SITE CHARACTERIZATION REPORT ON 80TH DIVISION LIGHTER AMPHIBIOUS RESUPPLY CARGO (LARC) 60 AREA FORT STORY VA

6/20/1994

ENVIRONMENTAL RESTORATION COMPANY

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SITE CHARACTERIZATION REPORT

on

80th Division LARC 60 Area
Fort Story, Virginia

prepared for

Directorate of Public Works
Environmental and Natural Resources Division
Fort Eustis, Virginia

prepared by

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date

June 20, 1994

ERC #4418

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DISCLAIMER

The items contained within this Site Characterization Report (SCR) are statements of fact based upon a site inspection, monitoring well installations, and soil and groundwater sampling and analyses. Conclusions reached in this report are objectively based upon the information available at the time work was performed.

Every effort has been made to obtain accurate facts upon which to base opinions. Since operations, surface, subsurface, hydrogeologic, and geotechnical conditions are subject to variations, no responsibilities are accepted by Environmental Restoration Company for any actions taken as a consequence of this report.

EXECUTIVE SUMMARY

Environmental Restoration Company (ERC) was contracted by the Directorate of Public Works, U.S. Army Transportation Center, Fort Eustis, to perform a Site Characterization Report (SCR) at the 80th Division LARC 60 Area at Fort Story, Virginia, hereafter called the subject site or site.

In February, 1994, Montgomery Watkins (Montgomery) was contracted by the United States Army Corps of Engineers, Omaha District, to conduct a Site Assessment at the subject site to evaluate the presence of possible soil contamination. Excavations will be performed in portions of the subject site area during the planned expansion of the wash pad.

Soil contamination was a concern because of the following possible sources of contamination:

- vehicle decontamination procedures on the existing wash pad.
- possible leakage from the on-site underground storage tank (UST).
- leakage or spillage from the on-site aboveground storage tank (AST) and former drum storage pad.

Based on Montgomery's Site Assessment, elevated levels of Total Recoverable Petroleum hydrocarbons (TRPH), Volatile Organic Compounds (VOCs) and lead were discovered in the shallow soil (0-2 feet below grade) adjacent to the drum storage area, tank area and wash pad. An elevated TRPH concentration was also reported for one soil sample obtained from a depth of 2-4 feet. During the Site Assessment groundwater was reported to be approximately 8 feet below grade.

On May 12 and 13 1994, ERC installed six 2 inch diameter groundwater monitoring wells on the site. Soil samples were obtained from a depth of 0-2 feet below grade and at the soil/groundwater interface from each monitoring well location. Groundwater was encountered at depths ranging from approximately 3-8 feet below grade. On May 19, 1994, ERC personnel obtained groundwater samples from each of the six monitoring wells.

The soil and groundwater samples were submitted to EnviroCompliance Laboratories, Inc., for Total Petroleum Hydrocarbons (TPH, Method 418.1), VOCs (Method 7420) and lead (Method 239.1) analses.

Twelve soil samples were submitted from the monitoring well soil borings. Of the twelve samples submitted, TPH concentrations ranged from 25 mg/kg to 96.4 mg/kg. Two of the twelve soil sample analyzed for lead had reported lead concentrations of 84.9 and 86.9 mg/kg. The other ten soil samples had reported lead concentrations

below the detection limit (12.5 mg/kg). Results of the TPH and lead analyses are presented in Table I below. Of the twelve soil samples analyzed for VOCs one soil sample exhibited a Methylene Chloride concentration of 29.4 ug/L. Other analytes were below the laboratories detection limits.

TABLE I. SUMMARY OF LABORATORY ANALYSES

SAMPLE ID	DEPTH, feet	TPH, mg/kg	LEAD, mg/kg
MW-1	0-2	96.4	BDL
MW-2	0-2	53.3	84.9
MW-3	0-2	29.6	BDL
MW-4	0-2	47.7	86.5
MW-5	0-2	31.8	BDL
MW-6	0-2	29.6	BDL
MW-1	4-6	25.0	BDL
MW-2	4-6	31.8	BDL
MW-3	4-6	31.8	BDL
MW-4	6-8	BDL	BDL
MW-5	6-8	25.0	BDL
MW-6	6-8	27.3	BDL

BDL - Below Detection Limit

The six groundwater samples obtained from the monitoring wells were analyzed for TPH and lead. These groundwater samples exhibited non-detectable TPH and lead concentrations. Of the six groundwater samples analyzed for VOCs, one sample exhibited a Trichloroethene (TCE) concentration of 5.31 ug/L and a Tetrachloroethene (PCE) concentration of 157.7 ug/L. Other analytes were below the laboratories detection limit.

On May 19, 1994, ERC personnel performed ten shallow (0-5 feet) hand auger soil borings in the LARC staging area. Two soil samples were obtained from each boring; one at 0-2 feet below grade, and the second at 2-4 feet below grade.

The soil samples obtained from the hand auger borings were submitted to EnviroCompliance Laboratories, Inc., for Total Petroleum Hydrocarbons (TPH, Method 418.1) and lead (Method 239.1) analses.

Ten of the shallow soil samples and three of the deep soil samples exhibited TPH concentrations ranging from 513 mg/kg to 17,872 mg/kg. The other seven deep soil sampled exhibited TPH concentrations ranging from less than 25 mg/kg to 37.5 mg/kg. Of the ten shallow soil samples analyzed for lead, eight samples exhibited lead concentrations ranging from 94.2 to 356 mg/kg. All ten of the deep soil samples, and two background soil samples exhibited lead concentrations below the detection limit (12.5 mg/kg). Results of the TPH and lead analyses are presented in Table II below.

TABLE II. SUMMARY OF LABORATORY ANALYSES

SAMPLE ID	DEPTH, feet	TPH, mg/kg	LEAD, mg/kg
HA-1 S1	0-2	17,872	95.7
HA-2 S1	0-2	14,370	286
HA-3 S1	0-2	17,872	212
HA-4 S1	0-2	5,194	94.2
HA-5 S1	0-2	1,662	356
HA-6 S1	0-2	1,494	252
HA-7 S1	0-2	1,117	356
HA-8 S1	0-2	5,529	BDL
HA-9 S1	0-2	37.5	BDL
HA-10 S1	0-2	35.0	BDL
HA-1 S2	2-4	513	BDL
HA-2 S2	2-4	13,363	BDL
HA-3 S2	2-4	1,155	BDL
HA-4 S2	2-4	37.5	BDL
HA-5 S2	2-4	BDL	BDL
HA-6 S2	2-4	30.0	BDL
HA-7 S2	2-4	35.0	BDL
HA-8 S2	2-4	27.5	BDL
HA-9 S2	2-4	25.0	BDL
HA-10 S2	2-4	27.5	BDL

BDL - Below Detection Limit

Based on the services performed during these SCR services, two areas of soil contamination and one area of groundwater contamination are present on the site. TPH and lead contamination was discovered in the shallow soil of the LARC staging area. These contaminants are most likely the result of bilge water discharge (TPH) and sand blasting (lead). Minor Methylene Chloride contamination was discovered at a depth of 4-6 feet in the soil of monitoring well MW-2. TCE and PCE contaminated groundwater was detected in minor concentrations in the groundwater obtained from monitoring well MW-4. The source of the Methylene Chloride, TCE and PCE contamination is most likely cleaning fluids/solvents used when cleaning the LARC vehicles.

The Methylene Chloride, TCE and PCE concentrations are minimal and further investigation is not deemed necessary. However, elevated TPH and lead concentrations were detected in the soil samples obtained from the LARC staging area. These soils should be excavated and disposed of at an appropriate landfill. In-situ soils should be sampled and analyzed to determine in contaminated soil have been removed.

1.0 SITE ASSESSMENT

1.1 Site Location and Description

Fort Story is located on Cape Henry in Virginia Beach, Virginia. Fort Story is bounded by the Chesapeake Bay and the Atlantic Ocean to the west, north and east, and by Seashore State Park to the south. The subject site, the 80th Division LARC 60 Area, is located northeast of the intersection of Da Nang and Hospital Roads. A Site Location Map is included in Figure 1.

The subject site operates as an amphibious landing craft (LARC) washing and maintenance area. The site contains a 50 foot by 70 foot concrete pad, surrounded by asphalt on the west, south and east sides. The north side is bordered by sand of the LARC staging area. The north side of the site is bounded by a mix of open and semi-wooded sand flats and sand ridges. A 1,000 gallon used oil UST, 250 gallon antifreeze AST and former drum storage area are located west of the wash pad. The AST is located on a raised, bermed concrete pad with a valved outlet for water drainage. A Site Observation Map is included in Figure 2.

1.2 Nature and Quantity of the Release

According to the Montgomery Site Assessment, soil contamination of TRPH and lead was determined to exist in the shallow soil north of the former drum storage area and around the wash pad. The sources and estimated quantities of a release are unknown, however; possible sources are spillage from the drum pad and AST, and run-off from the wash pad.

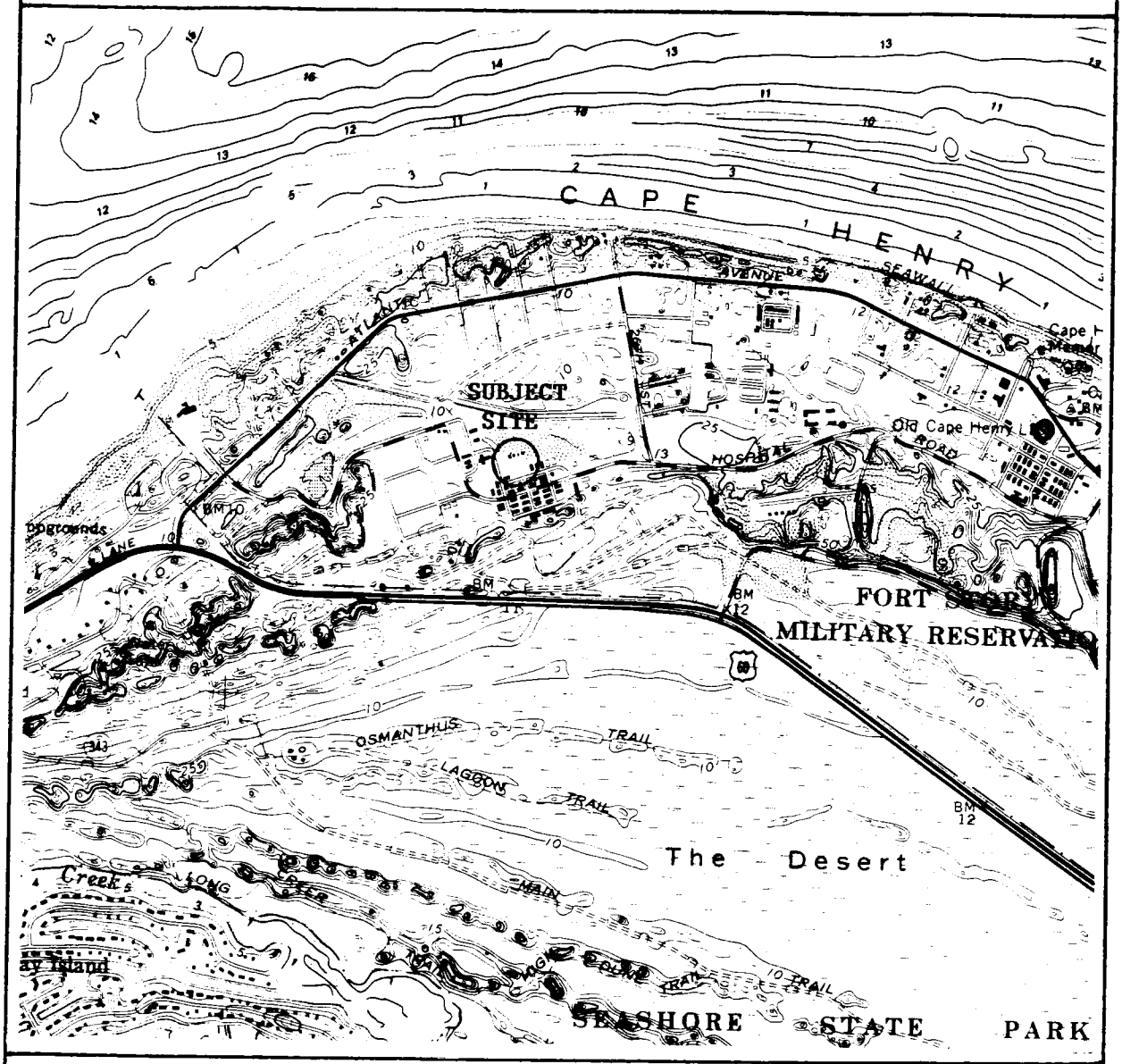
1.3 Physical/Chemical Properties of the Contaminant

Based on the analytical results from the soil and groundwater analyses of the samples obtained during this study, and the results of the Montgomery Site Assessment, the groundwater contaminants (TCE and PCE) and Methylene Chloride contaminant are most likely a result of solvents used during LARC decontamination events. The TPH and lead contamination of the soil in the LARC staging area are most likely a result of the discharge of bilge water from the vehicles and lead based paint removed from the LARC vehicles during sand blasting.

1.4 Free Product Removal Report

No free product was encountered during the Montgomery Site Assessment or during the SCR services performed by ERC. Free product removal reports are not warranted.

FIGURE 1 SITE LOCATION MAP
FORT STORY SITE CHARACTERIZATION



SCALE 1:24000

1 0 1 M

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 5 0 1 KILOMETER

CONTOUR INTERVAL 5 FEET

MN
GN

9° 160 MILS | 0°38' 11 MILS

UTM GRID AND 1986 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

QUADRANGLE LOCATION

CAPE HENRY, VA.

36076-H1-TB-024

1964

PHOTOREVISED 1986

BATHYMETRY ADDED 1986

DMA 5757 I NE-SERIES V834

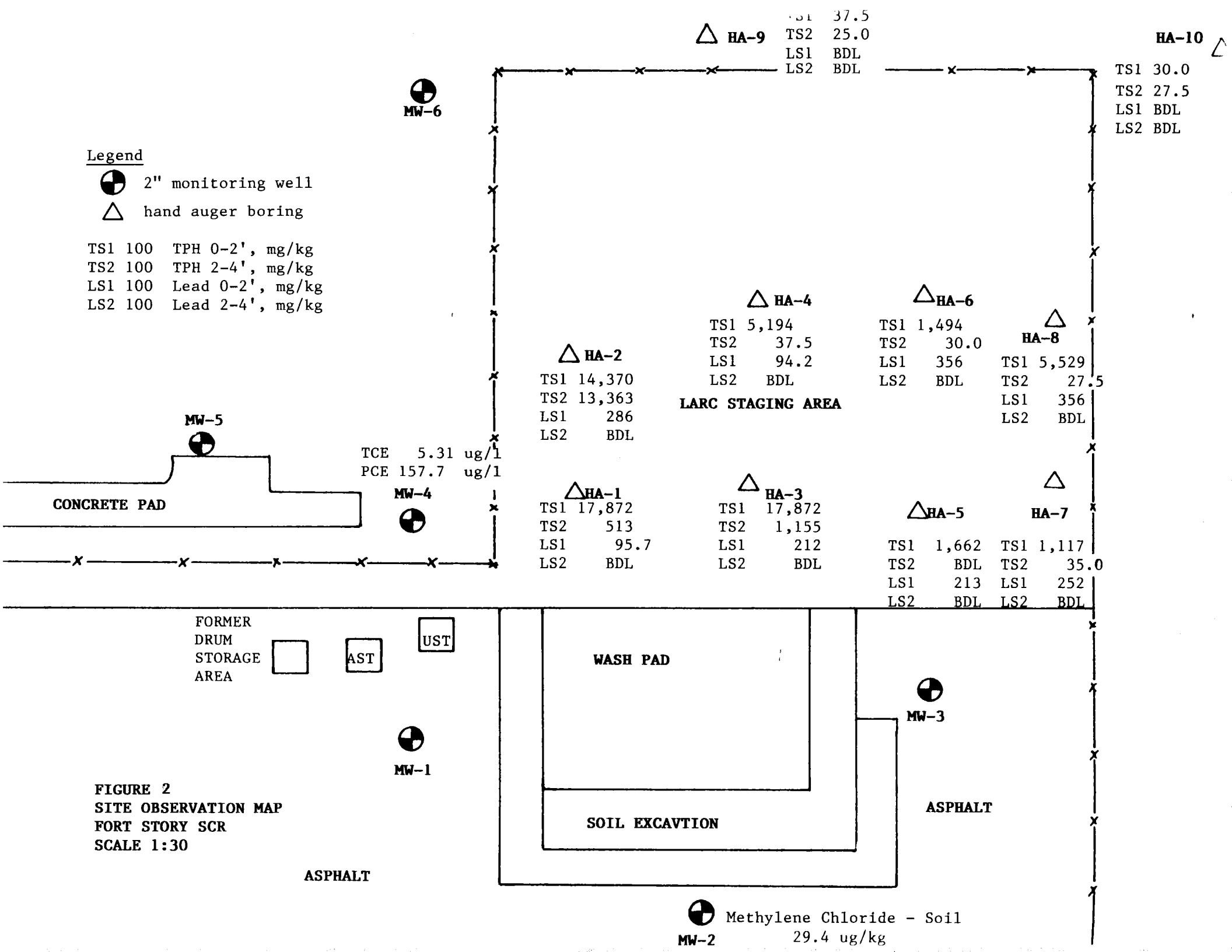


FIGURE 2
SITE OBSERVATION MAP
FORT STORY SCR
SCALE 1:30

1.5 Tank Capacities, Locations, and Contents

SUMMARY

One 1,000 gallon used oil UST (Tank # 1032)
One 250 gallon used antifreeze AST
Numerous 55 gallon drums, nor longer on-site

Tank #1032 tested tight on October 27, 1993.

1.6 Geology/Hydrogeology Site Information

Fort Story is located on Cape Henry, which is bounded by the Chesapeake Bay to the west and northwest, and the Atlantic Ocean to the northeast and east. Cape Henry is located on the Coastal Plain physiographical province. Coastal Plain sediments consist of an eastward thickening wedge of unconsolidated interbedded sands and clays with gravel lenses. Sediments are in excess of 3,500 feet thick and are underlain by crystalline bedrock.

Groundwater was encountered at depths of 3-8 feet below grade across the site. According to the Montgomery Site Assessment, groundwater was encountered at a depth of 8 feet during the month of February. This fluctuation may be due to the seasonal water cycle and tidal changes.

1.6.1 Site Geology/Topography

Soil encountered during monitoring well installation consisted primarily of tan, very loose to loose, fine, poorly graded sand.

The elevation of the site lies at approximately 10 feet above sea level. The topography of the site is characterized as relatively flat with sand dunes less than 10 feet high. Land features around the site consist of low sand ridges and sand flats. The southern half of the subject site is a flat asphalt parking area. The northern portion of the site is a low lying sand dunes and flats.

1.6.2 Subsurface Conduits

No man-made subsurface conduits exist on the subject site. Due to the uniform nature of the sandy sediments encountered in the six soil borings performed during this study, no natural conduits (fractures or lenses) are expected to exist beneath the subject site.

1.6.3 Pumping/injection wells

No pumping wells are located on either the subject site or within 1,000 feet of the subject site.

1.6.4 Drillers/geologic logs and monitoring well construction details

Soil Boring Logs and monitoring well construction details are included in Appendix A.

1.6.5 Aquifer characteristics

The following describes pertinent aquifer characteristics.

1.6.5.1 Name

A Final Site Investigation Report for the Fort Story Preliminary Assessment/Site Investigation and Fort Story NIKE Preliminary Assessment/Site Investigation was prepared by James M. Montgomery in January 1992 (Montgomery, 1992). A copy of the report was provided to ERC by the client. According to the report, the site is underlain by the unconfined Columbia Aquifer, which is composed of Holocene age sediments.

1.6.5.2 Thickness

According to Montgomery (1992) the Columbia Aquifer is approximately 120 feet thick.

1.6.5.3 Conductivity

ERC attempted to perform a rising head bailer test on monitoring well MW-1 during the sampling visit on May 19, 1994. After five minutes of constant bailing, a change in head could not be achieved. Groundwater removed from the well was discharged into a 5 gallon pail during the bailer test. Due to the unchanged head, groundwater recharge was estimated to be at least approximately one gallon per minute.

According to Montgomery (1992) the hydraulic conductivity for sediments of nearby groundwater monitoring well sites with similar sand soils ranged from $1.21X10^{-2}$ cm/sec to $1.24X10^{-2}$ cm/sec. These values appear to be representative of the subject site's sandy aquifer sediments.

1.6.5.4 Transmissivity

The transmissivity on the unconfined aquifer was estimated to be 1.47 ft^2/sec. The aquifer thickness is reported to be approximately 120 feet.

1.6.5.5 Hydraulic gradient

The hydraulic gradient between monitoring wells MW-1 and MW-6 is approximately 0.000167.

1.6.5.6 Flow velocity/direction

Hydraulic conductivity of the subsurface at this site is estimated to be $1.24X10^{-2}$ cm/sec. Porosity for this subsurface material is estimated to range from 25-50% (Freeze & Cherry). Figure 3 is the Groundwater Contour Map showing groundwater flow direction, determined from gauging data. Flow direction is generally toward the north. The gradient is estimated to be approximately 0.000167 ft/ft. Based on this gradient, a hydraulic conductivity value of $1.24X10^{-2}$ cm/sec, and an average estimated porosity of .37, Linear Groundwater Velocity was calculated to be $5.6X10^{-6}$ cm/sec or 5.6 ft/year.

Calculations:

Determination of Average Linear Velocity, V (Freeze and Cherry, 1979), where K is the estimated co-efficient of permeability, dh/dl is the hydraulic gradient and n is the estimated volumetric porosity (est. to be .37). To obtain velocity in feet per year, K must be converted to feet per year.

$$V = \frac{K(dh/dl)}{n}$$

therefore,

$$V = \frac{1.24X10^{-2} \text{ cm/sec } (0.000167 \text{ ft/ft})}{.37}$$

$V = 5.60X10^{-6}$ cm/sec or 5.6 ft/year

Note:The above calculated rate of flow assumes homogeneous medium, isotropic and constant hydraulic gradient.

1.6.5.7 Hydrogeologic Cross Section

Figure 4 is the Hydrogeologic Cross Section.

1.7 Water resources within 1,000 ft. of the site

The closest water body is an unnamed pond located approximately 1,000 southeast of the subject site, opposite of the direction of groundwater flow.

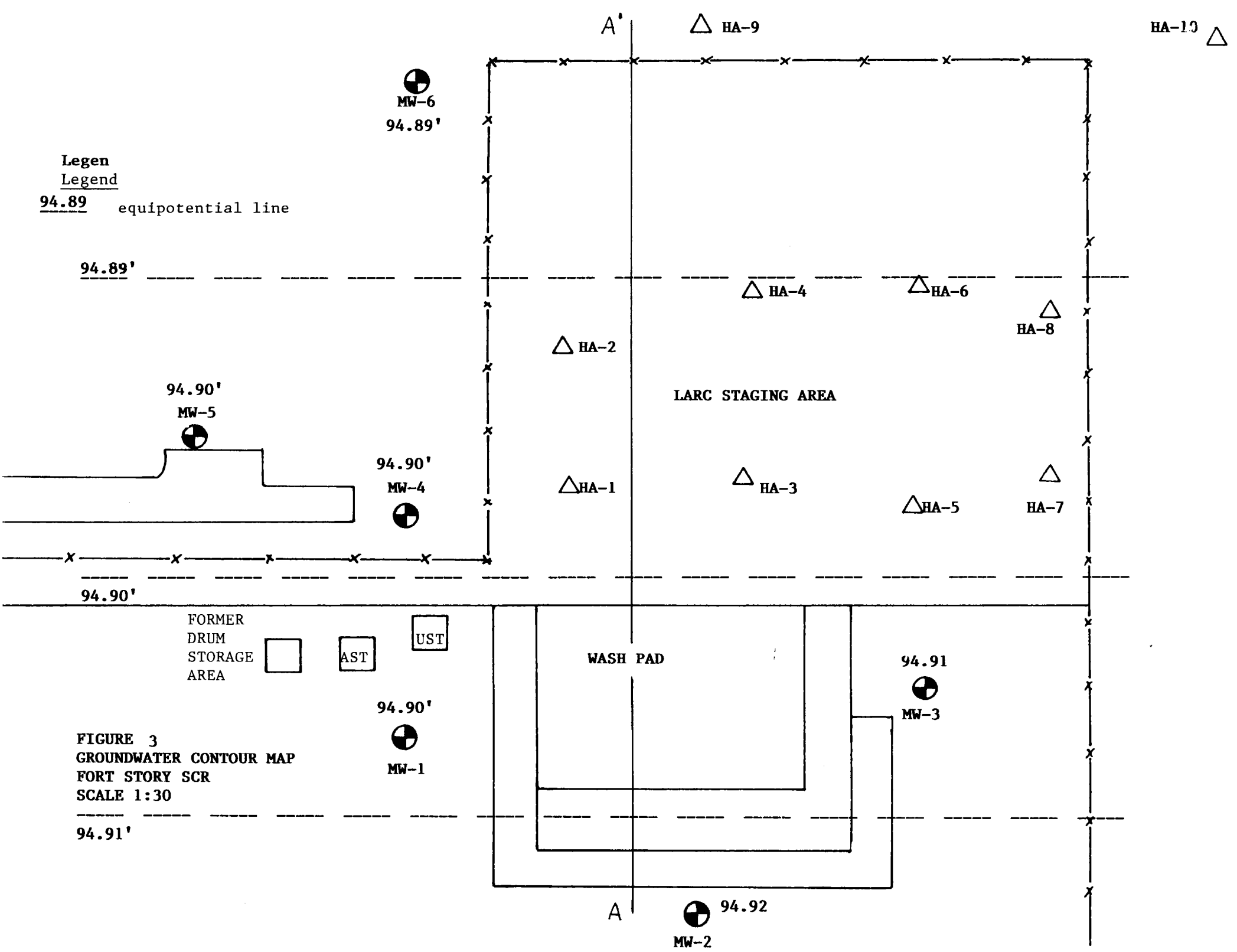


FIGURE 3
GROUNDWATER CONTOUR MAP
FORT STORY SCR
SCALE 1:30

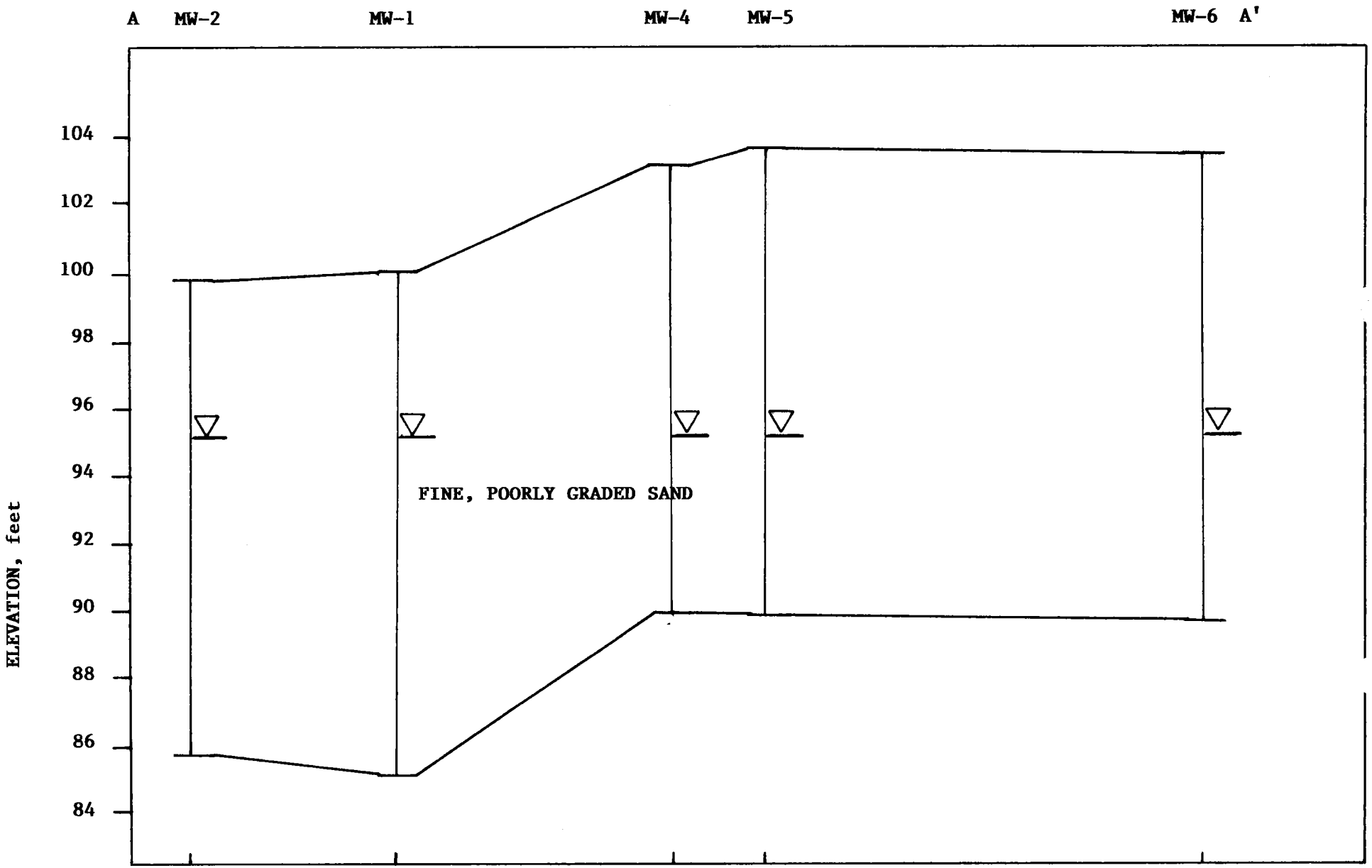


FIGURE 4
HYDROGEOLOGIC CROSS SECTION
FORT STORY SCR

1.8 Information as to Adjacent Property Owners and Potentially Affected Ground and surface water users

The properties adjacent to the subject site are part of the Fort Story Military installation. Adjacent parcels include: sand flats to the north and east; single-story military offices approximately 800 feet to the southeast; a grass-covered lot to the south; a maintenance shop approximately 300 feet to the southwest; asphalt-paved parking lot and sand flat immediately to the west; sand flat and military office building approximately 300 feet to the northwest. The office buildings are serviced by water and sewer utilities. No groundwater usage is practiced in the vicinity of the subject site.

1.9 Information on historical releases on site and adjacent properties

The 80th Division LARC 60 Area is used to maintain and wash the LARC vehicles. The wash pad consists of a 50 foot by 70 foot concrete pad bounded by asphalt on the east, south and west sides. The north side is bounded by sand. No water collection ditches or troughs are located around the wash pad. Surface run-off evaporates from the surface and infiltrates the sand along the northern margin of the wash pad. Surface run-off consisted of wash water with detergents, and bilge water that often contained some amount of oil and other lubricating fluids. A possible source of lead contamination in the soil is most likely a result of sand-blasting lead based paint from the LARC vehicles.

The 1,000 gallon used-oil UST is approximately 5 years old. A tank tightness test performed on the UST in October, 1993, indicated that the tank did <u>not</u> leak.

The used-antifreeze AST is located on a bermed concrete pad with an outlet valve. Dark staining was observed on the concrete pad and on the adjacent asphalt lot on the north side of the pad, indicating that spillage and run-off had occurred.

Dark staining was also observed on the asphalt in the former drum storage area.

Products that were leaked or spilled in these areas may have flowed to the edge of the asphalt and into the adjacent sand. However, aside from the reported releases of bilge water onto the wash pad and sand-blasting events, no spills or leakage have been reported for the area.

1.10 Potentially affected wells construction information.

No groundwater wells are located within 1,000 feet of the subject site, nor do any potentially affected receptors appear to be located within 1,000 feet of the subject site.

1.11 Current and projected groundwater/land use

Current Land Use

The site is owned and operated by the U.S. Government and is maintained as Fort Story USA. Therefore, development is strictly controlled and the site will be maintained as a military reservation. Groundwater usage at the site is not expected.

Projected Land Use

The projected land use for the site will be the same as its current use.

1.12 Description of vertical and lateral extent of contamination

1.12.1 Free Product Phase

No free product was detected in any of the six soil borings, 10 hand auger borings or six groundwater monitoring wells observed during this study.

1.12.2 Dissolved Phase

Dissolved phase contamination is limited to Trichloroethene (TCE) and Tetrachloroethene (PCE) detected in monitoring well MW-4, adjacent to the edge of asphalt, the antifreeze AST and the former drum storage pad. These contaminants were not detected in the groundwater samples obtained from monitoring wells MW-5 and MW-6, located approximately 40 feet northwest and 114 feet north of MW-4, respectively.

Other parameters analyzed for, but not detected, were Volatiles and Semi-volatiles, lead, and VOCs (Method 8240).

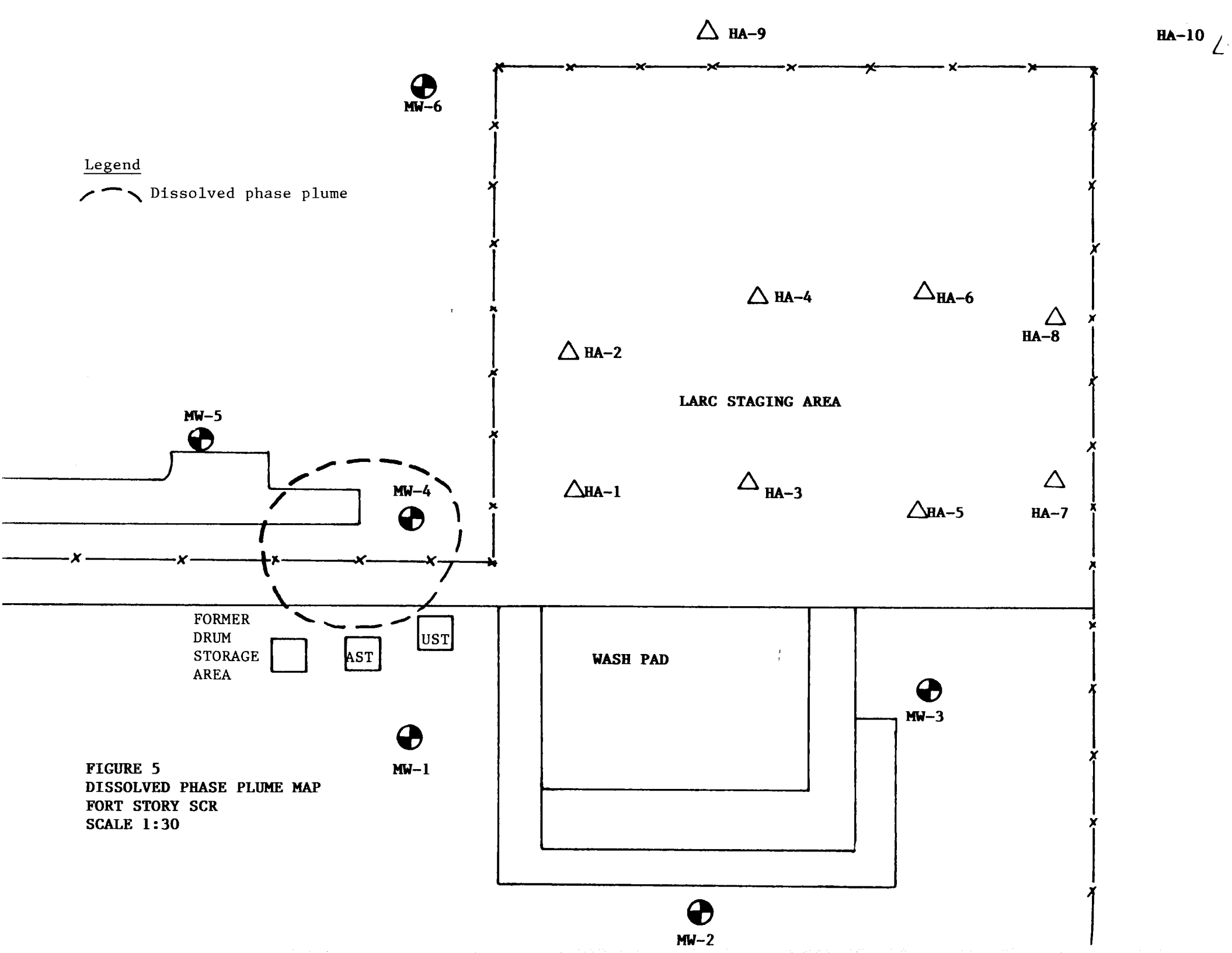


FIGURE 5
DISSOLVED PHASE PLUME MAP
FORT STORY SCR
SCALE 1:30

1.12.3 Residual Phase

Residual phase petroleum hydrocarbons (TPH) were encountered in 11 of 12 soil samples obtained from the soil borings performed for the groundwater monitoring wells. The TPH concentrations ranged from 25.0 mg/kg to 96.4 mg/kg. The higher concentrations detected were in soil samples that were obtained from 0-2 feet below grade. Soil samples obtained from the depth of the soil/groundwater interface exhibited TPH concentrations less than 32 mg/kg TPH. All of the TPH concentrations are below the DEQ's typical action level for TPH in soil (100 mg/kg). Results of the TPH concentrations in the soil borings are presented in Table I below.

TABLE I. SUMMARY OF LABORATORY ANALYSES

SAMPLE ID	DEPTH, feet	TPH, mg/kg	LEAD, mg/kg
MW-1	0-2	96.4	BDL
MW-2	0-2	53.3	84.9
MW-3	0-2	29.6	BDL
MW-4	0-2	47.7	86.5
MW-5	0-2	31.8	BDL
MW-6	0-2	29.6	BDL
MW-1	4-6	25.0	BDL
MW-2	4-6	31.8	BDL
MW-3	4-6	31.8	BDL
MW-4	6-8	BDL	BDL
MW-5	6-8	25.0	BDL
MW-6	6-8	27.3	BDL

BDL - Below Detection Limit

Residual phase petroleum hydrocarbons (TPH) were also encountered in the 10 hand augered soil borings performed around the LARC staging area north of the wash pad. Two soil samples were obtained from each of the 10 hand auger borings; one sample from a depth of 0-2 feet, and the second sample from a depth of 2-4 feet, the depth of the approximate soil/groundwater interface. Of the 10 soil samples obtained from the surface borings (0-2 feet), 8 samples exhibited TPH concentrations ranging from 1,111 mg/kg to 17,872

mg/kg. The two other surface soil samples exhibited TPH concentrations of 37.5 and 35.0 mg/kg. These samples were outside of the immediate staging area and were considered background concentrations. Results of the TPH concentrations in the hand auger soil borings are presented in Table II below.

1.12.4 Vapor Phase

Soil cuttings and soil samples were screened using a Foxboro brand Organic Vapor Analyzer (OVA). OVA readings from the soil borings were non-detectable. OVA readings for the soil excavated during the hand auger borings ranged from 0-60 parts per million(ppm).

1.12.5 Plume Migration Direction and Rate

The contamination plume of TCE and PCE is expected to migrate in the same direction and at a similar velocity as the groundwater flow direction; to the north at approximately 5.6 feet/year See Figure 3).

1.12.6 Sampling/monitoring results

The sampling and monitoring results are found in Appendix B.

2.0 RISK ASSESSMENT

2.1 Description of Demographics

The site is located on the Fort Story military reservation, on Cape Henry, north of Virginia Beach, Virginia.

Population on and around the site is estimated to be less than 100 people between the hours of 8:00 am and 5:00 pm. This estimate is based on site and adjacent site usage and visits to the on-site and nearby facilities.

2.2 Impacted and Potentially Receptors

The contaminants of concern are TPH and lead, found in high concentrations in the LARC storage area, and TCE and PCE found as dissolved phase contaminants in the groundwater in monitoring well MW-4.

The soil in monitoring well MW-2 exhibited a Methylene Chloride concentration of 29.4 ug/L, which is well below the EPA Risk based typical action level of 85 ppm in residential soil.

No human receptors have been identified as impacted by the TCE and PCE. Neither stressed vegetation nor stressed animals have been observed on the site.

The shallow soil of the LARC staging area has been impacted by TPH and lead. The soil is exposed at the surface and is composed of loose, poorly-graded sand. Travel through the area would expose persons to the impacted soil and should be avoided.

2.3 Exposure Pathways for Receptors

Fort Story is a restricted access military installation. The subject site is located within a fenced, secured area with little thru-traffic.

TCE and PCE are highly mobile in soil and readily leach into the groundwater. Their high vapor pressure indicates that they exist as vapor phase above the water table. Due to the shallow groundwater table encountered on-site, exposure to the vapor phase around monitoring well MW-4 is likely when the aquifer is encountered.

The TPH and lead that impacted the soil in the LARC staging area appeared as a dark waxy film on the sand.

2.3.1 Ingestion

Ingestion of the on-site contaminants is unlikely due to the activities that take place on-site, and the depth of the contaminated groundwater and Methylene Chloride contaminated soil. The possibility of ingestion of the TPH and lead contaminated soil does exist, since it is located on the surface. Proper personal protective equipment (PPE) and hygiene will help reduce the risk of ingestion.

2.3.2 Dermal contact

Dermal contact with the TCE, PCE, Methylene Chloride, lead and TPH is possible during excavation or drilling. Contact can be minimized through the use of proper PPE.

2.3.3 Inhalation

Inhalation of contaminant vapors and dusts is possible during excavation and drilling.

2.3.4 Other

Not applicable.

2.4 Exposure Levels for Receptors

The U.S. EPA Drinking Water Standard lists a TCE maximum contaminant level of 5 parts per billion (ppb). No comparable standard has been set for PCE.

The Virginia Department of Environmental Quality's (DEQ) typical action level for TPH in soil is 100 mg/kg.

The U.S. EPA typical risk based concentration for Methylene Chloride is 85 mg/kg for residential soil, and 380 mg/kg for industrial soil.

According to the VDEQ's Voluntary Remediation Program standards, 87 ppm total lead is not considered elevated. Total lead concentrations of MW-2 and MW-4 ranged from 84.9 ppm to 86.5 ppm. Total lead concentrations of the soil samples obtained from the shallow hand auger soil borings are significantly higher, ranging from 212 ppm to 356 ppm.

2.4.1 Exposure level determination

2.4.1.1 Tap water sample

A tap water sample was not collected.

2.4.1.2 Direct well sample

No groundwater supply wells are located either on-site or within 1,000 feet of the subject site.

2.4.1.3 Surface water sample

No surface water samples were collected. The nearest surface water body is an unnamed pond located approximately 1,000 feet southeast of the site. Groundwater is expected to flow north beneath the site, opposite of the direction of the pond.

2.4.1.4 OVA and location of measurements

OVA reading of the soil cutting from the monitoring well borings were non-detectable. OVA readings of the hand auger borings ranged from 0-60 ppm.

2.4.1.5 Extrapolation

Not applicable.

2.4.1.6 Other

Not applicable.

2.5 Evaluation of Existing/Potential Risk to Receptors

Because the subsurface contamination is believed to be minor in quantity, the risk for potential and existing receptors appears to be negligible.

However, elevated lead and TPH concentrations were detected in the shallow soil of the LARC staging area. Traffic through this area is primarily by vehicle, however; foot traffic is possible. TPH and lead can be picked up on footwear and clothing and carried onto the vehicles and elsewhere.

2.6 Evaluation of Existing/Potential Risk to Environment

Detectable TCE and PCE concentrations are present in the vicinity of monitoring well MW-4. Neither of these contaminants are present in monitoring wells MW-1, MW-5 and MW-6, which surround monitoring well MW-4. The concentration of TCE (5.31 ug/L) is only slightly above the U.S. EPA's drinking water standard of 5 mg/L. No standard has been set for PCE. Due to these conditions, the TCE and PCE contamination is believed to be minor and does not appear, nor is expected, to have a significant impact to the environment.

Methylene Chloride in the soil around monitoring well MW-2 is present in a very low concentration and is not expected to have a significant impact to the soil or groundwater.

Elevated TPH and lead concentrations were detected in the shallow soil of the LARC staging area. Elevated TPH concentrations were also detected in three soil samples obtained from the soil/groundwater interface. Due to the shallow groundwater table, the potential for leaching TPH and lead from the soil does exist.

Even though the subsurface contamination is believed to be minor in the groundwater and in the soil around monitoring well MW-2, the TPH and lead contamination in the LARC staging area provides the potential for further environmental damage is possible if these contaminants are not removed.

2.7 Evaluation/Provision of Alternate Water Supply

Since the subject site is serviced by public utilities, the need for an alternative water supply is not warranted.

3.0 REMEDIATION ASSESSMENT

3.1 Remediation Feasibility

The goals of a Remedial Action Plan are to remove the source of contamination, to reduce the contamination concentration, and to reduce the areal and vertical extent of the contamination plume.

The source of the TCE and PCE contamination is reported to be from spillage of stored products from either the former drum storage area or aboveground storage tank. Remediation of the contaminated groundwater is feasible considering the limited lateral and vertical extent of contamination encountered, if required.

The source of the TPH and lead contamination is most likely from the maintenance of the LARC vehicles. Remediation of the contaminated soil is feasible considering the limited lateral and vertical extent of the contaminated soil both vertically and horizontally.

3.2 Projected Remediation Endpoints Based on Site, Risk, and Remediation Assessments

3.2.1 Free Product

No free product was encountered in either the soil or the ground water.

3.2.1 Dissolved

Dissolved phase TCE and PCE contamination was encountered in MW-4. The contaminant concentrations are considered low and are not expected to pose a risk to the environment. A no-action approach appears appropriate with endpoints established at present concentrations.

3.2.3 Residual

Residual phase petroleum hydrocarbons and lead were encountered in the shallow soil of the LARC staging area. Leaching of these contaminants to the shallow aquifer is possible, and the soil should be removed from the site to prevent groundwater contamination. The endpoint for residual phase contamination would be less than 100 ppm, the VDEQ's typical action level for TPH in soil.

3.2.4 Vapor

Vapor phase petroleum hydrocarbons were detected in the hand auger soil borings performed in the LARC staging area. The endpoint for vapor phase contamination would be background levels.

3.3 Description and Evaluation of Applicable Technologies

Generally, remediation of a product release such as this can be handled in five different ways:

(1) Excavation - An optimal solution for near surface contamination, but geometrically more expensive with depth due to the volume of material to be removed and treated and due to the increased difficulty of excavation with depth. Excavation of the TPH and lead contaminated soil in the LARC staging area is the most practical option due to the shallow soil contamination.

(2) Trenching/Pumping - A very effective solution for the containment and removal of TCE and PCE contamination. This could be a viable option for remediation at this site, if required.

(3) Recovery Wells - A good solution for many recovery systems as it provides great recovery potential for free product and dissolved phase contamination while slowing down the migration. This could be a viable option for remediation at this site, if required.

(4) Vapor Recovery - Most effective for recovery of highly volatile compounds in contaminated soils. This method is not practical due to the nature of the TPH contamination of the soil in the LARC staging area.

(5) Bioremediation - Most effective in well aerated contaminated soils where indigenous micro organisms have a sufficient oxygen supply to function (i.e. microbiological breakdown and digestion of petroleum hydrocarbons). Natural bioremediation may or may not be a recommended approach for this site. A further study to determine the feasibility would be necessary.

(6) No Action/Monitoring Schedule - Effective when the quantity of contamination is small and that potentially impacted water supplies or receptors can be monitored. This is best performed by siting monitoring wells between the potential receptor and the source or origin of the contamination and monitoring these wells on a schedule frequency applicable to site conditions. This alternative is applicable for the TCE and PCE contamination.

3.3.1 Design for each Applicable Technologies

Detail design of the applicable would be furnished in the Corrective Action Plan. The following are the general designs for the applicable technologies.

(1) Excavation - Excavation is typically performed in conjunction with field screening soil samples with a PID. When it is apparent that the contamination has been removed, as indicated by the PID, then excavation is discontinued. Soil samples are then taken and analyzed to confirm the removal of contamination.

(2) Trenching/Pumping - Typically a trench is excavated down gradient of the UST excavation. The trench is excavated perpendicular to the direction of groundwater movement, below the groundwater table. Perforated pipe backfilled with crushed stone is placed in the trench to collect water. The collected water is pumped out and treated to acceptable standards prior to discharge.

(3) Recovery Wells - Recovery well(s) are sited near the center of the contamination plume. Pumps in the recovery wells are adjusted to maintain a cone of depression that captures the

plume. The cone of depression reverses the downgradient hydraulic gradient. The groundwater that is pumped out is treated to acceptable standards prior to discharge.

(4) Vapor Recovery - Vapor recovery well(s) are sited near the center of the contamination plume. A vacuum is pulled on these wells and the air is striped of petroleum hydrocarbons prior to discharge to the atmosphere.

(5) Bioremediation - Natural bioremediation utilizes indigenous micro organisms that consume petroleum hydrocarbons. The population growth of the organisms can be enhanced by introducing oxygen and nutrients into the subsurface. Careful monitoring is required to maintain optimal conditions.

(6) No Action Monitoring Schedule - A groundwater monitoring well sampling schedule applicable to site conditions is conducted to ensure that the water supply and other potentially impacted receptors are not contaminated.

3.3.2 Timeframe for Implementation and Duration for each Applicable Technology to Achieve Projected Remediation Endpoints

TECHNOLOGY	DURATION
SOIL EXCAVATION	1 WEEK
TRENCHING/PUMPING	APPROX. 1-5 YEARS
RECOVERY WELLS	APPROX. 1-5 YEARS
VAPOR RECOVERY	APPROX. 1-5 YEARS
SOIL BIOREMEDIATION	APPROX. 1-2 YEARS
NO ACTION MONITORING SCHEDULE	1-3 YEARS

3.3.3 Projected Costs for each Applicable Technology to Achieve Projected Remediation Endpoints

TECHNOLOGY	DURATION
SOIL EXCAVATION	$10 - $100K
TRENCHING/PUMPING	$10 - $100K
RECOVERY WELLS	$10 - $100K
VAPOR RECOVERY	$10 - $100K
SOIL BIOREMEDIATION	$5 - $75K
NO ACTION MONITORING SCHEDULE	$5 - $15K

3.3.4 Achievable Endpoints for each Applicable Technology

TECHNOLOGY	DURATION
SOIL EXCAVATION	$10 - $100K
TRENCHING/PUMPING	$10 - $100K
RECOVERY WELLS	$10 - $100K
VAPOR RECOVERY	$10 - $100K
SOIL BIOREMEDIATION	$5 - $75K
NO ACTION MONITORING SCHEDULE	$5 - $15K

3.3.4.1 Free Product

No free product was encountered during this study.

3.3.4.2 Dissolved

No action approach with monitoring is proposed.

3.3.4.3 Residual

Soil in the LARC staging area will contain less than 100 ppm TPH.

3.3.4.4 Vapor

All soil vapors remaining would be below 100 ppm TPH.

3.3.5 Estimated Timeframe for Achieving Endpoints for each Applicable Technology

TECHNOLOGY	DURATION
SOIL EXCAVATION	6 Months
TRENCHING/PUMPING	APPROX. 1 - 5 YEARS
RECOVERY WELLS	APPROX. 1 - 5 YEARS
VAPOR RECOVERY	APPROX. 1 - 5 YEARS
SOIL BIOREMEDIATION	APPROX. 1 - 2 YEARS
NO ACTION MONITORING SCHEDULE	1 - 3 YEARS

3.4 Recommendation of Most Appropriate Technologies with Costs

A wash water collection system has been planned for the wash pad. This system should be designed to collect run-off from all sides of the pad. Efforts should also be made to repair all possible leaks in the wash pad joints and cracks in the adjacent asphalt surfacing.

The TCE and PCE contamination present appears to be isolated around MW-4 and in low concentrations. Due to the limited extent of contamination and the low concentrations, the potential risk to the environment appears to be minimal. Therefore, a no action monitoring approach is recommended.

Residual phase TPH and lead contamination is present in the LARC staging area. Leaching of these contaminants from the soil to the groundwater is possible. Soil exhibiting greater than 100 ppm should be excavated and disposed of at an appropriate landfill. In-situ soil should be sampled and analyzed for TPH and lead to verify the contaminated soil has been excavated from the site.

REFERENCES

American Society for Testing and Materials (ASTM), 1987, Section 4, v. 04.08, Philadelphia, PA, p. 296-301.

Freeze, R. A. and Cherry, J. A., 1979, Groundwater, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, p. 604.

APPENDIX A

Soil Boring Logs and Monitoring Well Construction Illustrations

BORING LOG

Client: FORT EUSTIS — **ERC Project No.** 965

Project: FORT STORY SCR — **Weather:** SUNNY, WARM

Boring: MW-1 — **Depth:** 15' — **Auger:** 8" hollow — **Started:** 5-12-94

Driller: Bedford Drilling — **Inspector:** JEFF CORON — **Completed:** 5-12-94

Depth (ft)	Description	Blow Counts	Sample Depth	PID (ppm)	Remarks
	tan, moist, well graded sand	---	3-5	0	
5.0		---	5-7	0	Groundwater encountered at approx. 5 feet
10.0					
15.0	tan, wet, well graded sand	---	15-17	0	Boring terminated at 15 feet 15 foot well set
20.0					
25.0					
30.0					

Notes: Set MW-1 at 15 ft
10 ft of .01 ft slotted PVC screen
5 ft PVC 2.0" diameter riser

BORING LOG

Client: FORT EUSTIS — **ERC Project No.** 965

Project: FORT STORY SCR — **Weather:** SUNNY, WARM

Boring: MW-2 — **Depth:** 14' — **Auger:** 8" hollow — **Started:** 5-13-94

Driller: Bedford Drilling — **Inspector:** JEFF CORON — **Completed:** 5-13-94

Depth (ft)	Description	Blow Counts	Sample Depth	PID (ppm)	Remarks
5.0	tan, moist, well graded sand	---	3-5	0	Groundwater encountered at approx. 5 feet
10.0					
15.0	tan, wet, well graded sand	---	14-16	0	Boring terminated at 14 feet 14 foot well set
20.0					
25.0					
30.0					

Notes: Set MW- 2 at 14 ft
10 ft of .01 ft slotted PVC screen
4 ft PVC 2.0" diameter riser

BORING LOG

Client: FORT EUSTIS — **ERC Project No.** 965

Project: FORT STORY SCR — **Weather:** SUNNY, WARM

Boring: MW-3 — **Depth:** 13.5 — **Auger:** 8" hollow — **Started:** 5-13-94

Driller: Bedford Drilling — **Inspector:** JEFF CORON — **Completed:** 5-13-94

Depth (ft)	Description	Blow Counts	Sample Depth	PID (ppm)	Remarks
5.0	tan, moist, well graded sand	---	3-5	0	Groundwater encountered at approx. 5 feet
10.0					
15.0	tan, wet, well graded sand	---	13.5-15	0	Boring terminated at 13.5 feet 13.5 foot well set
20.0					
25.0					
30.0					

Notes: Set MW-3 at 13.5 ft
10 ft of .01 ft slotted PVC screen
3.5ft PVC 2.0" diameter riser

BORING LOG

Client: FORT EUSTIS — **ERC Project No.** 965

Project: FORT STORY SCR — **Weather:** SUNNY, WARM

Boring: MW-4 — **Depth:** 13' — **Auger:** 8" hollow — **Started:** 5-13-94

Driller: Bedford Drilling — **Inspector:** JEFF CORON — **Completed:** 5-13-94

Depth (ft)	Description	Blow Counts	Sample Depth	PID (ppm)	Remarks
	tan, moist, well graded sand	---	4-6	0	
5.0		---	6-8	0	Groundwater encountered at approx. 8 feet
10.0					
	tan, wet, well graded sand	---	13-15	0	Boring terminated at 13 feet
15.0					13 foot well set
20.0					
25.0					
30.0					

Notes: Set MW-4 at 13 ft
10 ft of .01 ft slotted PVC screen
4 ft PVC 2.0" diameter riser

BORING LOG

Client: FORT EUSTIS — **ERC Project No.** 965

Project: FORT STORY SCR — **Weather:** SUNNY, WARM

Boring: MW-5 — **Depth:** 13' — **Auger:** 8" hollow — **Started:** 5-13-94

Driller: Bedford Drilling — **Inspector:** JEFF CORON — **Completed:** 5-13-94

Depth (ft)	Description	Blow Counts	Sample Depth	PID (ppm)	Remarks
5.0	tan, moist, well graded sand	---	4-6	0	
		---	6-8	0	Groundwater encountered at approx. 8 feet
10.0	tan, wet, well graded sand	---	13-15		Boring terminated at 13 feet
15.0					13 foot well set
20.0					
25.0					
30.0					

Notes: Set MW- 5 at 13 ft
10 ft of .01 ft slotted PVC screen
3 ft PVC 2.0" diameter riser

BORING LOG

Client: FORT EUSTIS — **ERC Project No.** 965

Project: FORT STORY SCR — **Weather:** SUNNY, WARM

Boring: MW-6 — **Depth:** 13.5' — **Auger:** 8" hollow — **Started:** 5-13-94

Driller: Bedford Drilling — **Inspector:** JEFF CORON — **Completed:** 5-13-94

Depth (ft)	Description	Blow Counts	Sample Depth	PID (ppm)	Remarks
5.0	tan, moist, well graded sand	---	6-8	0	Groundwater encountered at approx. 8 feet
10.0					
15.0	tan, wet, well graded sand	---	13-15	0	Boring terminated at 13.5 feet 13.5 foot well set
20.0					
25.0					
30.0					

Notes: Set MW-6 at 13.5 ft
10 ft of .01 ft slotted PVC screen
3.5ft PVC 2.0" diameter riser

APPENDIX B

Analytical Results

CONSULTING CHEMISTS & LABORATORY SERVICES

ENVIROCOMPLIANCE
LABORATORIES, INC.

ROUTE 4, BOX 286 A
(RT. 1 & OLD KEETON RD.)
GLEN ALLEN, VA 23060
(804) 550-3971 FAX 550-3826

Certificate of Analysis

Project No. :
Project Name : Ft. Story #4418
Submitted by : Jeff Coron
Date Received: May 26, 1994
Date Issued : June 03, 1994

Reference Method: MCAWW Method 418.1

Twelve soil samples labeled MW-1 0-2', MW-2 0-2', MW-3 0-2', MW-4 0-2', MW-5 0-2', MW-6 0-2', MW-1 4-6', MW-2 4-6', MW-3 4-6', MW-4 4-6', MW-5 3-5', MW-6 3-5' were analyzed for TPH.

Sample ID	TPH mg/kg
MW-1 0-2'	96.4
MW-2 0-2'	53.3
MW-3 0-2'	29.6
MW-4 0-2'	47.7
MW-5 0-2'	31.8
MW-6 0-2'	29.6
MW-1 4-6'	25.0
MW-2 4-6'	31.8
MW-3 4-6'	31.8
MW-4 4-6' } 6-8' J.C.	BDL
MW-5 3-5' } 6-8' J.C.	25.0
MW-6 3-5' } 6-8' J.C.	27.3
Detection Limit	25.0

Reference Method: MCAWW Method 239.1

Twelve soil samples labeled MW-1 0-2', MW-2 0-2', MW-3 0-2', MW-4 0-2', MW-5 0-2', MW-6 0-2', MW-1 4-6', MW-2 4-6', MW-3 4-6', MW-4 4-6', MW-5 3-5', MW-6 3-5' were analyzed for Lead.

Sample ID	Lead mg/kg
MW-1 0-2'	BDL
MW-2 0-2'	84.9
MW-3 0-2'	BDL
MW-4 0-2'	86.5
MW-5 0-2'	BDL
MW-6 0-2'	BDL
MW-1 4-6'	BDL
MW-2 4-6'	BDL
MW-3 4-6'	BDL
MW-4 4-6' } 6-8' J.C	BDL
MW-5 3-5' } 6-8' J.C	BDL
MW-6 3-5' } 6-8' J.C	BDL
Detection Limit	12.5

BDL = Below Detection Limit

Carmela Tombes
Laboratory Manager

R4506431-1

ENVIROCOMPLIANCE
LABORATORIES, INC.

CONSULTING CHEMISTS & LABORATORY SERVICES
ROUTE 4, BOX 286 A
(RT. 1 & OLD KEETON RD.)
GLEN ALLEN, VA 23060
(804) 550-3971 FAX 550-3826

Certificate of Analysis

Project No. :
Project Name : Ft. Story #4418
Submitted by : Jeff Coron
Date Received: May 26, 1994
Date Issued : June 03, 1994

Reference Method: SW-846 Method 8240

Six soil samples labeled MW-1 0-2', MW-2 0-2', MW-3 0-2', MW-4 0-2', MW-5 0-2', MW-6 0-2' were analyzed for the following Volatile Organics.

Analyte	MW-1 0-2' ug/kg	MW-2 0-2' ug/kg	MW-3 0-2' ug/kg	MW-4 0-2' ug/kg	MW-5 0-2' ug/kg	MW-6 0-2' ug/kg	DL ug/kg
Chloromethane	BDL	BDL	BDL	BDL	BDL	BDL	20.0
Bromomethane	BDL	BDL	BDL	BDL	BDL	BDL	20.0
Vinyl Chloride	BDL	BDL	BDL	BDL	BDL	BDL	20.0
Chloroethane	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Methylene Chloride	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Trichlorofluoromethane	BDL	BDL	BDL	BDL	BDL	BDL	5.0
1,1-Dichlorethene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
1,1-Dichloroethane	BDL	BDL	BDL	BDL	BDL	BDL	5.0
trans-1,2-Dichloroethene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Chloroform	BDL	BDL	BDL	BDL	BDL	BDL	5.0
1,2-Dichloroethane	BDL	BDL	BDL	BDL	BDL	BDL	5.0
1,1-Trichloroethane	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Carbon Tetrachloride	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Bromodichloromethane	BDL	BDL	BDL	BDL	BDL	BDL	5.0
1,2-Dichloropropene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
cis-1,3-Dichloropropene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Trichloroethene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Benzene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Dibromochloromethane	BDL	BDL	BDL	BDL	BDL	BDL	5.0
1,1,2-Trichloroethane	BDL	BDL	BDL	BDL	BDL	BDL	5.0
trans-1,3-Dichloropropene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Bromoform	BDL	BDL	BDL	BDL	BDL	BDL	5.0
1,1,2,2-Tetrachloroethane	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Tetrachloroethene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Toluene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Chlorobenzene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Ethylbenzene	BDL	BDL	BDL	BDL	BDL	BDL	10.0
1,4-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	BDL	10.0
1,3-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	BDL	10.0
1,2-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	BDL	10.0
Xylene	BDL	BDL	BDL	BDL	BDL	BDL	10.0

BDL = Below Detection Limit

Carmela Tombes
Laboratory Manager

R4506431-2

CONSULTING CHEMISTS & LABORATORY SERVICES

ENVIROCOMPLIANCE
LABORATORIES, INC.

ROUTE 4, BOX 286 A
(RT. 1 & OLD KEETON RD.)
GLEN ALLEN, VA 23060
(804) 550-3971 FAX 550-3826

Certificate of Analysis

Project No. :
Project Name : Ft. Story #4418
Submitted by : Jeff Coron
Date Received: May 26, 1994
Date Issued : June 03, 1994

Reference Method: SW-846 Method 8240

Six soil samples labeled MW-1 4-6', MW-2 4-6', MW-3 4-6', MW-4 4-6', MW-5 3-5', MW-6 3-5' were analyzed for the following Volatile Organics.

Analyte	MW-1 4-6' ug/kg	MW-2 4-6' ug/kg	MW-3 4-6' ug/kg	MW-4 4-6' ug/kg	MW-5 3-5' ug/kg	MW-6 3-5' ug/kg	DL ug/kg
Chloromethane	BDL	BDL	BDL	BDL	BDL	BDL	20.0
Bromomethane	BDL	BDL	BDL	BDL	BDL	BDL	20.0
Vinyl Chloride	BDL	BDL	BDL	BDL	BDL	BDL	20.0
Chloroethane	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Methylene Chloride	BDL	29.4	BDL	BDL	BDL	BDL	5.0
Trichlorofluoromethane	BDL	BDL	BDL	BDL	BDL	BDL	5.0
1,1-Dichlorethene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
1,1-Dichloroethane	BDL	BDL	BDL	BDL	BDL	BDL	5.0
trans-1,2-Dichloroethene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Chloroform	BDL	BDL	BDL	BDL	BDL	BDL	5.0
1,2-Dichloroethane	BDL	BDL	BDL	BDL	BDL	BDL	5.0
1,1-Trichloroethane	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Carbon Tetrachloride	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Bromodichloromethane	BDL	BDL	BDL	BDL	BDL	BDL	5.0
1,2-Dichloropropene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
cis-1,3-Dichloropropene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Trichloroethene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Benzene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Dibromochloromethane	BDL	BDL	BDL	BDL	BDL	BDL	5.0
1,1,2-Trichloroethane	BDL	BDL	BDL	BDL	BDL	BDL	5.0
trans-1,3-Dichloropropene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Bromoform	BDL	BDL	BDL	BDL	BDL	BDL	5.0
1,1,2,2-Tetrachloroethane	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Tetrachloroethene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Toluene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Chlorobenzene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Ethylbenzene	BDL	BDL	BDL	BDL	BDL	BDL	10.0
1,4-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	BDL	10.0
1,3-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	BDL	10.0
1,2-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	BDL	10.0
Xylene	BDL	BDL	BDL	BDL	BDL	BDL	10.0

BDL = Below Detection Limit

Carmela Tombes
Laboratory Manager

R4506431-3

CHAIN OF CUSTODY

EnviroCompliance Laboratories, Inc.
Rt. 4 Box 286A (804)550-3971
Glen Allen, Virginia 23060

Page ____ of ____

Client : ERC Fredricksburg

Submit to : _____

PROJECT NO. | PROJECT NAME: Fort Story #4418

SAMPLERS: (Signatures) (Print) JEFF COLON

STATION	DATE	TIME	COMP	GRAB	SAMPLE IDENTIFICATION	# Cont	Matrix	ANALYSES: TPH 418.1	VOC 8240	Lead
	5/12				1. MW 1 0-2'	2	S	✓	✓	✓
	5/13				2. MW-2 0-2'	2	S	✓	✓	✓
	↓				3. MW-3 0-2'	2	S	✓	✓	✓
					4. MW-4 0-2'	2	S	✓	✓	✓
					5. MW-5 0-2'	2	S	✓	✓	✓
	↓				6. MW-6 0-2'	2	S	✓	✓	✓
	5/12				7. MW-1 4-6'	2	S	✓	✓	✓
	5/13				8. MW-2 4-6'	2	S	✓	✓	✓
					9. MW-3 4-6'	2	S	✓	✓	✓
					10. MW-4 4-6'	2	S	✓	✓	✓
					11. MW-5 3-5' (6-8')	2	S	✓	✓	✓
	↓				12. MW-6 3-5' X	2	S	✓	✓	✓
					13.					
					14.					
					15.					
					16.					
					17.					
					18.					
					19.					
					20.					

Address : _____

City : _____

Phone : _____ Fax: _____

PO No. : _____

1.
2. Reference to
3. COC 04049
4. R4506346
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Relinquished by: (Signature)	Date	Time	Received by: (Signature)
			Howard D. Ivey
Relinquished by: (Signature)	Date	Time	Received by: (Signature)
Relinquished by: (Signature)	Date	Time	Received for Lab by:

LAB USE ONLY

ERC R4506431
Due: 5-Day from 05-26-1994
TPH 8240 PB

W=Water S=Soil O=Organic Aq=Aqueous Sl=Sludge F=Filter M=Misc.

CONSULTING CHEMISTS & LABORATORY SERVICES

ENVIROCOMPLIANCE
LABORATORIES, INC.

ROUTE 4, BOX 286 A
(RT. 1 & OLD KEETON RD.)
GLEN ALLEN, VA 23060
(804) 550-3971 FAX 550-3826

Certificate of Analysis

Project No. : 4418
Project Name : Ft. Story
Submitted by : Jeff Coron
Date Received: May 23, 1994
Date Issued : May 31, 1994

Reference Method: SW-846 Modified Method 8015

Six water samples labeled MW-1, MW-2, MW-3, MW-4, MW-5, MW-6 were analyzed for Volatiles and Semi-volatiles.

Sample ID	Volatiles mg/l	Semi-volatiles mg/l
MW-1	BDL	BDL
MW-2	BDL	BDL
MW-3	BDL	BDL
MW-4	BDL	BDL
MW-5	BDL	BDL
MW-6	BDL	BDL
Detection Limit	0.5	0.5

Reference Method: MCAWW Method 239.1

Six water samples labeled MW-1, MW-2, MW-3, MW-4, MW-5, MW-6 were analyzed for Lead.

Sample ID	Lead mg/l
MW-1	BDL
MW-2	BDL
MW-3	BDL
MW-4	BDL
MW-5	BDL
MW-6	BDL
Detection Limit	0.5

BDL = Below Detection Limit

Carmela Tombes
Laboratory Manager

R4506412-1

CONSULTING CHEMISTS & LABORATORY SERVICES

ENVIROCOMPLIANCE
LABORATORIES, INC.

ROUTE 4, BOX 286 A
(RT. 1 & OLD KEETON RD.)
GLEN ALLEN, VA 23060
(804) 550-3971 FAX 550-3826

Certificate of Analysis

Project No. : 4418
Project Name : Ft. Story
Submitted by : Jeff Coron
Date Received: May 23, 1994
Date Issued : May 31, 1994

Reference Method: SW-846 Method 8240

Six water samples labeled MW-1, MW-2, MW-3, MW-4, MW-5, MW-6 were analyzed for the following Volatile Organics.

Analyte	MW-1 ug/l	MW-2 ug/l	MW-3 ug/l	MW-4 ug/l	MW-5 ug/l	MW-6 ug/l	DL ug/l
Chloromethane	BDL	BDL	BDL	BDL	BDL	BDL	20.0
Bromomethane	BDL	BDL	BDL	BDL	BDL	BDL	20.0
Vinyl Chloride	BDL	BDL	BDL	BDL	BDL	BDL	20.0
Chloroethane	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Methylene Chloride	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Trichlorofluoromethane	BDL	BDL	BDL	BDL	BDL	BDL	5.0
1,1-Dichloroethene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
1,1-Dichloroethane	BDL	BDL	BDL	BDL	BDL	BDL	5.0
trans-1,2-Dichloroethene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Chloroform	BDL	BDL	BDL	BDL	BDL	BDL	5.0
1,2-Dichloroethane	BDL	BDL	BDL	BDL	BDL	BDL	5.0
1,1,1-Trichloroethane	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Carbon Tetrachloride	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Bromodichloromethane	BDL	BDL	BDL	BDL	BDL	BDL	5.0
1,2-Dichloropropene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
cis-1,3-Dichloropropene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Trichloroethene	BDL	BDL	BDL	5.31	BDL	BDL	5.0
Benzene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Dibromochloromethane	BDL	BDL	BDL	BDL	BDL	BDL	5.0
1,1,2-Trichloroethane	BDL	BDL	BDL	BDL	BDL	BDL	5.0
trans-1,3-Dichloropropene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Bromoform	BDL	BDL	BDL	BDL	BDL	BDL	5.0
1,1,2,2-Tetrachloroethane	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Tetrachloroethene	BDL	BDL	BDL	157.7	BDL	BDL	5.0
Toluene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Chlorobenzene	BDL	BDL	BDL	BDL	BDL	BDL	5.0
Ethylbenzene	BDL	BDL	BDL	BDL	BDL	BDL	10.0
1,4-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	BDL	10.0
1,3-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	BDL	10.0
1,2-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	BDL	10.0
Xylene	BDL	BDL	BDL	BDL	BDL	BDL	10.0

BDL = Below Detection Limit

Carmela Tombes
Carmela Tombes
Laboratory Manager

R4506412-2

ENVIRONMENTAL RESTORATION COMPANY
9700 ASHLEY DAWN COURT
FREDERICKSBURG, VA 22408
2ND & MAURY
RICHMOND, VA 23224

04055

CHAIN OF CUSTODY RECORD

PO# 441803

1 of 3

GENERATOR

Ft. Story Project #4418

SAMPLERS Jeff Coron

DATE	TIME	SAMPLE LOCATION	GRAB	COMP.	# OF CONT.	WATER: TPH 8015	WATER: VOC BTEX 8240	WATER: Lead SW846 7420	WATER: Waste charac.	SOIL: TPH	SOIL: BTEX	SOIL: Waste characterization	SOLIDS	REMARKS
5-19		MW-1	✓		5	✓	✓	✓						
		MW-2	✓		5	✓	✓	✓						
		MW-3	✓		5	✓	✓	✓						
		MW-4	✓		5	✓	✓	✓						
		MW-5	✓		5	✓	✓	✓						
		MW-6	✓		5	✓	✓	✓						
		composite (Well cutting)	SO	✓	2							✓		
		COMPOSITE - WELL WATER		✓	~~2~~ 4				✓					

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LAB RECEIPT _____

REMARKS / SPECIAL INSTRUCTIONS

ERC R4506412
Due: 5-Day from 05-23-1994
8015 8240 LEAD WC

CONSULTING CHEMISTS & LABORATORY SERVICES

ENVIROCOMPLIANCE
LABORATORIES, INC.

ROUTE 4, BOX 286 A
(RT. 1 & OLD KEETON RD.)
GLEN ALLEN, VA 23060
(804) 550-3971 FAX 550-3826

Certificate of Analysis

Project No. : 4418
Project Name : Ft.Story
Submitted by : Jeff Coron
Date Received: May 23, 1994
Date Issued : May 31, 1994

Reference Method: MCAWW Method 418.1

Twenty soil samples labeled HA-1 S1, HA-2 S1, HA-3 S1, HA-4 S1, HA-5 S1, HA-6 S1, HA-7 S1, HA-8 S1, HA-9 S1, HA-10 S1, HA-1 S2, HA-2 S2, HA-3 S2, HA-4 S2, HA-5 S2, HA-6 S2, HA-7 S2, HA-8 S2, HA-9 S2, HA-10 S2 were analyzed for TPH.

Sample ID	TPH mg/kg
HA-1 S1	17872
HA-2 S1	14370
HA-3 S1	17872
HA-4 S1	5194
HA-5 S1	1662
HA-6 S1	1494
HA-7 S1	1117
HA-8 S1	5529
HA-9 S1	37.5
HA-10 S1	35.0
HA-1 S2	513
HA-2 S2	13363
HA-3 S2	1155
HA-4 S2	37.5
HA-5 S2	BDL
HA-6 S2	30.0
HA-7 S2	35.0
HA-8 S2	27.5
HA-9 S2	25.0
HA-10 S2	27.5
Detection Limit	25.0

BDL = Below Detection Limit

Carmela Tombes
Laboratory Manager

R4506413-1

CONSULTING CHEMISTS & LABORATORY SERVICES

ENVIROCOMPLIANCE
LABORATORIES, INC.

ROUTE 4, BOX 286 A
(RT. 1 & OLD KEETON RD.)
GLEN ALLEN, VA 23060
(804) 550-3971 FAX 550-3826

Certificate of Analysis

Project No. : 4418
Project Name : Ft.Story
Submitted by : Jeff Coron
Date Received: May 23, 1994
Date Issued : May 31, 1994

Reference Method: SW-846 Method 7420

Twenty soil samples labeled HA-1 S1, HA-2 S1, HA-3 S1, HA-4 S1, HA-5 S1, HA-6 S1, HA-7 S1, HA-8 S1, HA-9 S1, HA-10 S1, HA-1 S2, HA-2 S2, HA-3 S2, HA-4 S2, HA-5 S2, HA-6 S2, HA-7 S2, HA-8 S2, HA-9 S2, HA-10 S2 were analyzed for Lead.

Sample ID	Lead mg/kg
HA-1 S1	95.7
HA-2 S1	286
HA-3 S1	212
HA-4 S1	94.2
HA-5 S1	213
HA-6 S1	356
HA-7 S1	252
HA-8 S1	356
HA-9 S1	BDL
HA-10 S1	BDL
HA-1 S2	BDL
HA-2 S2	BDL
HA-3 S2	BDL
HA-4 S2	BDL
HA-5 S2	BDL
HA-6 S2	BDL
HA-7 S2	BDL
HA-8 S2	BDL
HA-9 S2	BDL
HA-10 S2	BDL
Detection Limit	12.5

BDL = Below Detection Limit

Carmela Tombes
Laboratory Manager

R4506413-2

ENVIRONMENTAL RESTORATION COMPANY
9700 ASHLEY DAWN COURT
FREDERICKSBURG, VA 22408
2ND & MAURY
RICHMOND, VA 23224

04062

CHAIN OF CUSTODY RECORD

PO# 441803

2 of 3

GENERATOR: Ft. Story Project # 4418

SAMPLERS: Jeff Coron

DATE	TIME	SAMPLE LOCATION	GRAB	COMP.	# OF CONT.	WATER TPH	WATER BTEX	SOIL TPH 418.1	SOIL BTEX	SOIL Lead	SOLIDS	REMARKS
5-19		HA-1 S1		✓	1			✓		✓		
1		HA-2 S1		✓	1			✓		✓		
		HA-3 S1		✓	1			✓		✓		
		HA-4 S1		✓	1			✓		✓		
		HA-5 S1		✓	1			✓		✓		
		HA-6 S1		✓	1			✓		✓		
		HA-7 S1		✓	1			✓		✓		
		HA-8 S1		✓	1			✓		✓		
		HA-9 S1		✓	1			✓		✓		
		HA-10 S1		✓	1			✓		✓		

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LAB RECEIPT _____

ERC Due: TPH R4506413 5-Day PB from 05-23-1994

REMARKS / SPECIAL INSTRUCTIONS

ENVIRONMENTAL RESTORATION COMPANY
9700 ASHLEY DAWN COURT
FREDERICKSBURG, VA 22408
2ND & MAURY
RICHMOND, VA 23224

04060

CHAIN OF CUSTODY RECORD

PO#441823

3 of 3

GENERATOR: Ft. Story Project # 4418

SAMPLERS: Jeff Coron

DATE	TIME	SAMPLE LOCATION	GRAB	COMP.	# OF CONT.	WATER TPH	WATER BTEX	SOIL TPH 418.1	SOIL BTEX	SOIL Lead	SOLIDS	REMARKS
5-19		HA-1 S2		✓	1			✓		✓		
"		HA-2 S2		✓	1			✓		✓		
		HA-3 S2		✓	1			✓		✓		
		HA-4 S2		✓	1			✓		✓		
		HA-5 S2		✓	1			✓		✓		
		HA-6 S2		✓	1			✓		✓		
		HA-7 S2		✓	1			✓		✓		
		HA-8 S2		✓	1			✓		✓		
		HA-9 S2		✓	1			✓		✓		
		HA-10 S2		✓	1			✓		✓		

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REMARKS / SPECIAL INSTRUCTIONS