U.S. Army Environmental Center

# PHASE III SITE INVESTIGATION DATA PACKAGE
# STUDY AREA 50
# MOORE ARMY AIRFIELD WORLD WAR II FUEL POINT
# FORT DEVENS, MASSACHUSETTS

## DATA ITEM A009

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## MOORE ARMY AIRFIELD WORLD WAR II FUEL POINT
## FORT DEVENS, MASSACHUSETTS

*Prepared for:*

U.S. Army Environmental Center
Aberdeen Proving Ground, Maryland
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*Prepared by:*

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Wakefield, Massachusetts
Project No. 6917.13

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PHASE III SITE INVESTIGATION
SA 50 - MOORE ARMY AIRFIELD WORLD WAR II FUEL POINT

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# 1.0 INTRODUCTION

## 1.1 DATA PACKAGE OBJECTIVES

The purpose of the Site Investigation (SI) Data Package is to preliminarily evaluate the data collected during the SI for the absence or presence of contamination at the subject study area (SA). Using these data, potential pathways of contaminant migration and potential risks to human and ecological receptors at the SA are evaluated. The data package also includes recommendations for future actions, permitting the acceleration of next-phase planning and contracting during the preparation of the SI Report. Based on the results of the preliminary evaluations, one of the following recommendations is made in the data package:

- Take no further action;
- initiate an immediate removal or interim action; or
- initiate additional studies (supplemental SI, environmental investigation alternatives analysis, or remedial investigation/feasibility study [RI/FS]).

Because of its inherent preliminary nature, the SI Data Package approach relies primarily on summary tables and figures with minimal supporting text.

This Phase III SI Data Package has been prepared to summarize field observations and laboratory chemical data results from Phase III SI activities performed at Fort Devens SA 50 (Moore Army Airfield [MAAF] World War II Fuel Point) to fill data gaps identified in the Supplemental SI (SSI) Data Package (ABB-ES, 1993e). The SSI was conducted to address data gaps identified in the original SI conducted on the Fort Devens SA Groups 3, 5 & 6. Where the original SI Data Package for SA Groups 3, 5 & 6 (ABB-ES, 1992) addressed all data gathered, this Phase III SI Data Package focuses on the data and field observations acquired under supplemental and Phase III field activities. These new data are discussed in conjunction with the original SI data, as appropriate, to assess contaminant conditions at SA 50. A chronology of SI Reports/Data Packages and Phase III Work Plans is provided in the following table.

| DOCUMENT TITLE | DATE ISSUED |
|---|---|
| Site Investigation Work Plan | June 1992 |
| Site Investigation Data Package | December 1992 |
| Final Site Investigation Report | April 1993 |
| Supplemental Site Investigation Work Plan | April 1993 |
| Supplemental Site Investigation Data Package | September 1993 |
| Phase III Site Investigation Work Plan | July 1994 |
| Phase III Site Investigation Work Plan Addendum | December 1994 |
| Phase III Site Investigation Data Package | June 1995 |

The preliminary contamination assessment in this Phase III SI Data Package provides the interpretive link between the tabulated chemical data, field observations, and the revised interpretation of the hydrogeological and physical environment. The major outputs of the contamination assessment (presented in Section 2) are the spatial distribution of chemical contaminants in each environmental medium, and identification and characterization of contaminant sources (qualitative and, to the extent possible, quantitative). These data are the basis for the preliminary assessment of contamination migration potential summarized in Section 2.3.

The Phase III SI contaminant assessment presented in Section 2 is then used in conjunction with the SI and SSI contaminant assessments to revise preliminary human health and ecological risk evaluations (Section 3). These risk evaluations form the basis for conclusions and recommendations presented in Section 4. In support of the data package recommendations presented in Section 4, a list of issues which should be considered when implementing the recommended actions is also included.

## 1.2 STUDY AREA BACKGROUND

SA 50 is located at the northern end of Moore Army Airfield (MAAF), on the Fort Devens North Post adjacent to Route 2A (Figure 1). During World War II there were two gasoline fueling systems at the airfield, one for fueling aircraft and trucks located on the airfield terrace (Fueling System A; Figure 2) and the other for only fueling trucks located at the base of the airfield terrace northern slope

(Fueling System B; Figure 2). According to Prior (1991, as cited by Biang et al., 1991, p. 4-186), these systems have not been in use since the late 1940s.

The two separate fueling systems were filled by gasoline shipments on a Boston & Maine Railroad spur (which no longer exists) located adjacent to Fueling System B. For Fueling System A, a rotary pump located in a pit near the railroad spur pumped gasoline through a 2½-inch pipe to two 25,000-gallon underground storage tanks (USTs) formally located on the airfield (beneath what is now the north ramp). From the USTs, the gasoline was piped under water pressure through a water-control and separator pit to four aircraft fueling-pit boxes and to one truck-fill stand at the airfield (Construction Division, 1941 and 1942; Aqua Systems, Inc., 1943).

Fueling System B consisted of three 25,000-gallon USTs formerly located at the base of the slope beside the railroad spur. Gasoline was piped from these tanks, under water pressure, to a truck fueling stand located approximately 150 feet away (west) along the base of the slope (U.S. Engineer Office, 1940, 1942a, and 1942b; Aqua Systems, Inc., 1943).

In 1992 the following fueling system components were still visible in their original locations:

| Fueling System A | Fueling System B |
|---|---|
| Gasoline transfer-pump pit and hose pits | Water-control pit and associated piping |
| Four aircraft fueling pits | Piping from tanks to truck fueling stand |
| | Tank-valve housings |
| | Three 25,000-gallon USTs |

## 1.3 Initial Site Investigation Activities (1992)

Investigations of SA 50 were conducted by ABB Environmental Services, Inc. (ABB-ES) as part of the Group 6 SIs undertaken in June 1992. Although no previous investigations of these fueling systems had been conducted, releases of

fuel associated with the 50-year-old USTs and incidental spills at the fuel transfer and dispensing points were considered possible sources of contamination.

A geophysical survey was conducted to identify other remaining fueling system components. The results of the geophysical surveys (magnetometer and ground penetrating radar) performed confirmed that at Fueling System A, the USTs, tank-valve housings, water-control and water-separator pits, and truck-fueling stand and associated piping had been removed, and that at Fueling System B the truck-fueling stand had been removed (ABB-ES, 1993a).

Ten soil borings (50B-92-01X through 50B-92-06X for System A, and 50B-92-07X through 50B-92-10X for System B) were drilled and sampled, and four monitoring wells (G6M-92-08X, -09X, -10X, and -11X) were installed (Figure 3). The monitoring wells were part of a network of 11 wells and four surface-water and sediment sampling locations (along the Nashua River located west of MAAF) established to evaluate the potential impacts of SA 50 and other Group 6 SAs on local groundwater conditions and the Nashua River. Soil, groundwater, surface water, and sediment samples were chemically analyzed by an Army-certified laboratory.

Analysis of the soil samples from the SA 50 borings detected total petroleum hydrocarbon compounds (TPHC) at Fueling System A in concentrations ranging from below the detection limit to a high of 244 $\mu$g/g (immediately beneath the pavement near the UST grave), and at Fueling System B ranging from below the detection limit to a high of 162 $\mu$g/g (at 12 feet below ground surface [bgs] adjacent to the USTs) (ABB-ES, 1993a).

Tetrachloroethylene (PCE) was the only volatile organic compound (VOC) detected in soil during the SI. The compound was found near the Fueling System B USTs in two samples from boring 50B-93-08X (0.00616 $\mu$g/g at the ground surface and 0.3 $\mu$g/g at 10 feet bgs) and in the 12-foot bgs sample from the soil boring at G6M-93-11X (0.0041 $\mu$g/g, in the duplicate sample only) (ABB-ES, 1993a).

The former fueling System B was located adjacent to a training and parachute-rigging facility of the U.S. Army 10$^{th}$ Group Special Forces Airborne (Buildings 3803 and 3840). In searching for a source of PCE, ABB-ES observed a 55-gallon drum labeled "Perchloroethylene" in that area. Perchloroethylene (PCE), a dry

cleaning solvent, is a chemical synonym for tetrachloroethylene. The drum had a spigot and was stored on a steel frame outdoors, at the east end of Shed 3801. It had no drip pad or other containment provisions. ABB-ES learned from the riggers that the PCE had been stored there for many years and that it was used by the riggers for cleaning parachute canopies. PCE was allegedly drawn from the drum into open hand-held containers and taken inside the rigging building (Building 3803) for use. In December 1992 the PCE drum was relocated into Building 3803.

Two rounds of groundwater sampling were conducted on the SA 50 monitoring wells. Samples were analyzed for organic and inorganic analytes, and TPHC. The only organic compound detected above the detection limits in groundwater from the four monitoring wells at SA 50 was bis(2-ethylhexyl)phthalate in Round 2 from wells G6M-92-09X and G6M-92-11X. Its presence in laboratory method blanks however, suggested that it may have been a laboratory artifact. TPHC was not found above the detection limit in groundwater from any of the SA 50 wells. Lead was detected above the Fort Devens background concentration in groundwater collected from G6M-92-09X and G6M-92-11X during Round 2 groundwater sampling (ABB-ES, 1993a).

## 1.4 UST REMOVAL

Between December 10 and 15, 1992 the gasoline transfer-pump pit and hose pits of Fueling System A and all remaining components of Fueling System B (Figure 4) were removed by Zenone, Inc., under contract to Fort Devens (Zenone, 1993).

Prior to excavation, 75,000 gallons of gasoline-contaminated water and 1,900 gallons of sludge were removed from the Fueling System B tanks. Two 600-gallon tanks were also found and removed from beneath the water-separator and water-control pits at Fueling System B. The gasoline tanks were observed to be in relatively good condition, with the asphalt coating generally still intact. Groundwater in the excavation appeared to have a thin film of hydrocarbon contamination on its surface (Zenone, 1993).

During the removal process, Zenone, Inc. field-screened for soil contamination by measuring total VOCs in soil-jar headspace using a photoionization detector

(PID). Approximately 450 tons of contaminated soil were removed from under the water-separator and water-control pits and from directly under the three 25,000-gallon USTs. Because of water in the excavation, it was not possible to excavate below a depth of approximately 18 feet. All excavations were backfilled to grade. Contaminated soil was temporarily stored in a parking lot near SA 50, and it was later batch-recycled by United Retek Corporation and transported to the Main Post (Zenone, 1993; Ostrowski, 1993).

Zenone, Inc. collected confirmatory soil samples from the excavations for all system components. Two water samples were also collected from the UST excavation. Based on field-screening results for total VOCs, selected samples (including two water samples) were sent for off-site laboratory analysis. Figure 5 show the sampling locations and the distribution of field-screening results from the UST excavation. Refer to Table 1 for a compilation of Zenone's field-screening and laboratory results.

The highest concentrations of total VOCs detected in PID-screened soils were 519 ppm and 535 ppm, collected from the water-separator and water-control pits, respectively. TPHC concentrations of 16 mg/kg in the water-separator-pit sample and "not detected" (ND) in the water-control pit sample were detected. The water-separator-pit sample also exhibited ethylbenzene at 121 $\mu$g/kg and xylene at 326 $\mu$g/kg. No VOCs were detected in the water-control pit sample. In soil collected from the bottom of the UST excavation, PID field-screening revealed total VOC concentrations ranging from less than 1 ppm to 278 ppm (Figure 5). The highest TPHC concentration (3,285 mg/kg) was measured in a soil sample collected near the west side of the UST excavation. All other TPHC concentrations at the site were less than 20 mg/kg, and most were ND. Lead concentrations in soil were in all cases less than the calculated Fort Devens background concentration of 34.4 mg/kg.

The two water samples from the UST excavation exhibited benzene concentrations of 38.8 $\mu$g/L and 297 $\mu$g/L. Insofar as the only benzene detected in groundwater was 5.0 $\mu$g/L in nearby monitoring well G6M-93-14X (installed during a later phase of investigation), it is likely that the benzene concentrations reported for the excavation water samples came from agitation and mixing with contaminated soil during soil removal. Lead concentrations were above the calculated Fort Devens background concentration for groundwater (4.25 $\mu$g/L). These elevated lead concentrations may have been the result of the same

agitation and mixing with contaminated soil that resulted in benzene contamination.

Confirmatory soil samples were collected during the UST excavation effort from areas where elevated soil headspace readings were observed. The samples obtained during the excavation of a buried pipeline (referred to in the Zenone [1993] report as Pipeline Area B [Figure 4]) at the former PCE drum storage location exhibited elevated head space readings. Samples were collected for laboratory analysis. The results revealed elevated concentrations of PCE (Table 1).

## 1.5 SUPPLEMENTAL SITE INVESTIGATION

Based on the SI results for both fueling systems, and Zenone's preliminary data, preliminary risk evaluations (PREs) were conducted on the available data and documented in the SI Report. It was concluded that while contaminants detected at SA 50 posed no unacceptable human health or ecological risks, contaminant distribution (specifically PCE) was not fully characterized at Fueling System B. Thus, it was recommended that no further action be taken at Fueling System A and that a SSI be conducted to further characterize the nature and extent of PCE contamination at Fueling System B.

### 1.5.1 SSI Field Activities Summary

The SSI field program at SA 50 began in May 1993, in accordance with the Task Order Work Plan (ABB-ES, 1993c) and in conformance to the provisions of the Project Operations Plan (ABB-ES, 1993b). The SSI focused on characterizing the distribution of PCE in soil and groundwater, and assessing the potential for downgradient migration of both PCE and possible residual gasoline compounds associated with the former USTs. The purpose and rationale for explorations completed as part of the SSI are presented in Table 2.

ABB-ES interviewed rigging staff from the 10$^{th}$ Special Forces Airborne. From these interviews, it was determined that in 1988, several troops hand carried a full drum of PCE out to the storage location adjacent to Shed 3801. In the process a spigot broke off the drum, and before the crew could stop the flow, "several" gallons of PCE were spilled onto the ground (ABB-ES, 1993d). The incident was

not reported, and no steps were taken to remove contaminated soil. With the additional information provided in that interview, the primary source of PCE in the soil was assumed to be from the major spill and perhaps other similar releases that occurred in the past. Incidental releases resulting from the day-to-day use of PCE were assumed to be secondary sources of soil contamination.

Prior to the start of subsurface investigation during the SSI, a ground-penetrating-radar (GPR) survey was conducted to locate buried utilities, and to verify that all components of Fueling System B had been removed by Zenone, Inc. None were found.

Soil-vapor samples were collected at 30 locations from a depth of 3 feet bgs (Figure 6). Using a portable gas chromatograph (GC), the samples were screened for VOCs in the field to indicate areas with elevated concentrations of PCE and gasoline compounds (benzene, toluene, ethylbenzene, and xylenes [BTEX]) in shallow soil. Concentrations were highest in the UST excavation and at the suspected PCE source (Table 3 and Figure 6).

Six soil borings (50B-93-11X through 50B-93-16X) were advanced during the SSI in locations exhibiting elevated soil vapor concentrations (Figure 7). Boring 50B-93-11X was drilled adjacent to the UST excavation and near the suspected PCE source area. Borings 50B-93-12X and 50B-93-14X were drilled in the suspected PCE source area. Borings 50B-93-13X, -15X, and -16X were drilled at locations intended to identify the distribution of PCE contamination. Soil boring data, including sampling and GC screening results, are summarized in Table 4 and provided in detail on the soil boring logs in the Appendix.

Three monitoring wells (G6M-93-12X through G6M-93-14X) were installed based in part on the groundwater flow patterns inferred from synoptic water-level rounds (ABB-ES, 1993a), and all of the wells were screened at the water table (Table 5). Monitoring wells G6M-93-12X and G6M-93-13X were installed at locations that were assumed to be downgradient from the UST excavation and the suspected PCE source (Figure 7). Monitoring well G6M-93-14X (installed in boring 50B-93-11X) is located between both the UST excavation and the suspected PCE source area.

The new monitoring wells were developed, and two hydraulic conductivity tests were performed in each (Table 6). Two rounds of groundwater samples were collected from these wells (June and September 1993).

### 1.5.2 Laboratory Results

Laboratory results for soil samples collected from SA 50 during the SSI are summarized in Table 7, and the distribution of contaminants detected in all SA 50 soil borings is illustrated in Figure 8. Where analyzed, PCE was detected in soil samples from all of the new borings except 50B-93-16X. The highest PCE concentrations were 3,000 $\mu$g/g in the 7-foot bgs sample from boring 50B-93-12X (the sample interval in which free-phased PCE was observed during drilling) and 3.0 $\mu$g/g in the surface sample from 50B-93-14X.

Laboratory results for SI and SSI groundwater are listed in Table 8 and illustrated in Figure 9.

The distribution of PCE identified in soil and groundwater at SA 50 is consistent with the description of its storage and use, and with the account of the release in 1988. It also corresponds closely to the pattern of PCE concentrations revealed by the soil vapor survey (Figure 6) and by the GC-screening of soil boring samples (Table 4). The highest concentrations detected were from the area between Building 3801 and the UST excavation: 3,000 $\mu$g/g in boring 50B-93-12X, 176 $\mu$g/g in a confirmatory sample from the pipeline excavation near Building 3801 (Zenone, 1993), and 3.0 $\mu$g/g in boring 50B-93-14X. PCE concentrations in soil decline in all directions away from this presumed source area. PCE was not detected in laboratory analyses of soil samples from borings 50B-92-07X, -09X, -10X, G6M-92-10X, and 50B-93-16X.

Free product was observed in the 7- to 9-foot bgs interval in boring 50B-93-14X. Between 7- to 9-feet bgs sampling interval and the 10- to 12-foot bgs interval, PCE concentrations in soil decreased from 3,000 $\mu$g/g to 0.1 $\mu$g/g. With the exception of 0.500 $\mu$g/g of xylene in the 2- to 4-foot bgs sample collected from 50B-93-14X, PCE was the only VOC detected in soils collected during the SI and SSI. PCE biodegrades anaerobically, which likely accounts for the absence of associated PCE breakdown products in the vadose zone soil samples and shallow groundwater (water-table) samples.

Organic compounds were detected in groundwater collected from G6M-93-12X and G6M-93-14X. With the exception of a few low concentrations of organic compounds (most determined to be laboratory contaminants), PCE was the only significant organic compound detected during the SSI sampling effort. Between the two SSI groundwater sampling rounds, PCE concentrations detected in groundwater decreased from highs of 10,000 $\mu$g/L in monitoring well G6M-93-14X (located in the PCE source area) and 1,300 $\mu$g/L in nearby well G6M-93-12X, to 5,000 $\mu$g/L and 1,000 $\mu$g/L, respectively.

### 1.5.3 SSI PREs

Human health and ecological preliminary risk evaluations (PREs) were performed based on the SI and SSI data collected at Fueling System B of SA 50. Complete details of the PREs are documented in the Fort Devens Groups 3, 5 & 6 SSI Data Package (ABB-ES, 1993e).

In the SSI human health PRE, TPHC in one confirmatory soil sample from the UST excavation exceeded the risk-based concentration for industrial/commercial soil. However, that value was isolated and not representative of the conditions at the site or in the UST excavation. BTEX compounds did not exceed risk-based guidelines in soil or drinking water standards in groundwater.

In the PCE source area, free product was observed at 7 feet bgs, and detected concentrations in subsurface soil exceeded the risk-based concentration for industrial/commercial soil. Groundwater concentrations of PCE in and near the source area substantially exceeded the Massachusetts drinking water standard/guideline.

The laboratory results included single detects of chloroform (which exceeded its Massachusetts drinking water standard) and bis(2-ethylhexyl)phthalate (which exceeded its USEPA Region III risk-based concentration for tap water). However, these compounds are suspected laboratory contaminants.

For the ecological PRE, potential contaminant exposure pathways for terrestrial ecological receptors by incidental ingestion of surface soils and food web exposure were considered. A screening-level evaluation of potential effects from PCE and lead through surface soil exposures was conducted by comparison of the maximum

concentrations of these analytes with their respective ecological benchmark values (PCLs).

All surface soil lead concentrations at SA 50 were less than the Fort Devens background levels; therefore, exposure to lead at SA 50 was unlikely to result in ecological effects. The maximum concentration of PCE in SA 50 surface soils was greater than an order of magnitude less than the ecological PCL derived from the food web model. Therefore, it was unlikely that exposure to contaminants at SA 50 could result in significant ecological risk.

### 1.5.4 SSI Recommendations

Based on the combined findings of the SI and SSI, it was determined that PCE-contaminated soil and groundwater was posing an unacceptable potential threat to human health. Further, the free-phase PCE observed in vadose zone soils were possibly contributing to continued contamination of groundwater beneath SA 50. A recommendation to conduct an immediate interim removal action on PCE contaminated soil at the presumed source area was recommended. This action would constitute a source control measure while additional investigation activities could focus on addressing the uncertainties in groundwater flow directions and contaminant migration.

An in-situ soil vapor extraction (SVE) system was installed at SA 50 in December 1993 and January 1994. Several soil borings were advanced in the presumed source area in an effort to identify the location of the highest concentration of vadose zone PCE, as well as, to test the effectiveness of SVE as a PCE removal method. Five vapor extraction wells were ultimately installed, one in the center of the presumed PCE source and four on the periphery of the contaminated area, in an effort to capture vadose zone PCE. Five vadose zone piezometers were also installed to measure pressure during the operation of the SVE system to monitor its recovery performance.

The system has been in operation since its construction and is effectively removing vadose zone PCE.

# 2.0 PHASE III DATA SUMMARY

## 2.1 SUMMARY OF PHASE III SITE INVESTIGATIONS

In August 1994, after the installation and startup of the SVE system, the Phase III SI at SA 50 was initiated. The investigation was conducted in accordance with the Revised Work Plan for Phase III Site Investigations (ABB-ES, 1994a), the Work Plan Addendum for Phase III Site Investigations (ABB-ES, 1994b), and in conformance to the provisions of the Project Operations Plan (ABB-ES 1993b). The Phase III SI field investigation was designed to further characterize groundwater flow conditions, the vertical distribution of PCE near the source area and in downgradient groundwater.

A total of six borings and six monitoring wells were installed along with two piezometers as part of the Phase III SI field effort. A summary of the purpose of each exploration and the location selection rationale is presented in Table 2. Phase III SI exploration locations are illustrated with explorations from earlier investigations in Figure 10.

One soil boring (50B-94-17X) was drilled to the surface of bedrock at the presumed center of the PCE source area. Soil samples were collected continuously and analyzed for VOCs and TPHC. The results were used to select ten soil samples for off-site analysis at an Army-certified laboratory. The selected samples were analyzed for Project Analyte List (PAL) VOCs, and TPHC. In addition, grain-size distribution tests were performed on soil samples from selected intervals.

Elevated concentrations of PCE detected in soils collected from beneath the water table at 50B-94-17X prompted the subsequent conversion to a monitoring well (G6M-94-18X). The well screen was set at 22.5 to 27.5 bgs (10 to 15 feet below the water table), spanning the zone where the highest concentrations of PCE were detected. Bedrock was encountered at a depth of 92.5 feet bgs.

Three soil borings (G6M-94-15A, -16X, and -17A) were drilled south of the apparent source area in what was interpreted to be a downgradient location based on the data available at the conclusion of the SSI. Soil samples were collected at approximately five foot intervals and were analyzed for VOCs and TPHC. No

PCE was detected in any of the soil samples (Table 4). In addition, grain-size distribution tests were conducted on ten percent of the samples, and total organic carbon (TOC) analyses were performed on soil samples collected from the three monitoring well screen zones. Monitoring wells were installed in all three borings and the wells were screened across the water table.

An elevation survey was conducted on all the water table wells in the Fueling System B area mid-way through the Phase III well installation program to confirm suspected groundwater flow directions prior to installing the remaining deep wells. Based on the results of this survey, the assumed local groundwater flow directions were incorrect. Flow at the water table was determined to be to the north, not to the south with the regional flow. The well installation program was suspended until the inconsistency could be resolved. Nine rounds of weekly water level measurements were conducted on all the SA 50 wells to determine if the re-interpreted flow direction was a transient response to a recent precipitation event. The results indicated that very little change in the relative head values occurred during this period (see Table 1; ABB-ES, 1994b). Based on these new findings, a Work Plan Addendum for Phase III Site Investigation (ABB-ES, 1994b) was issued in December 1994 to outline modifications to the remaining Phase III well installation plan.

Two borings (G6M-95-19X and -20X), drilled as substitutes for G6M-94-15B and G6M-94-17B, were advanced to the surface of bedrock north and northwest of the apparent source area in the newly-interpreted downgradient locations (Figure 10). Samples were collected continuously in each boring and analyzed for VOCs. Grain-size distribution tests and total organic carbon (TOC) analysis were also performed on selected soil samples collected from these well borings. A monitoring well was installed in each of these borings with well screens positioned to span the zones of highest soil contamination based on the VOC screening results. In addition, 0.75-inch piezometers were installed adjacent to each of the borings and screened across the water table to characterize vertical gradients in this area.

Soil boring data, including sampling and GC-screening results are summarized in Table 4 and provided in detail in the Appendix A boring logs. Monitoring well completion details are summarized in Table 5.

Soil types and grain-size distribution tests were consistent with earlier soil boring findings nearby. Borings completed on the airfield terrace (G6M-94-15A, -16X, and -17A) encountered poorly graded sands to a depth of approximately 35 feet bgs. Below that depth, sandy silt and silty sand layers similar to those observed in borings installed in the PCE source area were encountered. These silty layers appear to be laterally continuous. Jahns (1953) mapped these units as late-Lake Nashua or post-Lake Nashua river terrace or floodplain deposits, stratified and characterized by lensing and lateral facies changes.

The new monitoring wells were developed and two hydraulic conductivity tests were performed in each well (Table 6). Calculated hydraulic conductivities were in the range of $10^{-4}$ to $10^{-5}$ cm/sec.

The new and existing wells were included in the January 31, 1995 installation-wide water-level measurements at Fort Devens, and the results for the SA 50 area are presented in Table 6. Water table elevation contours were interpreted from these measurements and are illustrated in Figure 11. The interpreted water table elevation contours indicate converging flow at the base of the slope. This may be caused in part by localized groundwater mounding on the terrace near G6M-94-16X, and the effects of the southwesterly regional groundwater flow. Based on the elevation for G6M-92-09X and historical elevations at G6M-92-08X, regional groundwater flow appears to be to the southwest towards the Nashua River. The source of the apparent mounding near G6M-94-16X is not known, however, it may be due to increased infiltration of run-off from paved areas of the airfield, and/or decreased permeability of soils near the water table as indicated by calculated hydraulic conductivities and grain-size result.

Groundwater elevation differences between wells screened below the water table (G6M-94-18X, -19X, -20X), and adjacent piezometers and monitoring wells screened at the water table, indicate significant local downward gradients exist there.

One round of groundwater samples were collected from each of the six Phase III monitoring wells and the four existing wells nearby.

## 2.2 LABORATORY RESULTS

A total of 11 soil and 10 groundwater samples collected during the Phase III SI were submitted for laboratory analysis. The results are presented by medium in the following sections.

### 2.2.1 Soil

The Phase III SI analytical soil data consists of eleven samples (ten plus one duplicate) collected from soil boring 50B-94-17X. Newly acquired laboratory results and laboratory results for soils from explorations completed in 1992 and 1993 are presented in Table 7.

PCE was the only VOC detected in Phase III soils with the exception of trichlorofluoromethane (six detections from 0.017 $\mu$g/g to 0.052 $\mu$g/g), and benzene (one detection at 0.002 $\mu$g/g). PCE detections ranged from 0.0018 $\mu$g/g to 0.039 $\mu$g/g with the highest detections occurring in samples from 22 to 26 feet bgs. PCE was not detected in 50B-94-17X soil samples collected below 40 feet bgs. The trace concentration of benzene was observed in a near surface sample possibly associated with the UST removal effort. Trichlorofluoromethane has been identified as a laboratory contaminant in past investigations and is not likely representative of soil contamination at SA 50.

TPHC was not detected above the sample quantitation limit in any of the soil samples analyzed. Grain-size distribution tests and TOC results are presented in Table 9.

### 2.2.2 Groundwater

Laboratory results for groundwater samples from SA 50 are presented in Table 8 and the distribution of PCE is illustrated in Figure 12. PCE was the only VOC detected in Phase III SI groundwater samples and was detected in six of the ten samples at concentrations ranging from 1.9 $\mu$g/L to 20,000 $\mu$g/L.

## 2.3 SOURCE EVALUATION AND MIGRATION POTENTIAL

Field screening and laboratory analysis of soil samples collected at 50B-94-17X in the presumed source area have shown evidence of downward migration of PCE to a maximum depth of 40 feet bgs (roughly 28 feet below the water table). The highest concentrations in soils appear just above the water table, at approximately 11 feet bgs (interval where free-phase product was encountered during the SSI) and in the interval from 22 feet bgs to 30 feet bgs. The absence of free-phased product in the vadose zone of this boring suggests that the SVE system has effectively controlled the presumed PCE source in soil. The groundwater sample from the well installed at this location (G6M-94-18X) exhibited the highest concentration of PCE (20,000 $\mu$g/L) suggesting that the well is screened in, or very near, the groundwater contaminant source.

Away from the presumed source area, PCE was detected in soils between 10 feet bgs (the water table) to 38 feet bgs at G6M-95-20X with the highest detections occurring at 20 feet bgs. PCE was also detected in soil collected from 20 feet to 60 feet bgs in G6M-95-19X with the highest detections occurring around 50 feet bgs. Given what is known about the contaminant distribution and the interpreted groundwater flow directions, contaminant migration pathways from the source area to these wells is not clear. The detection of PCE in deep (below 40 feet bgs) soil and groundwater at G6M-94-19X (110 $\mu$g/L), suggests that contaminants have migrated downward away from the source area. Downward migration of contaminants may be the results of the observed downward groundwater gradients, as well as, possible dense non-aqueous phase liquid (DNAPL) migration at the source area. The absence of PCE in the upgradient wells G6M-94-15A, -16X, and 17A, however, suggests contaminants have not migrated to the south of the presumed source area at the water table. The full extent of PCE migration in saturated soils has not been completely determined to the north and west, and at depth to the south of the apparent source area.

During the performance period of the various investigations at SA 50, PCE concentrations in groundwater collected from G6M-93-14X and G6M-93-12X dropped from highs of 10,000 $\mu$g/L and 1,300 $\mu$g/L, respectively, to 3,000 $\mu$g/L and 21 $\mu$g/L, respectively. This is likely attributable to a combination of source control measures that include the elimination of continuing releases from the former 55-gallon drum, and the reduction of vadose zone contaminants by the SVE system, in conjunction with the continuing dilution due to groundwater flow.

Based on the January 1995 water level measurements, groundwater appears to converge on SA 50 in a complex manner from the south due to a groundwater mound beneath the airfield terrace and from the north beneath Route 2A. This is complicated by strong downward gradients in and around the presumed contaminants source area. Regional flow beneath MAAF interpreted from the MAAF monitoring well system and the installation-wide flow model suggests a southwestern regional flow.

# 3.0 PRELIMINARY RISK EVALUATIONS

Human health and ecological PREs were performed based on the SI, SSI and Phase III SI data collected at Fueling System B of SA 50. The methods used in these PREs have been established and are detailed in the SI Report (ABB-ES, 1993a). The results are presented below.

## 3.1 PRELIMINARY HUMAN HEALTH RISK EVALUATION

This PRE is based on data gathered during the SI from borings and monitoring wells at and near the former Fueling System B, on confirmatory sampling results from the tank removal conducted by Zenone, Inc., and on all the data collected during the SSI and the Phase III SI. Tables 10 through 12 present summary statistics, background concentrations, and human health standards and guidelines used in the PRE for SA 50. The health standards and guidelines have been updated and are current through May 1995.

### 3.1.1 Soil

This PRE considers all soil to a depth of 3 feet as surface soil and, therefore, accessible under a residential future use scenario. This is a conservative approach because the future use of SA 50 is as part of the airfield. Soils between 3 and 15 feet are considered to be subsurface soil, accessible under a commercial/industrial future use exposure scenario. Samples were analyzed for VOCs, lead, and TPHC. Lead was analyzed for because it may have been present in fuels. TPHC was analyzed for as the primary indicator of a fuel release.

**3.1.1.1 Surface Soil.** Table 10 presents summary statistics on surface soil at SA 50 and human health standards and guidelines for comparison. The maximum detected concentration of lead (20 $\mu$g/g) was below the base-wide background concentration (34.4. $\mu$g/g), the USEPA interim guidance on Superfund soil lead screening value of 400 $\mu$g/g for a residential exposure scenario, and the MCP Method 1 S-1/GW-1 soil standard of 300 $\mu$g/g. The maximum concentration of PCE (3.4 $\mu$g/g) is below the Region III risk-based concentrations for residential soils (12 $\mu$g/g), but above the MCP Method 1 S-1/GW-1 soil standard (0.5 $\mu$g/g). PCE was detected in five surface soil samples; however, in only one sampling

location (50B-93-14X) was PCE detected at a concentration above a screening guideline. In consideration of the significant soil reworking in the 50B-93-14X area, conducted during the SVE system installation and because this boring location is within the capture zone of the currently operating SVE system, this isolated concentration of PCE has likely been significantly reduced through volatilization. Xylenes were detected in one sample (0.50 $\mu$g/g) at well below the Region III residential soil concentration (160,000 $\mu$g/g) and the MCP Method 1 S-1/GW-1 soil standard (500 $\mu$g/g).

To evaluate the health risk associated with TPHC in soil, ABB-ES developed risk-based concentrations for petroleum products. These concentrations were calculated using the same exposure assumptions as those used by USEPA toxicologists in the USEPA Region III Risk-Based Concentration Table, Third Quarter, 1994 for residential soils and commercial/industrial soils. Dose response values for gasoline and marine diesel used in the calculations are provisional values developed by USEPA, Environmental Criteria and Assessment Office (USEPA, 1992). USEPA suggests using the reference dose value for diesel oil as a surrogate for No. 2 fuel.

The table below presents the risk-based concentrations for petroleum products:

| Analyte | Residential Soil ($\mu$g/g) | Commercial/Industrial Soil ($\mu$g/g) |
|---|---|---|
| Gasoline | 380 | 1,680 |
| No. 2 Fuel Oil | 630 | 8,180 |

The maximum detected TPHC concentration in surface soil (109 $\mu$g/g) is below the risk-based residential soil concentration of 380 $\mu$g/g for gasoline, which is the likely source of the TPHC based on the site history. It is also below the MCP Method 1 S-1/GW-1 soil standard for TPHC of 500 $\mu$g/g.

In summary, none of the surface soil contaminants detected during the SA 50 investigations are expected to pose an unacceptable risk to human health.

**3.1.1.2 Subsurface Soil.** Table 11 presents summary statistics on subsurface soil at SA 50 and human health standards and guidelines for comparison. The maximum detected concentration of lead (12 $\mu$g/g) was below the base-wide soil

background concentration of 34.4 μg/g (see Appendix H; ABB-ES, 1993a), USEPA interim guidance for soil lead cleanup based on a residential exposure scenario (400 μg/g), and the MCP Method 1 S-2/GW-1 soil standard (600 μg/g). The maximum concentration of TPHC (3,285 μg/g in Zenone's confirmatory sampling from the UST excavation) is above the risk-based concentration for industrial/commercial soil (1,680 μg/g for gasoline-derived TPHC) and the MCP Method 1 S-2/GW-1 soil standard (2,500 μg/g). The depth at which this confirmatory sample was collected was not documented, however, because soil was reportedly removed down to a depth of 18 feet bgs in the tank excavation, it was likely greater than 15 feet bgs. At this depth, soil contamination is not expected to pose a significant exposure threat.

Toluene, ethylbenzene, and xylenes were detected by Zenone, Inc. in confirmatory soil samples at concentrations well below their respective Region III risk-based guidelines. A single detection of PCE (2,600 μg/g at a depth of 7 feet in boring 50B-93-12X) exceeds the Region III risk-based guideline for industrial/commercial soil (110 μg/g) and the MCP Method 1 S-2/GW-1 soil standard (0.5 μg/g). This boring is located within the currently operating SVE system capture zone. The other 13 detects of PCE out of 30 samples analyzed are very low (0.3 μg/g is the second highest detected concentration).

Trichlorofluoromethane and benzene were detected at one boring location (50B-94-17X) during Phase III SI sampling, but they were detected at concentrations well below their Region III risk-based industrial/commercial soil guidelines and the MCP Method 1 S-2/GW-1 soil standard for benzene. Neither compound is expected to pose an unacceptable threat to human health.

Zenone, Inc. reported a PCE concentration of 176 μg/g from the Fueling System pipeline excavation. Although the sample depth was not reported, and consequently it is not known whether the residential guideline (12 μg/g) or the commercial/industrial guideline (110 μg/g) applies, the detected concentration exceeds both guidelines as well as the respective MCP Method 1 soil standards. The elevated concentrations were detected in soil samples collected near the former storage location of the PCE drum which is now within the capture zone of the SVE system. Concentrations of PCE in soils are expected to be reduced to the MCP Method 1 S-2/GW-1 soil standard for 0.5 μg/g.

### 3.1.2 Groundwater

Table 12 presents summary statistics on groundwater at SA 50 and human health standards and guidelines for comparison. Only unfiltered samples were used in the PRE. Eight monitoring well locations were used to evaluate groundwater quality in the area of the SA (monitoring wells G6M-92-10X and -11X; G6M-93-12X, -13X, and -14X; and G6M-94-18X, -19X, and -20X). Except for toluene, the maximum concentrations of all four organics detected exceed their respective drinking water standard/guideline. PCE (up to 20,000 $\mu$g/L) exceeds its Massachusetts drinking water standard and MCP Method 1 GW-1 standard of 5 $\mu$g/L in nine out of ten samples in which it was detected. Chloroform (7.1 $\mu$g/L) slightly exceeds the Massachusetts drinking water guideline and MCP Method 1 GW-1 standard of 5 $\mu$g/L in the one of the two samples in which it was detected. Bis(2-ethylhexyl)phthalate (18.0 and 5.10 $\mu$g/L) exceeds the Massachusetts drinking water standard and Method 1 GW-1 standard (6 $\mu$g/L) in one out of the two samples in which it was detected. Both chloroform and bis(2-ethylhexyl)phthalate, however, are likely laboratory contaminants, often detected in laboratory method blanks.

Not all of the inorganics were analyzed for at each location. Several of the inorganics exceed their groundwater background concentration: barium, calcium, lead, magnesium, manganese, potassium, sodium, and zinc. Barium (208 $\mu$g/L) and zinc (41.2 $\mu$g/L) do not exceed their respective standard/guidelines of 2,000 $\mu$g/L and 5,000 $\mu$g/L. The maximum concentrations of aluminum (2,340 $\mu$g/L) and iron (2,600 $\mu$g/L), which do not exceed background, exceed their secondary MCLs (SMCLs) of 50-200 $\mu$g/L and 300 $\mu$g/L, respectively. SMCLs are federal standards promulgated for aesthetic reasons, not health effects. Manganese (309 $\mu$g/L), detected above background in only one well, also exceeds its SMCL of 50 $\mu$g/L and the Region III risk-based concentration for tap water (180 $\mu$g/L). Sodium (1,200,000 $\mu$g/L) exceeds its Massachusetts drinking water guideline of 20,000 $\mu$g/L. Lead (24.0 $\mu$g/L) has a single exceedance out of seven samples of the federal drinking water action level of 15 $\mu$g/L, but in no case was lead detected above background in the filtered samples.

With the exception of lead, none of the inorganic analytes detected in groundwater can be directly linked to either the operation of the fueling system or the release of PCE. Because lead was not detected at significant concentrations

in filtered groundwater samples, the elevated concentrations detected in unfiltered samples are likely the result of sample turbidity.

Based on these findings for organic and inorganic analytes, only PCE has been identified as the only compound likely to pose an unacceptable threat to human health.

## 3.2 ECOLOGICAL PRELIMINARY RISK EVALUATION

The purpose of the PRE at SA 50 is to provide a screening-level evaluation of actual and potential risks that environmental contaminants may pose to the resident and migratory ecological receptors at the site.

SA 50 consists of an area of approximately 5 acres at the far northern end of Moore Army Airfield. Several structures are located on the site, and much of the area is used for parking automobiles. A mixed oak/pitch pine woodland occurs to the southeast of the Fueling System B portion of SA 50.

A review of the Fort Devens database indicates that no rare and endangered flora or fauna are known to occur in the vicinity of SA 50. However, the Commonwealth of Massachusetts has established an unofficial "Watch List" of uncommon or rare plants (Massachusetts Natural Heritage Program, 1990). This list includes flora which are believed to be uncommon but for which insufficient information exists documenting the true status of the plant in the state. One Watch List species is known to occur in the vicinity of SA 50 (Hunt and Zaremba, 1992); however, this species is not located in the developed area that characterizes the area of contamination at SA 50.

Eleven surface soil samples collected from SA 50 were evaluated in the ecological PRE. Lead was analyzed for and detected in six surface soil samples (Table 13). The concentrations of lead were all below soil background (34.4 $\mu$g/g) and ranged from 2.58 to 20 $\mu$g/g. PCE was detected in five of the 11 surface soil samples analyzed from SA 50. Concentrations ranged from 0.0062 to 3.4 $\mu$g/g. The mean surface soil PCE concentration at SA 50 was 0.69 $\mu$g/g; however, this arithmetic average is misleading, because four of the five samples collected contained less than 0.008 $\mu$g/g PCE. Excluding sample 50B-93-14X, which contained 3.0 $\mu$g/g PCE, the average PCE concentration in SA 50 surface soils was 0.007 $\mu$g/g.

Potential contaminant exposure pathways exist at SA 50 for terrestrial ecological receptors by incidental ingestion of surface soils and food web exposure. A screening-level evaluation of potential effects from PCE and lead through surface soil exposures was conducted by comparison of the maximum concentrations of these analytes with their respective ecological benchmark values (PCLs) (Table 13).

All surface soil lead concentrations at SA 50 were less than the Fort Devens background levels; therefore, exposure to lead at SA 50 is unlikely to result in ecological effects. The maximum concentration of PCE in SA 50 surface soils (3.4 $\mu$g/g) was greater than an order of magnitude less than the ecological PCL derived from the food web model. Therefore, it is unlikely that exposure to contaminants at SA 50 is resulting in significant ecological risk.

# 4.0 CONCLUSIONS AND RECOMMENDATIONS

The concentrations of contaminants detected in the surface soil at SA 50 were compared to health-based standards and guidelines. With the exception of PCE, the maximum detected concentrations of analytes in surface soil at SA 50 were below their respective health standards and/or guidelines. PCE was detected in five of 11 surface soil samples, but at only one sampling location (50B-93-14X) was it detected at a concentration above a screening guideline.

In subsurface soil, the concentrations of analytes generally at SA 50 were below the health screening guidelines. TPHC was detected in only one soil sample exceeding the screening guidelines for TPHC, but was collected from below 15 feet bgs and not expected to be a significant exposure threat. PCE was detected in 14 of 30 subsurface soil samples but at only two locations (50B-93-12X and at the Fueling System pipeline excavation) was it detected at a concentration above a screening guideline.

Thus, soils at SA 50 do pose a potential threat to human health. The operation of the SVE system, however, is expected to eliminate the potential threat by reducing soil concentrations below the MCP Method 1 S-1, GW-1 standard.

In the ecological PRE, which focuses on surface soil contaminants, no significant ecological risks would be expected from detected contaminants. The screening-level evaluation concluded that contaminant concentrations detected in the surface soil would not pose an unacceptable risk to ecological receptors. Further, much of SA 50 is paved and provides limited habitat for ecological receptors.

In groundwater, PCE at SA 50 represents a potentially significant health risk if the groundwater were to be used for drinking water. In nine of 10 groundwater samples, at five monitoring wells, the concentrations of PCE exceeded the drinking water standard. The concentrations of several inorganic analytes exceeded their respective secondary MCLs set for aesthetic reasons, and thus do not pose an unacceptable human health risk. The maximum concentration of sodium exceeded its drinking water guideline, developed as a notification requirement for water distribution systems. It is unlikely, however, that sodium is related to the operation of the SA 50 gasoline fueling systems or the PCE release. Lead had an exceedance in one of seven unfiltered groundwater samples, but no

exceedances in the filtered samples. The elevated concentrations of lead were determined to be the result of sample turbidity and not due to releases from the fueling system.

The evaluation of the cumulative data collected during three phases of SI at SA 50 has revealed in the fuel-related contaminants associated with both abandoned gasoline fueling systems have not contributed significant contamination to soil and groundwater, and likely pose no significant threat to human health or the environment. PCE contamination, however, unrelated to the fueling systems, was detected in soil and groundwater at concentrations that could pose a potential threat to human health. With the SVE system in operation, only groundwater contamination remains a potential threat.

Significant PCE migration in groundwater has been observed at SA 50. Although the PCE release mechanism has been reasonably well characterized, the complexity in groundwater hydrology at SA 50 makes mapping actual migration pathways difficult. The nature of local groundwater flow is not fully understood and further hydrogeologic characterization is required.

Therefore, in order to fully understand the nature of contaminant migration at SA 50 and assess risk to human health, further characterization of local and regional hydrologic conditions in the form of an RI/FS is necessary and recommended for SA 50. The following items should be addressed in the RI:

- Further characterize local and regional groundwater flow,
- further characterize the distribution of PCE in soils at the presumed source and in groundwater to the north and west of the apparent source area,
- assess the risk to potential downgradient receptors, and
- gather data needed to support an FS.

| | |
|---|---|
| ABB-ES | ABB Environmental Services, Inc. |
| bgs | below ground surface |
| BTEX | benzene, toluene, ethylbenzene, and xylenes |
| cm/sec | centimeters per second |
| DNAPL | Dense Non-Aqueous Phase Liquid |
| GC | gas chromatograph |
| GPR | ground-penetrating radar |
| MAAF | Moore Army Airfield |
| MCL | Maximum Contaminant Level |
| MCP | Massachusetts Contingency Plan |
| mg/kg | milligrams per kilogram (parts per million) |
| ND | Not Detected |
| PAL | Project Analyte List |
| PCE | Tetrachloroethylene |
| PCL | Protective Contaminant Level |
| PID | photoionization detector |
| ppm | parts per million |
| PRE | Preliminary Risk Evaluation |
| RI/FS | Remedial Investigation/ Feasibility Study |
| SA | Study Area |
| SI | Site Investigation |
| SMCL | Secondary Maximum Contaminant Level |
| SSI | Supplemental Site Investigation |
| SVE | Soil Vapor Extraction |
| $\mu$g/g | micrograms per gram (parts per million) |
| $\mu$g/L | micrograms per liter (parts per billion) |
| USCS | Unified Soil Classification System |

| | |
|---|---|
| TOC | total organic carbon |
| TPHC | total petroleum hydrocarbon compounds |
| USEPA | U.S. Environmental Protection Agency |
| UST | underground storage tank |
| VOC | volatile organic compound |

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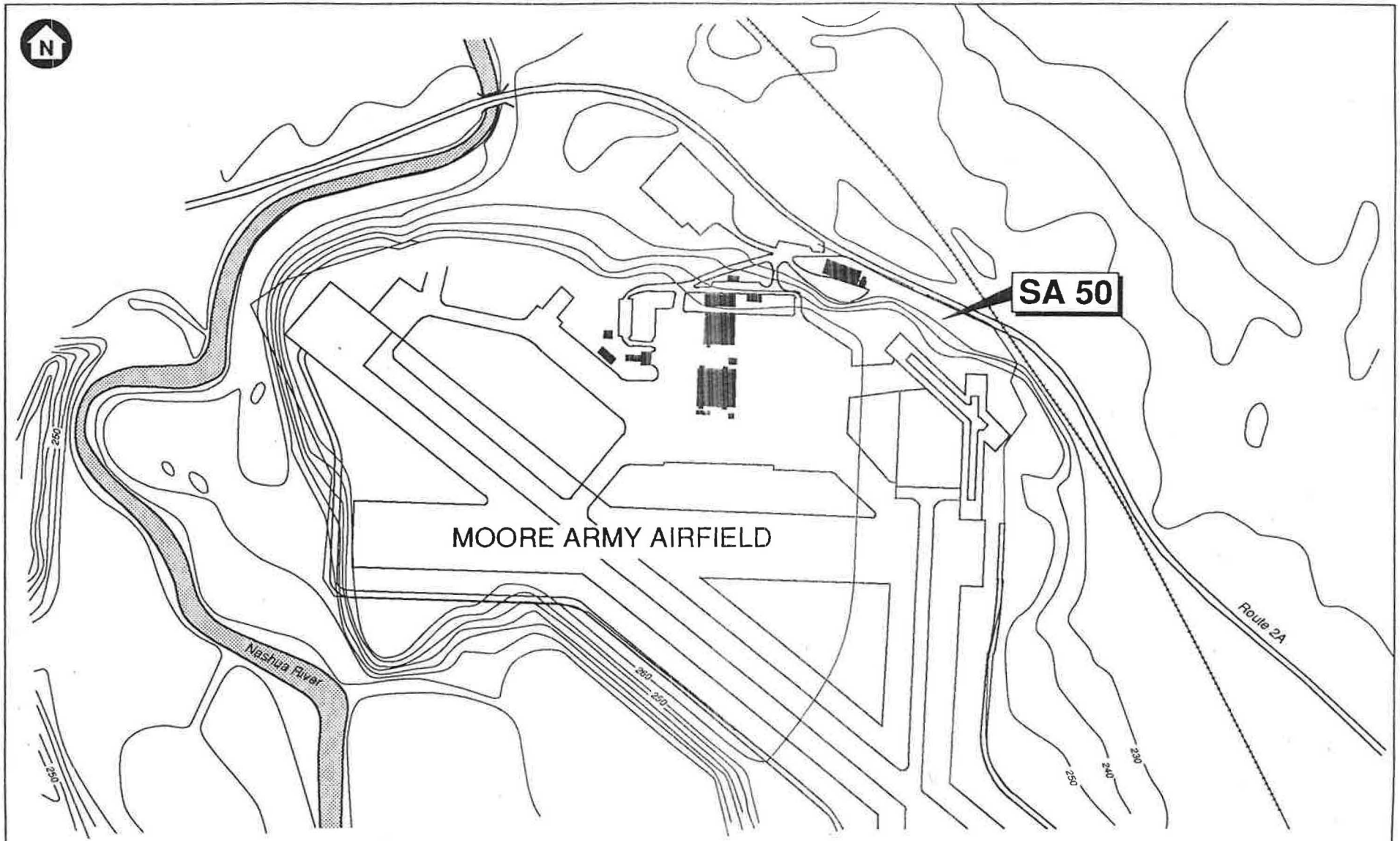


**FIGURE 1**
**LOCATION OF SA 50**
**PHASE III SI DATA PACKAGE**
**STUDY AREA 50**
**FORT DEVENS, MA**

ABB Environmental Services, Inc.

6917-07(a)

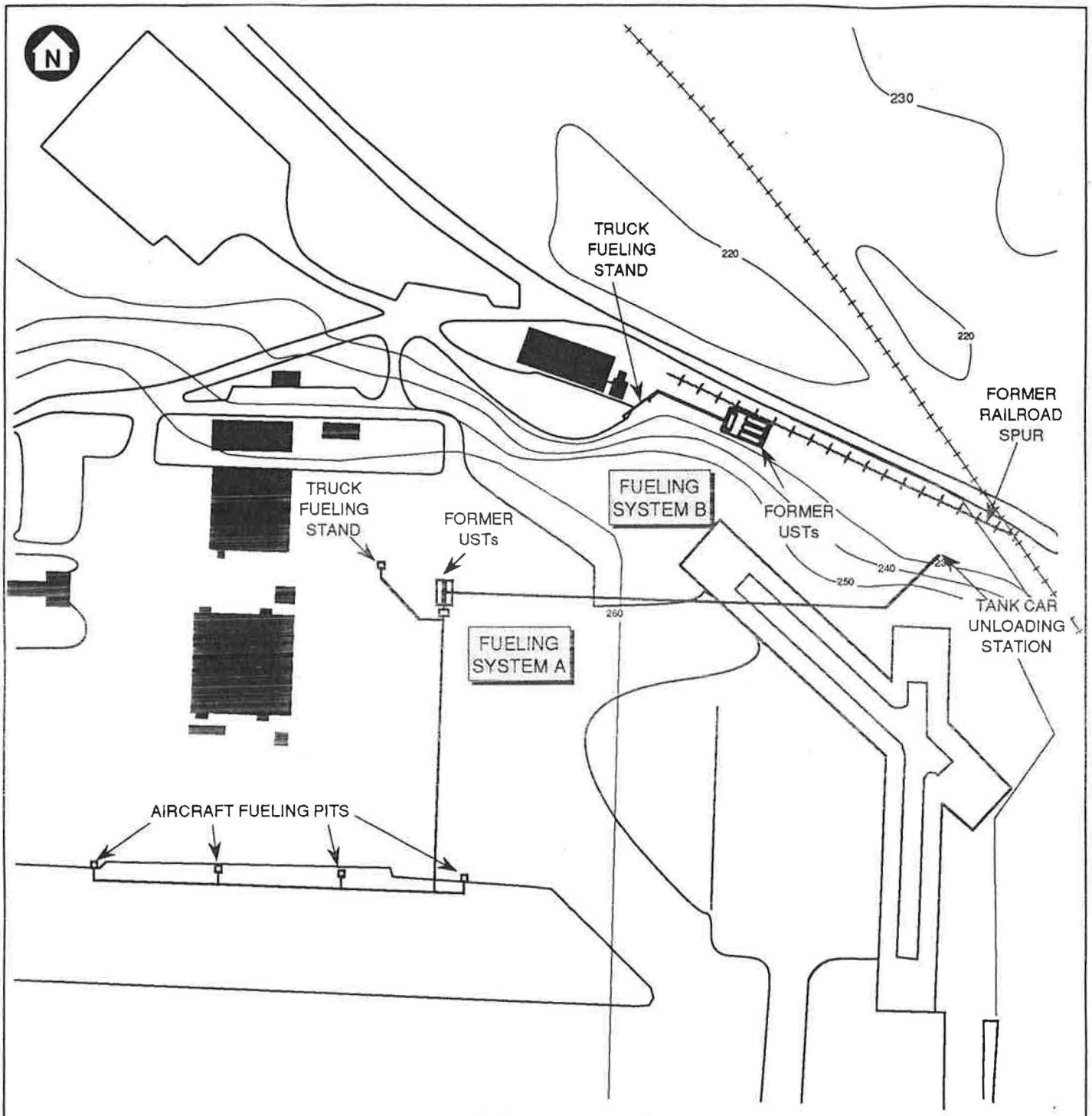


**FIGURE 2**
**LOCATION OF FORMER MAAF FUELING SYSTEMS**
**PHASE III SI DATA PACKAGE**
**STUDY AREA 50**
**FORT DEVENS, MA**

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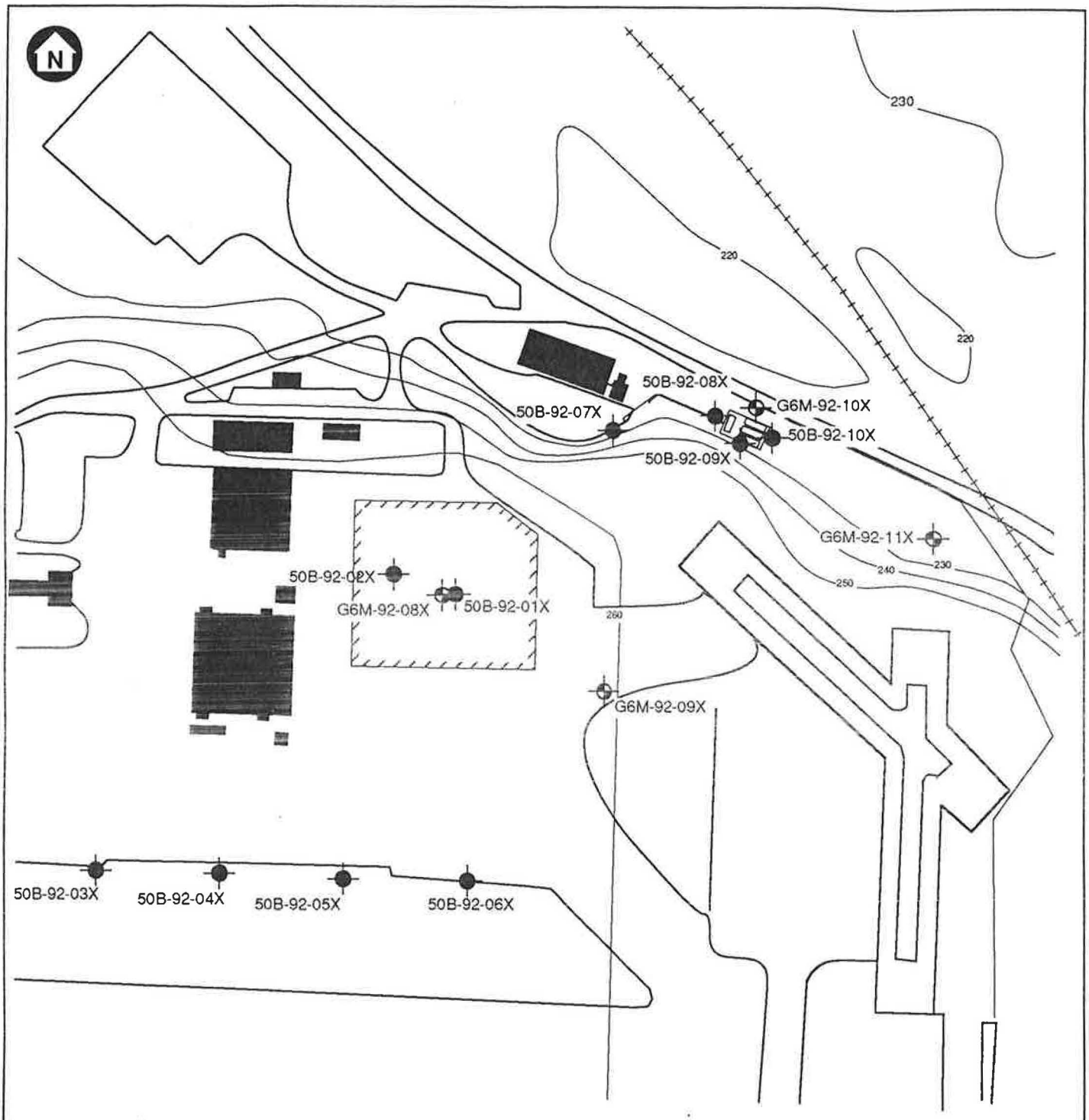



LEGEND

- MONITORING WELL LOCATION
- SOIL BORING LOCATION
- MAGNETOMETER SURVEY GRID

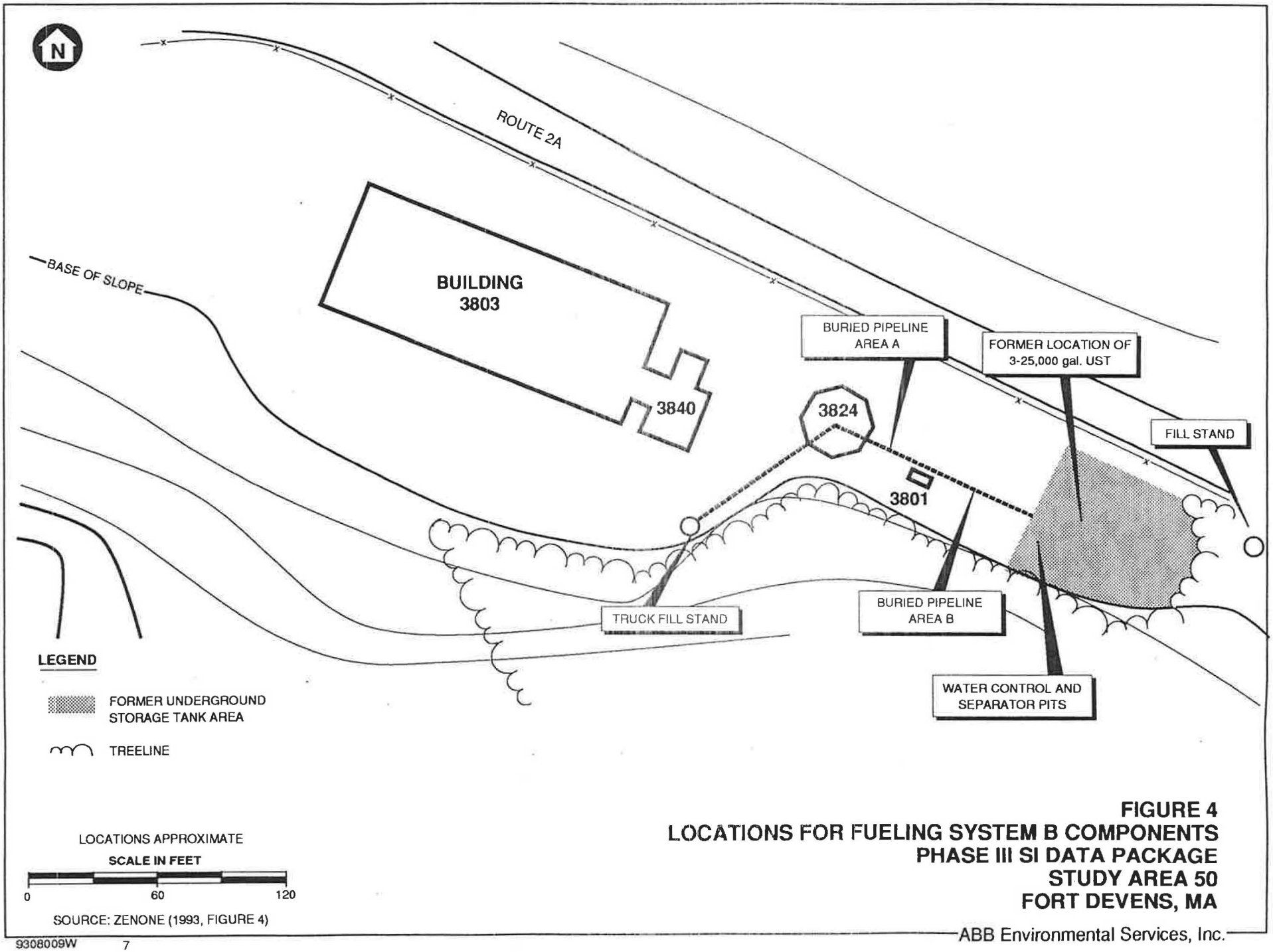
SCALE IN FEET

0 240 480

**FIGURE 3**
**SI BORING AND WELL LOCATIONS**
**PHASE III SI DATA PACKAGE**
**STUDY AREA 50**
**FORT DEVENS, MA**

ABB Environmental Services, Inc.

6917-07(b) -123




SOURCE: ZENONE (1993, FIGURE 4)

**FIGURE 4**
**LOCATIONS FOR FUELING SYSTEM B COMPONENTS**
**PHASE III SI DATA PACKAGE**
**STUDY AREA 50**
**FORT DEVENS, MA**

ABB Environmental Services, Inc.

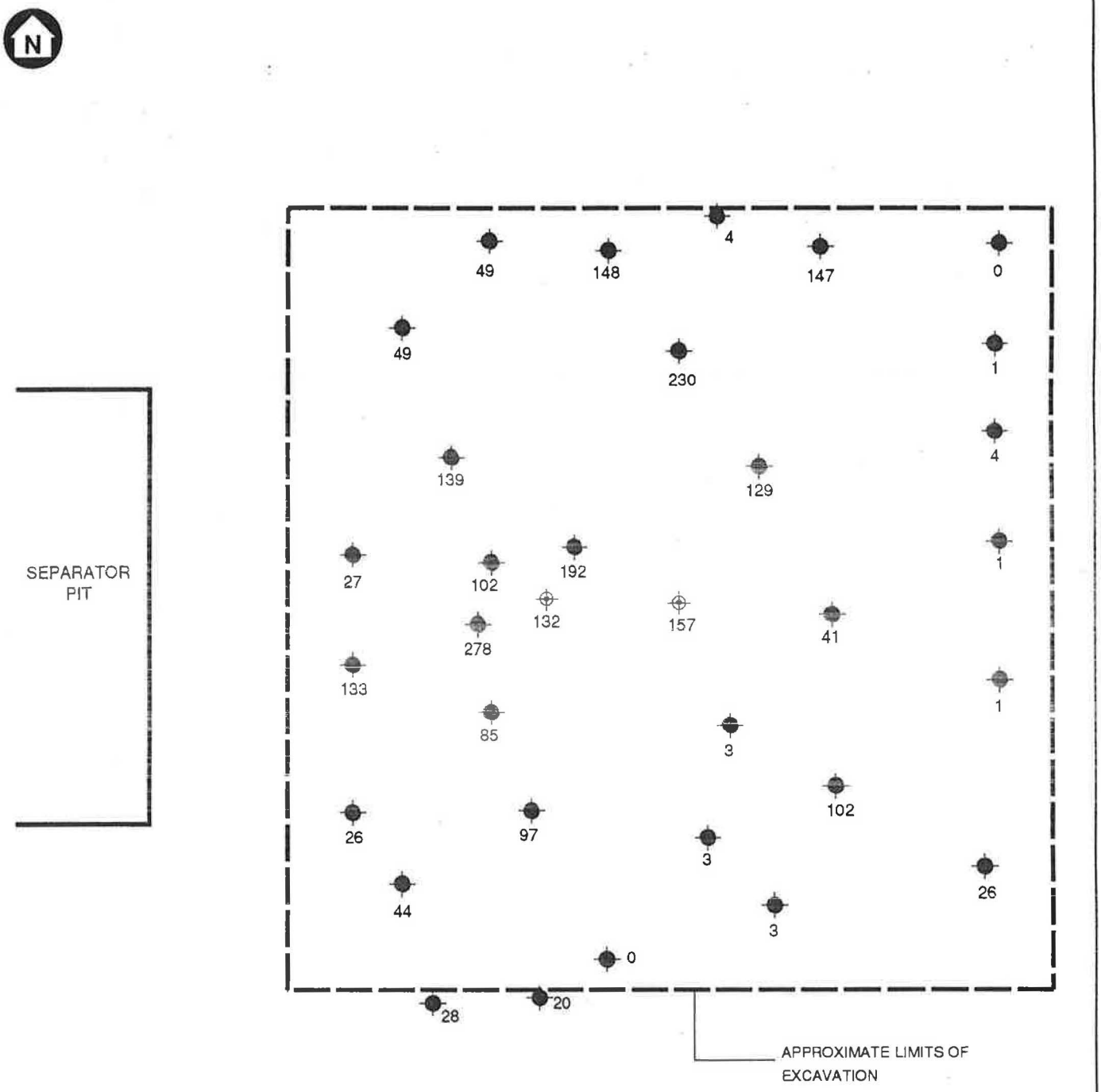



**FIGURE 5**
**CONFIRMATORY PID HEADSPACE RESULTS FOR UST EXCAVATION**
**PHASE III SI DATA PACKAGE**
**STUDY AREA 50**
**FORT DEVENS, MA**

ABB Environmental Services, Inc.

9308015W

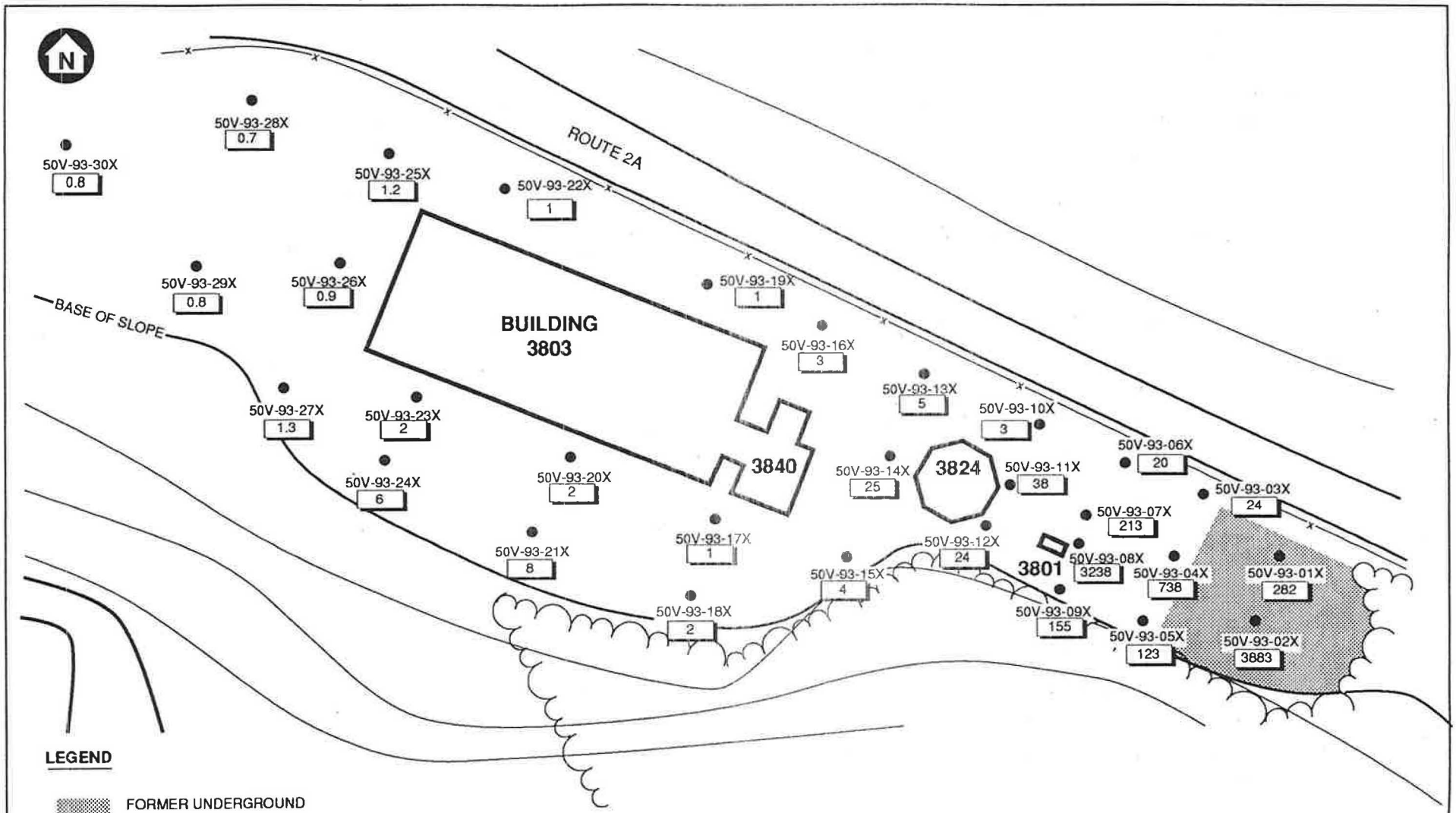



**FIGURE 6**
**SOIL VAPOR SCREENING RESULTS**
**PHASE III SI DATA PACKAGE**
**STUDY AREA 50**
**FORT DEVENS, MA**

ABB Environmental Services, Inc.

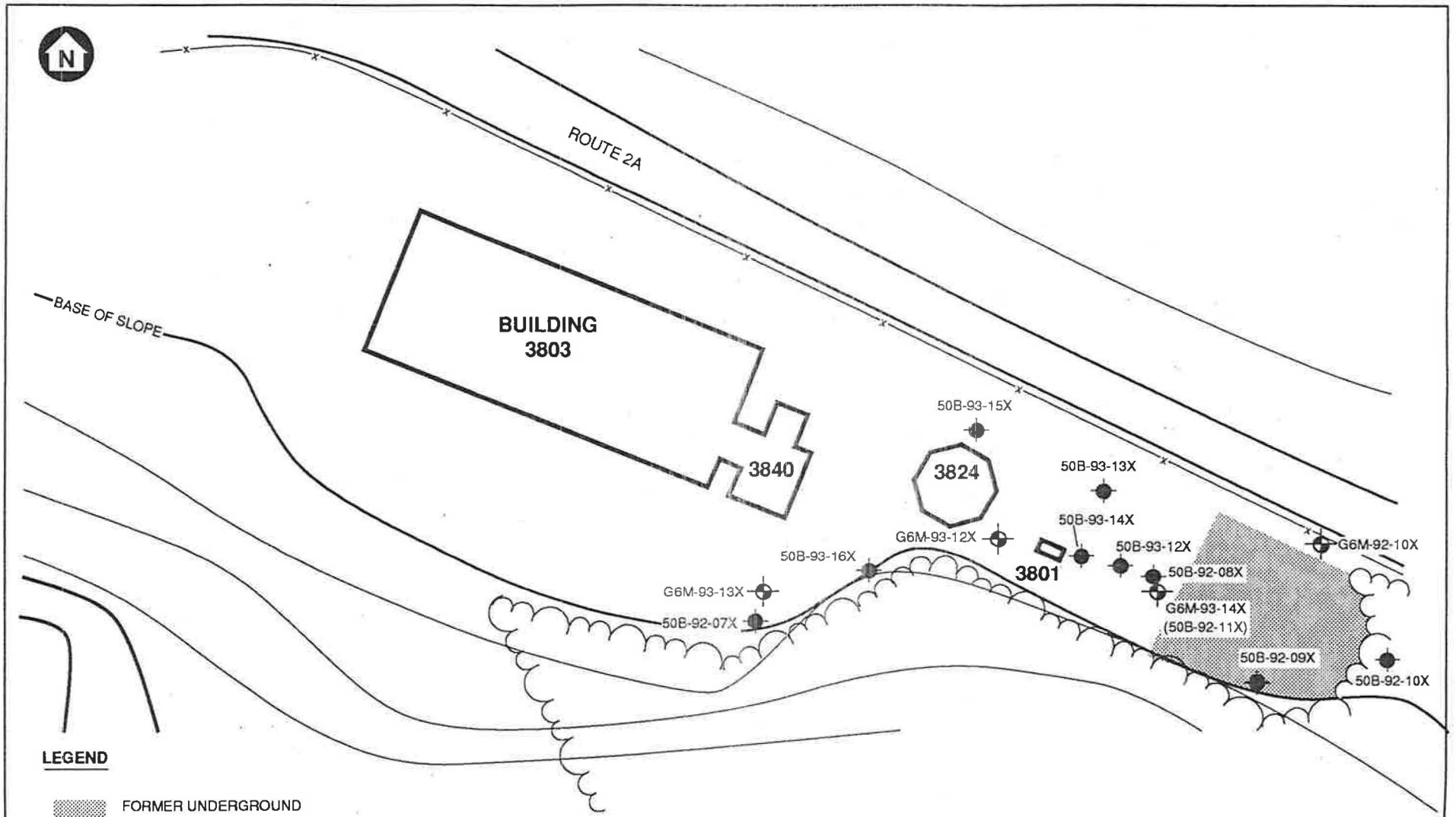



**FIGURE 7**
**SI AND SSI BORING AND WELL LOCATIONS**
**FUELING SYSTEM B**
**PHASE III SI DATA PACKAGE**
**STUDY AREA 50**
**FORT DEVENS, MA**

ABB Environmental Services, Inc.

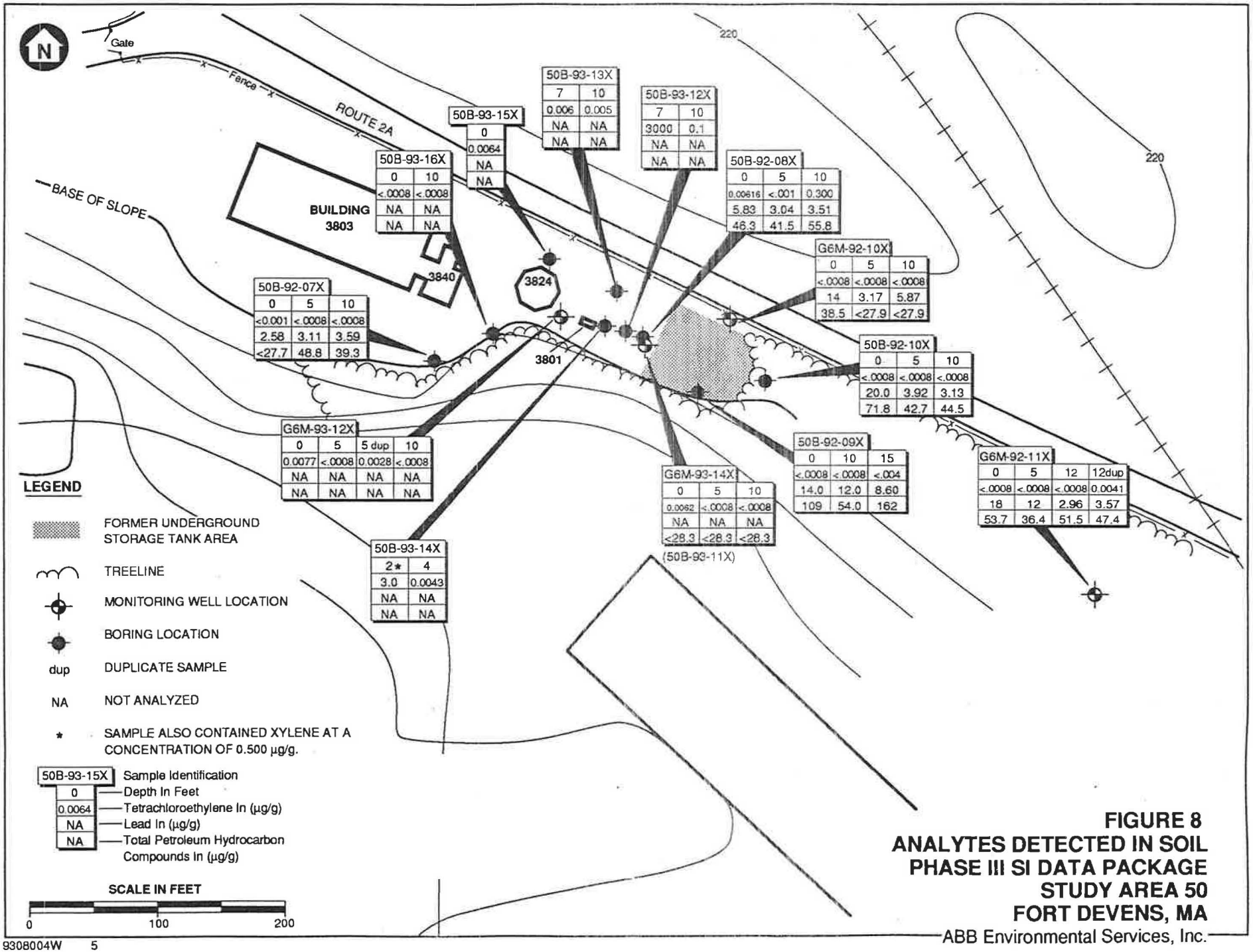



**FIGURE 8**
**ANALYTES DETECTED IN SOIL**
**PHASE III SI DATA PACKAGE**
**STUDY AREA 50**
**FORT DEVENS, MA**

ABB Environmental Services, Inc.

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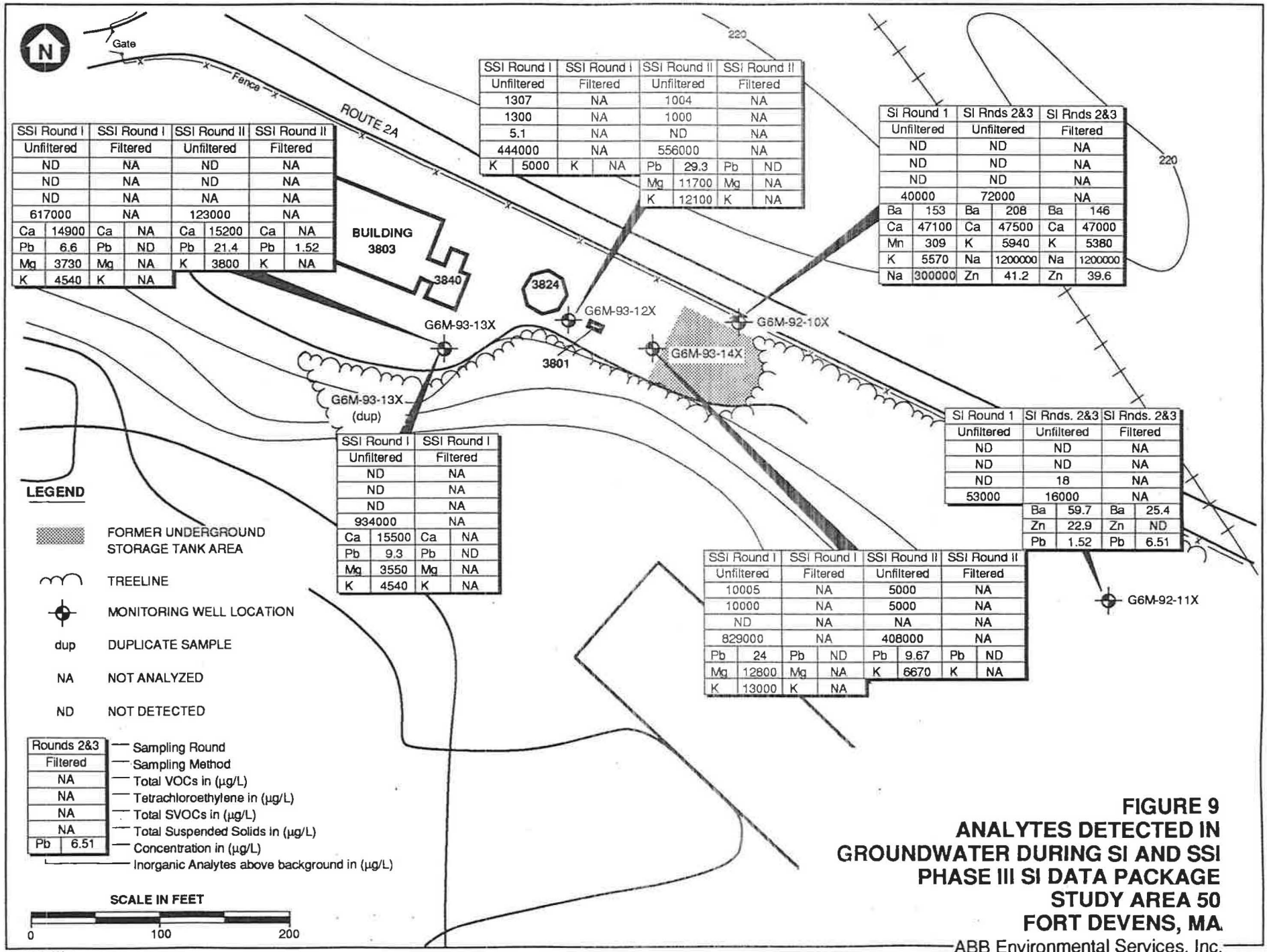


| SSI Round I | SSI Round I | SSI Round II | SSI Round II |
|---|---|---|---|
| Unfiltered | Filtered | Unfiltered | Filtered |
| ND | NA | ND | NA |
| ND | NA | ND | NA |
| ND | NA | NA | NA |
| 617000 | NA | 123000 | NA |
| Ca 14900 | Ca NA | Ca 15200 | Ca NA |
| Pb 6.6 | Pb ND | Pb 21.4 | Pb 1.52 |
| Mg 3730 | Mg NA | K 3800 | K NA |
| K 4540 | K NA | | |

| SSI Round I | SSI Round I | SSI Round II | SSI Round II |
|---|---|---|---|
| Unfiltered | Filtered | Unfiltered | Filtered |
| 1307 | NA | 1004 | NA |
| 1300 | NA | 1000 | NA |
| 5.1 | NA | ND | NA |
| 444000 | NA | 556000 | NA |
| K 5000 | K NA | Pb 29.3 | Pb ND |
| | | Mg 11700 | Mg NA |
| | | K 12100 | K NA |

| SI Round 1 | SI Rnds 2&3 | SI Rnds 2&3 |
|---|---|---|
| Unfiltered | Unfiltered | Filtered |
| ND | ND | NA |
| ND | ND | NA |
| ND | ND | NA |
| 40000 | 72000 | NA |
| Ba 153 | Ba 208 | Ba 146 |
| Ca 47100 | Ca 47500 | Ca 47000 |
| Mn 309 | K 5940 | K 5380 |
| K 5570 | Na 1200000 | Na 1200000 |
| Na 300000 | Zn 41.2 | Zn 39.6 |

| SSI Round I | SSI Round I |
|---|---|
| Unfiltered | Filtered |
| ND | NA |
| ND | NA |
| ND | NA |
| 934000 | NA |
| Ca 15500 | Ca NA |
| Pb 9.3 | Pb ND |
| Mg 3550 | Mg NA |
| K 4540 | K NA |

| SI Round 1 | SI Rnds. 2&3 | SI Rnds. 2&3 |
|---|---|---|
| Unfiltered | Unfiltered | Filtered |
| ND | ND | NA |
| ND | ND | NA |
| ND | 18 | NA |
| 53000 | 16000 | NA |
| | Ba 59.7 | Ba 25.4 |
| | Zn 22.9 | Zn ND |
| | Pb 1.52 | Pb 6.51 |

| SSI Round I | SSI Round I | SSI Round II | SSI Round II |
|---|---|---|---|
| Unfiltered | Filtered | Unfiltered | Filtered |
| 10005 | NA | 5000 | NA |
| 10000 | NA | 5000 | NA |
| ND | NA | NA | NA |
| 829000 | NA | 408000 | NA |
| Pb 24 | Pb ND | Pb 9.67 | Pb ND |
| Mg 12800 | Mg NA | K 6670 | K NA |
| K 13000 | K NA | | |

**FIGURE 9**
**ANALYTES DETECTED IN GROUNDWATER DURING SI AND SSI PHASE III SI DATA PACKAGE**
**STUDY AREA 50**
**FORT DEVENS, MA**

ABB Environmental Services, Inc.

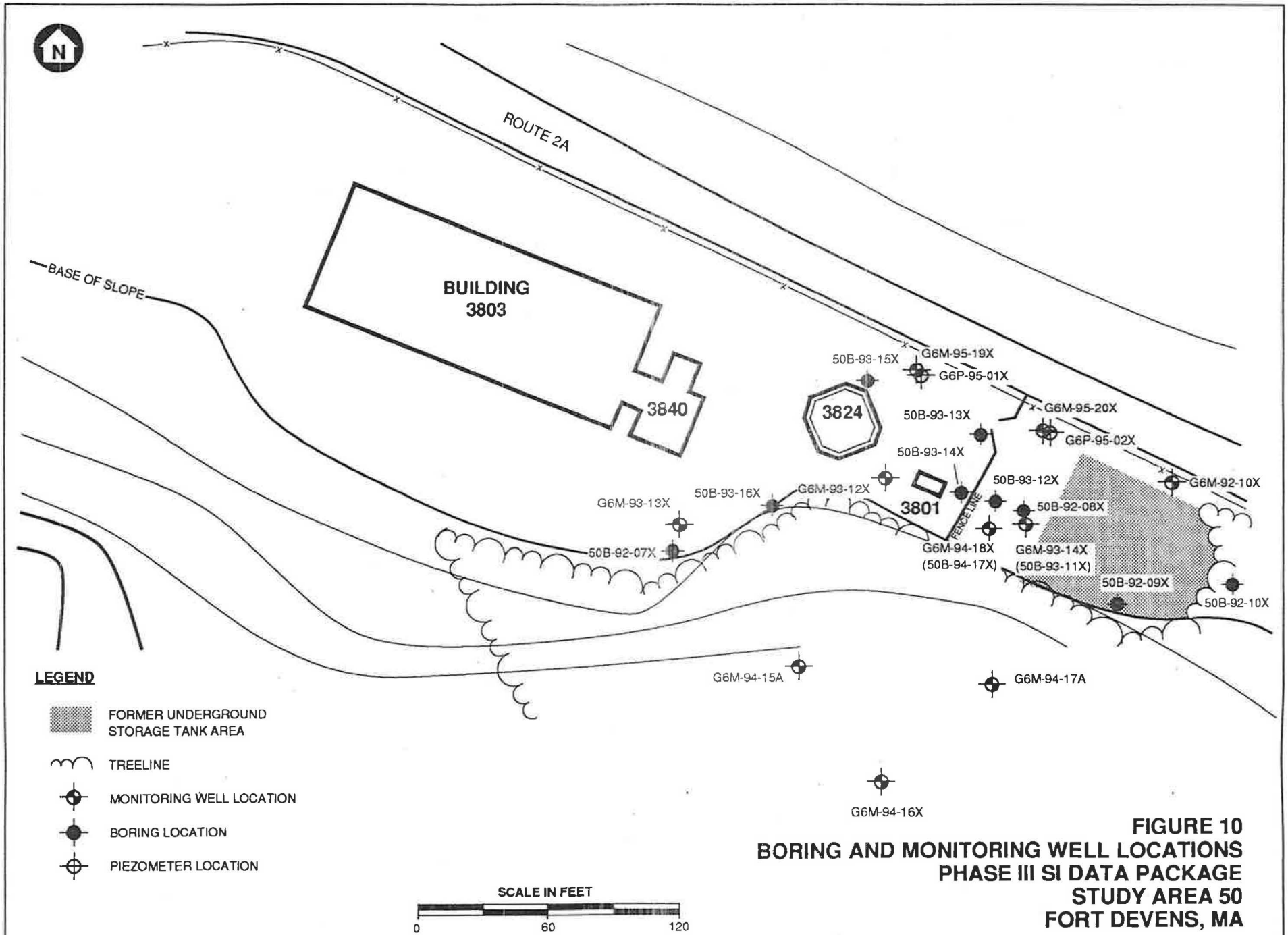


**FIGURE 10**
**BORING AND MONITORING WELL LOCATIONS**
**PHASE III SI DATA PACKAGE**
**STUDY AREA 50**
**FORT DEVENS, MA**

ABB Environmental Services, Inc.

6917-13A 123 6 9

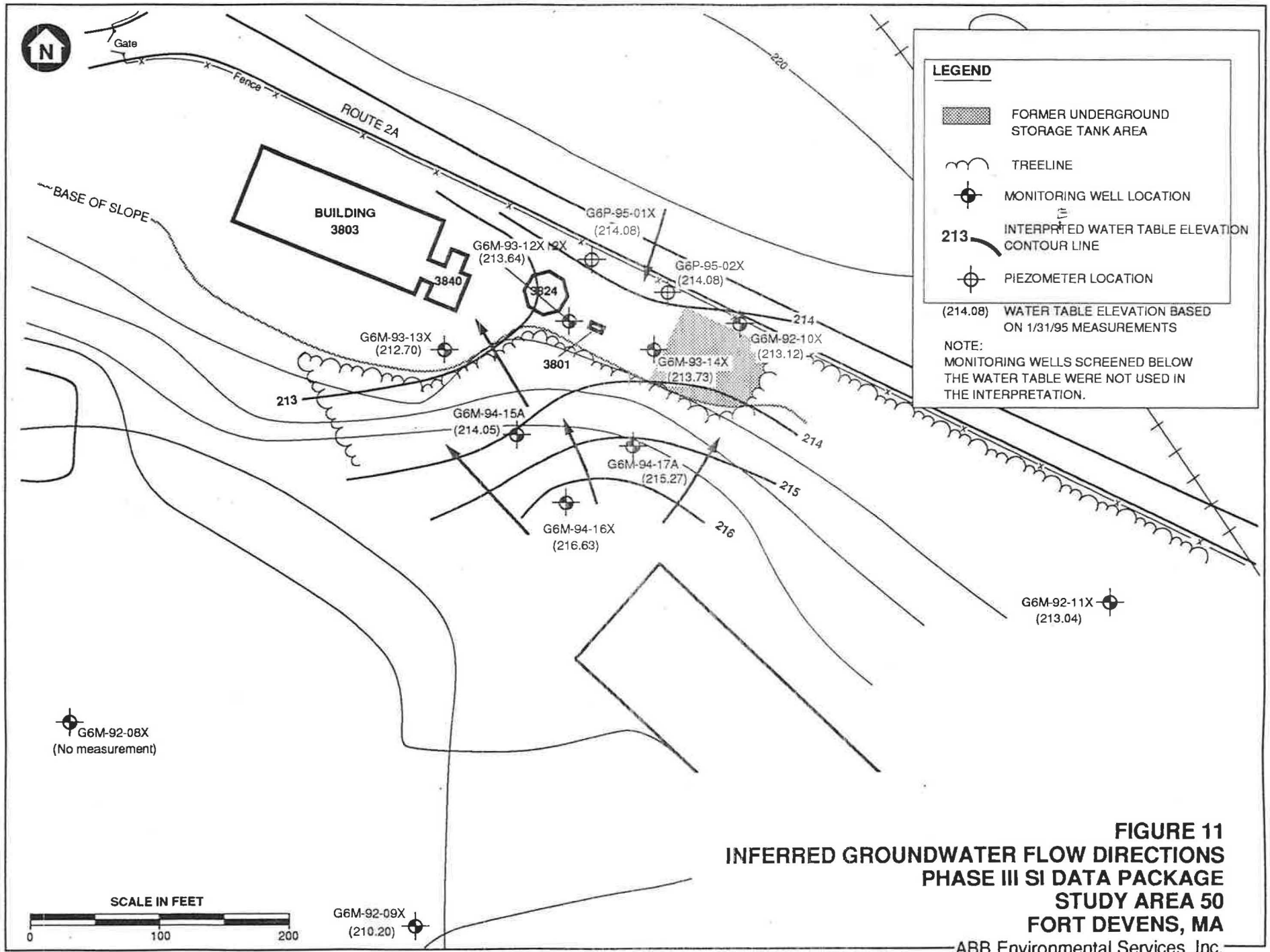


**FIGURE 11**
**INFERRED GROUNDWATER FLOW DIRECTIONS**
**PHASE III SI DATA PACKAGE**
**STUDY AREA 50**
**FORT DEVENS, MA**

ABB Environmental Services, Inc.

9308004W 23 11

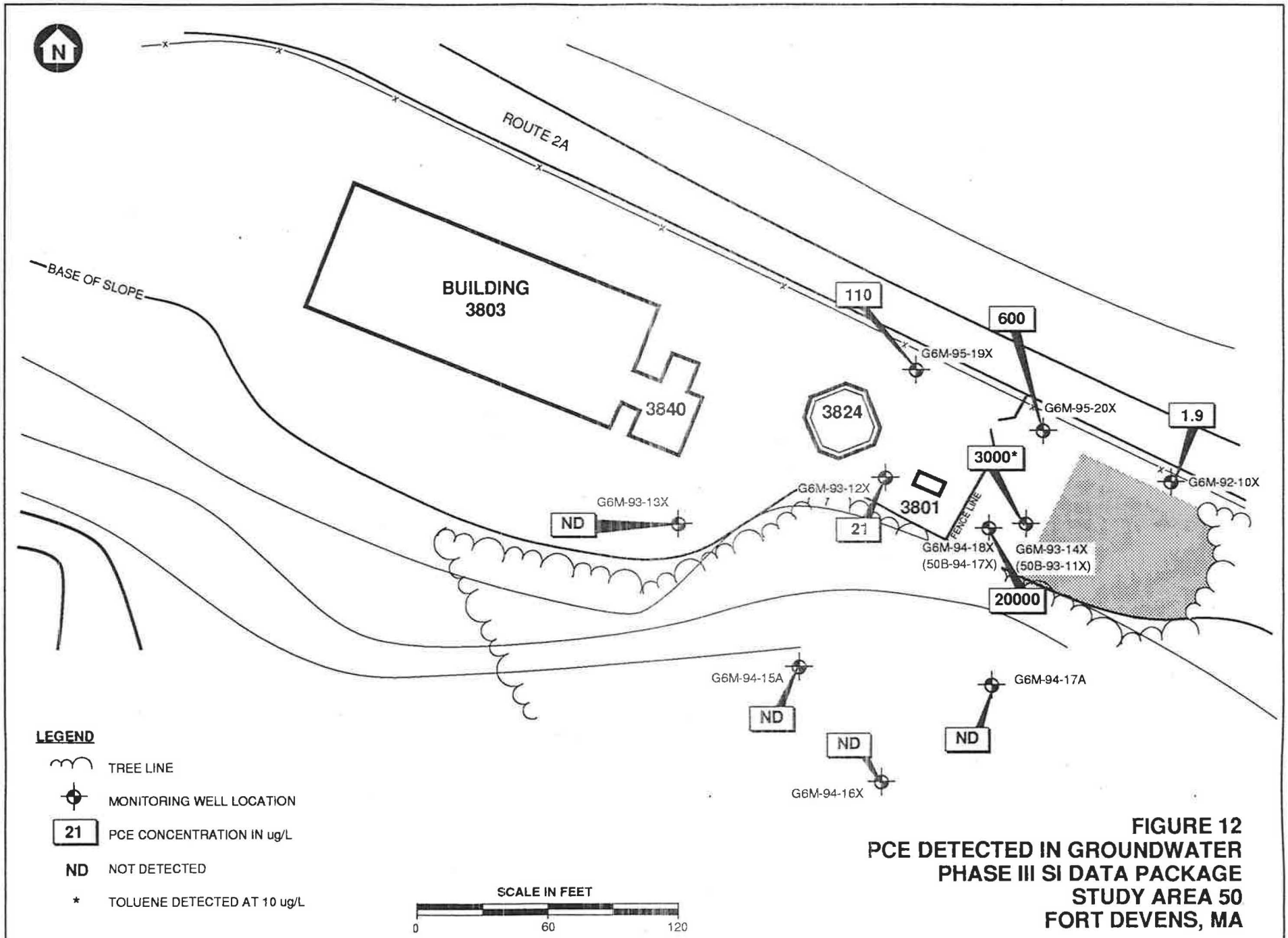


**FIGURE 12**
**PCE DETECTED IN GROUNDWATER**
**PHASE III SI DATA PACKAGE**
**STUDY AREA 50**
**FORT DEVENS, MA**

ABB Environmental Services, Inc.

# TABLE 1
## CONFIRMATORY SAMPLES – UST AND ANCILLARY EQUIPMENT REMOVAL
## SA 50 – MOORE army AIRFIELD WORLD WAR II FUEL POINT

## PHASE III SITE INVESTIGATION DATA PACKAGE
## FORT DEVENS

| AREA | SAMPLE NO. | TOTAL VOCs (PID) (ppm) | LABORATORY ANALYSIS | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | BENZENE (µg/kg) | TOLUENE (µg/kg) | ETHYL-BENZENE (µg/kg) | TOTAL XYLENES (µg/kg) | PCE (µg/kg) | TOTAL SVOCs (µg/kg) | TPHC (mg/kg) | TOTAL LEAD (mg/kg) |
| TANK HOLE (SOIL) [1] | TNK-19 | 133 | ND | ND | ND | ND | ND | 5.1 | 14 | 13.2 |
| | TNK-25 | 139 | ND | ND | ND | ND | ND | 2.65 | 3,285 | 17.3 |
| | TNK-26 | 85 | ND | ND | ND | ND | ND | 0.95 | ND | 12.8 |
| | TNK-27 | 97 | ND | ND | ND | 19 | ND | 1.97 | ND | 11.7 |
| TANK HOLE (WATER) [2] | TKH-1 | 157 | 38,8 | 119 | ND | 291 | ND | 240.2 | ND | 0.007 |
| | ES-1 | ND | 297 | 137 | ND | 900 | ND | 33.7 | ND | 0.035 |
| WATER CONTROL PIT (SOIL) | WCP-1 | 52 | | | | | | | | |
| | WCP-2 | 109 | | | | | | | | |
| | WCP-3 | 3 | | | | | | | | |
| | WCP-4 | 535 | ND | ND | ND | ND | ND | NA | ND | 7.1 |
| | WCP-5 | 166 | | | | | | | | |
| WATER SEPARATOR PIT (SOIL) | WSP-1 | 16 | | | | | | | | |
| | WSP-2 | 33 | | | | | | | | |
| | WSP-3 | 243 | | | | | | | | |
| | WSP-4 | 519 | ND | ND | 121 | 326 | ND | NA | 16 | 7.2 |
| | WSP-5 | 52 | | | | | | | | |
| PIPELINE, AREA A (SOIL) | PL-A-1 | 4 | | | | | | | | |
| | PL-A-2 | 0 | | | | | | | | |
| | PL-A-3 | 2 | | | | | | | | |
| PIPELINE, AREA B (SOIL) | PL-B-4 | 113 | ND | ND | ND | ND | 175,850 | ND | ND | 10.5 |
| | PL-B-5 | 34 | | | | | | | | |
| | PL-B-6 | 242 | ND | 798 | ND | ND | 4,167 | 105 | ND | 5 |
| TRUCK STAND (SOIL) | TS-1 | 0 | | | | | | | | |
| | TS-2 | 3 | | | | | | | | |
| | TS-3 | 3 | | | | | | | | |
| | TS-4 | 14 | ND | ND | ND | ND | 197 | ND | ND | 2.8 |
| | TS-5 | 3 | | | | | | | | |
| | TS-6 | 8 | ND | ND | ND | ND | ND | ND | ND | 2.1 |
| FILL STAND (SOIL) | FS-1 | 0 | | | | | | | | |
| | FS-2 | 2 | | | | | | | | |
| | FS-3 | 0 | | | | | | | | |

Source: Zenone (1993), Table 3

Notes: ND = Not Detected
NA = Not Analyzed

[1] other PID screening results shown in Figure 4
[2] concentrations in µg/l (organic analytes) and mg/l (TPHC and lead)

15-May-95
09:09 AM

TABLE 2
SUMMARY OF TECHNICAL APPROACH
SUPPLEMENTAL SI AND PHASE III SI EXPLORATIONS
SA 50 – MOORE ARMY AIRFIELD WORLD WAR II FUEL POINT

PHASE III SITE INVESTIGATION DATA PACKAGE
FORT DEVENS

| ACTIVITY | PURPOSE | EXPLORATION IDENTIFICATION | RATIONALE FOR SELECTED LOCATIONS |
|---|---|---|---|
| GEOPHYSICAL SURVEY | To Locate and Map Underground Utilities | Fueling System B | Area Around Original Fueling System Piping |
| SOIL VAPOR SURVEY | To Identify Potential Distribution of Contaminants in Soil and/or Groundwater, as a Basis for Locating Borings and Monitoring Wells | 30 Sampling Points Between Fueling System B and Guard House Beyond Rigging Building | Conditions at and Downgradient of the Fueling System B Tank Grave and Presumed PCE Source Area |
| SOIL BORINGS | Characterize Soils; Collect Samples for Off–Site Laboratory Analysis, and Identify Contaminants in Soil | 50B–93–12X<br>50B–93–13X | In Area of Elevated VOCs in Soil Vapor |
| | | 50B–93–14X | In Area of Elevated VOCs in Soil Vapor at Presumed PCE Source |
| | | 50B–93–15X<br>50B–93–16X | In Area of Elevated VOCs in Soil Vapor |
| | | G6M–93–12X | Downgradient of Tank Grave, Downgradient and Near PCE Source, In Area of Elevated VOCs in Soil Vapor |
| | | G6M–93–13X | Downgradient of Tank Grave and PCE Source |
| | | G6M–93–14X<br>(50B–93–11X) | In Area of Elevated VOCs in Soil Vapor, Adjacent to Tank Grave |
| | | G6M–94–15A<br>G6M–94–16X<br>G6M–94–17A | In an Area Interpreted to be Downgradient of the Apparent Source of PCE – Later Determined to be in an Upgradient Location |
| | | G6M–95–18X<br>(50B–94–17X) | In the Apparent Source Area |
| | | G6M–95–19X<br>G6M–95–20X | Downgradient of Apparent Source Area |

TABLE 2
SUMMARY OF TECHNICAL APPROACH
SUPPLEMENTAL SI AND PHASE III SI EXPLORATIONS
SA 50 – MOORE ARMY AIRFIELD WORLD WAR II FUEL POINT

PHASE III SITE INVESTIGATION DATA PACKAGE
FORT DEVENS

| ACTIVITY | PURPOSE | EXPLORATION IDENTIFICATION | RATIONALE FOR SELECTED LOCATIONS |
|---|---|---|---|
| MONITORING–WELL INSTALLATION AND GROUNDWATER SAMPLING | Monitoring Groundwater Levels; Monitoring Groundwater Quality; and Determine Aquifer Conductivities | G6M–93–12X<br>G6M–93–13X<br>G6M–93–14X | To Provide Coverage Downgradient of the Tank Grave and PCE Source |
| | | G6M–94–15A<br>G6M–94–16X<br>G6M–94–17A | To Further Evaluate Local Groundwater Flow Conditions |
| | | G6M–95–18X | Originally Slated to be a Soil Boring – Converted to a Monitoring Well to Evaluate the Vertical Distribution of PCE in Groundwater Below the Source Area |
| | | G6M–95–19X<br>G6M–95–20X | To Determine if PCE has Migrated Downgradient of the Source Area and to Evaluate the Vertical Distribution in Groundwater – Both Wells Installed with Water Table Piezometers. |

NOTES: Shaded areas identify Phase III SI Explorations
VOCs = Volatile Organic Compounds
PCE = Tetrachloroetheylene

19–May–95
02:03 PM

# TABLE 3
## FIELD GAS CHROMATOGRAPH–SCREENING OF SOIL VAPOR
## SA 50 – MOORE ARMY AIRFIELD WORLD WAR II FUEL POINT

## PHASE III SITE INVESTIGATION DATA PACKAGE
## FORT DEVENS

| EXPLORATION IDENTIFICATION | SAMPLE DEPTH (Feet bgs) | TOTAL VOCs (ppm) | COMMENTS |
|---|---|---|---|
| 50V–93–01X | 3 | 282 | Gasoline; possible PCE 4 ppm. |
| 50V–93–02X | 3 | 3,883 | Gasoline. |
| 50V–93–03X | 3 | 24 | Gasoline. |
| 50V–93–04X | 3 | 738 | Gasoline; possible PCE 28 ppm. |
| 50V–93–05X | 3 | 123 | Gasoline; possible PCE 29 ppm. |
| 50V–93–06X | 3 | 20 | Gasoline; possible PCE 8 ppm. |
| 50V–93–07X | 3 | 213 | Gasoline; possible PCE 75 ppm. |
| 50V–93–08X | 3 | 3,138 | Gasoline; possible PCE 625 ppm. |
| 50V–93–09X | 3 | 155 | Gasoline (?); possible PCE 61 ppm. |
| 50V–93–10X | 3 | 3 | Gasoline (?); possible PCE 8 ppm. |
| 50V–93–11X | 3 | 38 | Gasoline / PCE (?). |
| 50V–93–12X | 3 | 24 | Gasoline / PCE (?) 7 ppm. |
| 50V–93–13X | 3 | 5 | Possible PCE 2 ppm. |
| 50V–93–14X | 3 | 25 | Gasoline (?); possible PCE 0.08 ppm. |
| 50V–93–15X | 3 | 4 | Possible PCE 1 ppm. |
| 50V–93–16X | 3 | 3 | Possible PCE 1 ppm. |
| 50V–93–17X | 3 | 1 | Possible PCE 0.4 ppm. |
| 50V–93–18X | 3 | 2 | Possible PCE 0.6 ppm. |
| 50V–93–19X | 3 | 1 | Possible PCE 0.01 ppm. |
| 50V–93–20X | 3 | 2 | Possible PCE 0.04 ppm. |
| 50V–93–21X | 3 | 8 | Possible TCE 0.09 ppm; possible PCE 0.1 ppm. |
| 50V–93–22X | 3 | 1 | Possible PCE 0.4 ppm. |
| 50V–93–23X | 3 | 2 | Possible PCE 0.2 ppm. |
| 50V–93–24X | 3 | 6 | Possible PCE 0.5 ppm. |
| 50V–93–25X | 3 | 1.2 | Possible PCE 0.04 ppm. |
| 50V–93–26X | 3 | 0.9 | Possible PCE 0.06 ppm. |
| 50V–93–27X | 3 | 1.3 | Possible PCE 0.2 ppm. |
| 50V–93–28X | 3 | 0.7 | |
| 50V–93–29X | 3 | 0.8 | |
| 50V–93–30X | 3 | 0.8 | |

NOTES: bgs = below ground surface
VOCs = Volatile Organic Compounds
ppm = parts per million
PCE = Tetrachloroethylene

15–May–95
11:12 AM

TABLE 4
SUMMARY OF SOIL BORINGS
SA 50 – MOORE ARMY AIRFIELD WORLD WAR II FUEL POINT

PHASE III SITE INVESTIGATION DATA PACKAGE
FORT DEVENS

| EXPLORATION IDENTIFICATION | COMPLETION DEPTH Feet (bgs) | REFERENCE SAMPLE INTERVALS Feet (bgs) | ANALYTICAL SAMPLES COLLECTED | SOIL TYPE (USCS) | TOTAL VOCs BY PID (ppm) | GC SCREENING RESULTS (ug/kg) | COMMENTS |
|---|---|---|---|---|---|---|---|
| 50B–93–12X | 12 | 0 – 2 | NO | SP | <1 | PCE >240; benzene 2.5 | |
| | | 5 – 7 | NO | SP | BKG | NA | Poor recovery |
| | | 7 – 9 | YES | ML/ SM | 100 | PCE 459,700; fuel high | Strong odor; product present within silt. |
| | | 10 – 12 | YES | SM | 100 | PCE 35,782 | |
| 50B–93–13X | 12 | 0 – 2 | NO | SP – SM | BKG | PCE 131 | |
| | | 5 – 7 | NO | SM | BKG | PCE 45 | |
| | | 7 – 9 | YES | SM – ML | 2 | PCE 497 | |
| | | 10 – 12 | YES | ML | <1 | PCE 11,140 | |
| 50B–93–14X | 12 | 0 – 2 | NO | SM | 9 | PCE 1,743 | |
| | | 2 – 4 | YES | ML | 70 | PCE 1,924; fuel | |
| | | 4 – 6 | YES | ML – SM | 10 | PCE 2,006; fuel | |
| | | 6 – 8 | NO | ML – SM | 20 | PCE 1,940 | |
| | | 8 – 10 | NO | ML – SM | 40 | PCE 747 | |
| | | 10 –12 | NO | ML – SM | 10 | PCE 897 | |
| 50B–93–15X | 12 | 0 – 2 | YES | SP – SM | BKG | PCE 419 | |
| | | 5 – 7 | NO | SW | BKG | PCE 152 | |
| | | 7 – 9 | NO | SM – SL | BKG | NA | |
| | | 10 – 12 | NO | ML – SM | BKG | PCE 190 | |
| 50B–93–16X | 12 | 0 – 2 | YES | SP | BKG | PCE 160 | |
| | | 5 – 7 | NO | ML/ SM – ML | BKG | PCE 137 | |
| | | 10 – 12 | YES | ML – SM | BKG | PCE 150 | |

TABLE 4
SUMMARY OF SOIL BORINGS
SA 50 – MOORE ARMY AIRFIELD WORLD WAR II FUEL POINT

PHASE III SITE INVESTIGATION DATA PACKAGE
FORT DEVENS

| EXPLORATION IDENTIFICATION | COMPLETION DEPTH Feet (bgs) | REFERENCE SAMPLE INTERVALS Feet (bgs) | ANALYTICAL SAMPLES COLLECTED | SOIL TYPE (USCS) | TOTAL VOCs BY PID (ppm) | GC SCREENING RESULTS (ug/kg) | COMMENTS |
|---|---|---|---|---|---|---|---|
| G6M-93-12X | 20 | 0 – 2 | YES | SP | BKG | PCE 42 | |
| | | 5 – 7 | YES | SM – ML | BKG | PCE 43 | Rust discoloration. |
| | | 10 – 12 | YES | ML – SM | BKG | PCE 101 | |
| | | 15 – 17 | NO | ML | BKG | ND | |
| G6M-93-13X | 19 | 0 – 2 | NO | SM | BKG | ND | |
| | | 5 – 7 | NO | ML/ SM | BKG | ND | |
| | | 10 – 12 | NO | SM – ML | 1 | ND | |
| | | 15 – 17 | YES | SM – ML | BKG | ND | |
| G6M-93-14X | 20 | 0 – 2 | YES | SP – SM | 1.5 | PCE >1 | |
| (50B-93-11X) | | 5 – 7 | YES | SM | 7 | PCE 202; benzene 3.4 | Odor present. |
| | | 10 – 12 | YES | SM – ML | BKG | PCE >164 | |
| G6M-94-15A[2] | 44.5 | 0-2 | NO | SP-SM / SW | <1 | Toluene 37 | |
| | | 5-7 | NO | SP | <1 | ND | |
| | | 10-12 | NO | SP | <1 | ND | |
| | | 15-17 | NO | SP | BKG | Toluene 26 | |
| | | 20-22 | NO | SP | BKG | Toluene 31 | |
| | | 25-27 | NO | SP | BKG | ND | |
| | | 30-32 | NO | SP / SP-SM | BKG | ND | Iron staining |
| | | 35-37 | NO | SP / SM-CL | BKG | ND | Iron staining |
| | | 40-42 | YES[1] | SM / SP-SM | NR | Xylene 49 | |

TABLE 4
SUMMARY OF SOIL BORINGS
SA 50 – MOORE ARMY AIRFIELD WORLD WAR II FUEL POINT

PHASE III SITE INVESTIGATION DATA PACKAGE
FORT DEVENS

| EXPLORATION IDENTIFICATION | COMPLETION DEPTH Feet (bgs) | REFERENCE SAMPLE INTERVALS Feet (bgs) | ANALYTICAL SAMPLES COLLECTED | SOIL TYPE (USCS) | TOTAL VOCs BY PID (ppm) | GC SCREENING RESULTS (ug/kg) | COMMENTS |
|---|---|---|---|---|---|---|---|
| G6M-94-16X [2] | 44 | 0-2 | NO | SP / SW | BKG | ND | |
| | | 5-7 | NO | SP | BKG | ND | |
| | | 10-12 | NO | SP | BKG | ND | |
| | | 15-17 | NO | SP | BKG | ND | |
| | | 20-22 | NO | SP | BKG | ND | |
| | | 25-27 | NO | SP | BKG | ND | |
| | | 30-32 | NO | SP | BKG | ND | |
| | | 35-37 | NO | SM / SP | BKG | ND | Iron staining |
| | | 40-42 | YES [1] | SP - SM | BKG | NA | Iron staining |
| G6M-94-17X [2] | 44 | 0-2 | NO | SP | <1 | ND | Some fibrous roots |
| | | 4-6 | NO | SP | <1 | Xylene 57 | |
| | | 9-11 | NO | SP | BKG | Xylene 24 | |
| | | 14-16 | NO | SP | BKG | Xylene 55 | |
| | | 19-21 | NO | SP | BKG | Chlorobenzene 85 | Fine statification / color bands |
| | | 24-26 | NO | SP | BKG | Chlorobenzene 63 | Fine statification / color bands |
| | | 29-31 | NO | SP | BKG | ND | Finely statified |
| | | 34-36 | NO | SP - SM / ML | BKG | ND | Finely statified |
| | | 39-41 | YES [1] | SM - ML/ CL | BKG | Xylene 42 | |
| | | 41-44 | NO | SM - ML | BKG | NA | |
| G6M-94-18X [2] (50B-94-17X) | 93 | CONTINOUS AT 2 FOOT INTERVALS | 4, 6, 8, 10, 12, 22, 24, 26, 40, 90 ft/bgs | See Appendix A | BKG TO 192 | PCE (ND - 1450) | See Appendix A |
| G6M-95-19X [2] | 87 | CONTINOUS AT 2 FOOT INTERVALS | YES [1] AT 50 ft/bgs | See Appendix A | BKG AND NR | PCE (ND - 173) | See Appendix A |
| G6M-95-20X [2] | 89 | CONTINOUS AT 2 FOOT INTERVALS | YES [1] AT 20 ft/bgs | See Appendix A | NR | PCE (ND - 1872) | See Appendix A |

(bgs) = below ground surface
USCS = Unified Soil Classification System
ppm = parts per million
ug/kg = micro grams per kilogram
VOCs = Volatile Organic Compounds
PID = Photoionization Detector
GC = Gas chromatography
PCE = Tetrachloroethylene
NR = Not Recorded
NA = Not Analyzed
[1] = Sample analyzed for Total Organic Carbon only
[2] = Explorations (shaded) completed as part of the Phase III Site Investigation; GC screening results (estimated concentrations not shown)

TABLE 5
MONITORING WELL COMPLETION DETAILS
SA 50 – MOORE ARMY AIRFIELD WORLD WAR II FUEL POINT

PHASE III SITE INVESTIGATION DATA PACKAGE
FORT DEVENS

| WELL IDENTIFICATION | SOIL DRILLING METHOD | MEDIA SCREENED | WELL SCREEN INTERVAL (Feet bgs) | WELL SCREEN ELEVATION (Feet above msl) | COMPLETION DEPTH (Feet bgs) | WELL CONSTRUCTION MATERIAL |
|---|---|---|---|---|---|---|
| G6M-92-08X | HOLLOW STEM AUGER | SOIL | 53 – 63 | 210.2 – 200.2 | 63 | 4" ID PVC |
| G6M-92-09X | HOLLOW STEM AUGER | SOIL | 48 – 58 | 210.6 – 200.6 | 58 | 4" ID PVC |
| G6M-92-10X | HOLLOW STEM AUGER | SOIL | 9 – 19 | 218.2 – 208.2 | 20 | 4" ID PVC |
| G6M-92-11X | HOLLOW STEM AUGER | SOIL | 8.5 – 18.5 | 214.7 – 204.7 | 20 | 4" ID PVC |
| G6M-93-12X | HOLLOW STEM AUGER | SOIL | 9 – 19 | 214.1 – 204.1 | 20 | 4" ID PVC |
| G6M-93-13X | HOLLOW STEM AUGER | SOIL | 9 – 19 | 214.7 – 204.7 | 20 | 4" ID PVC |
| G6M-93-14X | HOLLOW STEM AUGER | SOIL | 9 – 19 | 214.2 – 204.2 | 20 | 4" ID PVC |
| G6M-94-15A [1] | HOLLOW STEM AUGER | SOIL | 33 – 43 | 218.5 – 208.5 | 44 | 4" ID PVC |
| G6M-94-16X [1] | HOLLOW STEM AUGER | SOIL | 34 – 44 | 218.9 – 208.9 | 44 | 4" ID PVC |
| G6M-94-17A [1] | HOLLOW STEM AUGER | SOIL | 33.5 – 43.5 | 219.5 – 209.5 | 44 | 4" ID PVC |
| G6M-94-18X [1] | DRIVE AND WASH | SOIL | 22.5 – 27.5 | 201.1 – 191.1 | 92 [2] | 2" ID PVC |
| G6M-95-19X [1] | HOLLOW STEM AUGER / DRIVE AND WASH | SOIL | 48 – 58 | 174.8 – 164.8 | 87 [2] | 2" ID PVC |
| G6M-95-20X [1] | HOLLOW STEM AUGER / DRIVE AND WASH | SOIL | 18 – 23 | 205.0 – 200.0 | 89 [2] | 2" ID PVC |

NOTES: [1] Explorations installed as part of the Phase III Site Investigation

[2] Boring completion depth. Portion of boring completed below the bottom of the well screen was sealed with grout or grout and bentonite.

bgs = below ground surface msl = mean sea level NA = Not Applicable

4" ID PVC = 4-inch internal diameter schedule 40 polyvinyl chloride pipe

15-May-95
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# TABLE 6
## SUMMARY OF WATER LEVELS AND HYDRAULIC CONDUCTIVITIES
## SA 50 – MOORE ARMY AIRFIELD WORLD WAR II FUEL POINT

## PHASE III SITE INVESTIGATION DATA PACKAGE
## FORT DEVENS

| WELL IDENTIFICATION | ELEVATION REFERENCE (Feet above msl) | | DEPTH TO WATER (Feet bgs) | ELEVATION OF WATER (Feet above msl) | HYDRAULIC CONDUCTIVITY (cm/sec) | |
|---|---|---|---|---|---|---|
| G6M-92-08X | PVC RISER | 262.94 | Access Problem | Not Available | 1.4E-03 | |
| G6M-92-09X | PVC RISER | 261.25 | 51.05 | 210.20 | 1.3E-03 | |
| G6M-92-10X | PVC RISER | 225.81 | 12.69 | 213.12 | 4.7E-05 | |
| G6M-92-11X | PVC RISER | 225.62 | 12.58 | 213.04 | 1.4E-04 | |
| G6M-93-12X | PVC RISER | 224.73 | 11.09 | 213.64 | 1.0E-03 | |
| G6M-93-13X | PVC RISER | 225.58 | 12.88 | 212.70 | 9.3E-04 | |
| G6M-93-14X | PVC RISER | 224.89 | 11.16 | 213.73 | 9.9E-04 | |
| G6M-94-15A | PVC RISER | 253.67 | 39.62 | 214.05 | 1.2E-04 | 1 |
| G6M-94-16X | PVC RISER | 254.77 | 38.14 | 216.63 | 6.9E-05 | 1 |
| G6M-94-17A | PVC RISER | 256.15 | 40.88 | 215.27 | 9.7E-05 | 1 |
| G6M-94-18X | PVC RISER | 225.78 | 13.25 | 212.53 | 5.5E-04 | 1 |
| G6M-95-19X | PVC RISER | 224.59 | 12.17 | 212.42 | 2.5E-04 | 1 |
| G6M-95-20X | PVC RISER | 225.31 | 12.54 | 212.77 | 1.5E-04 | 1 |

NOTES: The reported water levels were measured on January 31, 1995

Two hydraulic conductivity tests were condected for each well, and conductivites reported above were calculated using the Hvorslev (1951) method. The conductivity listed for each well is the average of the two tests.

[1] = Test conducted as part of the Phase III Site Investigation.

PVC = Polyvinyl chloride

bgs = below ground surface

cm/sec = centimeter per second

msl = mean sea level

TABLE 7
ANALYTES DETECTED IN SOIL
SA 50 – MOORE ARMY AIRFIELD WORLD WAR II FUEL POINT

PHASE III SITE INVESTIGATION DATA PACKAGE
FORT DEVENS

| SITE IDENTIFICATION | SAMPLE DEPTH | ANALYTE CONCENTRATION (ug/g) | | |
|---|---|---|---|---|
| | | PCE | LEAD | TPHC |
| 50B-92-07X | 0 | <0.001 | 2.58 | <27.7 |
| | 5 | <0.00081 | 3.11 | 48.8 |
| | 10 | <0.00081 | 3.59 | 39.3 |
| 50B-92-08X | 0 | 0.00616 | 5.83 | 46.3 |
| | 5 | <0.001 | 3.04 | 41.5 |
| | 10 | 0.300 | 3.51 | 55.8 |
| 50B-92-09X | 0 | <0.00081 | 14.0 | 109 |
| | 10 | <0.00081 | 12.0 | 54.0 |
| | 15 | <0.004 | 8.60 | 162 |
| 50B-92-10X | 0 | <0.00081 | 20.0 | 71.8 |
| | 5 | <0.00081 | 3.92 | 42.7 |
| | 10 | <0.00081 | 3.13 | 44.5 |
| 50B-93-11X | 0 | 0.0062 | NA | <30.9 |
| (G6M-93-14X) | 5 | <0.00081 | NA | <32.0 |
| | 10 | <0.00081 | NA | <35.9 |
| 50B-93-12X | 7 | 3000 | NA | NA |
| | 10 | 0.100 | NA | NA |
| 50B-93-13X | 7 | 0.006 | NA | NA |
| | 10 | 0.005 | NA | NA |
| 50B-93-14X | 2 * | 3.00 | NA | NA |
| | 4 | 0.0043 | NA | NA |
| 50B-93-15X | 0 | 0.0064 | NA | NA |
| 50B-93-16X | 0 | <0.00081 | NA | NA |
| | 10 | <0.00081 | NA | NA |
| G6M-92-10X | 0 | <0.00081 | 14.0 | 38.5 |
| | 5 | <0.00081 | 3.17 | <27.9 |
| | 10 | <0.00081 | 5.87 | <27.9 |
| G6M-92-11X | 0 | <0.00081 | 18.0 | 53.7 |
| | 5 | <0.00081 | 12.0 | 36.4 |
| | 12 | <0.00081 | 2.96 | 51.5 |
| | 12 DUP | 0.0041 | 3.57 | 47.4 |
| G6M-93-12X | 0 | 0.0077 | NA | NA |
| | 5 | <0.00081 | NA | NA |
| | 5 DUP | 0.0028 | NA | NA |
| | 10 | <0.00081 | NA | NA |

# TABLE 7
## ANALYTES DETECTED IN SOIL
## SA 50 – MOORE ARMY AIRFIELD WORLD WAR II FUEL POINT

## PHASE III SITE INVESTIGATION DATA PACKAGE
## FORT DEVENS

| SITE IDENTIFICATION | SAMPLE DEPTH | | ANALYTE CONCENTRATION (ug/g) PCE | LEAD | TPHC |
|---|---|---|---|---|---|
| 50B-94-17X [1] | 4 | ** ++ | 0.0026 | NA | <28 |
| (G6M-94-18X) | 6 | ** | 0.017 | NA | <28 |
| | 8 | ** | 0.0024 | NA | <28 |
| | 8 DUP | ** | 0.0021 | NA | <28 |
| | 10 | | 0.016 | NA | <28 |
| | 12 | | 0.0018 | NA | <28 |
| | 22 | | 0.039 | NA | <28 |
| | 24 | | 0.038 | NA | <28 |
| | 26 | ** | 0.0017 | NA | <28 |
| | 40 | ** | <0.00081 | NA | <28 |
| | 90 | | <0.00081 | NA | <28 |

NOTES:

PCE = Tetrachloroethylene

TPHC = Total Petroleum Hydrocarbon Compounds

ug/g = micrograms per gram

DUP = Duplicate sample

NA = Not Analyzed

[1] = Samples collected as part of the Phase III Site Investigation

* = Xylene was detected in this sample at a concentration of 0.50 ug/g.

** = Trichlorofluoromethane was detected in these six samples at concentrations ranging from 0.017 ug/g to 0.052 ug/g.

++ = Benzene was detected in this sample at a concentration of 0.002 ug/g.

31-May-95

01:57 PM

TABLE 8
ANALYTES DETECTED IN GROUNDWATER
SA – 50 MOORE ARMY AIRFIELD WORLD WAR II FUEL POINT

PHASE III SITE INVESTIGATION DATA PACKAGE
FORT DEVENS

| ANALYTE | BACK-GROUND | G6M-92-10X | | | | G6M-92-11X | | | G6M-93-12X | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | SI | SI Rounds 2 & 3 | | Phase III | SI | SI Rounds 2 & 3 | | SSI Round 1 | | SSI Round 2 | | Phase III |
| | | Round 1 | unfiltered | filtered | SI | Round 1 | unfiltered | filtered | unfiltered | filtered | unfiltered | filtered | SI |
| **ORGANICS (ug/L)** | | | | | | | | | | | | | |
| BENZENE | | <5.0 | <5.0 | NA | <0.50 | <5.0 | <5.0 | NA | <5.0 | NA | <2 | NA | <0.50 |
| BIS(2-ETHYLHEXYL)PHTHALATE | | <4.80 | <4.80 | NA | NA | <4.80 | 18.0 | NA | 5.10 | NA | <4.80 | NA | NA |
| CHLOROFORM | | <5.0 | <5.0 | NA | <0.50 | <5.0 | <5.0 | NA | 7.1 | NA | 4 | NA | <0.50 |
| TETRACHLOROETHYLENE | | <1.60 | <1.60 | NA | 1.9 | <1.60 | <1.60 | NA | 1300 | NA | 1000 | NA | 21 |
| TOLUENE | | <0.50 | <0.50 | NA | <0.50 | <0.50 | <0.50 | NA | <5.0 | NA | <2 | NA | <0.50 |
| **INORGANICS (ug/L)** | | | | | | | | | | | | | |
| ALUMINUM | 6870 | 850 | 2340 | 264 | NA | 1920 | 148 | <141 | NA | NA | NA | NA | NA |
| ARSENIC | 10.5 | <2.54 | 2.98 | <2.54 | NA | <2.54 | <2.54 | <2.54 | NA | NA | NA | NA | NA |
| BARIUM | 39.6 | 153 | 208 | 146 | NA | 16.1 | 59.7 | 25.4 | NA | NA | NA | NA | NA |
| CALCIUM | 14700 | 47100 | 47500 | 47000 | NA | 5940 | 12600 | 11400 | 6020 | NA | 10200 | NA | NA |
| CHROMIUM | 14.7 | <6.02 | 7.44 | <6.02 | NA | 6.36 | <6.02 | <6.02 | NA | NA | NA | NA | NA |
| IRON | 9100 | 816 | 2600 | <38.8 | NA | 2390 | 205 | 58.7 | NA | NA | NA | NA | NA |
| LEAD | 4.25 | 1.52 | 2.06 | <1.26 | NA | 2.28 | 1.52 | 6.51 | 4.00 | <1.3 | 29.3 | <1.3 | NA |
| MAGNESIUM | 3480 | 2430 | 2820 | 2350 | NA | 855 | 766 | 671 | 2780 | NA | 11700 | NA | NA |
| MANGANESE | 291 | 309 | 263 | 216 | NA | 99.0 | 99.6 | 97.1 | NA | NA | NA | NA | NA |
| POTASSIUM | 2370 | 5570 | 5940 | 5380 | NA | 645 | 1710 | 1360 | 5000 | NA | 12100 | NA | NA |
| SODIUM | 10800 | 300000 | 1200000 | 1200000 | NA | 2420 | 5560 | 4380 | NA | NA | NA | NA | NA |
| ZINC | 21.1 | <21.1 | 41.2 | 39.6 | NA | <21.1 | 22.9 | <21.1 | NA | NA | NA | NA | NA |
| **ANIONS/CATIONS (ug/L)** | | | | | | | | | | | | | |
| BICARBONATE | | 8540 | 24000 | NA | NA | 28100 | 12000 | NA | 10000.0 | NA | 18300 | NA | NA |
| CHLORIDE | | 200000 | 2100000 | NA | NA | 3480 | 15800 | NA | 4650 | NA | 3420 | NA | NA |
| SULFATE | | 47000 | 50300 | NA | NA | <10000 | <10000 | NA | <10000 | NA | <10000 | NA | NA |
| NITRATE/NITRITE | | 1400 | 1400 | NA | NA | 78.5 | 97.7 | NA | 102 | NA | 82.6 | NA | NA |
| ALKALINITY | | 7000 | 7000 | NA | NA | 23000 | 10000 | NA | NA | NA | 15000 | NA | NA |
| **OTHER (ug/L)** | | | | | | | | | | | | | |
| TSS | | 40000 | 72000 | NA | NA | 53000 | 16000 | NA | 444000 | NA | 5560000 | NA | NA |

TABLE 8
ANALYTES DETECTED IN GROUNDWATER
SA – 50 MOORE ARMY AIRFIELD WORLD WAR II FUEL POINT

PHASE III SITE INVESTIGATION DATA PACKAGE
FORT DEVENS

| ANALYTE *** | G6M-94-15A | G6M-94-16X | G6M-94-17A | G6M-94-18X | G6M-95-19X | G6M-95-20X |
|---|---|---|---|---|---|---|
| | Phase III SI | Phase III SI | Phase III SI | Phase III SI | Phase III SI | Phase III SI |
| ORGANICS (ug/L) | | | | | | |
| BENZENE | <0.5 | <0.5 | <0.5 | <50 | <0.5 | <2 |
| BIS(2-ETHYLHEXYL)PHTHALATE | NA | NA | NA | NA | NA | NA |
| CHLOROFORM | <0.5 | <0.5 | <0.5 | <50 | <0.5 | <2 |
| TETRACHLOROETHYLENE | <1.6 | <1.6 | <1.6 | 20000 | 110 | 600 |
| TOLUENE | <0.5 | <0.5 | <0.5 | <50 | <0.5 | <2 |

NOTES:

1) TABLE LISTS DETECTED ANALYTES ONLY – SEE PROJECT ANALYTE LIST FOR SUMMARY
2) HARDNESS VALUES WERE REPORTED FOR SOME SAMPLES BUT RESULTS ARE NOT INCLUDED IN THIS TABLE
NA = NOT ANALYZED
[ ] = GREATER THAN BACKGROUND CONCENTRATION
ug/L = MICROGRAMS PER LITER
*** = PHASE III SAMPLES ANALYZED FOR VOLATILE ORGANIC COMPOUNDS ONLY

# TABLE 9
## SUMMARY OF GRAIN SIZE AND TOC RESULTS
## SA 50 – MOORE ARMY AIRFIELD WORLD WAR II FUEL POINT

## PHASE III SITE INVESTIGATION DATA PACKAGE
## FORT DEVENS

| EXPLORATION IDENTIFICATION | DEPTH INTERVAL FEET (bgs) | GRAIN SIZE | | | SOIL CLASSIFICATION (USCS) | TOC RESULTS (ug/g) |
|---|---|---|---|---|---|---|
| | | % GRAVEL | % SAND | % SILT AND CLAY | | |
| G6M-94-15A | 35-37 | 0.2 | 43.6 | 56.2 | ML | – |
| | 40-42 | – | – | – | – | 770 |
| G6M-94-16X | 40-42 | 0.0 | 39.0 | 61.0 | ML | 630 |
| G6M-94-17A | 34-36 | 0.0 | 22.7 | 77.3 | ML | – |
| | 39-41 | – | – | – | – | 1100 |
| G6M-94-18X | 22-24 | 0.0 | 41.0 | 59.0 | ML | – |
| | 26-28 | 0.0 | 82.6 | 17.4 | SM | – |
| | 32-34 | 0.0 | 82.4 | 17.6 | SM | – |
| | 40-42 | 0.0 | 97.9 | 2.1 | SP | – |
| G6M-95-19X | 24-26 | 0.0 | 42.2 | 57.8 | ML | – |
| | 48-50 | 0.0 | 80.3 | 19.7 | SM | – |
| | 50-52 | 0.0 | 80.6 | 19.4 | SM | 1570 |
| | 58-60 | 0.0 | 86.0 | 14.0 | SM | – |
| G6M-95-20X | 20-22 | – | – | – | – | 5310 |
| | 22-24 | 0.0 | 27.5 | 72.5 | ML | – |
| | 28-30 | 0.0 | 81.9 | 18.1 | SM | – |
| | 30-32 | 0.0 | 83.5 | 16.5 | SM | – |
| | 36-38 | 0.0 | 74.0 | 26.0 | SM | – |
| | 38-40 | 0.0 | 68.1 | 31.9 | SM | – |

NOTES:

TOC = Total Organic Carbon
bgs = below ground surface
– = Analysis not requested on the sample from this interval
USCS = Unified Soil Classification System
ug/g = micro grams per gram
ML = Silt/Clay
SM = Silty Sand
SP = Gravelly Sand

TABLE 10
HUMAN HEALTH PRE FOR SURFACE SOIL
STUDY AREA 50 – MOORE ARMY AIRFIELD WORLD WAR II FUEL POINT

PHASE III SITE INVESTIGATION DATA PACKAGE
FORT DEVENS

| ANALYTE | SOIL BACKGROUND CONCENTRATION [a] | MAXIMUM DETECTED CONCENTRATION [b] | FREQUENCY OF DETECTION | MAXIMUM EXCEEDS BACKGROUND ? | REGION III RESIDENTIAL SOIL CONCENTRATION (ug/g) | MCP METHOD 1 S-1/GW-1 SOIL STANDARD (ug/g) | MAXIMUM EXCEEDS SCREENING GUIDELINE |
|---|---|---|---|---|---|---|---|
| **INORGANICS (ug/g)** | | | | | | | |
| lead | 34.4 | 20 | 6/6 | NO | 400 [c] | 300 | NO |
| **ORGANICS (ug/g)** | | | | | | | |
| xylene | | 0.50 | 1/11 | NA | 160,000 | 500 | NO |
| tetrachloroethylene | | 3.40 | 5/11 | NA | 12 | 0.5 | YES |
| TPHC | | 109 | 5/7 | NA | 380 [d] | 500 | NO |

NOTES:

[a] Base-wide backgound soil inorganics database.

[b] Surface soil samples from sampling stations 50B-92-07X to 50B-92-10X, 50B93-11X, 50B-93-14X to 50B-93-16X, G6M-92-10X, G6M-92-11X, and G6M-93-12X.

[c] USEPA interim guidance for Superfund soil lead cleanup based on a residential exposure scenario.

[d] Calculated risk-based concentration for residential soil based on TPHC originating from gasoline.

NA = available.

Shading indicates exceedance of a screening guideline

# TABLE 11
# HUMAN HEALTH PRE FOR SUBSURFACE SOIL
# STUDY AREA 50 – MOORE ARMY AIRFIELD WORLD WAR II FUEL POINT

## PHASE III SITE INVESTIGATION DATA PACKAGE
## FORT DEVENS

| ANALYTE | SOIL BACKGROUND CONCENTRATION [a] | MAXIMUM DETECTED CONCENTRATION [a] | FREQUENCY OF DETECTION | MAXIMUM EXCEEDS BACKGROUND ? | REGION III INDUSTRIAL/ COMMERCIAL SOIL CONCENTRATION (ug/g) | MCP METHOD 1 S-1/GW-1 SOIL STANDARD (ug/g) | MAXIMUM EXCEEDS SCREENING GUIDELINE |
|---|---|---|---|---|---|---|---|
| **INORGANICS (ug/g)** | | | | | | | |
| lead | 34.4 | 12 | 12/12 | NO | 400[c] | 600 | NO |
| **ORGANICS (ug/g)** | | | | | | | |
| tetrachloroethylene | | 2600 | 14/30 | NA | 110 | 0.5 | YES |
| TPHC | | 162 | 11/21 | NA | 1680 [d] | 2,500 | NO |
| trichlorofluoromethane | | 0.02 | 4/30 | NA | 610,000 | NA | NO |
| benzene | | 0.002 | 1/30 | NA | 200 | 10 | NO |

NOTES:

[a] Base-wide backgound soil inorganics database.

[b] Subsurface soil samples from sampling stations 50B-92-07X to 50B-92-10X, 50B-93-11X to 50B-93-14X, 50B-93-16X, G6M-92-10X, G6M-92-11X, G6M-93-12X, and 50B-94-17X (G6M-94-18X).

[c] USEPA interim guidance for Superfund soil lead cleanup based on a residential exposure scenario.

[d] Calculated risk-based concentration for industrial/commercial soil based on TPHC originating from gasoline.

NA = available.

Shading indicates exceedance of a screening guideline

TABLE 12
HUMAN HEALTH PRE FOR GROUNDWATER
SA 50 – MOORE ARMY AIRFIELD WORLD WAR II FUEL POINT

PHASE III SITE INVESTIGATION DATA PACKAGE
FORT DEVENS

| ANALYTE | GROUNDWATER BACKGROUND CONCENTRATION | MAXIMUM DETECTED CONCENTRATION [a] | MAXIMUM EXCEEDS BACKGROUND | DRINKING WATER STANDARD/GUIDELINE [b] (ug/L) | MCP METHOD 1 GW-1 STANDARD (ug/l) | MAXIMUM EXCEEDS STANDARD/GUIDELINE ? |
|---|---|---|---|---|---|---|
| **ORGANICS (ug/L)** | | | | | | |
| benzene | | 5 | | 5 | 5 | NO |
| tetrachloroethylene | | 20,000 | | 5 | 5 | YES |
| chloroform | | 7.1 | | 5 | 5 | YES |
| bis(2-ethylhexyl)phthalate | | 18 | | 6 | 6 | YES |
| toluene | | 10 | | 1,000 | 1,000 | NO |
| **INORGANICS (ug/L)** | | | | | | |
| aluminum | 6,870 | 2,340 | NO | 50 - 200 | NA | YES |
| arsenic | 10.5 | 2.98 | NO | 50 | 50 | NO |
| barium | 39.6 | 208 | YES | 2,000 | 2,000 | NO |
| calcium | 14,700 | 47,500 | YES | NA | NA | NA |
| chromium | 14.7 | 7.44 | NO | 100 | 50 | NO |
| iron | 9,100 | 2,600 | NO | 300 | NA | YES |
| lead | 4.25 | 24.0 | YES | 15 | 15 | YES |
| magnesium | 3,480 | 12,800 | YES | NA | NA | NA |
| manganese | 291 | 309 | YES | 50 | NA | YES |
| potassium | 2,370 | 13,000 | YES | NA | NA | NA |
| sodium | 10,800 | 1,200,000 | YES | 20,000 | NA | YES |
| zinc | 21.1 | 41.2 | YES | 5,000 | 2,000 | NO |
| **ANIONS/CATIONS (ug/L)** | | | | | | |
| nitrate/nitrite | | 1,400 | NA | 10,000 | NA | NO |

NOTES:
[a] Maximum from either SI, Supplemental SI, or Phase III SI. Only unfiltered samples used.
[b] Standard/Guideline selected in order of the following preference: MA drinking water standard, USEPA drinking water standard, Region III Tap Water Concentration.
[c] SA 50 is represented by the following monitoring wells: G6M-92-10X, G6M-92-11X, G6M-93-12X, G6M-93-13X, G6M-93-14X, G6M-94-18X, G6M-95-19X, and G6M-95-20X.
ND Not detected
NA Not available
Shading indicates exceedance of a screening guideline.

# TABLE 13
# ECOLOGICAL PRE FOR SURFACE SOIL
# STUDY AREA 50 – MOORE ARMY AIRFIELD WORLD WAR II FUEL POINT

## PHASE III SITE INVESTIGATION DATA PACKAGE
## FORT DEVENS

| ANALYTE | SOIL BACKGROUND CONCENTRATION [a] | DETECTED CONCENTRATION [b] | | FREQUENCY OF DETECTION | MAXIMUM EXCEEDS BACKGROUND ? | ECOLOGICAL BENCHMARK (ug/g) | MAXIMUM EXCEEDS BENCHMARK ? |
|---|---|---|---|---|---|---|---|
| | | AVERAGE | MAXIMUM | | | | |
| **ORGANICS (ug/g)** | | | | | | | |
| PCE | | 0.69 | 3.4 | 5/11 | NA | 400 | NO |
| Xylene | | 0.05 | 0.50 | 1/11 | NA | 2100 | NO |
| **INORGANICS (ug/g)** | | | | | | | |
| lead | 34.4 | 12.4 | 20 | 6/6 | NO | 48.4 | NO |

NOTES:

[a] Base–wide background soil inorganics database.

[b] Surface soil samples from from sampling stations 50B–92–07X through 50B–92–10X, 50B–93–11X, 50B–93–14X through 50B–93–16X, G6M–92–10X, G6M–92–11X, and G6M–93–12X.

NA = not available.

# BORING LOGS

| SOIL BORING LOG - FORT DEVENS, MA. | PROJECT NO.: 6917.04 | BORING NO.: G6M-92-08X |
|---|---|---|
| CLIENT: AEC | DATE STARTED: 6/22/92 | GROUP: 6 |
| CONTRACTOR: D. L. Maher | DATE COMPLETED: DRAFT | PROTECTION: Modified D |
| METHOD: 6.65" HSA | BORING DIAMETER: 10" | PID METER: Microtip |
| GROUND ELEV.: 263.21' | REFERENCE PT. ELEV.: NA | TOTAL DEPTH: 63' |
| LOGGED BY: RRR | CHECKED BY: DSP | WATER TABLE BGS: 54.7' |

| SAMPLE NO. | DEPTH (ft) | PEN/REC (ft/ft) | PID OF SPOON (ppm) | SOIL DESCRIPTION AND PHYSICAL CONDITIONS | BLOWS/6" | COMMENTS |
|---|---|---|---|---|---|---|
| | 0-1 | | | ASPHALT AND CONCRETE | | |
| S-1 | 1-3 | 2.0/1.5 | BKGD | SAND, well graded, fine to coarse, 20-30% gravel, 10-15% cobbles, dense, dry, 10YR7/6 Munsell yellow SW | 10/27/21/25 | Rock caught in shoe of spoon analyticals collected PID=BKGD, LEL/O2=0/21 |
| S-2 | 5-7 | 2.0/0.6 | BKGD | SAND, well graded, same as S-1, except medium dense SW | 8/8/9/10 | PID=BKGD, LEL/O2=0/21 Rock caught in shoe of spoon |
| S-3 | 10-12 | 2.0/1.4 | BKGD | (10.0-11.0') SAND, poorly graded, medium to fine, 10-15% subangular to subrounded gravel, 10-15% fines, medium dense, dry SP<br>(11.0-11.1') SANDY SILT, fine sand, soft, dry, 5Y4/3 Munsell olive ML<br>(11.1-11.4') SAND, poorly graded, same as 10.0-11.0' SP | 8/9/4/2 | PID=BKGD, LEL/O2=0/21 |
| S-4 | 15-17 | 2.0/0.4 | BKGD | GRAVELLY SAND well graded, coarse to fine, 20-40% cobbles, loose, dry, 7.5YR6/4 Munsell light brown SW | 4/4/4/5 | Poor recovery due to cobble zone at 15' PID=BKGD, LEL/O2=0/21 |
| | | | | Fewer cobbles 17-18'; encounter cobbles at 19' | | PID=BKGD, LEL/O2=0/21 |
| S-5 | 20-22 | 2.0/1.2 | BKGD | (20.0-20.2') GRAVELLY SAND well graded, coarse to fine, 20-40% cobbles, medium dense, dry, 7.5YR6/4 Munsell light brown SW<br>(20.2'-21.2') SANDY SILT, fine sand, stiff, dry 5Y4/3 Munsell olive ML | 8/6/7/9 | PID=BKGD, LEL/O2=0/21 |
| S-6 | 25-27 | 2.0/1.9 | BKGD | SANDY SILT, fine sand, stiff, dry ML | 9/8/7/9 | PID=BKGD, LEL/O2=0/21 Spoon overdriven for maximum recovery, analytical taken VOC, Lead, TPHC |
| S-7 | 30-32 | 2.0/2.0 | BKGD | (30.0-31.0') SANDY SILT, fine sand, stiff, dry, 5Y4/3 Munsell olive ML<br>(31.0-31.2') CLAY, firm, moist, 5GY4/1 Munsell dark greenish gray CL<br>(30.0-31.0') SANDY SILT, same as 30.0-31.0' ML | 4/5/8/7 | PID=BKGD, LEL/O2=0/21 |

DRAFT

## SOIL BORING LOG - FORT DEVENS, MA.

BORING NO.: **G6M-92-08X** (continued)

| SAMPLE NO. | DEPTH (ft) | PEN/REC (ft/ft) | PID OF SPOON (ppm) | SOIL DESCRIPTION AND PHYSICAL CONDITIONS | BLOWS/6" | COMMENTS |
|---|---|---|---|---|---|---|
| S-8 | 35-37 | 2.0/1.8 | BKGD | (35.0-35.4') SANDY SILT, fine, stiff, dry, 5Y4/3 Munsell olive ML<br>(35.4-36.8') SAND, poorly graded, fine to medium, 10-20% fines, loose, dry, SP<br>7.5YR6/4 Munsell light brown | 4/5/5/7 | Draeger tubes for 1,1,1-TCA - no detects<br>PID=BKGD, LEL/O2=0/21 |
| S-9 | 40-42 | 2.0/1.6 | BKGD | (40.0-41.0') SAND, poorly graded, fine to medium, 10-20% fines, loose, dry, 7.5YR6/4 Munsell light brown SP<br>(41.0-42.0') SILTY SAND, poorly graded, 35-45% fines loose, damp 7.5YR6/4 Munsell light brown SM | 8/4/5/6 | PID=BKGD, LEL/O2=1/21 |
| S-10 | 45-47 | 2.0/1.7 | BKGD | SILTY SAND, same as above, except medium dense SM<br>grading to SAND same as 40.0-41.0, except medium dense SM/SP | 6/6/5/7 | PID=BKGD, LEL/O2=1/21 |
| S-11 | 50-52 | 2.0/1.3 | BKGD | SILTY SAND, poorly graded, same as 41.0-42.0' except medium dense SM | 6/7/12/15 | PID=BKGD, LEL/O2=1/21 |
| S-12 | 55-57 | 2.0/2.0 | BKGD | SILTY SAND, poorly graded, same as above SM saturated | 5/6/8/11 | Analyticals collected. Water encountered at 54.7' 1500hrs 6/22/92.<br>PID=BKGD, LEL/O2=1/21 |
| S-13 | 60-62 | 2.0/1.2 | BKGD | SILTY SAND, poorly graded, same as above, saturated SM | 6/3/5/4 | PID=BKGD, LEL/O2=1/21<br>Grain size sample collected -> SM |
| | | | | Bottom of Exploration at 63.0' | | |

| SOIL BORING LOG - FORT DEVENS, MA. | PROJECT NO.: 6917-04 | BORING NO.: G6M-92-09X |
|---|---|---|
| CLIENT: AEC | DATE STARTED: 6/18/92 | GROUP: 6 |
| CONTRACTOR: L. Maher | DATE COMPLETED: 6/19/92 DRAFT | PROTECTION: Modified D |
| METHOD: HSA Maherksman | BORING DIAMETER: 10" | PID METER: Microtip 10.6eV |
| GROUND ELEV.: 258.6' | REFERENCE PT. ELEV.: NA | TOTAL DEPTH: 58' |
| LOGGED BY: R. Donagan | CHECKED BY: RRR | WATER TABLE BGS: 49' |

| SAMPLE NO. | DEPTH (ft) | PEN/REC (ft/ft) | PID OF SPOON (ppm) | SOIL DESCRIPTION AND PHYSICAL CONDITIONS | | BLOWS/6" | COMMENTS |
|---|---|---|---|---|---|---|---|
| S-1 | 0-2 | 2.0/1.9 | BKGD | (0-0.6') PEAT, organic soil<br>(0.6-1.1') SILTY SAND, well graded, fine to coarse, 10-15% fines, medium dense, dry, 7.5YR3/4 Munsell dark<br>(1.1-1.9') SAND, poorly graded, medium to fine, 10-15% fines, medium dense, dry, 5YR6/4 to 5YR3/3 Munsell light reddish brown to dark reddish brown | OL<br><br>SM<br><br>SP | 7/7/7/7 | PID = BKGD, LEL/O2 = 0/21 |
| S-2 | 5-7 | 2.0/1.8 | BKGD | SAND, poorly graded, medium to fine, 10-15% fines, loose, dry, 5YR6/4 to 5YR3/3 Munsell light reddish brown to dark reddish brown | SP | 4/4/3/4 | PID = BKGD, LEL/O2 = 0/21 |
| S-3 | 10-12 | 2.0/1.6 | BKGD | SAND, poorly graded, same as above except medium dense | SP | 4/8/6/10 | PID = BKGD, LEL/O2 = 0/21 |
| S-4 | 15-17 | 2.0/1.4 | BKGD | SAND, poorly graded, same as above except loose | SP | 3/4/5/7 | PID = BKGD, LEL/O2 = 0/21 |
| S-5 | 20-22 | 2.0/1.2 | BKGD | (20.0-22.8') SAND, same as above<br>(22.8-23.2') SAND, poorly graded, fine to medium, subrounded, loose, dry, 7.5YR6/4 Munsell light brown | SP<br><br>SP | 3/3/6/8 | PID = BKGD, LEL/O2 = 0/21 |
| S-6 | 25-27 | 2.0/1.6 | BKGD | (25.0-25.3') SAND, same as 22.8-23.2'<br>(25.3-26.6') SILTY SAND, poorly graded, fine to medium, medium dense, moist, 7.5YR6/4 Munsell light brown, 3" lense of sandy silt | SP<br><br>SM | 8/11/13/13 | PID = BKGD, LEL/O2 = 0/21 |
| S-7 | 30-32 | 2.0/2.0 | BKGD | SANDY SILT, 30% fine to medium sand, stiff, 7.5YR6/4 Munsell light brown | ML<br>O | 6/6/8/10 | PID = BKGD, LEL/O2 = 0/21 |
| S-8 | 35-37 | 2.0/1.5 | BKGD | (35.0-35.5') SANDY SILT, same as above<br>(35.5-36.5') SILTY SAND, poorly graded, medium to fine, 10-20% fines, medium dense, dry, 7.5YR6/6 Munsell pinkish gray | ML<br><br>SM | 5/8/8/12 | PID = BKGD, LEL/O2 = 0/21 |
| S-9 | 40-42 | 2.0/2.0 | BKGD | SILTY SAND, poorly graded, medium to fine, 10-20% fines, medium dense, moist, 7.5YR6/2 to 7.5YR3/2 Munsell pinkish gray to dark brown | SM | 8/10/12/14 | PID = BKGD, LEL/O2 = 0/21 |
| S-10 | 45-47 | 2.0/2.0 | BKGD | SILTY SAND, poorly graded, fine, medium dense, moist 7.5YR5/2 Munsell brown | SM | 6/11/11/12 | PID = BKGD, LEL/O2 = 0/21 |

DRAFT

## SOIL BORING LOG - FORT DEVENS, MA.

BORING NO.: **G6M-92-09X** (CONTINUED)

| SAMPLE NO. | DEPTH (ft) | PEN/REC (ft/ft) | PID OF SPOON (ppm) | SOIL DESCRIPTION AND PHYSICAL CONDITIONS | | BLOWS/6" | COMMENTS |
|---|---|---|---|---|---|---|---|
| S-11 | 50-52 | 2.0/2.0 | BKGD | SILTY SAND, poorly graded, fine, medium dense, saturated , 7.5YR5/2 Munsell brown | SM | 10/12/12/16 | PID = BKGD, LEL/O2 = 0/21 |
| S-12 | 55-57 | 2.0/2.0 | BKGD | SILTY SAND, same as S-11 | SM | 5/10/12/12 | PID = BKGD, LEL/O2 = 0/21 |
| | | | | Bottom of Exploration at 58' | | | |

| SOIL BORING LOG - FORT DEVENS, MA. | PROJECT NO.: 6917-04 | BORING NO.: G6M-92-10X |
|---|---|---|
| CLIENT: AEC | DATE STARTED: 6/24/92 | GROUP: 6 |
| CONTRACTOR: D. L. Maher | DATE COMPLETED: 6/24/92 | PROTECTION: Modified D |
| METHOD: 6.65" HSA | BORING DIAMETER: 10" DRAFT | PID METER: TE 10.6 eV |
| GROUND ELEV.: 227.2' | REFERENCE PT. ELEV.: NA | TOTAL DEPTH: 17.0' |
| LOGGED BY: GF | CHECKED BY: DSP | WATER TABLE BGS: 10.6' |

| SAMPLE NO. | DEPTH (ft) | PEN/REC (ft/ft) | PID OF SPOON (ppm) | SOIL DESCRIPTION AND PHYSICAL CONDITIONS | BLOWS/6" | COMMENTS |
|---|---|---|---|---|---|---|
| S-1 | 0-2 | 2.0/1.7 | BKGD | SAND, well graded, coarse to fine, 0-10% fines, 0-5% subrounded gravel, loose, 10YR7/3 to 10YR5/3 Munsell very pale brown to brown SW | 2/2/3/4 | PID = BKGD, LEL/O2 = 0/21 |
| S-2 | 5-7 | 2.0/2.0 | BKGD | SAND, well graded, same as above except damp, 10YR7/3 very pale brown SW | 2/2/3/4 | PID = BKGD, LEL/O2 = 0/21 |
| S-3 | 10-12 | 2.0/2.0 | BKGD | SANDY SILT, well graded, coarse to fines, 50-60% fines, 0-5% subrounded gravel, medium dense, saturated at 10.6', 10YR6/4 to 10YR7/3 Munsell light yellowish brown to very pale brown ML | 3/5/7/4 | PID = BKGD, LEL/O2 = 0/21 Grain size analysis performed - ML |
| S-4 | 15-17 | 2.0/2.0 | BKGD | SANDY SILT, well graded, same as S-3, except 10YR6/4 Munsell yellowish-brown ML | 3/5/6/3 | |
| | | | | Bottom of Exploration at 17.0' | | |

| SOIL BORING LOG - FORT DEVENS, MA. | PROJECT NO.: 6917-04 | BORING NO.: G6M-92-11X |
|---|---|---|
| CLIENT: AEC | DATE STARTED: 6/25/92 | GROUP: 6 |
| CONTRACTOR: D. L. Maher | DATE COMPLETED: 6/25/92 | PROTECTION: Modified D |
| METHOD: 6.65" HSA | BORING DIAMETER: 10" hole | PID METER: 10.6eV TE |
| GROUND ELEV.: 223.2' | REFERENCE PT. ELEV.: NA | TOTAL DEPTH: 17.0' |
| LOGGED BY: GF | CHECKED BY: DSP | WATER TABLE BGS: 10.6' |

DRAFT

| SAMPLE NO. | DEPTH (ft) | PEN/REC (ft/ft) | PID OF SPOON (ppm) | SOIL DESCRIPTION AND PHYSICAL CONDITIONS | BLOWS/6" | COMMENTS |
|---|---|---|---|---|---|---|
| S-1 | 0-2 | 2.0/1.5' | BKGD | SAND , well graded, coarse to fine, 0-10% fines, 0-5% subrounded gravel, loose, dry, 10YR6/4 to 5YR5/3 Munsell light yellowish-brown to reddish-brown SW | 3/3/2/2 | PID = BKGD, LEL/O2 = 0/21 |
| S-2 | 5-7 | 2.0/2.0 | BKGD | SILTY SAND, well graded, coarse to fine, 30-40% fines, 0-5% subrounded gravel, medium dense, dry, 2.5YR6/4 to 10YR4/4 Munsell dark yellowish-brown to dark yellowish-brown SM | 3/6/6/5 | PID = BKGD, LEL/O2 = 0/21 |
| S-3 | 10-12 | 2.0/0.0 | BKGD | No recovery, saturated at approximately 10.6' | 7/8/9/9 | PID = BKGD, LEL/O2 = 0/21 |
| S-4 | 12-14 | 2.0/2.0 | BKGD | SILTY SAND, same as S-2, except saturated, 10YR5/4 Munsell yellowish-brown SM | 5/5/8/8 | PID = BKGD, LEL/O2 = 0/21 |
| S-5 | 15-17 | 2.0/1.7 | BKGD | SILTY SAND, same as above, except loose SM | 4/4/5/8 | PID = BKGD, LEL/O2 = 0/21 |
| | | | | Bottom of Exploration at 17.0' | | |

| SOIL BORING LOG - FORT DEVENS, MA. | | | | PROJECT NO.: 6917.04 | | BORING NO.: G6M-93-12X | |
|---|---|---|---|---|---|---|---|
| CLIENT: AEC | | | | DATE STARTED: 6/1/93 | | STUDY AREA: 50 | |
| CONTRACTOR: New Hampshire Boring | | | | DATE COMPLETED: 6/2/93 | | PROTECTION: Modified D | |
| METHOD: HSA | | | | BORING DIAMETER: | | PID METER: Model 580B OVM | |
| GROUND ELEV: | | | | REFERENCE PT. ELEV.: DRAFT | | TOTAL DEPTH: 20' | |
| LOGGED BY: S. Murray | | | | CHECKED BY: | | WATER TABLE BGS: ~10' | |
| SAMPLE NO. | DEPTH (ft.) | PEN./REC. (ft./ft.) | PID OF SPOON (ppm) | SOIL/ROCK DESCRIPTION AND PHYSICAL CONDITIONS | BLOWS/6 IN. | USCS SOIL CLASS. | COMMENTS |
| S-1 | 0-2 | 2.0/1.3 | BG | SAND, poorly graded, fine to medium, 0 - 5% gravel, 0 - 5% fines, dense, dry, dark brown | 7-14-17-12 | SP | |
| S-2 | 5-7 | 2.0/1.7 | BG | Silty SAND, poorly graded, fine, 20 - 40% fines, medium dense, damp to moist, yellowish brown | 7-6-8-11 | SM-ML | Rusty discoloration. Tip of spoon is wet. |
| S-3 | 10-12 | 2.0/1.5 | BG | Sandy SILT, 20 - 45% fine sand, stiff, saturated, dark yellowish brown | 5-6-7-8 | ML-SM | |
| S-4 | 15-17 | 2.0/1.5 | BG | Sandy SILT, as in S-3. | 6-6-9-9 | ML-SM | |

BOE at 20'

| SOIL BORING LOG - FORT DEVENS, MA. | | | | PROJECT NO.: 6917.04 | | BORING NO.: G6M-93-13X | |
|---|---|---|---|---|---|---|---|
| CLIENT: AEC | | | | DATE STARTED: 6/1/93 | | STUDY AREA: 50 | |
| CONTRACTOR: New Hampshire Boring | | | | DATE COMPLETED: 6/1/93 | | PROTECTION: Modified D | |
| METHOD: HSA | | | | BORING DIAMETER: | | PID METER: Model 580B OVM | |
| GROUND ELEV: | | | | REFERENCE PT. ELEV.: DRAFT | | TOTAL DEPTH: 19' | |
| LOGGED BY: S. Murray | | | | CHECKED BY: | | WATER TABLE BGS: ~10' | |
| SAMPLE NO. | DEPTH (ft.) | PEN./REC. (ft./ft.) | PID OF SPOON (ppm) | SOIL/ROCK DESCRIPTION AND PHYSICAL CONDITIONS | BLOWS/6 IN. | USCS SOIL CLASS. | COMMENTS |
| S-1 | 0-2 | 2.0/1.0 | BG | Top 0.5': SAND and GRAVEL.<br>Bottom 1.5': SAND, poorly graded, very fine, 12 - 20% fines, med dense, damp, light olive brown (2.5Y5/3) | 8-10-11-13 | GW/SW<br>SM | |
| S-2 | 5-7 | 2.0/1.6 | BG | Top 0.5': SILT, damp, light olive brown<br>Bottom 1.5': SAND, poorly graded, fine, 12 - 20% fines, medium dense, damp, yellowish brown (10YR5/4) | 6-7-8-9 | ML<br>SM | 5% rust discoloration |
| S-3 | 10-12 | 2.0/2.0 | 1.0 | Sandy SILT/silty SAND, poorly graded, 20 - 55% fines, med dense, saturated, dark yellowish brown (10YR4/4) | 6-10-12-16 | SM-ML | 5% rust discoloration. |
| S-4 | 15-17 | 2.0/1.8 | BG | Sandy SILT/silty SAND, poorly graded, 20 - 55% fines, loose, saturated, dark yellowish brown (10YR4/4) | 4-5-5-5 | SM-ML | 5% rust discoloration. |

BOE at 19'

| SOIL BORING LOG - FORT DEVENS, MA. | | | | PROJECT NO.: 6917.04 | | BORING NO.: 50B-93-11X / G6M-93-14X | |
|---|---|---|---|---|---|---|---|
| CLIENT: AEC | | | | DATE STARTED: 6/2/93 | | STUDY AREA: 50 | |
| CONTRACTOR: New Hampshire Boring | | | | DATE COMPLETED: 6/2/93 | | PROTECTION: Modified D | |
| METHOD: HSA | | | | BORING DIAMETER: | | PID METER: Model 580B OVM | |
| GROUND ELEV: | | | | REFERENCE PT. ELEV.: DRAFT | | TOTAL DEPTH: 20' | |
| LOGGED BY: S. Murray | | | | CHECKED BY: | | WATER TABLE BGS: 10' | |
| SAMPLE NO. | SAMPLE DEPTH (ft.) | PEN./REC. (ft./ft.) | PID OF SPOON (ppm) | SOIL/ROCK DESCRIPTION AND PHYSICAL CONDITIONS | BLOWS/6 IN. | USCS SOIL CLASS. | COMMENTS |
| S-1 | 0-2 | 2.0/1.7 | 1.5 | SAND, poorly graded, fine to medium, 5% gravel, 5 - 12% fines, medium dense, dry, dark grayish brown | 5-6-7-11 | SP-SM | |
| S-2 | 5-7 | 2.0/1.8 | 5.7 | Top 1.0 - SAND, poorly graded, very fine sand, 5 - 12% fines, medium dense, dry, very pale brown<br>Bottom 1.0 - Sandy SILT, 20 - 40% fine sand, stiff, moist to wet | 5-6-7-7 | SP-SM<br>ML | Odor present. |
| S-3 | 10-12 | 2.0/1.8 | BG | Sandy SILT, 20 - 40% fine sand, stiff, saturated | 7-7-7-9 | ML | |

BOE at 20'. Monitoring well G6M-93-14X installed at this location.

| SOIL BORING LOG - FORT DEVENS, MA. | | | | PROJECT NO.: 6917.07 | | BORING NO.: G6M-94-15A | |
|---|---|---|---|---|---|---|---|
| CLIENT: AEC | | | | DATE STARTED: 8/8/94 | | STUDY AREA: 50 | |
| CONTRACTOR: New Hampshire Boring | | | | DATE COMPLETED: | | PROTECTION: D | |
| METHOD: HSA | | | | BORING DIAMETER: | | PID METER: TE 580 B OVM | |
| GROUND ELEV: | | | | REFERENCE PT. ELEV.: DRAFT | | TOTAL DEPTH: 44.5' | |
| LOGGED BY: R. Rustad | | | | CHECKED BY: | | WATER TABLE BGS: 36' | |
| SAMPLE NO. | DEPTH (ft.) | PEN./REC. (ft./ft.) | PID OF SPOON (ppm) | SOIL/ROCK DESCRIPTION AND PHYSICAL CONDITIONS | BLOWS/6 IN. | USCS SOIL CLASS. | GC SCREENING RESULTS FOR PCE (ug/kg) |
| S-1 | 0-2 | 2.0/1.6 | 0.2 | Top 0.6': Silty SAND,poorly graded, 5 - 10% coarse sand, fine, loose, dry, very dark gray (10YR3/1)<br>Next 0.3': SAND, well graded, 10% coarse sand, fine to med, 10% silt, loose, dry, yellowish brown (10YR5/6)<br>Next 0.7': SAND, poorly graded, 10 - 20% medium, fine sand, 5% silt, loose, dry, very pale brown | 3-3-3-3 | SP-SM<br>SW<br>SP | < 19 |
| S-2 | 5-7 | 2.0/1.9 | 0.1 | SAND, poorly graded, 10 - 20% medium sand, fine sand, 5% silt, loose, dry, very pale brown | 7-3-5-7 | SP | < 16 |
| S-3 | 10-12 | 2.0/1.3 | 0.2 | SAND, poorly graded, medium to coarse, 10% fines, loose, dry, light brown (7.5YR6/4) | 3-3-4-6 | SP | < 16 |
| S-4 | 15-17 | 2.0/1.4 | 0.0 | SAND, poorly graded, < 5% coarse, fine to medium sand, < 5% silt, loose, dry, light brown (7.5YR6/4) | 4-4-6-7 | SP | < 20 |
| S-5 | 20-22 | 2.0/2.0 | 0.0 | SAND,poorly graded, < 5% medium sand, fine sand, 5% silt, loose, dry, pinkish gray (7.5YR7/2) | 4-4-4-5 | SP | < 18 |
| S-6 | 25-27 | 2.0/1.8 | 0.0 | SAND, poorly graded, < 5% medium sand, fine sand, 5% silt, loose, dry, pinkish gray (7.5YR7/2) | 7-7-8-8 | SP | < 21 |
| S-7 | 30-32 | 2.0/2.0 | 0.0 | Top 0.3': SAND, as in S-6<br>Next 0.8': Silty SAND, poorly graded, fine, 10% silt, medium dense, wet<br>Next 0.2': SAND, poorly graded, fine, moist, iron staining<br>Bottom 0.7': Silty SAND, poorly graded, fine, 10 - 15% silt, medium dense, moist, brown (7.5YR5/3) | 7-8-9-13 | SP<br>SM<br>SP<br>SP-SM | < 31 |
| S-8 | 35-37 | 2.0/1.9 | 0.0 | Top 0.9': SAND, poorly graded, fine, 5 - 10% silt, medium dense, wet<br>Next 0.6': Sandy SILT, 1% medium sand, 43% fine sand, stiff, gray<br>Next 0.1': Clayey SILT<br>Bottom 0.3': SAND, poorly graded, fine, wet, iron staining | 7-5-6-9 | SP<br>ML<br>SM-CL<br>SP | < 27 |
| S-9 | 40-42 | 2.0/2.0 | not recorded | Top 1.2': Sandy SILT, 10 - 15% clay, loose to medium dense, wet, grayish brown (10YR5/2)<br>Bottom 0.8': Silty SAND, poorly graded, fine, 15 - 20% silt, medium dense to loose, wet, brown (7.5YR5/3) | 11-8-11-12 | SM<br>SP-SM | < 32 |
| BOE at 44.5' | | | | | | | |

| SOIL BORING LOG - FORT DEVENS, MA. | PROJECT NO.: 6917.07 | BORING NO.: G6M-94-16X |
|---|---|---|
| CLIENT: AEC | DATE STARTED: 8/11/94 | STUDY AREA: 50 |
| CONTRACTOR: New Hampshire Boring | DATE COMPLETED: | PROTECTION: Modified D |
| METHOD: HSA | BORING DIAMETER: DRAFT | PID METER: Model 580B OVM |
| GROUND ELEV: | REFERENCE PT. ELEV.: | TOTAL DEPTH: 44' |
| LOGGED BY: R. Rustad | CHECKED BY: | WATER TABLE BGS:35' |

| SAMPLE NO. | SAMPLE DEPTH (ft.) | PEN./REC. (ft./ft.) | PID OF SPOON (ppm) | SOIL/ROCK DESCRIPTION AND PHYSICAL CONDITIONS | BLOWS/6 IN. | USCS SOIL CLASS. | GC SCREENING RESULTS FOR PCE (ug/kg) |
|---|---|---|---|---|---|---|---|
| S-1 | 0-2 | 2.0/1.5 | 0.0 | Top 0.5': SAND, poorly graded, < 5% c gravel, 5% c gravel, 5% c sand, fine to medium sand, < 5% silt, very loose, dry, dk grayish brown (10YR4/2) Bottom 1.0': SAND, well graded, 5% gravel, fine to coarse, <5% silt, very loose, dry, brownish yellow (10YR6/6) | 3-3-4-6 | SP SW | < 27 |
| S-2 | 5-7 | 2.0/1.5 | 0.0 | SAND, poorly graded, 5 - 10% coarse, medium, 5% fine, < 5% fines, very loose, dry, very pale brown (10YR7/4) | 2-4-4-5 | SP | < 26 |
| S-3 | 10-12 | 2.0/1.4 | 0.0 | SAND, poorly graded, 5 - 10% coarse, medium, 5% fine, < 5% fines, very loose, dry, very pale brown (10YR7/4) | 3-4-3-4 | SP | < 26 |
| S-4 | 15-17 | 2.0/2.0 | 0.0 | SAND, poorly graded, fine, < 5% fines, very loose, dry, light brown (10YR6/4) | 2-4-4-4 | SP | < 27 |
| S-5 | 20-22 | 2.0/2.0 | 0.0 | SAND, poorly graded, fine, < 5% fines, loose, dry, light brown (10YR6/4) | 6-6-7-9 | SP | < 27 |
| S-6 | 25-27 | 2.0/2.0 | 0.0 | SAND, poorly graded, fine, < 5% fines, loose, dry, light brown (10YR6/4) | 4-5-7-7 | SP | < 27 |
| S-7 | 30-32 | 2.0/1.7 | 0.0 | SAND, poorly graded, < 5% coarse, fine to medium, < 5% fines, loose, dry, very pale brown (10YR7/4) | 4-6-7-8 | SP | < 27 |
| S-8 | 35-37 | 2.0/2.0 | 0.0 | Top 0.6': Silty SAND, poorly graded, < 5% med, fine sand, 15 - 20% silt, loose, wet, iron staining at contact between lithologies Bottom 1.4': SAND, poorly graded, 5% medium, fine, < 5% fines, loose, wet, yellowish brown (10YR5/6), iron staining | 4-6-10-10 | SM SP | < 32 |
| S-9 | 40-42 | 2.0/2.0 | 0.0 | Top 1.8': Sandy SILT, 39% fine sand, stiff, wet, yellowish brown (10YR5/6) Bottom 0.2': SAND, poorly graded, < 5% medium, fine, < 5% fines, loose, wet, yellowish brown (10YR5/6), extensive iron staining | 5-7-9-10 | ML SP | NA |

**BOE at 44'**

| SOIL BORING LOG - FORT DEVENS, MA. | PROJECT NO.: 6917.07 | BORING NO.: G6M-94-17A (p. 1 of 2) |
|---|---|---|
| CLIENT: AEC | DATE STARTED: 8/10/94 | STUDY AREA: 50 |
| CONTRACTOR: New Hampshire Boring | DATE COMPLETED: | PROTECTION: Modified D |
| METHOD: HSA | BORING DIAMETER: | PID METER: Model 580B OVM |
| GROUND ELEV: | REFERENCE PT. ELEV.: DRAFT | TOTAL DEPTH: 44.0' |
| LOGGED BY: D. Pierce | CHECKED BY: | WATER TABLE BGS: 36.3' |

| SAMPLE NO. | SAMPLE DEPTH (ft.) | PEN./REC. (ft./ft.) | PID OF SPOON (ppm) | SOIL/ROCK DESCRIPTION AND PHYSICAL CONDITIONS | BLOWS/6 IN. | USCS SOIL CLASS. | GC SCREENING RESULTS FOR PCE (ug/kg) |
|---|---|---|---|---|---|---|---|
| S-1 | 0-2 | 2.0/1.3 | 0.3 | SAND, poorly graded, < 10% gravel to 1" max., sand coarse to fine, mostly fine to coarse, < 5% fines, very loose, damp, brown (10YR5/3), some fibrous roots | 2-2-2-3 | SP | NA |
| S-2 | 4-6 | 2.0/1.2 | 0.2 | SAND,poorly graded, <10% gravel to 1" max, sand coarse to fine, < 5% fines, med dense, damp, white (10YR8/2) | 6-7-7-6 | SP | < 29 |
| S-3 | 9-11 | 2.0/1.2 | 0.0 | SAND, poorly graded, fine to medium (mostly med), < 5% fines, loose, moist, salt & pepper, white (10YR8/2) | 2-3-5-7 | SP | < 26 |
| S-4 | 14-16 | 2.0/1.5 | 0.0 | Top 1.2': SAND, poorly graded, fine to med (mostly med), <5% fines, loose, damp, salt & pepper, white (10YR8/2) Bottom 0.3': Gravelly SAND, 20 - 30% gravel to 3/4" max, mostly f gravel, c to med sand (mostly coarse), < 5% fines, med dense, moist, light yellowish brown (10YR6/4) | 4-6-5-6 | SP<br>SP | < 26 |
| S-5 | 19-21 | 2.0/1.7 | 0.0 | Top 0.3': SAND, poorly graded, fine to coarse, mostly med, < 5% fines, loose, moist, lt yellow brn (10YR6/6) Bottom 1.4': SAND, uniform, fine, < 5% fines, med dense, damp, white (10YR8/2), fine stratification visible from color bands | 5-6-7-6 | SP<br>SP | < 27 |
| S-6 | 24-26 | 2.0/2.0 | 0.0 | SAND, uniform, fine, < 5% fines, medium dense, damp, white (10YR8/2), fine stratification visible from color bands | 8-8-8-9 | SP | < 27 |
| S-7 | 29-31 | 2.0/1.6 | 0.0 | SAND, poorly graded, f to med, < 5% fines, damp, med dense, very pale brown (10YR8/3), finely stratified | 8-9-9-9 | SP | < 28 |
| S-8 | 34-36 | 2.0/1.8 | 0.0 | Top 1.0': SILT, slightly plastic, 23% fine sand, very stiff, saturated, very pale brown (10YR7/3), finely stratified Next 0.2': SAND, poorly graded, med to f, 5 - 10% nonplastic fines, med dense, saturated, banded colors dark reddish brown (5YR2.5/2 and yellowish red (5YR5/6). Next 0.3': Sandy SILT, as in top 1.0'. Bottom 0.3': Silty SAND, fine, 20 - 40% slightly plastic fines, very stiff, saturated, reddish yellow (7.5YR8/6) | 6-7-11-12 | ML<br>SP-SM<br>ML<br>SM | < 32 |
| | | | | | | | |

| SOIL BORING LOG - FORT DEVENS, MA. | | | | PROJECT NO.: 6917.07 | | | BORING NO.: G6M-94-17A (p. 2 of 2) |
|---|---|---|---|---|---|---|---|
| CLIENT: AEC | | | | DATE STARTED: 8/10/94 | | | STUDY AREA: 50 |
| CONTRACTOR: New Hampshire Boring | | | | DATE COMPLETED: | | | PROTECTION: Modified D |
| METHOD: HSA | | | | BORING DIAMETER: DRAFT | | | PID METER: Model 580B OVM |
| GROUND ELEV: | | | | REFERENCE PT. ELEV.: | | | TOTAL DEPTH: 44.0' |
| LOGGED BY: D. Pierce | | | | CHECKED BY: | | | WATER TABLE BGS: 36.3' |
| SAMPLE NO. | DEPTH (ft.) | PEN./REC. (ft./ft.) | PID OF SPOON (ppm) | SOIL/ROCK DESCRIPTION AND PHYSICAL CONDITIONS | BLOWS/6 IN. | USCS SOIL CLASS. | GC SCREENING RESULTS FOR PCE (ug/kg) |
| S-9 | 39-41 | 2.0/2.0 | 0.0 | Top 0.3': Sandy SILT, slightly plastic, 10 - 20% f sand, stiff, saturated, lt yellowish brn (2.5Y6/3)<br>Next 0.2': Silty CLAY, slightly to mod. plastic, stiff, saturated, lt yellowish brown (2.5Y6/3)<br>Bottom 1.5': Silty SAND, fine, 20 - 50% slightly plastic fines, med dense, saturated, brownish yellow (10YR6/6) with some color banding (esp. 39.5' to 39.9'), yellowish red (5YR5/6) | 9-6-6-8 | ML<br>CL<br>SM-ML | < 31 |
| | 41-44 | | | Silty SAND | logged from auger cuttings | SM-ML | NA |

**BOE at 44'**

| SOIL BORING LOG - FORT DEVENS, MA. | PROJECT NO.: 6917.07 | BORING NO.: G6M-94-18X (p. 1 of 6) |
|---|---|---|
| CLIENT: AEC | DATE STARTED: 8/12/94 | STUDY AREA: 50 |
| CONTRACTOR: New Hampshire Boring | DATE COMPLETED: | PROTECTION: Modified D |
| METHOD: drive & wash | BORING DIAMETER: | PID METER: Model 580B OVM |
| GROUND ELEV: | REFERENCE PT. ELEV.: | TOTAL DEPTH: 92.75' |
| LOGGED BY: R. Rustad, D. Pierce | CHECKED BY: | WATER TABLE BGS: 11.9' |

DRAFT

| SAMPLE NO. | SAMPLE DEPTH (ft.) | PEN./REC. (ft./ft.) | PID OF SPOON (ppm) | SOIL/ROCK DESCRIPTION AND PHYSICAL CONDITIONS | BLOWS/6 IN. | USCS SOIL CLASS. | GC SCREENING RESULTS FOR PCE (ug/kg) / COMMENTS |
|---|---|---|---|---|---|---|---|
| S-1 | 0-2 | 2.0/1.6 | 0.3 | Top 0.5': SAND, well graded, 10% gravel, f to c, fill. Next 0.8': SAND, well graded, 5% gravel, f to c, 5 - 10% silt, very loose, dry, dk brn (10YR3/3), organic. Bottom 0.3': SAND, poorly graded, fine to med, < 5% fines, very loose, dry, pale brown (10YR6/3) | 2-2-5-4 | SW<br>SW<br>SP | 162 |
| S-2 | 2-4 | 2.0/1.3 | 0.0 | SAND, poorly graded, fine to med, < 5% fines, very loose, dry, pale brown (10YR6/3) | 3-4-4-5 | SP | < 26 |
| S-3 | 4-6 | 2.0/1.7 | 0.0 | Top 1.1': SAND, poorly graded, f to med, < 5% fines, very loose, dry, pale brn (10YR6/3). Next 0.2': Sandy SILT, poorly graded, 20 - 30% f sand, very loose, dry, gray brn (10YR5/2). Bottom 0.4': SAND, poorly graded, 10% coarse, f to med, < 5% fines, loose, dry, lt yellowish brown (10YR6/2) | 3-3-6-7 | SP<br>SM<br>SP | 42<br>organic black sand at 1.3' to 1.4' |
| S-4 | 6-8 | 2.0/2.0 | 11.2 | Top 1.3': SAND, poorly graded, fine, < 5% fines, loose, dry, very pale brown (10YR7/3). Bottom 0.7': Silty SAND, poorly graded, fine, 20 - 30% fines, loose, dry, pale brown (10YR6/3) | 12-6-8-10 | SP<br>SM | < 54<br>entire interval is finely laminated, with a slightly coarser lens from 7.6' to 7.7' |
| S-5 | 8-10 | 2.0/1.9 | 192.0 | Top 0.9': Silty SAND to sandy SILT, poorly graded, 40 - 50% f sand, 50 - 60% silt, med dense, moist Next 0.6': Sandy SILT grading into clayey SILT, slightly plastic, 5% f sand, wet, lt olive brown (2.5Y5/3) Bottom 0.4': Silty SAND, poorly graded, fine, 20% silt, med dense, wet, brown (10YR5/3) | 10-10-12-12 | SM<br>ML<br>SM-ML | 264<br>extensive orange iron staining from 9.4-9.6' bgs |
| S-6 | 10-12 | 2.0/1.7 | not recorded; PID not working | Silty SAND, fine, 20-40% nonplastic to slightly plastic fines, med dense, wet, very pale brn (10YR9/4) with scattered orange-brown spots | 8-7-7-8 | SM | 1450 |
| S-7 | 12-14 | 2.0/2.0 | not recorded; PID not working | Top 1.4': Silty SAND, fine, 20 - 40% grading into 12 - 20% nonplastic to slightly plastic fines, med dense, wet, very pale brn (10YR9/4) with orange-brn laminae. Next 0.2': Clayey SILT, slightly plastic, < 10% f sand, dense, moist, lt brownish gray (2.5Y6/2); overlain by 1/8" layer of orange-brn SAND. Bottom 0.4': Silty SAND, fine, 20-40% nonplastic fines, loose, moist, brownish yellow (10YR6/4). | 6-4-6-8 | SM<br>ML<br>SM | < 74 |
| S-8 | 14-16 | 2.0/1.6 | not recorded; PID not working | Silty SAND, fine, 20 - 40% nonplastic fines, med dense (loose in some layers), wet, laminated, alternating lt brownish gray (2.5Y6/2) and yellowish red (5YR4/6) | 12-10-8-11 | SM | 14E |

| SOIL BORING LOG - FORT DEVENS, MA. | PROJECT NO.: 6917.07 | BORING NO.: G6M-94-18X (p. 2 of 6) |
|---|---|---|
| CLIENT: AEC | DATE STARTED: 8/12/94 | STUDY AREA: 50 |
| CONTRACTOR: New Hampshire Boring | DATE COMPLETED: | PROTECTION: Modified D |
| METHOD: drive & wash | BORING DIAMETER: DRAFT | PID METER: Model 580B OVM |
| GROUND ELEV: | REFERENCE PT. ELEV.: | TOTAL DEPTH: 92.75' |
| LOGGED BY: R. Rustad, D. Pierce | CHECKED BY: | WATER TABLE BGS: 11.9' |

| SAMPLE NO. | SAMPLE DEPTH (ft.) | PEN./REC. (ft./ft.) | PID OF SPOON (ppm) | SOIL/ROCK DESCRIPTION AND PHYSICAL CONDITIONS | BLOWS/6 IN. | USCS SOIL CLASS. | GC SCREENING RESULTS FOR PCE (ug/kg) / COMMENTS |
|---|---|---|---|---|---|---|---|
| S-9 | 16-18 | 2.0/2.0 | not recorded; PID not working | Top 0.6': Silty SAND, as in S-8<br>Next 0.9': Silty SAND, fine, 12 - 25% nonplastic fines, med dense, saturated, very pale brown (10YR7/4) with scattered orange-brown spots (16.0' - 17.5' bgs) accompanied by unidentified fibers. Next 0.1': Silty SAND with ~10% angular gravel to 3/8" max<br>Bottom 0.4': Silty SAND, as in S-8 | 9-9-11-11 | SM<br>SM<br><br><br><br>SM<br><br>SM | 12E |
| S-10 | 18-20 | 2.0/2.0 | 16.9 | Silty SAND, fine, 12 - 20% fines, med dense, wet, lt yellowish brn (10YR6/4) | 12-10-10-11 | SM | 55 |
| S-11 | 20-22 | 2.0/1.0 | 6.4 | Silty SAND, as in S-10 | 13-8-10-9 | SM | 29 |
| S-12 | 22-24 | 2.0/1.3 | 11.4 | Sandy SILT, 41% fine sand (silt content varies with depth), stiff, wet, lt yellowish brn (10YR6/4) | 7-6-9-10 | ML | 777E |
| S-13 | 24-26 | 2.0/2.0 | 14.2 | Top 1.0': Silty SAND, as in S-11<br>Next 0.6': Interlayered clayey SILT and silty SAND, lt yellowish brown (10YR6/4) interlayered with orange-brown. Bottom 0.4': SAND, uniform, fine, 5 - 12% fines, med dense, wet, lt yellowish brn (10YR6/4) interlaminated with yellowish red (5YR5/8) | 5-5-9-11 | SM<br>ML & SM<br><br>SP-SM | 504E |
| S-14 | 26-28 | 2.0/1.5 | 44.2 | Top 0.7': SAND, uniform, fine, 5 - 12% fines, med dense, wet, lt yellowish frn (10YR6/4). Next 0.3': Sandy SILT, slightly plastic, 10 - 20% f sand, very stiff, wet, lt yellowish brn. Bottom 0.5': SAND, uniform, fine, 5 - 12% fines, med dense, wet, reddish yellow (7.5YR6/6) | 7-11-11-11 | SP-SM<br><br>ML<br><br>SP-SM | 252E<br><br><br><br>PID value highest in bottom layer |
| S-15 | 28-30 | 2.0/1.3 | 13.6 | Silty SAND, fine, 17% nonplastic fines, med dense, wet, lt yellowish brn (10YR6/4), infrequent and non-distinct pink laminae (7.5YR7/4) | 4-6-8-12 | SM | 154 |
| S-16 | 30-32 | 2.0/1.7 | 0.0 | Top 1.1': Silty SAND, fine, 15 - 25% nonplastic fines, med dense, wet, lt yellowish brn (10YR6/4). Next 0.1': Clayey SILT, slightly plastic, 10 - 20% f sand, very stiff, lt yellowish brn (2.5Y6/3). Bottom 0.5': Silty SAND, fine, 15 - 25% nonplastic fines, med dense, wet, lt yellowish brn (10YR6/4) with bands of reddish yellow (7.5YR6/6) | 7-8-9-10 | SM<br>ML<br><br>SM | < 17 |
| S-17 | 32-34 | 2.0/1.5 | 0.0 | Silty SAND, fine, 18% nonplastic fines, med dense, wet, lt yellowish brn (10YR6/4) with bands of reddish yellow (7.5YR6/6) | 4-5-7-12 | SM | 108E |
| | | | | | | | |

| SOIL BORING LOG - FORT DEVENS, MA. | | | PROJECT NO.: 6917.07 | | BORING NO.: G6M-94-18X (p. 3 of 6) |
|---|---|---|---|---|---|
| CLIENT: AEC | | | DATE STARTED: 8/12/94 | | STUDY AREA: 50 |
| CONTRACTOR: New Hampshire Boring | | | DATE COMPLETED: | | PROTECTION: Modified D |
| METHOD: drive & wash | | | BORING DIAMETER: | | PID METER: Model 580B OVM |
| GROUND ELEV: | | | REFERENCE PT. ELEV.: DRAFT | | TOTAL DEPTH: 92.75' |
| LOGGED BY: R. Rustad, D. Pierce | | | CHECKED BY: | | WATER TABLE BGS: 11.9' |

| SAMPLE NO. | SAMPLE DEPTH (ft.) | PEN./REC. (ft./ft.) | PID OF SPOON (ppm) | SOIL/ROCK DESCRIPTION AND PHYSICAL CONDITIONS | BLOWS/6 IN. | USCS SOIL CLASS. | GC SCREENING RESULTS FOR PCE (ug/kg) |
|---|---|---|---|---|---|---|---|
| S-18 | 34-36 | 2.0/1.5 | 1.6 | Silty SAND, fine, 12 - 20% nonplastic fines, med dense, wet, pale yellow (2.5Y8/3) with faint laminae of reddish yellow (7.5YR6/6), particularly in 35.6'-35.7' bgs | 6-8-8-15 | SM | < 103 |
| S-19 | 36-38 | 2.0/1.7 | 0.0 | Silty SAND, similar to S-18, except layering mostly indistinguishable | 5-10-12-14 | SM | < 34 |
| S-20 | 38-40 | 2.0/1.6 | 0.0 | Top 0.6': Silty SAND, as in S-19 Bottom 1.0': SAND, poorly graded, fine, 5 - 12% fines, med dense, wet, very pale brown (10YR7/3) | 3-7-9-10 | SM<br>SP-SM | < 26 |
| S-21 | 40-42 | 2.0/1.9 | 0.0 | Top 1.6': SAND, poorly graded, 2% med sand, fine sand, 2% fines, med dense, wet, very pale brown (10YR7/3) with laminae and layers of reddish yellow (7.5YR6/8). Bottom 0.3': CLAY, moderately to highly plastic, <10% fine sand, very stiff, wet, light olive brown (2.5Y5/3) with very thin laminae of reddish brown fine sand (5YR3/3) | 6-7-5-7 | SP<br>CH | < 35 |
| S-22 | 42-44 | 2.0/2.0 | 0.0 | Top 1.7': SAND, poorly graded, fine, 5 - 12% fines, med dense, wet, very pale brown (10YR7/3) with laminae and layers of reddish yellow (7.5YR6/8) Next 0.1': CLAY, moderately to highly plastic, stiff, wet, lt olive brown (2.5Y5/3). Bottom 0.2': SAND, as in top 1.7'. | 4-6-10-16 | SP-SM<br>CH<br>SP-SM | < 29 |
| S-23 | 44-46 | 2.0/2.0 | 0.0 | Top 0.9': SAND, poorly graded, fine, 5 - 12% fines, med dense, wet, very pale brown (10YR7/3) with laminae and layers of reddish yellow (7.5YR6/8) Bottom 1.1': Interbedded clay and sand. CLAY - mod. to highly plastic, stiff, wet, lt olive brn (2.5Y5/3). SAND - as in above 0.9', in layers 1/8" to 1" | 9-4-5-9 | SP-SM<br>CH & SP-SM | < 29 |
| S-24 | 46-48 | 2.0/2.0 | 0.0 | Top 0.8': SAND, poorly graded, fine, 5 - 12% fines, med dense, wet, light olive brown (2.5Y5/3). Next 0.5': Sandy CLAY, mod. to highly plastic, 35 - 50% f sand, very stiff, wet, lt olive brown (2.5Y5/3). Next 0.3': Clayey SAND, fine, 25 - 50% mod. to highly plastic fines, very stiff, wet, lt olive brown (2.5Y5/6). Next 0.3': Clayey SAND, fine, 15 - 25% moderately plastic fines, very dense, wet, reddish brown (5YR4/4). Bottom 0.1': CLAY, mod. to highly plastic, hard, wet, light olive brown (2.5Y5/3). | 10-9-17-21 | SP-SM<br>CH-SC<br>SC-CH<br>SC-CH<br>CH | < 30 |
| | | | | | | | |

| SOIL BORING LOG - FORT DEVENS, MA. | | | PROJECT NO.: 6917.07 | | BORING NO.: G6M-94-18X (p. 4 of 6) |
|---|---|---|---|---|---|
| CLIENT: AEC | | DATE STARTED: 8/12/94 | | | STUDY AREA: 50 |
| CONTRACTOR: New Hampshire Boring | | DATE COMPLETED: | | | PROTECTION: Modified D |
| METHOD: drive & wash | | BORING DIAMETER: DRAFT | | | PID METER: Model 580B OVM |
| GROUND ELEV: | | REFERENCE PT. ELEV.: | | | TOTAL DEPTH: 92.75' |
| LOGGED BY: R. Rustad, D. Pierce | | CHECKED BY: | | | WATER TABLE BGS: 11.9' |

| SAMPLE NO. | SAMPLE DEPTH (ft.) | PEN./REC. (ft./ft.) | PID OF SPOON (ppm) | SOIL/ROCK DESCRIPTION AND PHYSICAL CONDITIONS | BLOWS/6 IN. | USCS SOIL CLASS. | GC SCREENING RESULTS FOR PCE (ug/kg) |
|---|---|---|---|---|---|---|---|
| S-25 | 48-50 | 2.0/1.5 | 0.0 | Top 0.3': CLAY, moderately to highly plastic, hard, wet, light olive brown (2.5Y5/3). Bottom 1.2': SAND, poorly graded, fine, 5 - 12% slightly to mod. plastic fines, med dense, wet, pink (7.5YR7/3) interlaminated with yellowish red (5YR4/6). | 10-8-13-16 | CH<br>SP-SM | < 26 |
| S-26 | 50-52 | 2.0/0.0 | NA | - no recovery - | 8-8-11-14 | NA | NA |
| S-27 | 52-54 | 2.0/2.0 | 0.0 | Silty SAND, fine, 12 - 20% fines, dense, wet, interlayered brownish yellow (10YR6/6) and light brownish yellow (10YR6/4) | 10-12-21-25 | SM | < 28 |
| S-28 | 54-56 | 2.0/1.4 | 0.0 | SAND, poorly graded, fine, 5 - 12% fines, med dense, wet, interlayered very pale brown (10YR7/4) and brownish yellow (10YR6/6) | 10-9-10-12 | SP-SM | < 19 |
| S-29 | 56-58 | 2.0/2.0 | 0.0 | Top 0.1': CLAY, mod. to highly plastic, very stiff, wet, light olive brown (2.5Y5/3). Next 0.3': SAND, poorly graded, fine, < 5% fines, dense, wet, reddish yellow (7.5YR7/6). Bottom 1.6': SAND, poorly graded, fine, 5 - 12% fines (12 - 20% fines 56.4' - 56.8'), dense, very pale brown (10YR7/3) interlaminated with reddish yellow (7.5YR7/6). | 9-16-18-25 | CH<br>SP<br>SP-SM & SM | < 19 |
| S-30 | 58-60 | 2.0/2.0 | 0.0 | Top 0.6': Alternating layers (0.5" to 1.0" thick) of clay and sand. CLAY, mod to highly plastic, very stiff, wet, lt olive brown (2.5Y5/3). SAND,poorly graded, fine, 5 - 12% fines, very pale brown (10YR8/4) to strong brown (7.5YR5/6). Bottom 1.4': Silty SAND, fine, 15 - 30% fines, med dense, wet, very pale brown (10YR7/4). | 10-10-14-19 | CH & SP-SM<br>SM | < 19 |
| S-31 | 60-62 | 2.0/1.2 | 0.0 | Silty SAND, fine, 12 - 20% fines, med dense, wet, very pale brn (10YR7/4) | 5-4-8-11 | SM | < 16 |
| S-32 | 62-64 | 2.0/2.0 | 0.0 | SAND, fine, 5 - 12% fines, med dense, wet, very pale brown (10YR7/4) with occasional indistinct laminae of reddish yellow (7.5YR6/8) | 5-7-12-20 | SP-SM | < 18 |
| S-33 | 64-66 | 2.0/1.3 | 0.0 | SAND, poorly graded, fine, 10% fines, loose, wet, very pale brown (10YR7/4), angular to subangular grains | 5-5-7-14 | SP-SM | < 22 |
| | | | | | | | |

| SOIL BORING LOG - FORT DEVENS, MA. | PROJECT NO.: 6917.07 | BORING NO.: G6M-94-18X (p. 5 of 6) |
|---|---|---|
| CLIENT: AEC | DATE STARTED: 8/12/94 | STUDY AREA: 50 |
| CONTRACTOR: New Hampshire Boring | DATE COMPLETED: | PROTECTION: Modified D |
| METHOD: drive & wash | BORING DIAMETER: | PID METER: Model 580B OVM |
| GROUND ELEV: | REFERENCE PT. ELEV.: DRAFT | TOTAL DEPTH: 92.75' |
| LOGGED BY: R. Rustad, D. Pierce | CHECKED BY: | WATER TABLE BGS: 11.9' |

| SAMPLE NO. | SAMPLE DEPTH (ft.) | PEN./REC. (ft./ft.) | PID OF SPOON (ppm) | SOIL/ROCK DESCRIPTION AND PHYSICAL CONDITIONS | BLOWS/6 IN. | USCS SOIL CLASS. | GC SCREENING RESULTS FOR PCE (ug/kg) |
|---|---|---|---|---|---|---|---|
| S-34 | 66-68 | 2.0/1.7 | 0.0 | Top 1.5': SAND, poorly graded, fine, 10% fines, loose, wet, very pale brown (10YR7/4) with occasional reddish yellow laminae, micaceous flakes in sand (0.01 - 1.0 mm), angular to subangular grains. Bottom 0.2': SILT, slightly plastic, 5 - 10% f sand, medium dense, wet, gray (10YR5/1). | 5-9-14-20 | SP-SM<br>SM-SP | < 21 |
| S-35 | 68-70 | 2.0/1.4 | 0.0 | Top 0.7': SAND, poorly graded, fine, 5 - 10% fines with occasional reddish laminae, med dense to dense, wet, pale brown (10YR6/3). Next 0.2': Sandy SILT, poorly graded, 15 - 20% f sand, soft to firm, wet, lt brownish gray (10YR6/2). Bottom 0.5': SANDto silty SAND, poorly graded, fine, 10 - 25% silt, loose, wet, grayish brn (10YR5/2) | 20-19-7-10 | SP-SM<br>SM<br>SP-SM to SM | < 23 |
| S-36 | 70-72 | 2.0/1.5 | 0.0 | Sandy SILT, 20 - 30% f sand, medium dense, wet, pale brown (10YR6/3) | 9-11-15-14 | SM | < 19 |
| S-37 | 72-74 | 2.0/1.2 | 0.0 | Sandy SILT, 20 - 30% f sand, medium dense, wet, pale brown (10YR6/3) with thick reddish laminae (coarser texture from 72.5' to 72.6' and 73.0' to 73.1) | 7-10-19-17 | SM | < 22 |
| S-38 | 74-76 | 2.0/1.8 | 0.0 | Sandy SILT, as in S-37, but with thin laminae | 2-4-10-10 | SM | < 17 |
| S-39 | 76-78 | 2.0/1.6 | 0.0 | Top 1.1': Sandy SILT, 20 - 30% fine sand, med dense, wet, pale brown (10YR6/3) with thin reddish laminae - grading over 0.2' into - Bottom 0.5': SAND, poorly graded, fine, 5% med, 5 - 10% silt, med dense, wet, gray (10YR6/1) | 5-9-13-20 | SM<br>SP-SM | < 19 |
| S-40 | 78-80 | 2.0/1.9 | 0.0 | SAND, as in bottom 0.5' of S-39, but with increasing frequency of laminae (5 - 10 per inch) | 22-17-10-12 | SP-SM | < 22 |
| S-41 | 80-82 | 2.0/2.0 | 0.0 | Top 1.7': Silty SAND, poorly graded, f sand, 15 - 20% silt, loose, wet, lt brownish gray (10YR6/2), micaceous, no bedding or laminae. Bottom 0.3': Sandy SILT, slightly plastic, 20 - 30% f sand, loose, wet, gray (10YR5/1). | 5-4-7-8 | SM<br>SM | < 18 |
| S-42 | 82-84 | 2.0/2.0 | 0.0 | Top 1.1': Sandy SILT, as in bottom 0.3' of S-41. Bottom 0.9': Silty SAND to sandy SILT, slightly plastic, 30 - 45% f sand, loose, wet, gray (10YR5/1), some thin laminae present at 83' -83.2' (pale brown) | 3-4-7-8 | SM<br>SM-ML | < 19 |
| | | | | | | | |

| SOIL BORING LOG - FORT DEVENS, MA. | | | | PROJECT NO.: 6917.07 | | BORING NO.: G6M-94-18X (p. 6 of 6) | |
|---|---|---|---|---|---|---|---|
| CLIENT: AEC | | | | DATE STARTED: 8/12/94 | | STUDY AREA: 50 | |
| CONTRACTOR: New Hampshire Boring | | | | DATE COMPLETED: | | PROTECTION: Modified D | |
| METHOD: drive & wash | | | | BORING DIAMETER: DRAFT | | PID METER: Model 580B OVM | |
| GROUND ELEV: | | | | REFERENCE PT. ELEV.: | | TOTAL DEPTH: 92.75' | |
| LOGGED BY: R. Rustad, D. Pierce | | | | CHECKED BY: | | WATER TABLE BGS: 11.9' | |
| SAMPLE NO. | DEPTH (ft.) | PEN./REC. (ft./ft.) | PID OF SPOON (ppm) | SOIL/ROCK DESCRIPTION AND PHYSICAL CONDITIONS | BLOWS/6 IN. | USCS SOIL CLASS. | GC SCREENING RESULTS FOR PCE (ug/kg) |
| S-43 | 84-86 | 2.0/2.0 | 0.0 | Top 0.9': Silty SAND, fine, poorly graded, 15 - 20% silt, med dense, wet, gray (10YR5/1)<br>Bottom 1.1': Silty SAND, as in above 0.9', but including gravel-sized, angular phyllite (5 mm maximum) | 5-9-18-20 | SM-ML<br>SM-ML | < 16 |
| S-44 | 86-88 | 2.0/0.4 | 0.0 | Clayey SILT, plastic, firm, wet, gray (10YR5/1), contains angular phyllite gravel | 21-13-16-46 | ML-CL | < 19 |
| S-45 | 88-90 | 2.0/1.8 | 0.0 | Top 1.1': GRAVEL- to COBBLE-sized phyllite fragments, angular, in a sandy SILT matrix, f to c sand, dense, wet, dk gray (10YR4/1). Next 0.4': Coarse SAND and GRAVEL, 10% med sand, < 5% fines, including subangular phyllite fragments (max size 5 mm). Bottom 0.3': SILT, 5% gravel, 10% f to c sand, very stiff. | 18-52-22-7 | GM<br>GW<br>ML | < 20 |
| S-46 | 90-92 | 2.0/1.8 | 0.0 | Top 0.6': Sandy SILT, 30 - 40% fine sand, med stiff, wet, gray (10YR6/1)<br>Bottom 1.2': Silty SAND, well graded, f to c, 20 - 30% silt, med dense, wet, subangular to subrounded | 27-18-12-9 | ML<br>SM-ML | < 9 |
| S-47 | 92-92.5 | 0.75/0.5 | 0.0 | GRAVEL, well graded, angular, 20% fine to coarse sand, 20% silt. Phyllite cuttings from rollerbit. | 33-133/0.15" | GM | NA |
| | | | | **BOE at 92.75'** | | | |

| SOIL BORING LOG - FORT DEVENS, MA. | PROJECT NO.: 6917.07 | BORING NO.: G6M-95-19X (p. 1 of 3) |
|---|---|---|
| CLIENT: AEC | DATE STARTED: 1/20/95 | STUDY AREA: 50 |
| CONTRACTOR: New Hampshire Boring | DATE COMPLETED: 1/24/95 | PROTECTION: Modified D |
| METHOD: HSA and drive & wash | BORING DIAMETER: DRAFT | PID METER: Model 580B OVM |
| GROUND ELEV: | REFERENCE PT. ELEV.: | TOTAL DEPTH: 87.0' |
| LOGGED BY: J. Healey, H. Colby | CHECKED BY: | WATER TABLE BGS: 10.5' |

| SAMPLE NO. | DEPTH (ft.) | PEN./REC. (ft./ft.) | PID OF SPOON (ppm) | SOIL/ROCK DESCRIPTION AND PHYSICAL CONDITIONS | BLOWS/6 IN. | USCS SOIL CLASS. | GC SCREENING RESULTS FOR PCE (ug/kg) / COMMENTS |
|---|---|---|---|---|---|---|---|
| S-1 | 0-2 | 2.0/1.6 | BKG | Top 0.2': Silty SAND, f to med, 30% fines, nonplastic, loose, damp, dk brn<br>Bottom 1.3': SAND, poorly graded, 10% gravel, fine to med sand, 10% fines, med dense, damp, brown | 4-6-4-6 | SM<br>SP-SM | < 34.7<br>roots (topsoil) in top 0.2' |
| S-2 | 2-4 | 2.0/1.1 | BKG | Top 0.6': Silty SAND, f to med, 25% fines, med dense, damp, dk brown<br>Bottom 0.5': SAND, poorly graded, f to med, < 5% fines, med dense, damp, reddish brown | 10-11-5-4 | SM<br>SP | 26<br>some coal powder in top 0.6' |
| S-3 | 4-6 | 2.0/1.3 | BKG | SAND, poorly graded, 5% fine gravel, fine to coarse sand (mostly f to med), < 5% fines, loose, damp, yellow-brown | 2-4-5-8 | SP | 17EB |
| S-4 | 6-8 | 2.0/1.2 | BKG | SAND, well graded, 15% f gravel, fine to coarse sand, < 5% fines, med dense, damp to moist, tan | 14-13-15-14 | SW | 6EB |
| S-5 | 8-10 | 2.0/ | BKG | SAND, poorly graded, f to c (finer with depth), < 5% fines, med dense, wet (becoming saturated with depth), tan | 10-10-11-9 | SP | < 25.6 |
| S-6 | 10-12 | 2.0/2.0 | BKG | SAND, poorly graded, f to med (very fine at bottom 0.2'), med dense, saturated, tan with some rust staining | 2-5-7-9 | SP | 9EB |
| S-7 | 12-14 | 2.0/ | BKG | SAND, poorly graded, f to med (bottom 0.5' is very fine, denser), med dense, saturated, tan with some rust staining | 11-10-14-16 | SP | 12EB |
| S-8 | 14-16 | 2.0/ | BKG | SAND, poorly graded, fine to medium, med dense, saturated, tan | 4-4-5-7 | SP | < 24.0 |
| S-9 | 16-18 | 2.0/2.0 | BKG | Top 1.0': SAND, well graded, fine to coarse, < 5% fines, medium dense, saturated, tan<br>Bottom 1.0': SAND, poorly graded, fine, 10% silt, medium dense, saturated, tan | 9-10-12-16 | SW<br>SP | 13EB |
| S-10 | 18-20 | 2.0/2.0 | BKG | SAND, poorly graded, fine, 5 - 12% fines, medium dense, saturated, laminated, tan | 5-8-9-10 | SP-SM | 13EB |
| S-11 | 20-22 | 2.0/1.5 | BKG | SAND, poorly graded, fine, < 5% fines, medium dense, saturated, tan with rust staining | 10-11-13-15 | SP | 9E |
| S-12 | 22-24 | 2.0/2.0 | BKG | Top 1.0': SAND, as in S-11<br>Bottom 1.0': Silty SAND, fine, 25% fines, medium dense, saturated, laminated, tan | 11-10-13-13 | SP<br>SM | 17E |
| S-13 | 24-26 | 2.0/1.5 | BKG | Sandy SILT, 42% fine sand, very stiff, saturated, slightly laminated, tan with some rust color | 11-13-14-14 | ML | 21E |
| | | | | | | | |

| SOIL BORING LOG - FORT DEVENS, MA. | PROJECT NO.: 6917.07 | BORING NO.: G6M-95-19X (p. 2 of 3) |
|---|---|---|
| CLIENT: AEC | DATE STARTED: 1/20/95 | STUDY AREA: 50 |
| CONTRACTOR: New Hampshire Boring | DATE COMPLETED: 1/24/95 | PROTECTION: Modified D |
| METHOD: HSA and drive & wash | BORING DIAMETER: DRAFT | PID METER: Model 580B OVM |
| GROUND ELEV: | REFERENCE PT. ELEV.: | TOTAL DEPTH: 87.0' |
| LOGGED BY: J. Healey, H. Colby | CHECKED BY: | WATER TABLE BGS: 10.5' |

| SAMPLE NO. | SAMPLE DEPTH (ft.) | PEN./REC. (ft./ft.) | PID OF SPOON (ppm) | SOIL/ROCK DESCRIPTION AND PHYSICAL CONDITIONS | BLOWS/6 IN. | USCS SOIL CLASS. | GC SCREENING RESULTS FOR PCE (ug/kg) |
|---|---|---|---|---|---|---|---|
| S-14 | 26-28 | 2.0/1.8 | BKG | SAND, as in S-13 | 10-10-10-11 | ML | 20E |
| S-15 | 28-30 | 2.0/1.8 | BKG | SAND, as in S-13 | 12-13-14-15 | ML | 24E |
| S-16 | 30-32 | 2.0/1.8 | BKG | SAND, as in S-13 | 10-11-11-12 | ML | 19E |
| S-17 | 32-34 | 2.0/0.8 | BKG | SAND, as in S-13 | 12-14-18-21 | ML | 9E |
| S-18 | 34-36 | 2.0/1.7 | BKG | Silty SAND, fine, 20% fines, medium dense, saturated, tan with some rust | 8-8-9-11 | SM | < 30.5 |
| S-19 | 36-38 | 2.0/0.5 | BKG | Silty SAND, as in S-18 | 3-5-4-5 | SM | 7E |
| S-20 | 38-40 | 2.0/1.6 | BKG | Silty SAND, as in S-18 | 9-14-9-13 | SM | 11E |
| S-21 | 40-42 | 2.0/1.1 | BKG | Silty SAND, as in S-18 | 9-10-13-12 | SM | 46 |
| S-22 | 42-44 | 2.0/0.5 | BKG | Silty SAND, as in S-18 | 9-11-13-17 | SM | < 21.4 |
| S-23 | 44-46 | 2.0/ | BKG | Silty SAND, as in S-18 | 5-5-7-9 | SM | 30 |
| S-24 | 46-48 | 2.0/2.0 | not rec. | Silty SAND, as in S-18 | 8-8-12-12 | SM | < 27.9 |
| S-25 | 48-50 | 2.0/1.3 | not rec. | Silty SAND, as in S-18 | 6-8-12-13 | SM | 7E |
| S-26 | 50-52 | 2.0/1.5 | not recorded | Silty SAND, 2% med sand, fine sand, 19% fines, med dense, saturated, tan with some rust color | 25-13-11-12 | SM | 173 |
| S-27 | 52-54 | 2.0/2.0 | not recorded | Silty fine sand at top of interval. SAND, poorly graded, fine, medium dense, saturated, slightly laminated, tan with some rust color. | 10-17-16-13 | SM<br>SP | 36 |
| S-28 | 54-56 | 2.0/2.0 | not recorded | Top 0.8': Fine SAND with silt, trace clay. Next 0.4': Fine SAND, little silt, gray. Bottom 0.8': Fine SAND, yellowish brown. | 17-11-17-16 | SM<br>SP<br>SP | 87 |
| S-29 | 56-58 | 2.0/1.9 | not recorded | Silty SAND, 1% medium sand, fine sand, 14% fines, medium dense, saturated, tan, minor laminations | 8-6-10-8 | SM | 68 |
| S-30 | 58-60 | 2.0/2.0 | 0 | SAND, as in S-29 | 7-6-7-11 | SM | 19E |
| S-31 | 60-62 | 2.0/0.0 | NA | - no recovery - | 12-7-4-5 | NA | NA |
| S-32 | 62-64 | 2.0/1.8 | 0 | SAND, as in S-29 | 2-6-6-5 | SM | < 32.7 |
| S-33 | 64-66 | 2.0/ | not recorded | SAND, as in S-29, but slightly more grayish | 6-4-3-6 | SM | < 31.6 |
| S-34 | 66-68 | 2.0/2.0 | not rec. | SAND, as in S-33 | 0/6"-0/6"-8-8 | SM | < 35.3 |
| S-35 | 68-70 | 2.0/1.3 | not recorded | SAND, as in S-33, but with no laminations | 8-6-7-13 | SM | < 34.8 |
| S-36 | 70-72 | 2.0/2.0 | not rec. | SAND, as in S-35 | 4-6-5-4 | SM | < 21.5 |
| S-37 | 72-74 | 2.0/0.5 | not rec. | SAND, as in S-35 -- poor recovery | 0/6"-7-10-13 | SM | < 20.7 |

| SOIL BORING LOG - FORT DEVENS, MA. | | | | PROJECT NO.: 6917.07 | | BORING NO.: G6M-95-19X (p. 3 of 3) | |
|---|---|---|---|---|---|---|---|
| CLIENT: AEC | | | | DATE STARTED: 1/20/95 | | STUDY AREA: 50 | |
| CONTRACTOR: New Hampshire Boring | | | | DATE COMPLETED: 1/24/95 | | PROTECTION: Modified D | |
| METHOD: HSA and drive & wash | | | | BORING DIAMETER: DRAFT | | PID METER: Model 580B OVM | |
| GROUND ELEV: | | | | REFERENCE PT. ELEV.: | | TOTAL DEPTH: 87.0' | |
| LOGGED BY: J. Healey, H. Colby | | | | CHECKED BY: | | WATER TABLE BGS: 10.5' | |
| SAMPLE NO. | SAMPLE DEPTH (ft.) | PEN./REC. (ft./ft.) | PID OF SPOON (ppm) | SOIL/ROCK DESCRIPTION AND PHYSICAL CONDITIONS | BLOWS/6 IN. | USCS SOIL CLASS. | GC SCREENING RESULTS FOR PCE (ug/kg) |
| S-38 | 74-76 | 2.0/1.1 | not rec. | SAND, as in S-35 | 5-7-5-4 | SM | 29E |
| S-39 | 76-78 | 2.0/1.8 | not recorded | SAND with trace silt, poorly graded, med dense, saturated, grayish tan, minor laminations | 8-11-11-4 | SP | < 14.4 |
| S-40 | 78-80 | 2.0/2.0 | not recorded | SAND, poorly graded, medium dense, saturated, grayish tan, minor laminations | 8-12-17-21 | SP | < 34.6 |
| S-41 | 80-82 | 2.0/1.2 | not rec. | SAND, as in S-40 | 6-7-7-11 | SP | < 39.3 |
| S-42 | 82-84 | 2.0/2.0 | not recorded | Top 1.7': SAND, as in S-40. Bottom 0.3': SAND with little silt, poorly graded, med dense, saturated, grayish tan, minor laminations. Weathered rock fragments in tip. | 8-13-25-41 | SP<br>SP-SM | 15E |
| S-43 | 84-85 | 1.0/1.0 | not recorded | SAND, some f to med gravel, fine to medium sand, 5% fines, very dense, saturated, gray to brown, TILL | 32-48-100/5" | SW | < 16.7 |

BOE at 87'

| SOIL BORING LOG - FORT DEVENS, MA. | PROJECT NO.: 6917.07 | BORING NO.: G6M-95-20X (p. 1 of 4) |
|---|---|---|
| CLIENT: AEC | DATE STARTED: 1/16/95 | STUDY AREA: 50 |
| CONTRACTOR: New Hampshire Boring | DATE COMPLETED: 1/17/95 | PROTECTION: Modified D |
| METHOD: HSA and drive & wash | BORING DIAMETER: DRAFT | PID METER: Model 580B OVM |
| GROUND ELEV: | REFERENCE PT. ELEV.: | TOTAL DEPTH: 89' |
| LOGGED BY: J. Healey | CHECKED BY: | WATER TABLE BGS: 8' |

| SAMPLE NO. | SAMPLE DEPTH (ft.) | PEN./REC. (ft./ft.) | PID: HEADSPACE (ppm) | SOIL/ROCK DESCRIPTION AND PHYSICAL CONDITIONS | BLOWS/6 IN. | USCS SOIL CLASS. | GC SCREENING RESULTS FOR PCE (ug/kg) / COMMENTS |
|---|---|---|---|---|---|---|---|
| S-1 | 0-2 | 2.0/1.6 | 0 | Top 0.3': Sandy SILT, nonplastic, 30% f sand, very stiff, moist, dark brown. Next 0.7': SAND, mod. well graded, f to c (mostly med), loose, damp, light yellow-brown. Bottom 0.6': SAND, poorly graded, fine, loose, damp, tan. | 13-33-13-11 | SM-ML<br>SW<br>SP | 68.1<br>roots in top 0.3'<br>a few pieces of coal in 0.3' to 1.0' interval |
| S-2 | 2-4 | 2.0/1.4 | 0 | SAND, poorly graded, 10% med to coarse, fine sand, loose, damp, banded tan and yellow with a 1" band of dark brown silty sand at 0.2' | 8-5-4-6 | SP | < 16.6 |
| S-3 | 4-6 | 2.0/1.4 | 0 | SAND, poorly graded, fine, loose, damp. Top 0.4' is banded tan and yellow with one band of dark silt; bottom 1.0' is tan. | 3-4-6-8 | SP | < 23.5 |
| S-4 | 6-8 | 2.0/1.3 | 0 | SAND, poorly graded, fine, med dense, damp (bottom 0.1' wet), tan | 6-8-8-11 | SP | < 2400 |
| S-5 | 8-10 | 2.0/1.1 | 0 | SAND, poorly graded, fine, band of silt at 0.3', med dense, top 0.2' wet, bottom 0.9' saturated, tan | 3-6-7-7 | SP | < 2300 |
| S-6 | 10-12 | 2.0/1.6 | 2 | SAND, poorly graded, fine, 10% silt, med dense, saturated, tan with a few bands of rust, laminated | 4-6-6-8 | SP-SM | 98.3 |
| S-7 | 12-14 | 2.0/1.8 | 4 | SAND, poorly graded, fine, band of silt at 1', med dense, saturated, tan with some thick bands of rust, laminated | 8-9-16-13 | SP-SM | 166 |
| S-8 | 14-16 | 2.0/1.5 | 2 | SAND, poorly graded, fine, less silt than in S-7, med dense, saturated, tan with thinner bands of rust, laminated | 7-7-7-8 | SP | 242 |
| S-9 | 16-18 | 2.0/2.0 | 12 | SAND, poorly graded, fine, med dense, saturated, tan with thin bands of rust, laminated | 10-10-10-10 | SP | 516E |
| S-10 | 18-20 | 2.0/ | 76 | SAND, as in S-9 | 5-7-7-8 | SP | 1090E |
| S-11 | 20-22 | 2.0/2.0 | 74 | SAND, as in S-9, but more reddish | 6-6-7-5 | SP | 1760 |
| S-12 | 22-24 | 2.0/2.0 | 60 | Sandy SILT, 28% fine sand, very stiff, saturated, lt brown with thin bands of rust, laminated | 5-9-9-9 | ML | 1870 |
| S-13 | 24-26 | 2.0/2.0 | 10 | SAND, as in S-12 | 5-7-9-9 | ML | 700E |
| S-14 | 26-28 | 2.0/2.0 | 12 | Silty SAND, fine sand, 18% fines, med dense, saturated, light brown with thin bands of rust, laminated | 10-12-14-14 | SM | 230E |
| S-15 | 28-30 | 2.0/ | 7 | SAND, as in S-14 | 0-4-6-12 | SM | 480E |
| S-16 | 30-32 | 2.0/2.0 | 10 | Silty SAND, 1% medium sand, fine sand, 17% fines, med dense, saturated, light brown with thin rust bands, laminated | 8-11-14-10 | SM | 13E |

| SOIL BORING LOG - FORT DEVENS, MA. | PROJECT NO.: 6917.07 | BORING NO.: G6M-95-20X (p. 2 of 4) |
|---|---|---|
| CLIENT: AEC | DATE STARTED: 1/16/95 | STUDY AREA: 50 |
| CONTRACTOR: New Hampshire Boring | DATE COMPLETED: 1/17/95 | PROTECTION: Modified D |
| METHOD: HSA and drive & wash | BORING DIAMETER: DRAFT | PID METER: Model 580B OVM |
| GROUND ELEV: | REFERENCE PT. ELEV.: | TOTAL DEPTH: 89' |
| LOGGED BY: J. Healey | CHECKED BY: | WATER TABLE BGS: 8' |

| SAMPLE NO. | SAMPLE DEPTH (ft.) | PEN./REC. (ft./ft.) | PID: HEADSPACE (ppm) | SOIL/ROCK DESCRIPTION AND PHYSICAL CONDITIONS | BLOWS/6 IN. | USCS SOIL CLASS. | GC SCREENING RESULTS FOR PCE (ug/kg) |
|---|---|---|---|---|---|---|---|
| S-17 | 32-34 | 2.0/2.0 | 13 | SAND, as in S-16 | 13-16-19-23 | SM | 26E |
| S-18 | 34-36 | 2.0/0.3 | 0 | Silty SAND, 1% medium sand, fine sand, 26% fines, med dense, saturated, light brown with thin rust bands, laminated | not recorded | SM | 10E |
| S-19 | 36-38 | 2.0/1.8 | 7 | SAND, as in S-18 | 8-12-16-19 | SM | 5E |
| S-20 | 38-40 | 2.0/0.9 | 0 | Silty SAND, fine sand, 32% fines, medium dense, saturated, tan with some rust laminations | 6-9-16-18 | SM | < 23.5 |
| S-21 | 40-42 | 2.0/1.5 | 0 | SAND, as in S-20 | 9-12-20-23 | SM | < 30.4 |
| S-22 | 42-44 | 2.0/2.0 | 57 | SAND, as in S-20 | 8-6-10-18 | SM | < 23.5 |
| S-23 | 44-46 | 2.0/1.3 | 33<br>NOTE: PID readings suspect; may be due to moisture | Top 0.2': Silty CLAY, slightly plastic, very stiff, saturated, lt brn<br>Next 0.4': SILT, nonplastic, 25 - 30% f sand, very stiff, saturated, tan and rust, highly laminated<br>Bottom 0.7': SAND, poorly graded, fine, grain size decreases with depth, dense, saturated, tan with rust bands, laminated | 8-15-18-23 | CL<br>ML<br>SP | < 23.8 |
| S-24 | 46-48 | 2.0/2.0 | 10 | Top 1.5': SAND, as in bottom 0.7' of S-23. Bottom 0.5': Interbedded fine SAND, SILT, and CLAY, sand is poorly graded, 50% fines, saturated, tan and gray-brown, thin laminar beds | 6-8-8-14 | SP<br>SM, ML, and CL | < 21.7 |
| S-25 | 48-50 | 2.0/2.0 | 49 | Top 0.8': Silty SAND, poorly graded, fine, 15 - 20% fines, saturated, tan with rust laminations. Bottom 1.2': Interbedded SILT and CLAY, slightly plastic, 15% f sand, very stiff, saturated, tan and gray-brown and rust, highly laminated | not recorded | SM<br>ML and CL | < 30.9 |
| S-26 | 50-52 | 2.0/2.0 | 46 | Top 1.0': SAND, poorly graded, fine, 10 - 20% fines, dense, saturated, tan with rust laminations. Bottom 1.0': SAND, poorly graded, fine, dense, saturated, tan with rust laminations | 12-16-18-20 | SM<br>SP | < 29.2 |
| S-27 | 52-54 | 2.0/2.0 | 0 | SAND, poorly graded, fine, 5 - 10% fines (a few thin bands of silt and clay), medium dense, saturated, tan with rust staining | 8-11-13-22 | SP | < 21.3 |
| S-28 | 54-56 | 2.0/2.0 | 0 | SAND, poorly graded, fine, dense, saturated, tan with rust laminations | 10-18-14-14 | SP | 3.7E |
| S-29 | 56-58 | 2.0/2.0 | 0 | SAND, poorly graded, fine, 5% fines (a few thin bands of silt), dense, saturated, tan with rust laminations | 10-12-19-21 | SP | < 30.4 |
| S-30 | 58-60 | 2.0/1.7 | 0 | SAND, poorly graded, fine, dense, saturated, tan with rust laminations | 12-13-14-23 | SP | < 22.9 |

| SOIL BORING LOG - FORT DEVENS, MA. | | | | PROJECT NO.: 6917.07 | | BORING NO.: G6M-95-20X (p. 3 of 4) | |
|---|---|---|---|---|---|---|---|
| CLIENT: AEC | | | | DATE STARTED: 1/16/95 | | STUDY AREA: 50 | |
| CONTRACTOR: New Hampshire Boring | | | | DATE COMPLETED: 1/17/95 | | PROTECTION: Modified D | |
| METHOD: HSA and drive & wash | | | | BORING DIAMETER: DRAFT | | PID METER: Model 580B OVM | |
| GROUND ELEV: | | | | REFERENCE PT. ELEV.: | | TOTAL DEPTH: 89' | |
| LOGGED BY: J. Healey | | | | CHECKED BY: | | WATER TABLE BGS: 8' | |
| SAMPLE NO. | DEPTH (ft.) | PEN./REC. (ft./ft.) | PID: HEADSPACE (ppm) | SOIL/ROCK DESCRIPTION AND PHYSICAL CONDITIONS | BLOWS/6 IN. | USCS SOIL CLASS. | GC SCREENING RESULTS FOR PCE (ug/kg) |
| S-31 | 60-62 | 2.0/1.8 | 0 | SAND, poorly graded, fine, dense, saturated, tan with rust laminations | 28-21-21-35 | SP | < 21.1 |
| S-32 | 62-64 | 2.0/1.3 | 0 | SAND, as in S-31, but with increasing rust color at bottom of interval | 6-9-12-26 | SP | < 17.9 |
| S-33 | 64-66 | 2.0/2.0 | 0 | Top 0.6': SAND, poorly graded, fine, dense, saturated, rust colored<br>Bottom 1.4': SAND, poorly graded, fine, dense, saturated, tan with rust laminations | 10-30-45-61 | SP<br>SP | < 21.2 |
| S-34 | 66-68 | 2.0/1.4 | 0 | SAND, poorly graded, fine, dense, saturated, tan with very little rust | 13-17-25-27 | SP | < 28.2 |
| S-35 | 68-70 | 2.0/2.0 | 0 | Top 1.2': SAND, poorly graded, fine, dense, saturated, light reddish brown<br>Bottom 0.8': SAND, poorly graded, fine (finer than in top 1.2'), dense, saturated, tan | 14-20-27-41 | SP<br>SP | < 33.3 |
| S-36 | 70-72 | 2.0/1.2 | 0 | Top 0.8': SAND, poorly graded, fine, dense, saturated, light reddish brown<br>Bottom 0.4': SAND, poorly graded, fine (finer than in top 0.8'), dense, saturated, tan | 9-12-20-26 | SP<br>SP | < 29.9 |
| S-37 | 72-74 | 2.0/2.0 | 0 | SAND, poorly graded, fine (becoming finer at bottom 0.3'), medium dense, saturated, tan with rust-colored striations | 5-11-17-21 | SP | < 28.0 |
| S-38 | 74-76 | 2.0/2.0 | 0 | SAND, poorly graded, fine, dense, saturated, tan, some rust striations | 9-14-28-28 | SP | < 22.6 |
| S-39 | 76-78 | 2.0/2.0 | 0 | SAND, poorly graded, fine, med dense, saturated, tan | 8-3-13-17 | SP | < 27.7 |
| S-40 | 78-80 | 2.0/ | 0 | SAND, as in S-39 | 11-13-17-21 | SP | < 30.3 |
| S-41 | 80-82 | 2.0/2.0 | 0 | Top 1.2': SAND, poorly graded, fine, medium dense, saturated, tan<br>Bottom 0.3': SAND, poorly graded, fine, 10% fines, medium dense, saturated, gray-brown | 9-11-14-17 | SP<br>SP-SM | < 26.0 |
| S-42 | 82-84 | 1.5/1.5 | 0 | Top 0.8': SAND, poorly graded, fine, dense, saturated, tan. Bottom 0.7': Silty, gravelly SAND, well graded, 25 - 30% f to c gravel, fine, 25 - 30% fines, dense, saturated, gray-brown. | 26-28-31-50/0" | SP<br>SM | < 28.3 |
| S-43 | 84-86 | 2.0/1.0 | 0 | Top 0.5': Silty, gravelly SAND, as in bottom 0.7' of S-42<br>Bottom 0.5': Silty SAND, well graded, 10 - 15% fine gravel, fine to coarse, 15% fines, dense, saturated, gray | 35-20-27-15 | SM<br>SM | 10EB |
| | | | | | | | |

| SOIL BORING LOG - FORT DEVENS, MA. | PROJECT NO.: 6917.07 | BORING NO.: G6M-95-20X (p. 4 of 4) |
|---|---|---|
| CLIENT: AEC | DATE STARTED: 1/16/95 | STUDY AREA: 50 |
| CONTRACTOR: New Hampshire Boring | DATE COMPLETED: 1/17/95 | PROTECTION: Modified D |
| METHOD: HSA and drive & wash | BORING DIAMETER: | PID METER: Model 5808 OVM |
| GROUND ELEV: | REFERENCE PT. ELEV.: DRAFT | TOTAL DEPTH: 89' |
| LOGGED BY: J. Healey | CHECKED BY: | WATER TABLE BGS: 8' |

| SAMPLE NO. | SAMPLE DEPTH (ft.) | PEN./REC. (ft./ft.) | PID: HEADSPACE (ppm) | SOIL/ROCK DESCRIPTION AND PHYSICAL CONDITIONS | BLOWS/6 IN. | USCS SOIL CLASS. | GC SCREENING RESULTS FOR PCE (ug/kg) |
|---|---|---|---|---|---|---|---|
| S-44 | 86-88 | 2.0/2.0 | 0 | Top 1.2': SAND, poorly graded, fine, dense, saturated, tan<br>Next 0.3': Gravelly SAND, well graded, 40% fine gravel, fine to coarse sand, dense, saturated, gray<br>Bottom 0.5': SAND, poorly graded, 15% fine gravel, fine to medium sand, 5 - 10% fines, dense, saturated, gray, TILL | 8-18-15-38 | SP<br>SW<br>SP-SM | < 26.5 |
| S-45 | 88-89 | 1.0/1.0 | 0 | Top 0.5': SAND, poorly graded, 10% fine gravel, fine to coarse sand, very dense, saturated, gray<br>Bottom 0.5': SAND, poorly graded, 15% fine gravel, fine sand, 5% fines, very dense, saturated, gray | 60-88-100/0" | SP<br>SP | < 27.9 |

BOE at 89'