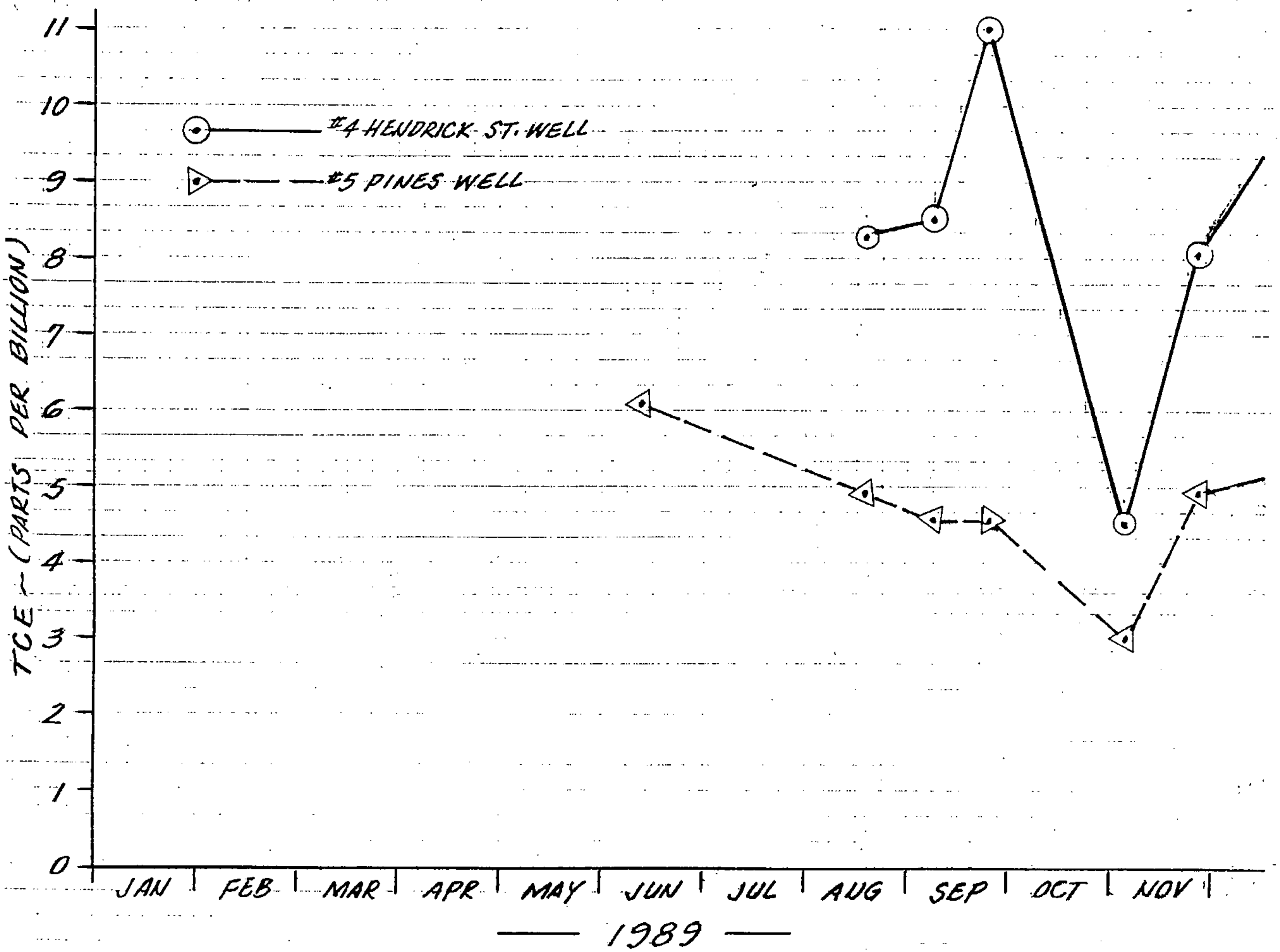
Effective: 1/25/89

Patricia L. Deese
Patricia L. Deese, P. E.
Director
Division of Water Supply

B\RHY\88POL2\P-8801\P-8801FN

APPENDIX F - Graphs of Historical TCE Concentrations

(Graphs Prepared by Easthampton Engineering Department)



TCE ~ (PARTS PER BILLION)
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#4 HENDRICK ST. WELL
#5 PINES WELL
JAN
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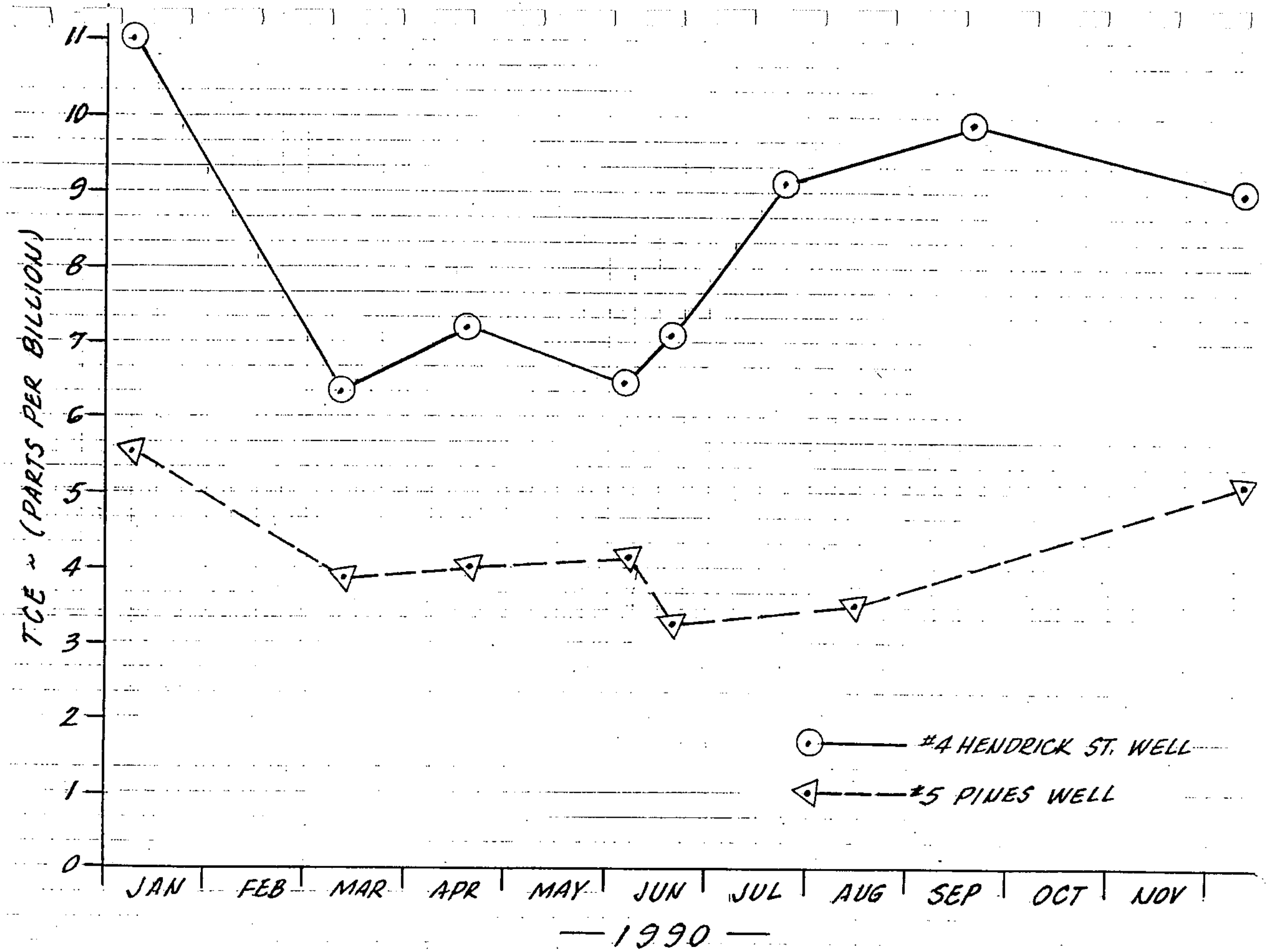
— 1989 —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TCE ~ (PARTS PER BILLION)
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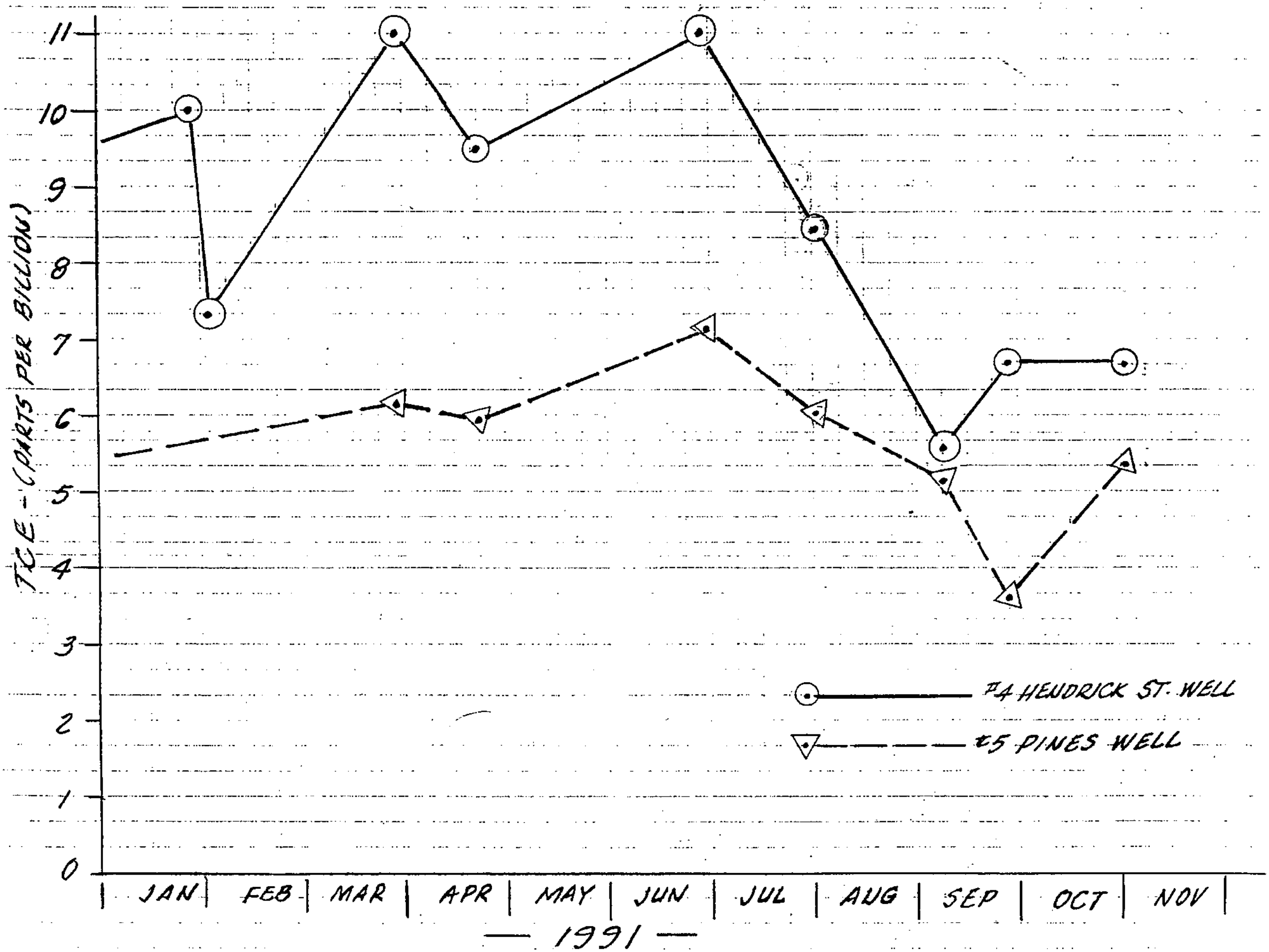
— 1990 —
#4 HENDRICK ST. WELL
#5 PINES WELL


TCE - (PARTS PER BILLION)
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#4 HENDRICK ST. WELL
#5 PINES WELL