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FINAL WORK PLAN FIELD INVESTIGATION PLAN REMEDIAL INVESTIGATION FIREFIGHTER TRAINING AREA, LIGHTER AMPHIBIOUS RESUPPLY CARGO (LARC) 60 MAINTENANCE AREA, AND AUTO CRAFT AREA FORT STORY VA

12/1/1994

MALCOLM PIRNIE

0151

Final Work Plan

FIELD INVESTIGATION PLAN

Remedial Investigation For Fort Story, Virginia

U. S. Army Transportation Center
Fort Eustis, Virginia

and

U. S. Army Corps of Engineers
Baltimore District

December 1994

0285-588

FINAL WORK PLAN:
FIELD INVESTIGATION PLAN

FIREFIGHTER TRAINING AREA (FTSTY-04)
LARC 60 MAINTENANCE AREA (FTSTY-06)
AUTO CRAFT BUILDING AREA (FTSTY-07)

FORT STORY
VIRGINIA BEACH, VIRGINIA

PREPARED FOR:

U.S. ARMY CORPS OF ENGINEERS
BALTIMORE DISTRICT
BALTIMORE, MARYLAND

CONTRACT DACA31-94-D-0017
DELIVERY ORDER NO. 0017, 0020, 0024

DECEMBER 1994

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0285-588-170

EXECUTIVE SUMMARY

This document, developed for the U.S. Army Transportation Center, Fort Eustis, Virginia and the U.S. Army Corps of Engineers (USACE), Baltimore District, presents relevant site background material, project objectives, and tasks, as wells as quality management elements for Remedial Investigations (RI) at the Firefighter Training Area (FTSTY-04), LARC 60 Maintenance Area (FTSTY-06) and the Auto Craft Building Area (FTSTY-07). The Work Plan is comprised of three components: a Field Investigation Plan (FIP), a Chemical Data Acquisition Plan (CDAP) and a Site Safety and Health Plan (SSHP).

This document contains the FIP, the purpose of which is to define the tasks for identifying potential contamination, delineating the extent of contamination, identifying contamination migration and assessing risk from the sites at Fort Story. The results of the RIs will determine the need for further action based on the risk associated with presence of contaminants in the soil, sediment, surface water and groundwater. This FIP addresses the necessary sampling and analytical tasks to provide information for the following:

- Delineation of the nature and extent of contamination at each site.
- Evaluation of potential migration of contaminants.
- Assessment of risks to human health and the environment posed by each site.
- Recommendations for future action at each site based on the findings.

ES.1 SITE DESCRIPTION AND HISTORY

Fort Story is located in southeastern Virginia within the city of Virginia Beach, Virginia. Fort Story occupies an area of approximately 1,450 acres and is situated on Cape Henry which roughly divides the waters of the Chesapeake Bay to the north and the Atlantic Ocean to the east. A description and brief history of each site is provided as follows:

Firefighter Training Area

The Firefighter Training Area (FTA) is located in a sandy flat area situated adjacent to the northern flank of the central sand ridge in the southwestern section of Fort Story along Hospital Road. A temporary hospital facility was located on the site until 1960 when it's operations were relocated and the structure demolished. From 1960 through 1978, the area adjacent to the southern boundary along

U.S. Route 60 was used as a wildlife game preserve. The site was cleared and used for fire training exercises in the latter part of 1978. Prior to 1980, these exercises consisted of extinguishing JP-4 aviation fuel, which was released and ignited directly to the surface soils of the site. The releases were reportedly extinguished by a mixture of firefighting foam and water.

LARC 60 Maintenance Area

The Lighter Amphibious Resupply Cargo (LARC) 60 maintenance area, which is the maintenance and wash rack area for LARC vehicles is located in the sand flat area that lies between the coastal dune complex to the north and the central sand ridge to the south. The LARC area includes Buildings 1081, 1082, 1083 and 1084. During the 1950s, the wash rack area was first used as the barge amphibious resupply cargo (BARC) motor pool and maintenance facility. In 1964, the BARC vehicle was phased out and the LARC vehicle was prototyped. In 1982, the LARC facility was modified with the construction of a concrete wash rack pad.

Auto Craft Building Area

The Auto Craft Building is located in the sand flat area south of the coastal dune complex at the junction of Atlantic Avenue and Cebu Road. Two solvent dip tanks were used for the storage of spent degreasing solvents and waste oils when the building was in use. Previously, waste oil generated at the site was piped out of the building and into the adjacent UST. The UST has subsequently been removed.

Prior to its use as the Auto Craft Building, the site was used as a motor pool for wheeled vehicles. During the winter of 1989 and 1990, a portion of the building was destroyed by fire. A portion of the building's concrete foundation and some debris remain in the area.

ES.2 PREVIOUS INVESTIGATIONS

James M. Montgomery PA/SI

Preliminary assessment/site investigation (PA/SI) activities were conducted in 1991 and 1992 by James M. Montgomery, Inc. (JMM). JMM conducted the PA/SI to determine the presence of significant contamination at eight sites including:

- Landfill 1 (FTSTY-01)
- Landfill 2 (FTSTY-02)
- Firefighter Training Area (FTSTY-04)
- Underground Fuel Storage Tank Farm (FTSTY-05)
- LARC 60 Maintenance Area (FTSTY-06)
- Auto Craft Building (FTSTY-07)
- Drainage Outfall Line (FTSTY-08)

- NIKE Facility (FTSTY-09)

For the eight sites investigated by JMM, three were recommended for no further action: Landfill 1, Drainage Outfall Line and the NIKE Facility. Further confirmatory investigation was recommended at Landfill 2. A remedial investigation/feasibility study (RI/FS) was recommended at the remaining four sites: FTA, Underground Fuel Storage Tanks, LARC 60 area and Auto Craft Building.

IT Corporation Removal Action

IT Corporation conducted several rapid response removal actions at two sites at Fort Story in 1994; (1) FTA Site - The removal of Fire Training Pit materials, excavation and treatment of petroleum contaminated soils, and demolition of the concrete-lined pit and (2) LARC 60 Site - Bioremediation of petroleum contaminated soils from within the sandbox area.

ES.3 FIELD INVESTIGATIONS

FIP Rationale

The main objective of the RI is to determine the nature and extent of any contamination in soil, sediment, surface water and groundwater at each site. The data generated from the chemical and physical analysis will be of sufficient quality to represent site conditions for determining if additional remedial investigations or removal actions are warranted or to prepare decision documents for no further actions. To achieve these objectives, the RI program is following the USEPA's document entitled "Data Quality Objectives for Remedial Response Actions, USEPA/540/G-87/003, March 1987.

Site Data Quality Objectives

The DQO levels for samples collected at each site will be Level I for field screening (e.g., HNu readings), Level II for on-site portable GC analysis and Level III for chemical analysis. Chemical analysis will be for Target Compound List (TCL)/Target Analyte List (TAL) compounds, unless otherwise noted. CLP methodologies will be used but without CLP data package generation and documentation. Level III data, combined with QA monitoring by the U.S. Army Corps of Engineers (ACE) will result in the desired data quality and confidence to support decisions regarding each site.

Existing Data Assessment

To better define data gaps and establish a comprehensive field investigation approach, an assessment of the existing database as it relates to the nature and extent of contamination and support of the risk assessment is necessary. The identification of data needs based on the uses and decisions we

are to make is critical in establishing the field investigation approach for the project. These data needs focus on the following:

- Establishing background data.
- Determining the extent of surficial/subsurface soil contamination on-site.
- Evaluating the potential migration of contaminants from source soils to groundwater on-site and downgradient of the site.
- Evaluating the potential migration of contaminants from source soils to surface water and sediment to on-site and downgradient receptors.

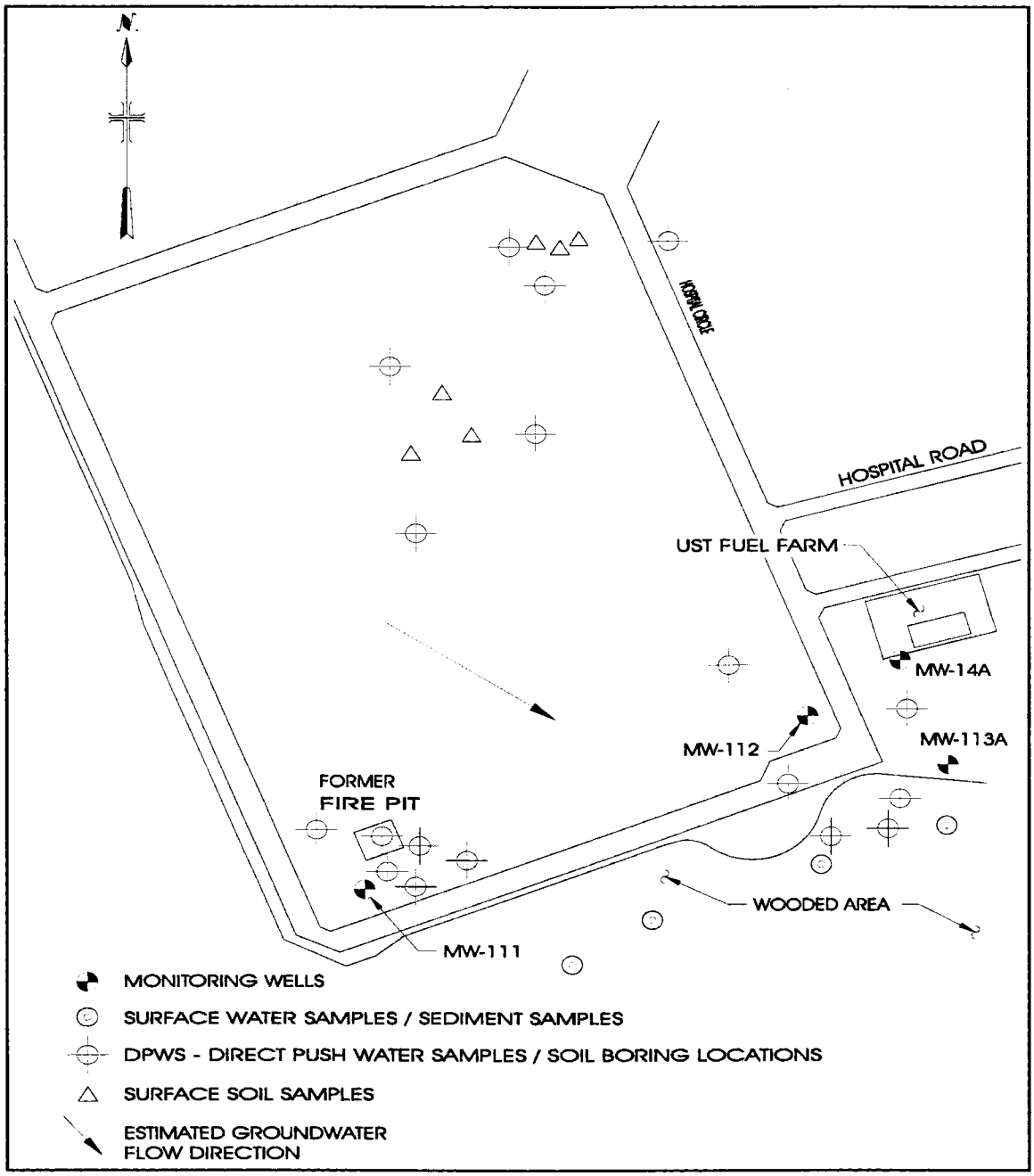
Site-Specific Field Investigations

The sampling program has been developed to augment the existing database by:

- Defining the nature and extent of surface and subsurface soil and upgradient, site, and downgradient groundwater contamination at each site.
- Determining/assessing migration of contaminants in surface water and sediments at each site.

Firefighter Training Area

The sampling program consists of on-site sampling of soils and groundwater and will extend downgradient of the site to determine the extent of contamination that could be have migrated off-site in groundwater. The following figure provides the sampling locations for this site.


HOSPITAL ROAD
HOSPITAL ROAD
UST FUEL FARM
MW-14A
MW-113A
MW-112
FORMER
FIRE PIT
WOODED AREA
MW-111
MONITORING WELLS
SURFACE WATER SAMPLES / SEDIMENT SAMPLES
DPWS - DIRECT PUSH WATER SAMPLES / SOIL BORING LOCATIONS
SURFACE SOIL SAMPLES
ESTIMATED GROUNDWATER
FLOW DIRECTION

The following table summarizes field investigations for this site:

Summary of Field Investigation							
Location	**Soil Borings/Samples**	**Surface Soil**	**Surface Water**	**Sediment**	**DPT Ground Water**	**Well Points**	**Permanent Wells**
Upgradient	4/12	0	0	0	4	0	0
Northern Area	4/12	6	0	0	4	0	0
Fire Pit	3/9	0	0	0	3	0	1
Solvent Plume	2/6	0	0	0	2	0	1
Downgradient	9/27	0	4	4	5	7	6
Total	22/66	6	4	4	18	7	8

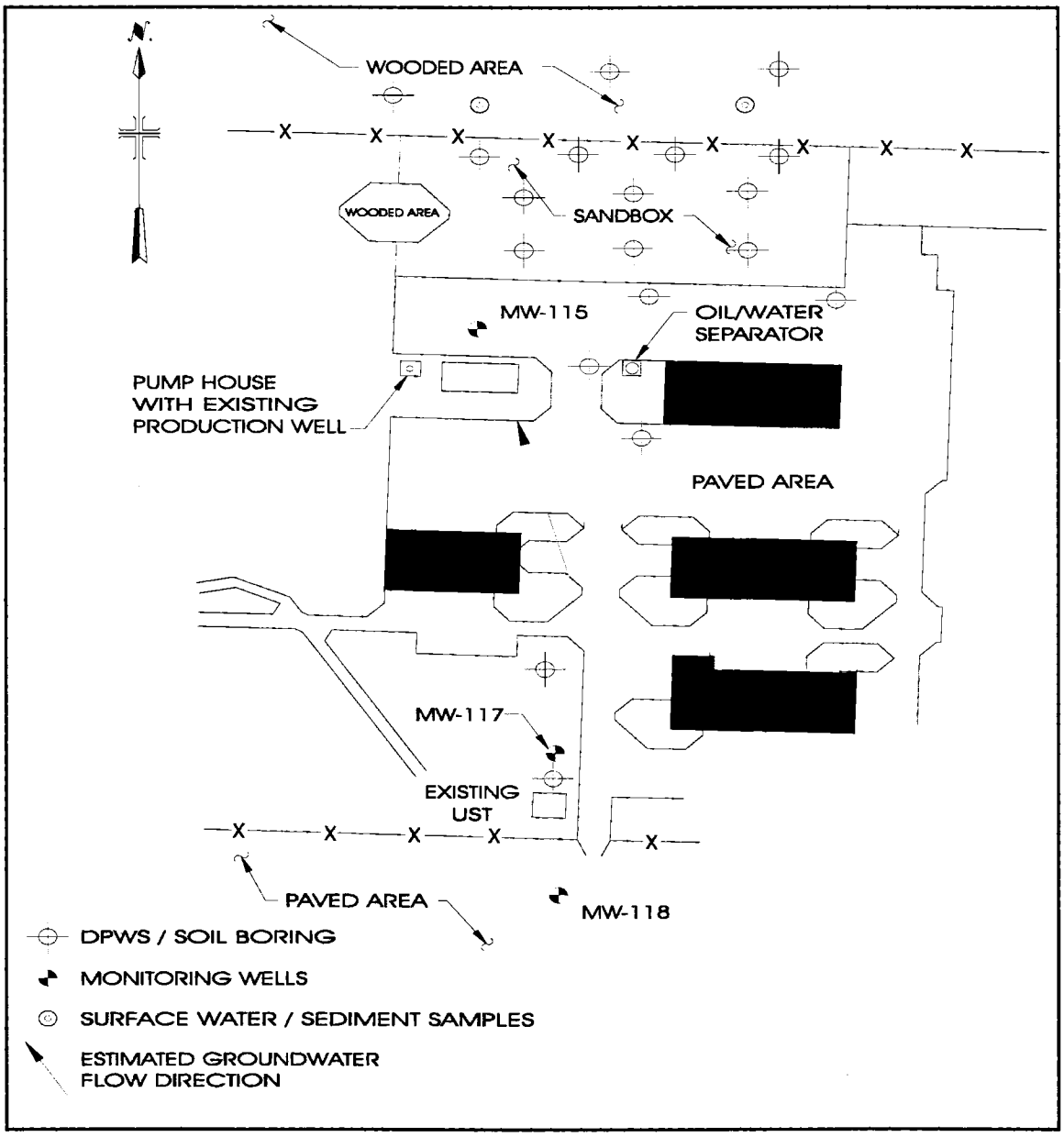
Twenty-two (22) soil boring locations have been established for the site to determine the vertical and horizontal extent of contamination in surface and subsurface soils. Eight (8) of these borings will be installed in the vicinity of the former fire training pit (FTP). Six (6) soil borings will be installed in the northern section of the site. The final eight (8) soil borings will be installed at the solvent plume area in the southeast corner of the site. In addition, six (6) surface soil samples will be collected at the northern section of the site in areas of visible soil staining.

Groundwater samples will be collected by DPT from eighteen (18) locations to determine the nature and extent of contamination in groundwater. Groundwater samples will be collected from four (4) existing and four (4) new permanent groundwater monitoring wells. Four (4) temporary direct push well points will be installed but not sampled. Their location will be based on on-site GC analysis. These well points may be used for short-term groundwater monitoring.

Four (4) sediment samples will be collected from within the wetlands area located to the south of the site. Four (4) surface water samples will be collected at the same locations as the sediment samples from the wetlands area located to the south of the site.

LARC 60 Maintenance Area

The sampling program consists of on-site sampling of soils and groundwater and will extend downgradient of the site to determine the extent of contamination that could be have migrated off-site in groundwater. The following figure provides the sampling locations for this site.



The following table summarizes field investigations for this site:

Summary of Field Investigation						
Location	**Soil Borings/Samples**	**Surface Water**	**Sediment**	**DPT Ground Water**	**Well Points**	**Permanent Wells**
Upgradient	0/0	0	0	0	0	1
UST	4/12	0	0	2	2	1
Oil/Water Separator	4/12	0	0	2	2	2
Sandbox	12/36	0	0	12	0	1
Downgradient	3/9	2	2	3	3	2
Total	23/69	2	2	19	7	7

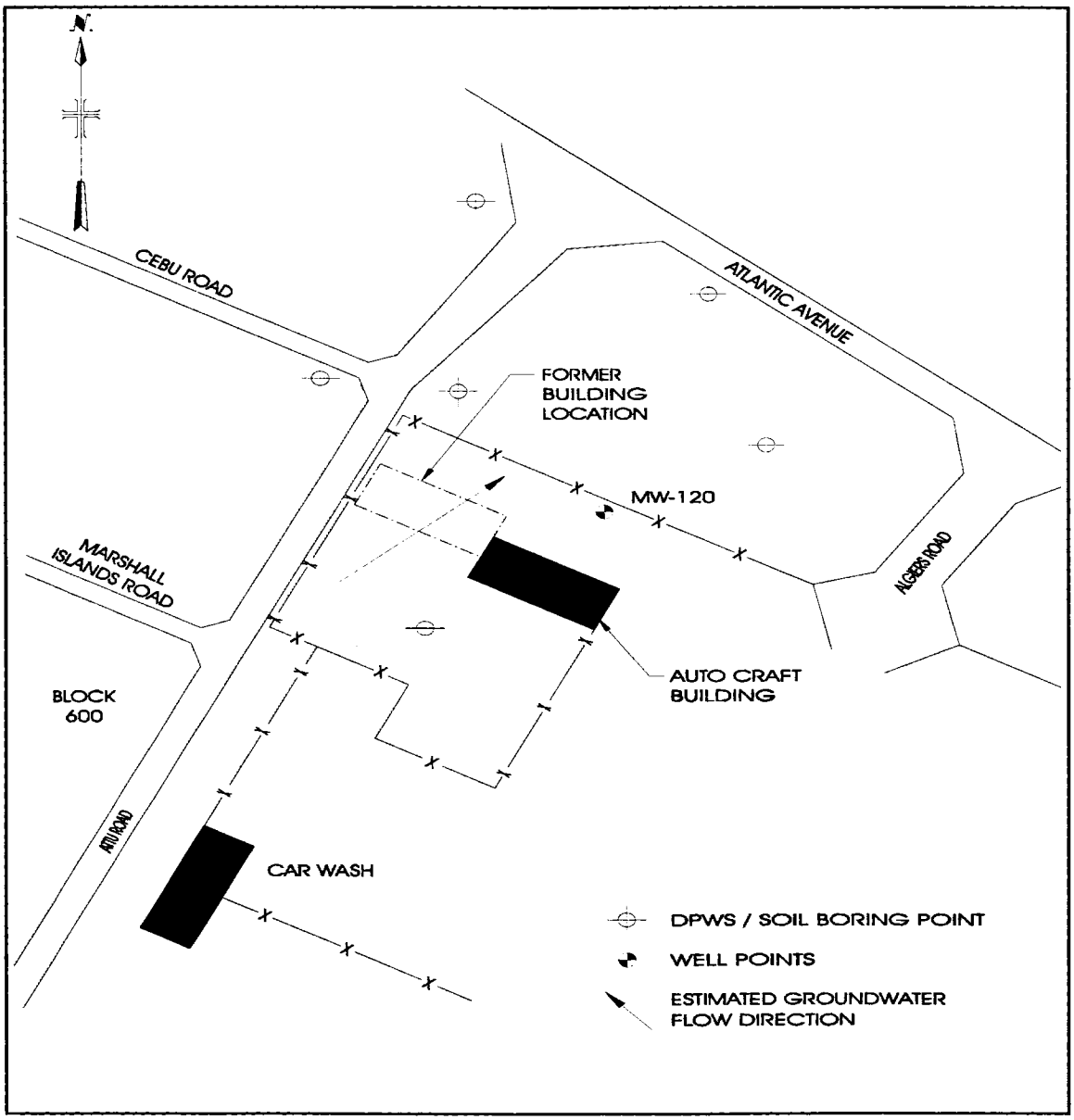
Twenty-three (23) soil boring locations have been established for the site to determine the vertical and horizontal extent of contamination in surface and subsurface soils. Four (4) of these borings will be installed in the vicinity of the waste oil UST on the southern end of the site. Four (4) soil borings will be installed near the oil-water separator in the central section of the site. The final fifteen (15) soil borings will be installed near the "sandbox" area in the northern section of the site.

Groundwater samples will be collected by DPT from nineteen (19) locations to determine the nature and extent of contamination in groundwater. Groundwater samples will be collected from four (4) existing permanent groundwater monitoring wells. These new wells will not be sampled as part of this field effort. Four (4) temporary direct push well points will be installed but not sampled. These well points may be used for short-term groundwater monitoring.

Two (2) sediment samples will be collected from the drainage ditch located between the sandbox and the wooded area. Two (2) surface water samples will be collected from the drainage ditch located between the sandbox and the wooded area.

Auto Craft Building Area

The sampling program consists of on-site sampling of soils and groundwater and will extend downgradient of the site to determine the extent of contamination that could be have migrated off-site in groundwater. The following figure provides the sampling locations for this site.



The following table summarizes our field investigations for this site:

Summary of Field Investigation				
Location	**Soil Borings/Samples**	**DPT Ground Water**	**Well Points**	**Permanent Wells**
Upgradient	1/3	1	0	0
Building Area	0/0	0	1	1
Downgradient	5/15	5	3	2
Total	6/18	6	4	3

Six (6) soil boring locations have been established for the site to determine the vertical and horizontal extent of contamination in surface and subsurface soils.

Groundwater samples will be collected by DPT from six (6) locations to determine the nature and extent of contamination in groundwater. Groundwater samples will be collected from one (1) existing permanent groundwater monitoring well. Three (3) temporary direct push well points will be installed but not sampled. These well points may be used for short-term groundwater monitoring.

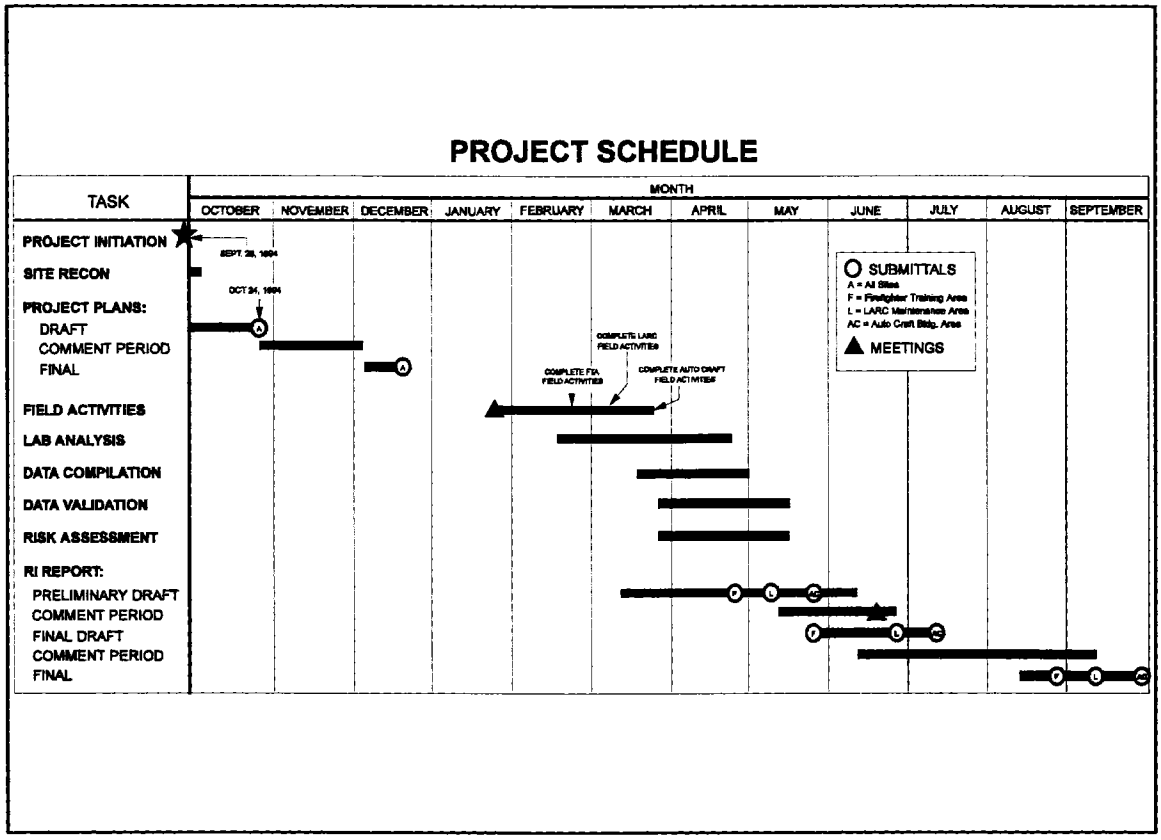
ES.4 REPORTING

Malcolm Pirnie will provide detailed Remedial Investigation (RI) Reporting to the U.S. Army Transportation Center, Fort Eustis and the USACE upon completion of field activities. The report will be submitted in Draft, Final Draft and Final formats and will outline findings for each site. The RI Reports will address the following:

- Site Description and History
- Previous Investigations
- Data Quality Objectives
- Site Investigation Activities
- Physical Characteristics of the Site
- Field and Laboratory Data
- Nature and Extent of Contamination
- Contaminant Fate and Transport
- Baseline Risk Assessment
- Conclusions and Recommendations

ES.5 SCHEDULE

A Preliminary Project Schedule for the Remedial Investigation (RI) work is provided as below. A final schedule will be developed in conjunction with the U.S. Army Corps of Engineers upon acceptance of the Final Work Plan.



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LIST OF ABBREVIATIONS AND ACRONYMS

ACE	U.S. Army Corps of Engineers
ACNED	U.S. Army Corps of Engineers New England Division
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
BARC	Barge amphibious resupply cargo
CDAP	Chemical Data Acquisition Plan
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFT	Code of Federal Regulations
CGI	Combustible gas indicator
CIH	Certified Industrial Hygienist
CLP	Contract Laboratory Program
CPR	Cardiopulmonary resuscitation
CPT	Cone penetrometer test
CRQL	Contract required quantitation limit
CRZ	Contamination reduction zone
CSHM	Corporate Safety and Health Manager
CSP	Certified Safety Professional
1,2-DCA	1,2-Dichloroethane
1,1-DCE	1,1-Dichloroethene
DEQ	Virginia Department of Environmental Quality
DI	Deionized
DMP	Data Management Plan
DNAPL	Dense non-aqueous phase liquid
DOD	Department of Defense
DOT	Department of Transportation
DPT	Direct push technology
DQCR	Daily Quality Control Report
DQO	Data quality objective
FID	Flame ionization detector
FIP	Field Investigation Plan
FS	Feasibility Study
FTA	Firefighter Training Area
FTP	Fire Training Pit
GC	Gas chromatograph
GSSHP	General Site Safety and Health Plan
HTRW	Hazardous, Toxic and Radioactive Waste
I.D.	Inside diameter
IDLH	Immediately dangerous to life and health
IRP	Installation Restoration Program
JMM	James M. Montgomery, Inc.
LARC	Lighter amphibious resupply cargo
LEL	Lower explosive limit
LNAPL	Light non-aqueous phase liquid
LOTS	Logistics Over-the-Shore
MSDS	Material Safety Data Sheet
MSHA	Mine Safety and Health Administration

MS/MSD	Matrix spike/matrix spike duplicate
NFPA	National Fire Protection Association
NGVD	National Geodetic Vertical Datum
NIOSH	National Institute of Occupational Safety and Health
NOAA	National Oceanic and Atmospheric Administration
NTU	Nephlometric turbidity unit
OSHA	Occupational Safety and Health Administration
PA/SI	Preliminary Assessment/Site Investigation
PCB	Polychlorinated biphenyl
PE	Professional Engineer
PID	Photoionization detector
PPB	Parts per billion
PPE	Personal protective equipment
PPM	Parts per million
PVC	Polyvinyl chloride
QA/QC	Quality assurance/quality control
RI	Remedial Investigation
RPD	Relative percent difference
SCBA	Self contained breathing apparatus
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
SSSHP	Site-specific Safety and Health Plan
SOP	Standard operating procedure
SOW	Scope of Work
TAL	Target Analyte List
TCA	1,1,1-Trichloroethane
TCL	Target Compound List
TEGD	Technical Enforcement Guidance Document
TPH	Total petroleum hydrocarbon
ug/L	Micrograms per liter
USAEHA	U.S. Army Environmental Hygiene Agency
USCG	U.S. Coast Guard
USCS	Unified Soil Classification System
USEPA	U.S. Environmental Protection Agency
UST	Underground storage tank
VOA	Volatile organic aromatic
VOC	Volatile organic compound

1.0 INTRODUCTION

1.1 PROJECT BACKGROUND

The Department of Defense (DOD) initiated investigations at its facilities to evaluate potential environmental impacts, if any, associated with prior suspected hazardous material releases. The Installation Restoration Program (IRP) was developed by DOD in response to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) to implement this investigation and remedial process.

Fort Story is participating in the IRP in which DOD has been investigating hazardous waste sites by identifying, evaluating and controlling the migration of hazardous contaminants.

1.2 INTRODUCTION

The U.S. Army Corps of Engineers (ACE), Baltimore District, has developed Scopes of Services, all dated 17 August 1994 and included in Appendix A, for Remedial Investigations (RI) at the Firefighter Training Area (FTSTY-04), LARC 60 Maintenance Area (FTSTY-06) and the Auto Craft Building Area (FTSTY-07). Malcolm Pirnie has prepared the Work Plan in accordance with the ACE Scope of Services for performance of the RIs.

Malcolm Pirnie is performing the RIs as a contractor to the ACE. The methodology and activities described herein will serve as the general operating procedures for field personnel performing the RIs.

The Work Plan is comprised of three components: a Field Investigation Plan (FIP), a Chemical Data Acquisition Plan (CDAP) and a Site Safety and Health Plan (SSHP). The FIP (this document) establishes the investigation objectives, provides the project approach and rationale and outlines the methods and activities which will be followed by the field personnel performing the field investigations. The CDAP presents the detailed standard operating procedures which will be utilized by project personnel to develop a site database of appropriate data quality to support a site and risk assessment. The SSHP details health and safety protocol, referencing OSHA regulations, which will be followed by field personnel during performance of the site work.

1.3 PROJECT PURPOSE

The purpose of the FIP is to define the tasks for identifying potential contamination, delineating the extent of contamination, identifying contamination migration and assessing risk from the sites at Fort Story. The results of the RIs will determine the need for further action based on the presence of contaminants in the soil, sediment, surface water and groundwater.

1.4 PROJECT SCOPE

This FIP addresses the necessary sampling and analytical tasks to provide information for the following:

- Delineation of the nature and extent of contamination at each site.
- Evaluation of potential migration of contaminants.
- Assessment of risks to human health and the environment posed by each site.
- Recommendations for future action at each site based on the findings.

2.0 SITE BACKGROUND AND PHYSICAL SETTING

2.1 LOCATION AND DESCRIPTION

2.1.1 Facility Location and Description

Fort Story is located in southeastern Virginia within the city of Virginia Beach, Virginia. Fort Story occupies an area of approximately 1,450 acres and is situated on Cape Henry which roughly divides the waters of the Chesapeake Bay to the north and the Atlantic Ocean to the east. Figure 2-1 provides the location of Fort Story.

The chief potable water supply in the region is the surface water reservoir system operated by the City of Norfolk. The system includes in-town lakes located near the Norfolk Airport and western reservoirs (Lake Prince, Western Branch, and Burnt Mills) located in Suffolk, Virginia. The in-town lakes are located over 5 miles from Fort Story while the western reservoirs are located over 20 miles from the facility. To a minor extent, potable water is obtained from groundwater sources located near these lakes and reservoirs. Based on these location of the reservoir system in relation to Fort Story, it is unlikely that impacts to Norfolk's potable water system could occur from on-site conditions. Groundwater use at Fort Story is restricted to withdrawal from a single well located at the Lighter Amphibious Resupply Cargo (LARC) maintenance area. The unavailability of construction data for this well precludes a determination of which aquifer unit provides the groundwater withdrawn from this well. Water is obtained from the well for nonpotable uses only.

The Virginia Department of Environmental Quality (DEQ), Division of Water, Tidewater Region, regulates wells in the region. Information obtained by Montgomery-Watson during performance of the PA/SI indicated that groundwater use is discouraged because of poor quality and withdrawal restrictions. High dissolved iron and manganese and total solids characterize the groundwater in the upper aquifers.

2.1.2 Site Locations and Descriptions

Firefighter Training Area (FTSTY-04)

The Firefighter Training Area (FTA) is located in a sandy flat area situated adjacent to the northern flank of the central sand ridge in the southwestern section of Fort Story along Hospital Road. Figure 2-2 provides the location of the site.

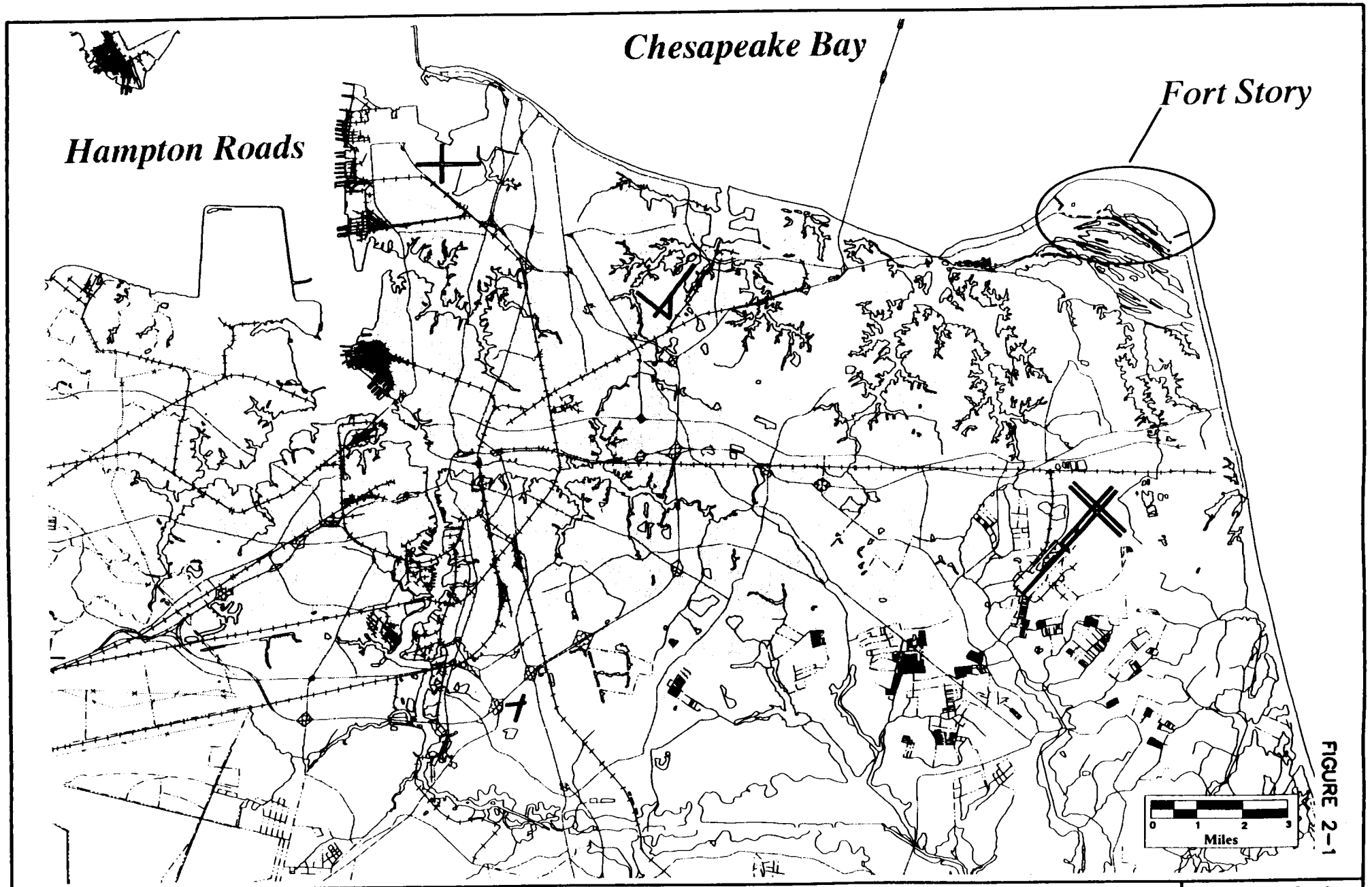

FIGURE 2-1

MALCOLM PIRNIE

FORT STORY, VIRGINIA
FIELD INVESTIGATION PLAN
FORT STORY LOCATION MAP

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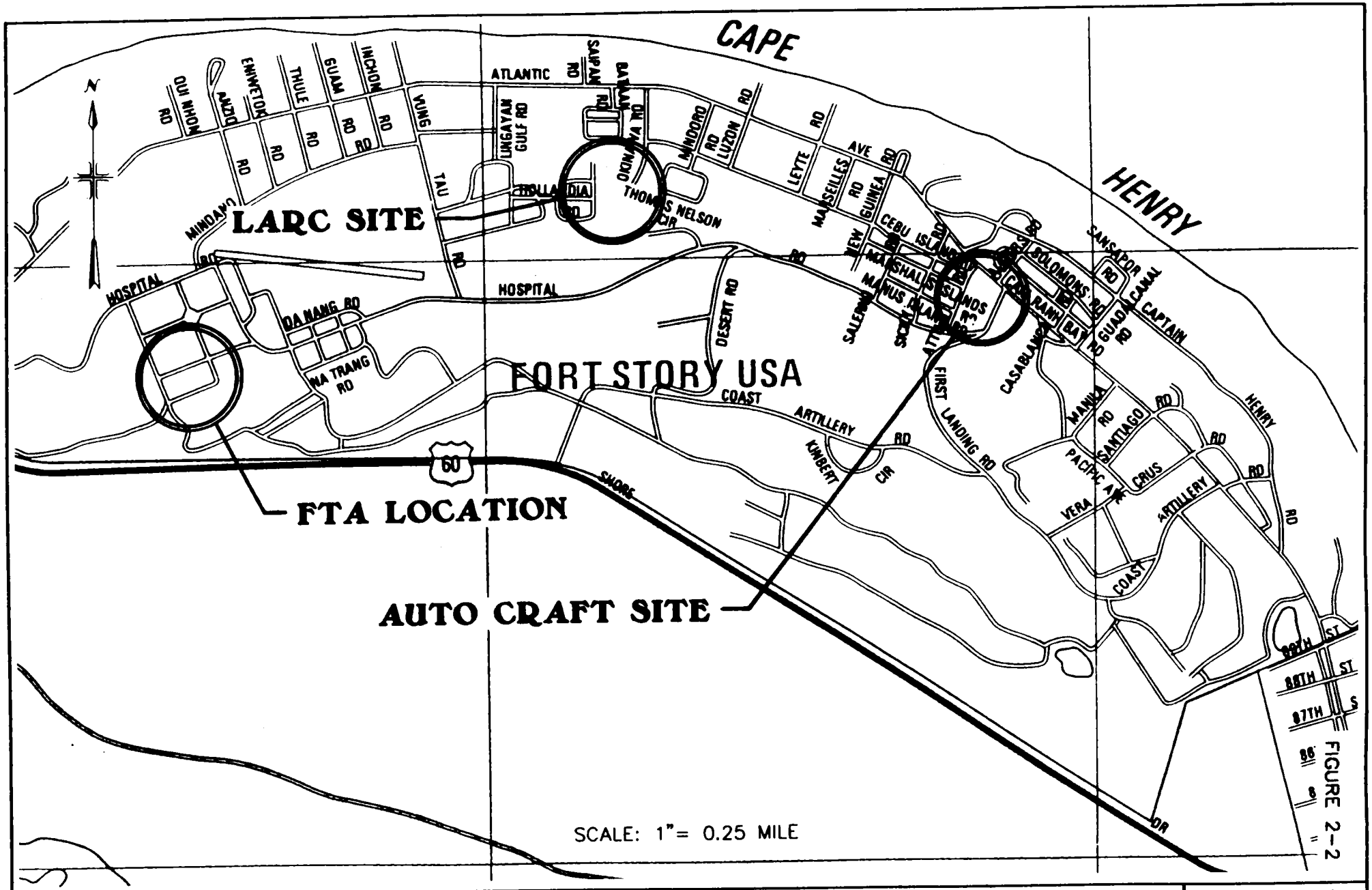

FIGURE 2-2

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FORT STORY, VIRGINIA
FIELD INVESTIGATION PLAN
SITE LOCATION MAP

MALCOLM PIRNIE, INC.

DECEMBER 1994

The site is underlain by Holocene Age sand deposits. The sand is typically subrounded to subangular, usually poorly graded and medium to coarse grained. The coarse grained facies is generally restricted to depths in excess of 4 feet. Silty sand is present to a depth of 2 to 4 feet in the eastern area of the site.

Water table elevations range from 8.5 feet National Geodetic Vertical Datum (NGVD) of 1929 in the northern portion of the site to less than 8.3 feet NGVD in the southern portion. Groundwater flow is from the northwest across the site to the south and east. Hydraulic conductivity values calculated by James M. Montgomery, Inc. (JMM) at the site range from 1.17×10^{-2} to 1.37×10^{-2} centimeters per second (cm/sec) with an average value of 1.24×10^{-2} cm/sec.

LARC 60 Maintenance Area (FTSTY-06)

The Lighter Amphibious Resupply Carco (LARC) 60 maintenance area, which is the maintenance and wash rack area for LARC vehicles is located in the sand flat area that lies between the coastal dune complex to the north and the central sand ridge to the south. The LARC area includes Buildings 1081, 1082, 1083 and 1084. The location of the site is provided on Figure 2-2.

The LARC area is underlain by Holocene Age sand deposits. The sand is typically described as fine to medium grained, poorly graded, subrounded and occasionally slightly silty. At one location within the site area, a peat lens less than 1 foot in thickness was encountered at a relatively shallow depth.

The measured depth to groundwater at the site ranged from 7.47 below ground surface to 5.07 feet below ground surface. Based on water level data from on-site and nearby off-site wells, the water table elevation ranges from approximately 8 feet NGVD in the southern portion of the site to less than 5 feet NGVD in the unpaved, wash rack area. Additionally, the water level data suggest the possible existence of a cone of depression in the vicinity of the wash rack supply well located at the southwestern corner of the wash rack area. The minimum groundwater level elevation within the cone of depression is approximately 4 feet NGVD. Though locally variable in magnitude and direction, the prevailing hydraulic gradient for the site is in a northward direction toward the coastline. Hydraulic conductivity values range from 1.99×10^{-3} to 1.84×10^{-2} centimeters per second (cm/sec) with an average value of 7.42×10^{-2} cm/sec.

Auto Craft Building Area (FTSTY-07)

The Auto Craft Building is located in the sand flat area south of the coastal dune complex at the junction of Atlantic Avenue and Cebu Road. The location of the site is provided on Figure 2-2.

The site is underlain by Holocene Age sand deposits. The sand is typically characterized as fine to medium grained, subrounded and poorly graded. Discontinuous units of clay and silt are located in the north area of the site at depths of 5 feet and thicknesses of 2 feet.

Depths to groundwater at the site vary from 7.80 feet below ground surface to 10.25 feet below ground surface. Water table elevations at the site ranged from 5.3 feet NGVD near the building to 5.07 feet NGVD. The lateral hydraulic gradient at the site is directed to the northeast. Based upon a limited number of wells, hydraulic conductivity values range from 3.23×10^{-3} to 7.11×10^{-3} centimeters per second (cm/sec) with an average value of 5.17×10^{-3} cm/sec.

2.2 HISTORY

2.2.1 Facility History

On 10 March 1914, the Virginia General Assembly ceded 343.1 acres, located at Cape Henry in Princess Anne County, to the U.S. Government "to erect fortifications and for other military purposes." On 14 June 1914, the U.S. District Court acquired title for the land by condemnation proceedings against the Cape Henry Syndicate and other landowners in the Cape Henry subdivision. War Department General Order No. 31, dated 24 July 1916, named this newly acquired tract of land Fort Story in honor of Major General John Patton Story.

Construction of powder magazines and projectile rooms got underway during the latter part of 1916 and by February 1917, construction of the 16-inch howitzer fortifications had begun. Also, during February 1917, the 2nd and 5th Coast Artillery Companies established the military garrison at Fort Story. From 1917 through 1925, the installation continued to develop as a small coastal artillery garrison consisting of little more than its armament. The only land expansion which occurred during the period was the acquisition of 9.38 acres from the Norfolk and Southern Railway Company in March 1917.

During World War I, Fort Story was integrated into the Coast Defenses of Chesapeake Bay which included Fort Monroe (Headquarters) and Fort Wool (located at the east entrance of the Hampton Roads Bridge Tunnel). On 9 June 1925, Fort Story was designated a Harbor Defense Command by War Department General Order No. 13, but the change in designation added little to the dwindling post-war activity of the garrison.

As World War II approached, Fort Story began an extensive development. Many of the facilities which exist at Fort Story today were constructed at that time, and the installation increased in size to 1,439 acres. An additional 11.82 acres were acquired in 1963 which increased its size to its present 1,451 acres. In the 1940s, the construction included temporary artillery batteries, theater, chapel, fire station, mess halls, barracks, Officer and NCO clubs, shops, additional powder magazines and projectile rooms, six underground storage bunkers and 19 seacoast searchlights.

In December 1941, the Headquarters of the Harbor Defense Command was moved from Fort Monroe to Fort Story. Two harbor defense installations were added to the network in 1941; Fort John Curtis and a mine base. On March 1, 1944, the Chesapeake Bay sector of the Harbor Defenses was inactivated, and control passed to Headquarters, Southeastern Sector, Eastern Defense Command, Raleigh, North Carolina.

By September 1944, Fort Story began a transition from a heavily fortified coast artillery garrison to a convalescent hospital. At the time of its closing on 15 March 1946, the hospital had accommodated over 13,472 patients.

At the closing of World War II, Fort Story again changed missions. This time it assumed the role which it still has today, to train units and individuals for amphibious operations. Fort Story was officially transferred to the Transportation Corps in July 1948 as a subpost of the Transportation Training Command, Fort Eustis, Virginia.

Fort Story trains army personnel in amphibious and Logistics Over-the-Shore (LOTS) operations. Fort Story is the only available facility which has the necessary natural terrain features and beaches, sand, surf, variable tide conditions (bay and ocean) and hinterlands, all of which are normally experienced by amphibious and LOTS operations. In addition, Fort Story contains beach training areas, tactical training areas and a series of trails throughout the installation. The deep water ship anchorage, off-road driving areas and soil of sufficient bearing strength for the heavy vehicles are indispensable in amphibious training, LOTS training and the testing of new equipment, doctrines and techniques.

2.2.2 Site History

Firefighter Training Area

A temporary hospital facility was located on the site until 1960 when it's operations were relocated and the structure demolished. From 1960 through 1978, the area adjacent to the southern boundary along U.S. Route 60 was used as a wildlife game preserve. The site was cleared and used for fire training exercises in the latter part of 1978. Prior to 1980, these exercises consisted of extinguishing JP-4 aviation fuel, which was released and ignited directly to the surface soils of the site. The releases were reportedly extinguished by a mixture of firefighting foam and water.

A concrete pit was constructed in 1980 and used for firefighting training exercises. The 100 foot square by 2 foot deep pit was used on a monthly basis. Procedures included:

- Filling the pit with several inches of water and 75 to 400 gallons of fuel (i.e., JP-4, contaminated fuels and hydraulic fluid).
- Igniting the mixture and allowing it to burn.
- Extinguishing the fire with 50 to 150 gallons of firefighting foam.
- Allowing the residues of the fuel and extinguishing mixtures to evaporate naturally.

Additionally, during 1980 through 1986, many installation personnel reportedly used the area as an unauthorized dumping site. The site is currently free of any surface debris or evidence of buried debris. In June 1988, firefighting training activities were discontinued at this site.

LARC Maintenance Area

During the 1950s, the wash rack area was first used as the barge amphibious resupply cargo (BARC) motor pool and maintenance facility. In 1964, the BARC vehicle was phased out and the LARC vehicle was prototyped. Presently, this is the only facility on the East Coast available to the Army Transportation Corps for amphibious training.

In 1982, the LARC facility was modified with the construction of a concrete wash rack pad. In 1987, the U.S. Army Environmental Hygiene Agency (USAEHA) conducted a study at Site 6 and concluded that the soil north of the wash rack area was contaminated

with grease, oil, lead and chromium but that this contaminated material did not pose a significant health hazard.

The underground storage tank (UST) area is located approximately 600 feet south of the wash rack area. A 10,000-gallon UST is located at the north gate of the LARC vehicle motor pool. This tank was installed in 1983. Although JMM's April 1990 field visits to this area identified soil-stained zones around the UST, no reports of tank failing or leaking have been documented. These soil-stained areas may have been caused by overfilling or spillage during use. In 1987, the USAEHA sampled the UST and found it contained oil, water, 1,1,1-trichloroethane and chromium. This UST is not presently being used.

Auto Craft Building Area

Two solvent dip tanks were used for the storage of spent degreasing solvents and waste oils when the building was in use. Previously, waste oil generated at the site was piped out of the building and into the adjacent UST. The UST has subsequently been removed.

Prior to its use as the Auto Craft Building, the site was used as a motor pool for wheeled vehicles. During the winter of 1989 and 1990, a portion of the building was destroyed by fire. A portion of the building's concrete foundation and some debris remain in the area. A previous investigation indicated that waste solvents were poured directly on the ground to control weed growth along the fence surrounding the site. A visual inspection by JMM in 1990 verified the presence of an apparent petroleum-based product around the area and distinctive petroleum odor at the site.

2.3 PREVIOUS CONDITIONS

As a result of the numerous operations and activities carried out on the base, hazardous substances and hazardous wastes have been disposed of at various locations on the base resulting in environmental contamination.

2.4 PREVIOUS INVESTIGATIONS

2.4.1 JMM Preliminary Assessment/Site Investigation

Preliminary assessment/site investigation (PA/SI) activities were conducted in 1991 and 1992 by James M. Montgomery, Inc. (JMM). JMM conducted the PA/SI to determine the presence of significant contamination at eight sites including:

- Landfill 1
- Landfill 2
- Firefighter Training Area
- Underground Fuel Storage Tank Farm
- LARC Maintenance Area
- Auto Craft Building
- Drainage Outfall Line
- NIKE Facility

Executive Summary

For the eight sites investigated by JMM, three were recommended for no further action: Landfill 1, Drainage Outfall Line and the NIKE Facility. Further confirmatory investigation was recommended at Landfill 2. A remedial investigation/feasibility study (RI/FS) was recommended at the remaining four sites: FTA, Underground Fuel Storage Tanks, LARC area and Auto Craft Building. The Underground Fuel Storage Tanks were removed in October 1994.

Firefighter Training Area

Site Investigations

Groundwater and soil matrices were investigated at the site with the installation of three monitoring wells and nine soil borings. Figures 2-9 and 2-10 in Appendix A show sampling locations. The locations for the wells and borings were selected based on the results of the soil gas survey conducted the field investigation.

Soil Gas Survey

Soil gas samples were collected at the intersections of a 100-foot by 100-foot grid having seven rows and six columns. Results of the survey indicate that potentially contaminated areas of the site include the north central site location, as indicated by detectable levels of benzene, and the extreme southeastern corner of the site, as indicated by elevated levels of benzene, 1,1,1-trichloroethane (TCA) and total hydrocarbons. Figures 2-12, 2-13 and 2-14 in Appendix A present the soil gas contour plots for these contaminants.

Soil Analytical Results

Figure 2-9 in Appendix A provides the sampling locations along with the soil analytes detected above trigger levels that warrant further investigation. Several analytes were detected at levels above the trigger levels. Media-specific trigger levels were developed for each of the analytes detected. The trigger levels were based on statistically significant site background data and regulatory standards promulgated by the EPA or the Commonwealth of Virginia for the chemicals of concern. Tables 2-8 and 2-9 in Appendix A provide the trigger levels for soil and groundwater contaminants. The largest concentration was associated with areas adjacent to the fire training pit (FTP), as well as an area located in the southeast corner of the site. Total fuel hydrocarbons, copper, and lead were detected above trigger levels at the site. Numerous analytes without trigger levels were detected at the site including xylenes and numerous semivolatiles.

Groundwater Analytical Results

Figure 2-10 in Appendix A provides the sampling locations along with the groundwater analytes detected above trigger levels. As with soil samples, numerous analytes were detected above trigger levels with the major areas of contamination associated with the FTP and the southeast corner of the site. Benzene, total fuel hydrocarbons, phenol, 1,2-dichloroethane (1,2-DCA), TCA and 1,1-dichloroethene (1,1-DCE) were detected above trigger levels.

LARC 60 Maintenance Area

Site Investigations

Groundwater and soil matrices were investigated at the site with the installation of four monitoring wells and twelve soil borings. Figures 2-20 and 2-21 in Appendix A show

sampling locations. The locations for the wells and borings were selected based on consideration of current and previous site activities suspected to have potentially resulted in the contamination of the environmental media at the site.

Soil Analytical Results

Figure 2-20 in Appendix A provides the sampling locations along with the soil analytes detected above trigger levels that warrant further investigation. Several analytes were detected at levels above the trigger levels. The site has two main areas of possible environmental concern: the wash rack area where the LARCs are parked which has an oil/water separator and the existing underground storage tank (UST) located at the southern end of the site. Total fuel hydrocarbons, copper, zinc, and lead were detected above trigger levels at the site.

Groundwater Analytical Results

Figure 2-21 in Appendix A provides the sampling locations along with the groundwater analytes detected above trigger levels. As with soil samples, numerous analytes were detected above trigger levels at the wash rack and UST areas. Benzene, vinyl chloride, total fuel hydrocarbons, and 1,1-DCE were detected above trigger levels.

Auto Craft Building Area

Site Investigations

Groundwater and soil matrices were investigated at the site with the installation of two monitoring wells and eight soil borings. Figures 2-23 and 2-24 in Appendix A show sampling locations. The locations for the wells and borings were selected based on consideration of current and previous site activities suspected to have potentially resulted in the contamination of the environmental media at the site.

Soil Analytical Results

Figure 2-23 in Appendix A provides the sampling locations along with the soil analytes detected above trigger levels that warrant further investigation. Several analytes were detected at levels above the trigger levels. Total fuel hydrocarbons, zinc, and lead were detected above trigger levels at the site.

Groundwater Analytical Results

Figure 2-24 in Appendix A provides the sampling locations along with the groundwater analytes detected above trigger levels. Total fuel hydrocarbons was the only analyte detected above trigger levels in groundwater.

2.4.2 IT Removal Actions

IT Corporation conducted several rapid response removal actions at several sites at Fort Story in 1994. Their removal actions consisted of the following:

Firefighter Training Area:

- Removal and containerization of Fire Training Pit (FTP) materials including water, concrete and debris.
- Excavate the contaminated soil surrounding the concrete pad of the FTP until a Total Petroleum Hydrocarbon (TPH) action level of 50 parts per million (ppm) was met.
- Transport the excavated soils to the LARC area for treatment.
- Demolish the concrete-lined FTP.
- Remove the monitoring well at the edge of the FTP.
- Install a recovery trench in the base of the FTP excavation using gravel to backfill the excavated FTP area.
- Transport and dispose of concrete and liquid wastes from the FTP area.

LARC Area:

- Dispose off-site of two piles of soil previously stockpiled adjacent to the LARC area which were believed to contain F-listed solvents.
- Design and install an in-situ bioremediation system for the treatment of TPH-contaminated soils.
- Bioremediate the soil within the LARC "sandbox" and the soils from the FTP to a TPH level of less than 50 ppm.
- Return the treated "sandbox" soils to the sandbox area.

2.5 GEOGRAPHY AND CLIMATE

2.5.1 Geography

Land features encountered at Fort Story consist of linear sand ridges, sand flats and wetland areas. The topography is dominated by a series of prominent linear, well-drained sand ridges that roughly bisect the Fort Story area. The central ridges trend parallel to the coastline and are characterized by maximum elevations in excess of 85 feet, National Geodetic Vertical Datum (NGVD) of 1929. A second series of sand ridges located on Fort Story are comprised of an active dune complex located adjacent to the coastline. The coastal sand ridges attain maximum elevation in excess of 25 feet NGVD. Broad, poorly drained sand flats are located adjacent to the sand ridge areas. Land surface elevations in the sand flat areas typically range between 5 and 10 feet, NGVD. Wetland areas, which are common features of the sand flats, occur locally in closed depressions. South of the central sand ridges, the Fort Story topography consists of an extensive wooded, wetland area, formerly a back-bay, lagoonal feature. Most of the installation's facilities and operations are confined to the sand ridge and sand flat areas.

2.5.2 Climate

Historical climatological data for the Fort Story area is recorded at the Norfolk-Virginia Beach Airport, and is available from the National Atmospheric and Oceanic Administration (NOAA) through the National Climatic Data Center. The Norfolk-Virginia Beach Airport is located approximately 8 miles west of Fort Story.

Table 2-1 summarizes average precipitation and temperature for the Fort Story area from 1941 to 1970.

Fort Story climate is characterized by mild winters and hot summers. Temperatures are affected by air flowing through the area from the Atlantic Ocean. Average relative humidity is high in the area, with an afternoon average humidity of approximately 60 percent, which rises in the nighttime to 80 percent. In Winter, the average temperature is 41 degrees F, with the lowest temperature recorded of 5 degrees F for the period of record. The average Summer temperature is 76 degrees F with a highest recorded temperature of 104 degrees F.

TABLE 2-1

AVERAGE TEMPERATURE AND PRECIPITATION DATA
FORT STORY AREA (1941 - 1970) (NOAA, 1982)

Month	Temperature (°F)			Precipitation (inches)
	Daily Min	Daily Max	Daily Mean	
January	32.2	48.8	40.5	3.35
February	32.7	50.0	41.4	3.31
March	38.9	57.3	48.1	3.42
April	47.9	67.7	57.8	2.71
May	57.2	76.2	66.7	3.34
June	65.5	83.5	74.5	3.62
July	69.9	86.6	78.3	5.70
August	68.9	84.9	76.9	5.92
September	63.9	79.6	71.8	4.20
October	53.3	70.1	61.7	3.06
November	42.6	60.5	51.6	2.94
December	34.0	50.6	42.3	3.11
Annual	50.6	68.0	59.3	44.68

The greatest percentage of precipitation occurs between April and September, which encompasses most of the growing season. The maximum amount of rainfall recorded in the area was 9.95 inches in a one day period.

2.6 GEOLOGIC SETTING

The Virginia Coastal Plan sediments consist of an eastward thickening wedge of generally unconsolidated, interbedded sands and clays with minor occurrences of gravel and shell fragments. Within the Fort Story area, the sediments are in excess of 3,500 feet thick and are underlain by crystalline basement rocks. Utilizing well data from the region, Meng and Harsh determined the distribution of the principal aquifer units within these sediments. Their analysis indicated that the hydrogeologic framework of the coastal plain sediments in the Fort Story vicinity consists of six aquifer units separated by intervening semi-confining units. In order of increasing depth from ground surface, these aquifers include:

- The Columbia Aquifer, which is the water table aquifer, comprised of undifferentiated Holocene age sediments.
- The Yorktown - Eastover Aquifer, which occurs within the Yorktown and Eastover formations of Pliocene and Miocene age, respectively.
- The Chickahominy - Piney Point Aquifer, which occurs within the Chickahominy and Piney Point formations of Eocene Age and the Old Church Formation of Oligocene Age, where present.
- The Upper, Middle, and Lower Potomac Aquifers, which occur within the Potomac Group of Cretaceous age.

The Columbia, Yorktown - Eastover, and Chickahominy - Piney Point aquifers and intervening semi-confining units comprise roughly the upper one-quarter of the total thickness of the coastal plain sediments in the Fort Story area. The remaining sediment thickness, in turn, consists of the Upper, Middle and Lower aquifers and intervening semi-confining units that comprise the Potomac Group.

Meng and Harsh indicate that the thickness of the Columbia Aquifer in the Fort Story area is approximately 120 feet and separated from the underlying Yorktown - Eastover Aquifer by the Yorktown semi-confining layer which has an approximate thickness of 40

feet. The lithology of the Columbia Aquifer is characterized primarily as Holocene beach sand and nearshore marine sand which commonly contains pebbles, shell fragments and blocks of coquinite. James Montgomery, Inc. has performed slug tests on 28 wells on the base. Hydraulic conductivities average 8.21 x 10^{-3} centimeters per second (cm/sec). The underlying Yorktown semi-confining unit is comprised of the upper portion of the Yorktown formation and described as marine silt with occasional interbeds of fine sand and coquina.

The Yorktown - Eastover Aquifer underlies the Yorktown confining unit and is encountered between the depths of 160 and 440 feet below ground surface.

Based on depth to water measurements obtained from the 28 monitoring wells that JMM installed for the PA/SI and three other studies, the water table occurs at an average depth of 10 feet in the Fort Story area. Generalized water table contours in the Fort Story area are characterized by the presence of a local groundwater divide in the vicinity of the central sand ridge complex. Groundwater elevations in excess of 10 feet are encountered in this area. Groundwater levels decline to approximately 3 feet in coastal sand ridges to the north. South of the central sand ridge complex, groundwater levels decline to approximately 8 feet in the vicinity of the wetland area. Based on these data, the general ambient groundwater flow directions are northward toward the coastline and southward toward the wooded wetland, from the central sand ridge area.

3.0 FIELD INVESTIGATION METHODOLOGIES

The purpose of the RI field investigations is to evaluate the presence or absence of contaminants in the environmental media at each site. The proposed investigation focuses on delineating the extent of contamination. The data will also be used to make recommendations as to future remedial investigation work to be conducted at each site, if necessary.

The following subsections give general methodologies for each field investigative technique to be used. More specific methodologies for certain activities are provided in Malcolm Pirnie's Chemical Data Acquisition Plan (CDAP). Potential health and safety concerns for each investigation activity are addressed in Malcolm Pirnie's Site Safety and Health Plan (SSHP).

3.1 FIP RATIONALE

The main objective of the RI is to determine the nature and extent of any contamination in soil, sediment, surface water and groundwater at each site. The data generated from the chemical and physical analysis will be of sufficient quality to represent site conditions for determining if additional remedial investigations or removal actions are warranted or to prepare decision documents for no further actions. To achieve these objectives, the RI program is following the USEPA's document entitled "Data Quality Objectives for Remedial Response Actions, USEPA/540/G-87/003, March 1987. These levels are described below:

- **Level V. Non-standard Methods.** Analyses which may require method modification and/or development.
- **Level IV. Contract Laboratory Program (CLP) Routine Analytical Services.** This level is characterized by rigorous QA/QC protocols and documentation and provides qualitative and quantitative analytical data.
- **Level III. Laboratory analysis using methods other than the CLP Routine Analytical Services.** This level is used primarily in support of engineering studies using standard EPA approved procedures. Some procedures may be equivalent to CLP Routine Analytical Services, without the CLP requirements for documentation.

- **Level II. Field Analysis.** This level is characterized by the use of portable analytical instruments which can be used on-site, or in mobile laboratories stationed near a site (close-support labs). Depending upon the type of contaminants, sample matrix, and personnel skills, qualitative and quantitative data can be obtained.

- **Level I. Field Screening.** This level is characterized by the use of portable instruments which can provide real-time data to assist in the optimization of sampling point locations and for health and safety support. Data can be generated regarding the presence or absence of certain contaminants (especially volatiles) at sampling locations.

3.1.1 Site Data Quality Objectives

The DQO levels for samples collected at each site will be Level I for field screening (e.g., HNu readings), Level II for on-site portable GC analysis and Level III for chemical analysis. Modified EPA 8010 methodology will be used by the on-site GC to identify and quantify chlorinated volatile organic compounds while modified EPA 8020 methodology will be used for petroleum and other non-halogenated compounds. Chemical analysis will be for Target Compound List (TCL)/Target Analyte List (TAL) compounds, unless otherwise noted. Methodologies to be used include SW-846 6010 for TAL metals, SW-846 9010 for TAL Cyanide, SW-846 8240 for TCL volatiles, SW-846 8270 for TCL semivolatiles, and modified EPA 8015 for total petroleum hydrocarbons. Level III data, combined with QA monitoring by the U.S. Army Corps of Engineers (ACE) will result in the desired data quality and confidence to support decisions regarding each site.

The data quality levels for samples are attained through sound chemical quality management, achieved through the implementation of the CDAP. The CDAP is in accordance with ACE document ER-1110-1-263, particularly Appendix E, Sampling Handling Protocol for Low, Medium and High Concentration Samples of Hazardous Waste; and applicable EPA and DOT standards and regulations.

On-site Portable GC Analysis

A field portable GC will be mobilized to Fort Story for on-site screening of volatile organics and petroleum compounds by modified EPA Methods 8010 and 8020 for groundwater samples. The field GC will produce Level II analytical data. The on-site analysis will be used to direct field activities in determining the vertical and horizontal extent of contamination in groundwater.

Off-site Laboratory Analysis

Analytical methods will follow SW-846 or EPA methodologies unless otherwise noted. All analytical methods, volume requirements, holding times and preservation requirements are outlined in Section 6.0 of the base-wide CDAP.

Table 6-2 of the CDAP identifies the sampling and analytical summary for each site. The base-wide CDAP and site-specific attachments will identify the precision, accuracy, and completeness goals used to select sampling and analysis methods.

The approach to be taken in the project will be structured so that the initial tasks of the RI will be performed to characterize the physical conditions of each site and to define the nature and extent of contamination.

The scope of the activities to be performed for the RI will be continually reviewed throughout the project. Modifications will be made when necessary to redirect or refine the project focus as the data indicate. All modifications will receive the proper prior approvals.

3.1.2 Existing Data Assessment

To better define data gaps and establish a comprehensive field investigation approach, an assessment of the existing database as it relates to the nature and extent of contamination and support of the risk assessment is necessary.

The identification of data needs based on the uses and decisions we are to make is critical in establishing the field investigation approach for the project. These data needs focus on the following:

- Establishing background data.
- Determining the extent of surficial/subsurface soil contamination on-site.
- Evaluating the potential migration of contaminants from source soils to groundwater on-site and downgradient of the site.
- Evaluating the potential migration of contaminants from source soils to surface water and sediment to on-site and downgradient receptors.

Based on a review of existing data and the data quality objectives for the project, the data gaps identified for the field investigation are summarized as follows:

Firefighter Training Area

- The vertical and lateral extent of contamination in soils and groundwater at the Fire Training Pit, solvent plume area and northern area of the site has not been established.
- The vertical and lateral extent of contamination in groundwater downgradient of the site has not been established.
- Presence/absence of contamination in other media such as sediments and surface water has not been determined.
- Impacts to human health and the environment through exposure to contaminants has not been evaluated.

LARC 60 Maintenance Area

- The vertical and lateral extent of contamination in soils and groundwater at the UST, oil/water separator and sand box areas has not been established.
- The vertical and lateral extent of contamination in groundwater downgradient of each area at the site has not been established.
- Presence/absence of contamination in other media such as sediments and surface water has not been determined.
- Impacts to human health and the environment through exposure to contaminants has not been evaluated.

Auto Craft Building Area

- The vertical and lateral extent of contamination in soils and groundwater at the site has not been established.
- The vertical and lateral extent of contamination in groundwater downgradient of the site has not been established.
- Impacts to human health and the environment through exposure to contaminants has not been evaluated.

Based on a review of the data gaps listed above, the data needs identified for the field investigation are summarized as follows:

- Vertical extent of soil contamination at each site will be addressed by the installation of soil borings with samples collected at three depths.

- Vertical and lateral extent of on-site and downgradient groundwater contamination at each site will be addressed by the collection of groundwater samples from DPT points, DPT temporary well points and permanent monitoring wells.

- Presence/absence of contamination in other media such as sediment and surface water at the FTA and LARC sites will be addressed with the collection of numerous samples for these media.

- Impacts to human health and the environment through exposure to contaminants will be evaluated through the performance of a baseline risk assessment at each site.

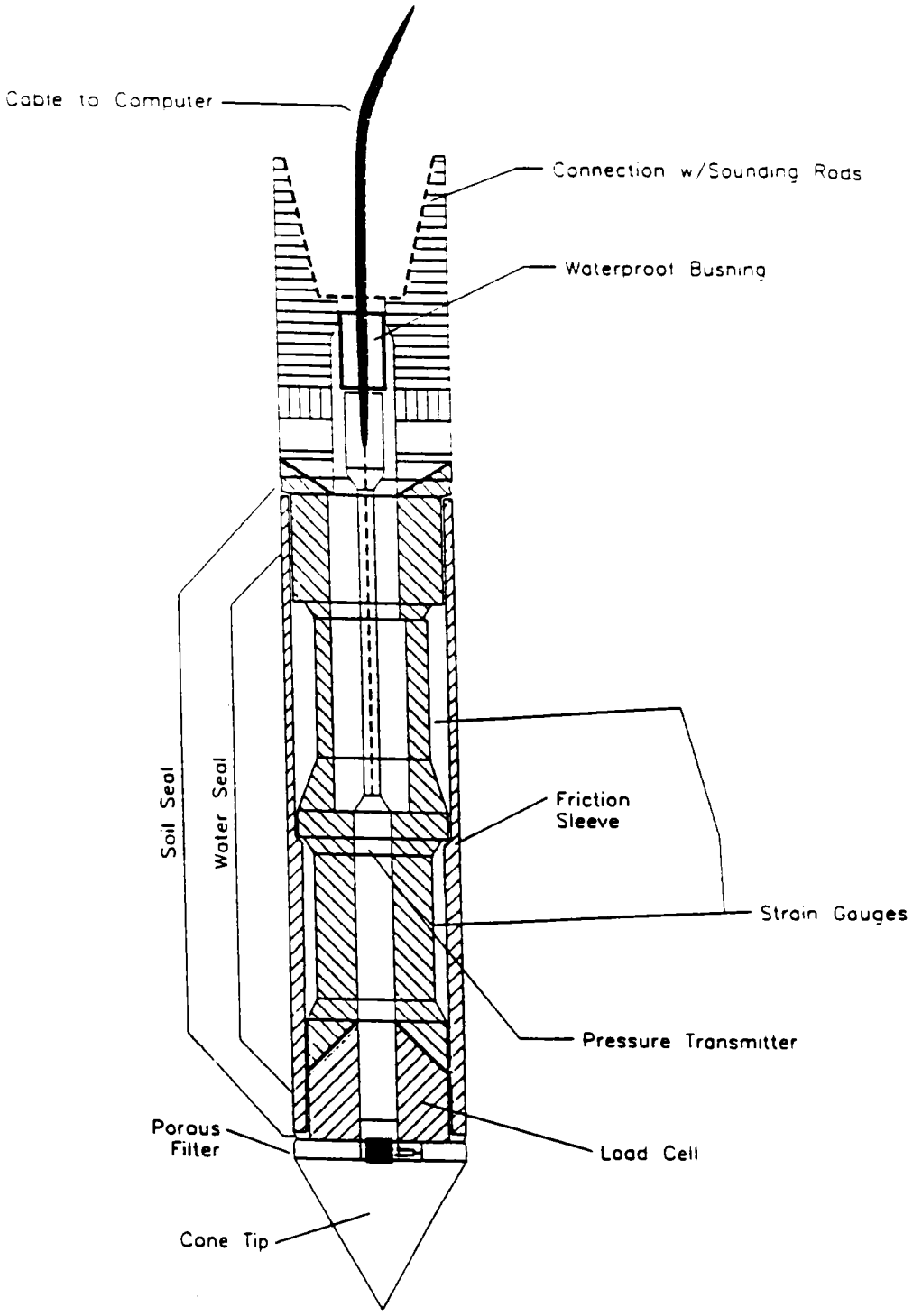
3.2 SOIL BORINGS

Hand augers will be used to collect samples in soil borings to a maximum depth of 12 inches. Samples will be collected from depth intervals as noted in Section 4.0.

Where field conditions do not allow for hand augering of near-surface soil borings, and where deeper soil samples are required (i.e., overburden soil borings), a direct push technology (DPT) rig equipped with a piezocone (Figure 3-1) and soil sampler (Figure 3-2) will be used. DPT minimizes the need for conventional drilling techniques by using hydraulic pressure to push geotechnical tools and subsurface sampling devices into the formations to be investigated. No cuttings are generated and no foreign substances are permanently introduced into the sampling zone during the procedure. Therefore, the volume of investigation derived wastes is reduced. Use of the DPT and piezocone is governed by ASTM Standard 3441.

The piezocone provides real-time geotechnical data which is used to identify standardized soil types in the subsurface. The data from the piezocone is continuously fed into the on-board computer, and a standardized soil type is generated for the formation through which the piezocone is passing. This information may be viewed on the computer's monitor in real-time. The piezocone will be used at two soil borings at each site to classify soil type only. Samples will not be collected in these borings. The geotechnical information generated on-site by the piezocone will be calibrated to provide stratigraphic information for each site. This will be done by collecting a continuous core sample adjacent to one of the piezocone soundings and adjusting the standardized soil type descriptions to match the

FIGURE 3-1



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FORT STORY, VIRGINIA
FIELD INVESTIGATION PLAN
PIEZOCONE SCHEMATIC

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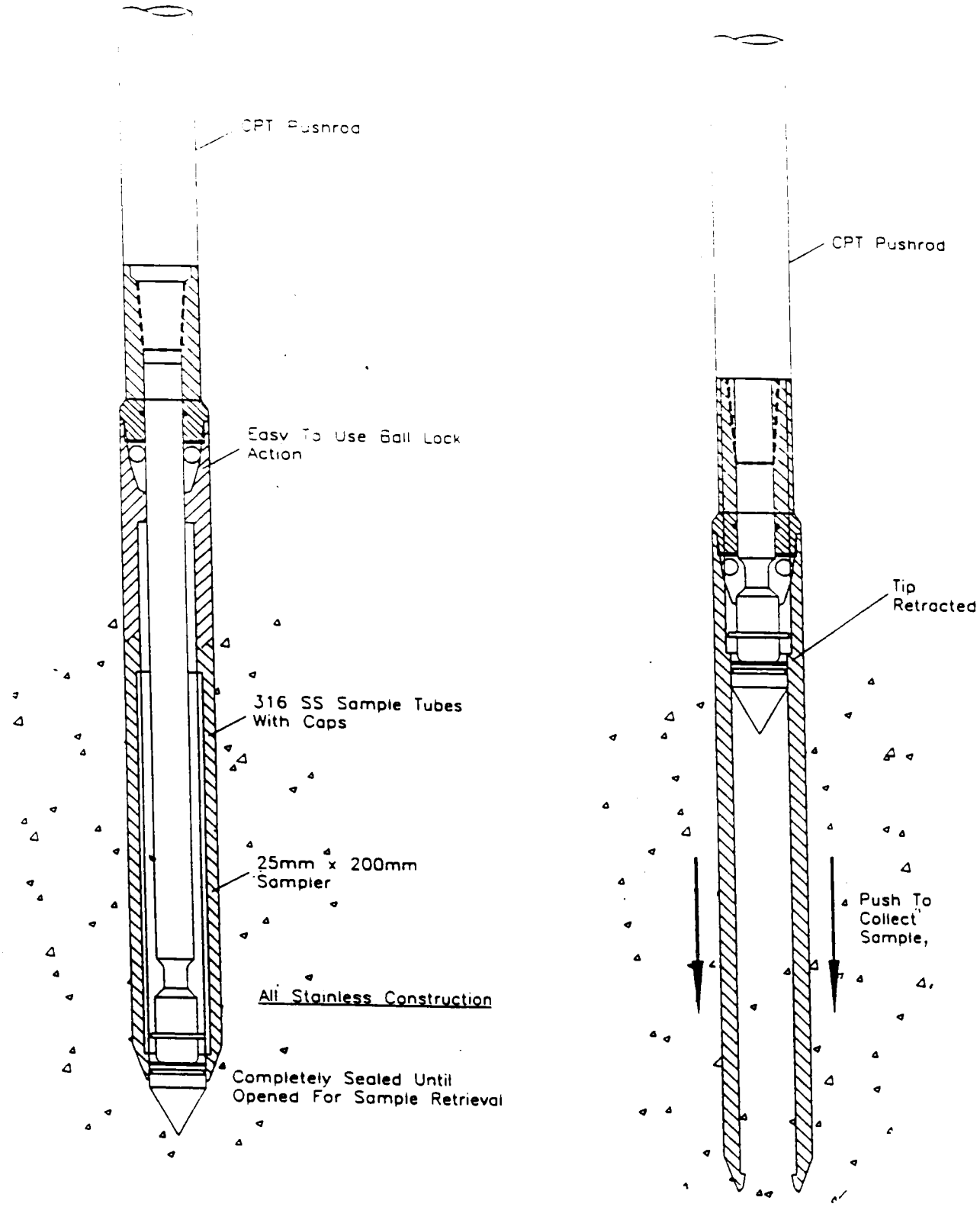
FIGURE 3-2



MALCOLM PIRNIE

FORT STORY, VIRGINIA
DRAFT FIELD INVESTIGATION PLAN
CPT SOIL SAMPLER

MALCOLM PIRNIE, INC.

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log from the core sample.

For collecting discrete soil samples, the tip is advanced to the top of the interval to be sampled. The tip is retracted and the sampler (Figure 3-2) is pushed through the desired interval to collect the sample. The sample is contained inside a stainless steel sampling tube located in the sampling tip. The sampling interval will be increased at those locations where duplicates samples are to be collected.

The soils recovered from borings for calibration to piezocone logs will be logged in accordance with the Unified Soil Classification System (USCS) by a geologist in accordance with the USACE Borehole Logging Requirements. Information generated during the boring process will be recorded on field boring logs with additional information recorded in the field log book.

If subsurface conditions are encountered where the DPT method for soil borings is not appropriate (e.g., large cobbles or boulders which may impede drilling), other drilling techniques are as hollow stem auger or water rotary drilling will be used upon approval of the USACE. If these drilling techniques are necessary, potable water will be used.

Soil samples to be sent to a laboratory for chemical analysis will be removed from the center of each soil sampler using a stainless steel spatula or spoon and placed in the appropriate sample jars. A portion of the soil samples obtained from each split spoon will be jarred and screened with a photoionization detector (PID) to screen for volatile organic compounds. Aliquots for VOC analysis will be taken directly from the soil sampler, packed tightly into two 40 ml VOA vials and stored at 4°C. Prior to placement into the sample jars, all soil not requiring volatile organic analysis will be homogenized as described in Section 4.3.2.2 of the CDAP. Refer to Table 4-2 of the CDAP for sample volume requirements.

Upon completion of overburden soil borings, the borehole will be tremie grouted to the ground surface with a bentonite grout. Any excess soils generated during the boring process will be disposed of in accordance with Section 3.9.

Drilling Equipment Decontamination Procedures

To prevent the possibility of cross-contamination between boreholes, the DPT rig and all drilling accessories will be thoroughly decontaminated before arriving on-site and between all drilling sites. A pressurized steam cleaner will be utilized for decontamination of the DPT rig and accessories. Decontaminant water and materials will be disposed of in

accordance with Section 3.9.

3.3 TEMPORARY WELL INSTALLATIONS

Temporary direct push well points will be installed to provide for short-term (up to 12 months after installation) monitoring of groundwater at each site. These well points will not be sampled during this phase of the investigation because their location will be at a point where a DPT sample was collected. They are being installed so that further investigations can include sample collection (for contaminant migration or trend analysis) for these points without further intrusive activities being conducted. The location of these points will be based on on-site portable GC analysis of groundwater samples collected by DPT. Monitoring point depth and screened interval will also be based on observed geologic data collected by the DPT piezocone, soil borings correlated to the DPT data, existing groundwater data and distribution of suspected contaminants within the subsurface. The presence of saturated sediments may be confirmed, if required, by conducting pore water dissipation tests over the interval which will be penetrated by the monitoring point screen.

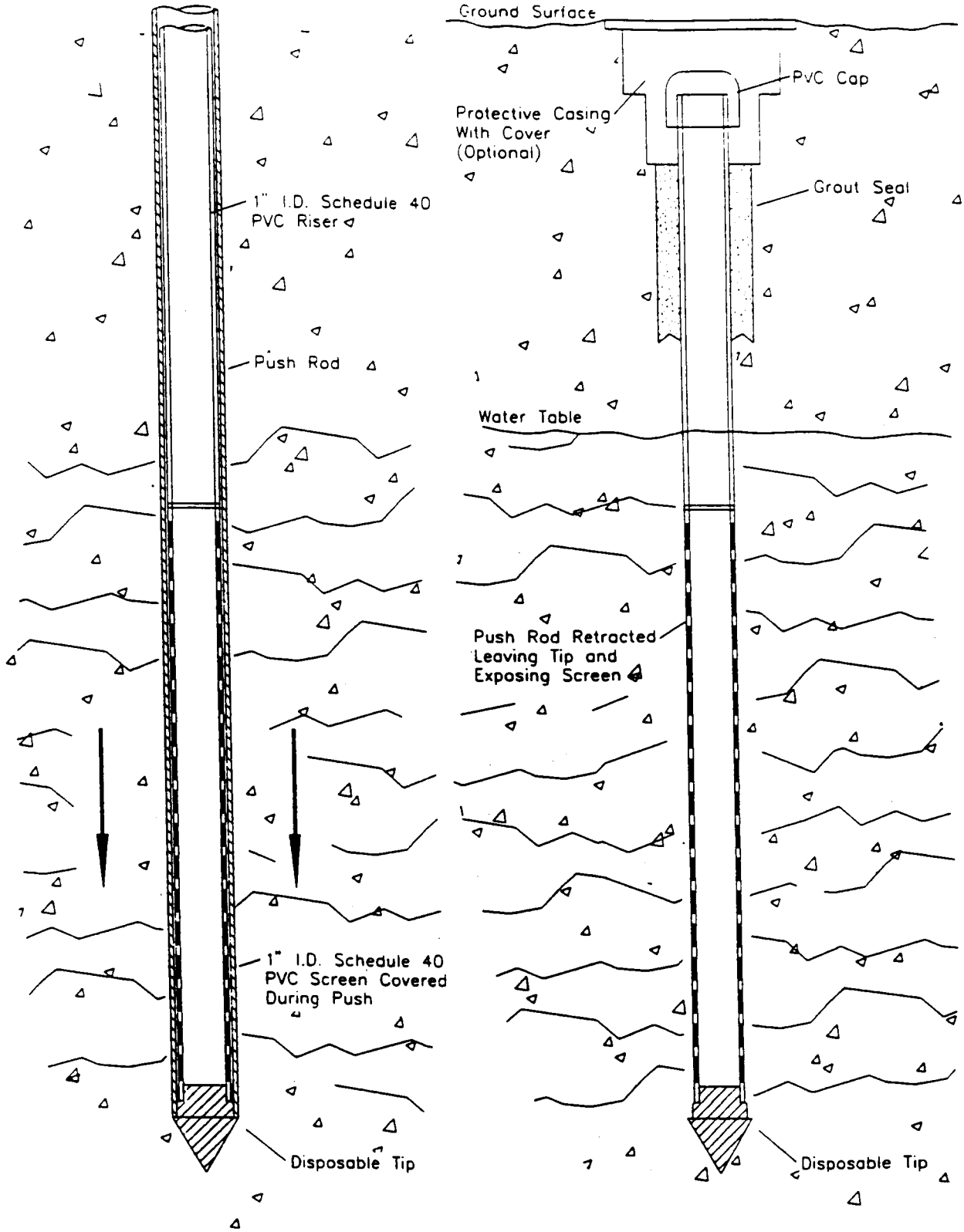
Temporary monitoring points will be installed using direct push technology. A disposable cone penetrometer tip will be attached to a 1-inch I.D. PVC screen which joined to a l-inch I.D. PVC riser pipe. The screen and riser is shielded during the pushing (drilling) activities by the push rod which abuts against the disposable tip. The assembly is pushed to the desired depth. Upon reaching the desired depth, the push rod is retracted which exposes the PVC screen to the sediments. A grout seal and well security casing, (flush-mount) will be constructed. The well construction is illustrated in Figure 3-3.

3.4 MONITORING WELL INSTALLATIONS

Groundwater monitoring wells will be installed at each site after on-site analysis of groundwater samples collected by DPT. These wells will be placed to provide for long-term continued monitoring of groundwater at each site. Monitoring well depths and screened intervals will also be based upon observed data collected by the DPT piezocone, soil borings, existing geologic data, and suspected contaminant distribution in the subsurface media.

Monitoring wells will be installed using a minimum 6 1/4-inch inside diameter (I.D.) hollow stem augers (minimum 11-inch outside diameter). The augers will be advanced

FIGURE 3-3



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DRAFT FIELD INVESTIGATION PLAN
TEMPORARY WELL POINT

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either by a truck-mounted or track-mounted drilling rig depending upon the ground surface conditions. Each monitoring well will be constructed in accordance with the RCRA Groundwater Monitoring Technical Enforcement Guidance Document (TEGD) and the U.S. Army Corps of Engineers Engineering and Design, Monitoring Well Installation at Hazardous and Toxic Waste Sites, EM MO-7-XX (FR). The Commonwealth of Virginia only provides general requirements in its RCRA Subtitle C and D regulations for monitoring well installation.

The monitoring wells will be installed through the hollow stem augers and will be constructed of 2-inch I.D., flush-threaded PVC well screen and riser. The well screen will be constructed of 0.010 inch slot size to minimize the intrusion of finer materials. A sand material of suitable particle size distribution will be placed in the annulus around the well screen to provide a filter zone. It is expected that a No. 1 filter sand will be used as the sandpack. It is anticipated that a 10-foot screen will be used for the monitoring wells. The sandpack will be placed 2 feet above the top of the well screen. A minimum of 1 foot of bentonite seal will then be placed above the sandpack while the remainder of the annular space will be cement grouted to the surface. Each well will be flush mounted and protected by a protective manhole. Figure 3-4 provides a typical flush mounted well design.

A more detailed installation procedures is provided as follows:

1. The hollow stem auger will be slowly advanced to the desired depth.

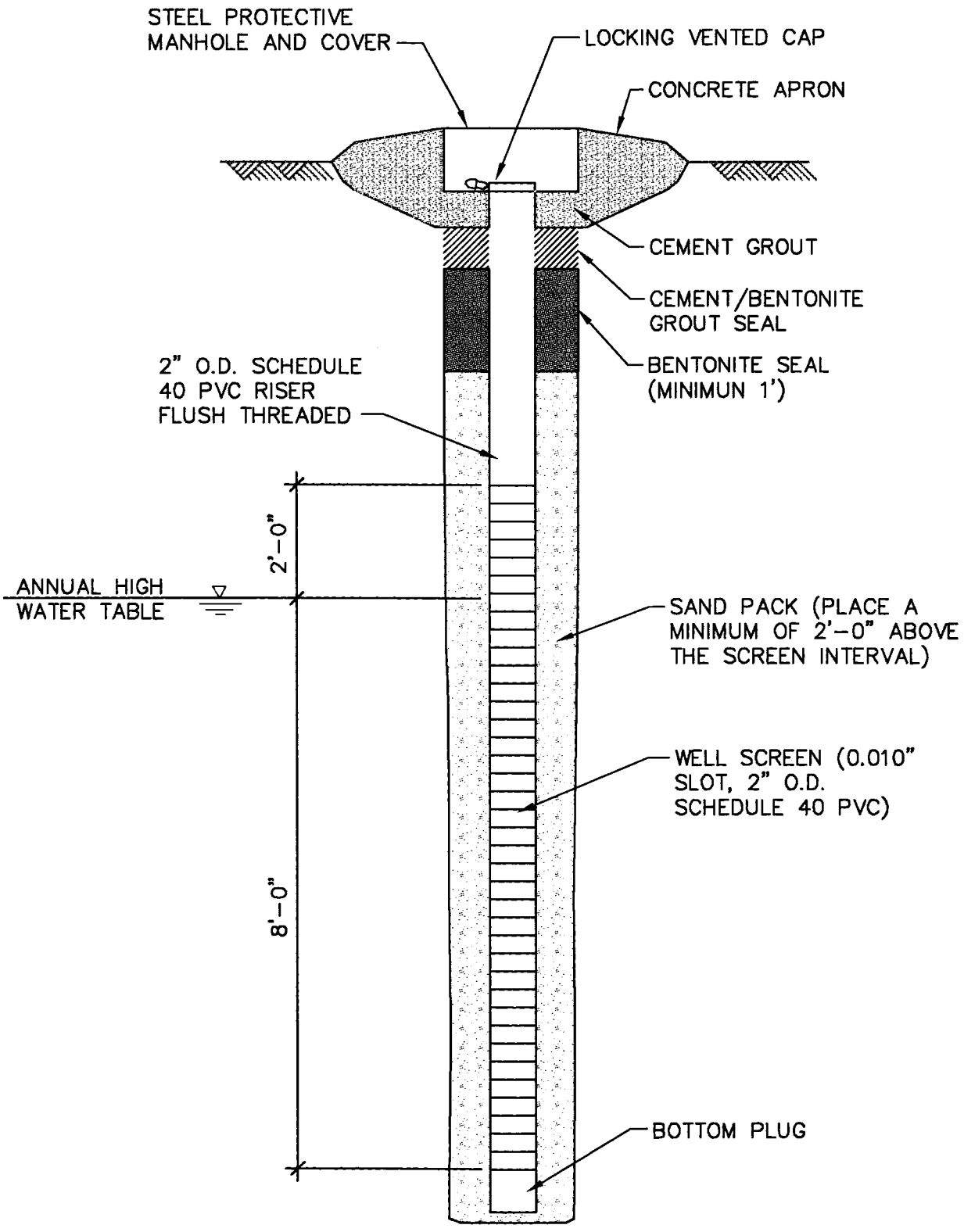
2. The screen and riser pipe will be assembled and lowered within the hollow stem augers. The well will be suspended several inches off the bottom of the boring to ensure that the casing is not bowed during installation.

3. After the screen and riser pipe are in place, a sandpack will be placed in the annular space to 2 feet above the top of the screen. As the sandpack is being poured into the annual space, the drilling augers in the hole will be simultaneously withdrawn, to prevent the sandpack from becoming jammed (bridged) between the well casing and drilling tools.

4. A 2-foot thick bentonite seal will be placed above the top of the screen (on top of the sandpack) to maintain a discrete sampling interval. It is important to seal the annulus to prevent water flow along a higher permeability zone in this space. This flow could alter the measured contamination.

5. A bentonite/cement seal will be placed on top of the bentonite seal and extend to within about 12 inches of the ground surface.

FIGURE 3-4



NOT TO SCALE

MALCOLM PIRNIE	FORT STORY, VIRGINIA FIELD INVESTIGATION PLAN TYPICAL FLUSH-MOUNTED WELL DESIGN	MALCOLM PIRNIE, INC. DECEMBER 1994

6. A flush-mounted well cap will be installed over the well. The flush mount construction will consist of a concrete pad sloping in all directions away from the well casing to prevent standing water from entering the well. The well casing will be truncated just below ground level and enclosed in a steel meter box equipped with a steel flush-mounted manhole cover.

   Note: As a function of the depth of groundwater, the thickness and placement of the sandpack (1 to 2 feet above top of screen), bentonite seal (1 to 2 feet thick), and cement/bentonite seal (thickness dependent upon depth of water table) may vary.

Well development is a critical step in well installation to ensure that groundwater samples are representative of aquifer conditions. Every type of drilling operation reduces the permeability of the water-bearing zone in the vicinity of the borehole. The purpose of well development is to increase the permeability of the formation after drilling operations and to stabilize the sand formation around the well screen. Well development will include an overpumping and backwashing method. This method of development will consist of alternately pumping the well at a high rate to draw the water level down and then "backwashing", reversing the flow direction so that water is passing from the well into the formation. This back and forth movement of water through the well screen and gravel pack will serve to remove fines from the formation while preventing bridging (wedging) of sand grains. Backwashing will be accomplished by starting and stopping a pump intermittently to change water levels. Wells will be considered developed when turbidity (< 5 NTUs), pH, specific conductance and temperature have stabilized for a minimum of three readings and all are within 10 percent of the previous two readings. Development water from the wells will be collected and disposed of in accordance with Section 3.9.

3.5 SURFACE SOIL SAMPLES

The surface soil sampling program will evaluate the nature and extent of any surface and near-surface soil contamination. The sample locations will generally be centered around areas of potential contamination due to accidental spills or historic industrial activities, areas of stressed vegetation and stained soils. The distances between sample points will be established based on historical information regarding the nature and source of contaminants, the shape and size of the contaminated area, and visual extent of contamination. Surface soil samples will be collected at locations described in Section 4.0.

Surface soil samples will be collected to a depth of 12 inches below ground surface. The semi-volatile and inorganic aliquots of the surface soil samples will be collected from the upper 6 inches of soil. The samples will be collected using a stainless steel scoop or stainless steel hand auger as deemed appropriate based on site conditions. VOC aliquots of the surface samples will be collected from the 6- to 12-inch depth interval as these constituents are not likely to be found closer to the surface. They will be collected as discrete samples using a stainless steel hand auger. Aliquots for VOC analysis will be placed directly from the hand auger, packed tightly into two 40-ml VOA vials, and immediately stored at 4°C in an ice chest. Prior to commencing and between each sample collection point, decontamination of sampling tools and equipment will be performed as described in Section 3.8.

Sample Homogenization

Samples will be homogenized (with exception of volatile organic samples which will be placed directly into two 40-ml vial sample containers) by first removing rocks, twigs, leaves and other debris if they are not considered part of the sample. The soil will then be removed from the sampling device, placed in a decontaminated stainless steel bowl, and thoroughly mixed using a stainless steel spoon. Refer to Table 4-2 of the CDAP for sample volume requirements.

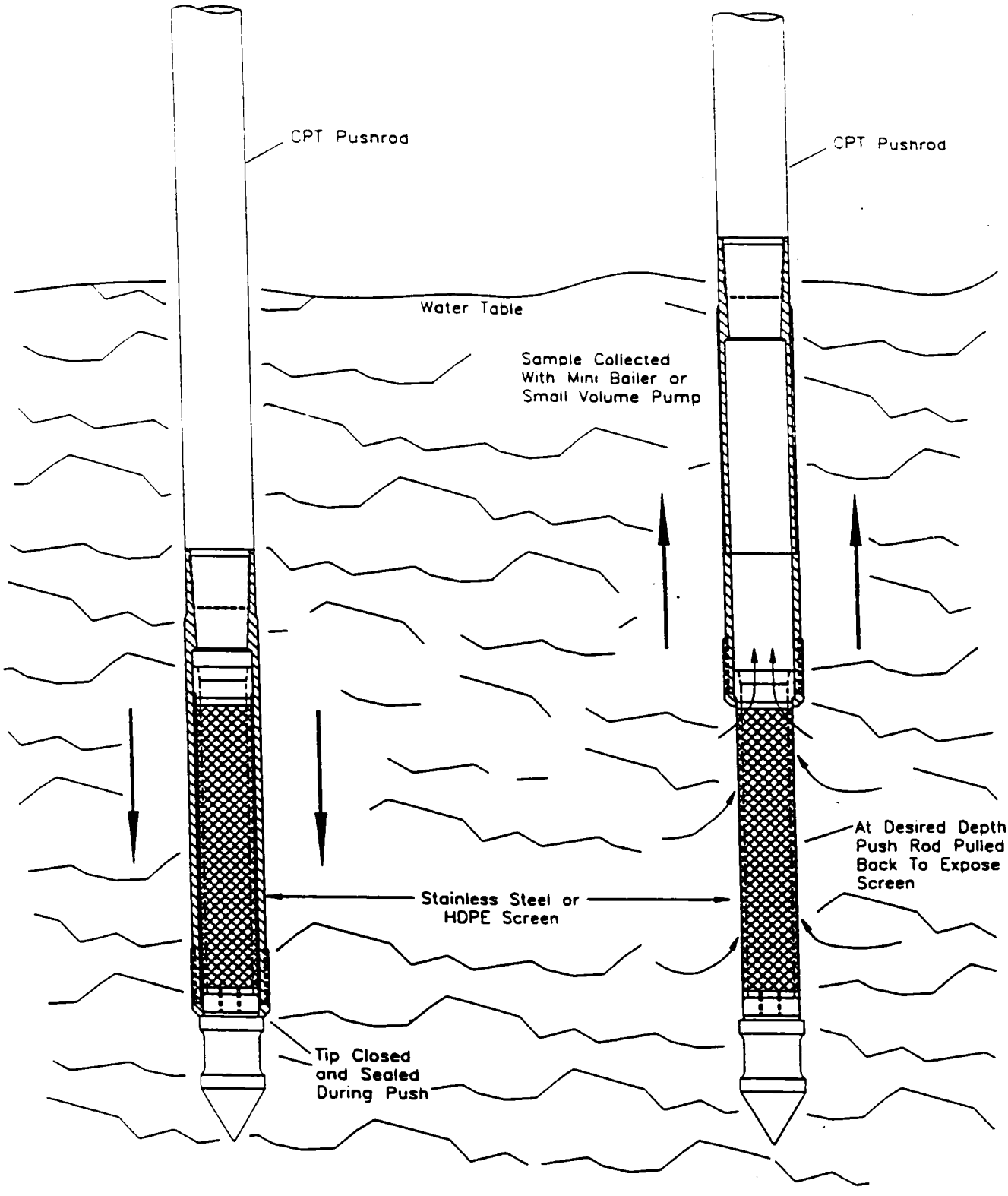
After mixing, a portion of the sample will be placed in a sample container and the container will be closed securely. The sample containers will then be labelled, added to the chain-of-custody and stored at 4°C for shipping to the laboratory.

3.6 GROUNDWATER SAMPLING

DPT Procedures

Following completion of soil boring to the desired depth by DPT rig, groundwater samples will be collected for laboratory chemical analyses. Sampling of groundwater at each location will not require well development. For collecting discrete groundwater samples, the tip is advanced below the water table to the bottom of the interval to be sampled. The push rod is retracted (Figure 3-5) exposing a 0.005 inch slotted stainless steel screen. The sample is collected from the push rod using a 0.75 inch bailer or pump.

FIGURE 3-5



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DRAFT FIELD INVESTIGATION PLAN
CPT GROUNDWATER SAMPLER

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Groundwater samples will be collected by DPT water sampler for laboratory chemical analyses. Groundwater samples collected for volatile analyses will be collected first, followed by inorganic analytes. Volatile samples will be placed in two 40-ml vials filled completely to the top with no air gaps or bubbles present. The vials should contain acid preservatives for aqueous volatile sampling. Refer to Table 4-2 of the CDAP for sample volume requirements. All samples will be placed in a cooler at 4°C and made ready for shipment to the laboratory. Field pH, Redo x (Eh-1) conductivity, and temperature will be measured.

Monitoring Wells/Temporary DPT Wells

Water levels will be measured at least twice in the existing and newly constructed monitoring wells during field investigation activities. In addition, water levels will be measured on an hourly basis for a 24-hour period in select wells to assess tidal influence. Water levels will be measured with an electronic water level indicator. The following procedures will be used:

- Equipment operation and accuracy will be checked and documented prior to taking measurements.
- All pertinent well data will be recorded.
- The water level will be recorded to nearest 0.01 foot.
- Weather at time and date of measurement will be recorded.

Following monitoring well installation and development, groundwater samples will be collected from monitoring wells for laboratory chemical analyses (refer to the CDAP for details on sample collection). Sampling of groundwater at each well location will begin no sooner than 14 days following well development. Each well will be purged of three to five well volumes (or more if required for stabilization of field parameters) prior to collecting groundwater samples. Stabilization of field parameters during purging is defined as less than 10 percent change in value over two successive measurements for turbidity, temperature, conductivity, pH, and Eh. The volume of standing water in the borehole will be calculated using the pre-purge water level, total depth of the well and a known constant for the number of gallons of water per foot of well diameter. Water purged from the well before sampling will be disposed of in accordance with procedures outlined in Section 3.9.

After purging, groundwater samples will be collected when the water level in the well has sufficiently recovered to a minimum of 75 percent of the pre-purge level or after 2 hours, whichever comes first. Field pH, conductivity, temperature, Eh, and turbidity will be measured for each well volume during purging in order to obtain a representative sample (refer to CDAP) from the aquifer, where field parameters reach equilibrium as discussed above, samples will be collected. Purging of the monitoring wells will be conducted using a PVC or disposable teflon bailer of appropriate dimensions for the well to be purged. Following collection of the organics and total inorganic samples, the groundwater samples will be filtered through 45 micron filters. Water passing through the 45 micron filter will be analyzed for the inorganics identified in Table 4-2 of the CDAP. Acid preservative will be added to the sample container after transferring the sample to the container.

After collection and transfer to the appropriate sample container, the samples will be secured in a cooler at 4°C and made ready for shipment to the laboratory.

3.7 SURFACE WATER AND SEDIMENT SAMPLING

Surface water and sediment samples will be collected to assess the potential for contaminants to migrate by storm water runoff and sediment deposition. Field information (e.g., pH, conductivity, temperature) will be recorded for the surface water. Surface water samples will be collected by direct immersion of sample bottles, where applicable, or a dipper jar, which will be decontaminated prior to collecting each sample. In the event that the surface water is heavily contaminated, the exterior of the sample bottles will be washed with soapy water and rinsed with deionized water after the bottles have been tightly capped. Care will be taken to avoid stirring up sediments that would contaminate or alter the water sample.

Sediment samples will be collected using a decontaminated stainless steel shovel or scoop following surface water sampling. Sampling will be conducted in a downstream-to-upstream order to limit disturbance of sediments upstream of a sample location. If the sampling team member has to enter the water, he will stand down stream of the sample point to avoid cross-contamination.

The sediment sample for volatile organic analysis will be immediately deposited in two, 40 ml glass vials with no mixing and placed in a cooler at 4°C for shipping to the laboratory to assure that the volatile fraction is not lost. Volatile sample fractions will not

be homogenized. All samples collected for fractions other than volatiles will be homogenized prior to being placed in the sample containers to minimize bias of sample representativeness. Refer to Table 4-2 of the CDAP for sample volume requirements. The procedure for sediment sample homogenization is described in Section 3.5.

Sampling equipment will be decontaminated as discussed in Section 3.8. Refer to the CDAP for more detailed sampling methods and specific sample volumes.

3.8 DECONTAMINATION PROCEDURES

Cross contamination of samples from any source is to be avoided. To achieve this, all equipment used in sampling must be clean and free from the residue of any previous samples. All non-dedicated sampling equipment and boring materials must be cleaned prior to being used and reused. All DPT equipment will be steam cleaned in a predesignated location prior to use and between locations. All other sampling equipment, including bailers (if needed), will be decontaminated using the following procedure:

- Wash and scrub with low phosphate, laboratory-grade detergent
- Rinse with tap water
- Rinse with methanol (use hexane, followed by a methanol rinse, for oil and grease contaminated equipment)
- Rinse with deionized demonstrated analyte free water
- Rinse with dilute nitric acid when sampling for metals
- Air dry
- Wrap in aluminum foil for transport

In the case of oil-contaminated soils, sampling equipment will be steam-cleaned prior to decontamination procedures outlined above or be dedicated and disposed of after use.

Field instrumentation should be cleaned as per manufacturer's instructions. Probes such as those used in pH and conductivity meters and thermometers must be rinsed prior to and after each use with deionized water.

3.9 CONTROL AND DISPOSAL OF CONTAMINATED MATERIALS

The DPT rig uses direct push technology which does not generate drill cuttings. Borings will then be topped off with a cement/bentonite grout cap.

Drill cuttings generated during monitoring well installation will be containerized in U.S. Department of Transportation (DOT) approved, 55-gallon steel drums with the contents identified on weather-resistant labels attached to drum exteriors.

Groundwater discharged from monitoring wells during purging, development and sampling activities will be collected in DOT 55-gallon steel drums.

Groundwater that may be pushed out of the ground during soil boring activities will be allowed to infiltrate into the ground at each site if the following conditions are met:

- There is no free product observed present such as LNAPLs and DNAPLs.
- The infiltrating groundwater is being returned to the same water-bearing zone from which it is being purged.

Depending on the levels of personal protection used during the field investigation, some disposable personal protective equipment (PPE) and decontamination fluids will be generated. Every attempt will be made to wash surface contamination off so that PPE (e.g., Tyveks, gloves, and other disposable items) may be disposed of as ordinary trash. Decontamination fluids, except those containing solvents, will be disposed of with drilling fluids generated at each site. Decontamination fluids containing solvents will be drummed separately from drilling fluids. Drums will be provided by the drilling contractor.

Drummed materials will be transported to, and staged at, the Fort Story Hazardous Waste Storage Facility. Malcolm Pirnie will maintain a log of the drums and drum contents; the contents will be evaluated upon receipt of results of the analytical data obtained during field investigations. If any drum is suspected to contain hazardous material, the drum will be securely sealed (i.e., capped and banded). Fort Story will be notified regarding the contents of each drum. Malcolm Pirnie will determine and arrange for ultimate disposal with Fort Story providing manifest authorization. Nonhazardous disposable items will be contained and disposed of in a dumpster or via a licensed waste hauler, as appropriate.

3.10 SITE SURVEYING

A site survey will be completed using horizontal and vertical control to accurately locate and document RI sampling points at each site. Malcolm Pirnie will subcontract all surveying required for the project site to a professional land surveyor licensed in the State of Virginia. Tasks will include surveying the locations and elevations of all groundwater monitoring points and wells installed for this field investigation. The horizontal location of all other sampling locations (i.e., soil boring, sediment and surface water) will be established by tying into permanent on-site structures such as fence posts, corners of buildings, roads, etc. The horizontal location of sediment and surface water point will be estimated by holding the surveying rod slightly above the water at the point where the water or sediment sample was taken. Locations will be surveyed to the nearest 0.50 foot, and elevations surveyed to the nearest 0.01 foot.

4.0 SITE-SPECIFIC FIELD INVESTIGATIONS

The following sections outline the specific remedial investigation (RI) field activities to be performed at the Firefighter Training Area, LARC 60 Maintenance Area and Auto Craft Building Area at Fort Story. Specific activities are based on the Scopes of Services for the project dated 17 August 1994. Data from previous investigations performed by others were used to optimize the field program which is detailed here. Data collected during the RI will be used in conjunction with existing data to delineate the extent of contamination and recommend further actions if necessary.

4.1 SITE VISIT

On October 18, 1994, representatives of Malcolm Pirnie visited the sites to inspect potential sample locations and current site conditions.

4.2 FIELD INVESTIGATIONS AND ENVIRONMENTAL SAMPLING

The sampling program has been developed to augment the existing database by:

- Defining the nature and extent of surface and subsurface soil and upgradient, site, and downgradient groundwater contamination at each site.
- Determining/assessing migration of contaminants in surface water and sediments at each site.

The order and scope of field investigations and sampling activities for each site is provided as follows:

- Collection of shallow soil boring (hand auger), sediment and surface water samples.
- Collection of soils data by piezocone at two soil borings followed by collection of a continuous core sample adjacent to one of the piezocone borings
- Collection of soil boring samples by direct push technology (DPT) at specified locations.

- Collection of shallow groundwater samples by DPT at the same locations as the soil borings. The on-site portable GC will be used to analyze these samples for volatile organic and petroleum compounds prior to submittal of samples to an off-site laboratory.

- Collection of deep groundwater samples by DPT. Because chlorinated solvents are of concern, assessing the vertical extent of contamination will be conducted by the collection of samples from varying depths in the groundwater. On-site GC analysis will be conducted to screen samples for volatile organic and petroleum compounds. The depth of the samples will be dependent upon the on-site GC results. At a shallow DPT point were organic compounds were detected with the GC, samples will be collected at depths every 10 feet until organics are no longer detected.

- After analysis of on-site GC results for the DPT groundwater samples, installation of temporary well points and permanent monitoring wells. The locations of these points and wells will be based on GC screening results and used to determine extent of groundwater contamination by providing either a temporary (well points) or permanent (monitoring wells) point at which additional samples can be collected in the future to track contamination migration or trends. A temporary well point will be installed at the location where the vertical extent was assessed by discrete DPT sample collection and on-site GC screening as previous discussed.

- Development of existing and/or newly installed groundwater monitoring wells.

- Sampling of permanent groundwater monitoring wells at the FTA site only. Groundwater samples will not be collected from the new permanent monitoring wells at the LARC and Auto Craft sites because they will be installed at locations where DPT groundwater samples were collected. As previously discussed, these wells will be installed to provide for future monitoring of the groundwater at the sites for migration and trends analysis.

- Surveying of horizontal locations of sampling points and vertical elevation of groundwater monitoring wells.

- Water level measurements will be taken on an hourly basis for a 24-hour period at three permanent groundwater monitoring wells at each site which are aligned perpendicular to the body of tidal influence to assess the tidal influence on groundwater flow direction.

4.2.1 Firefighter Training Area

The sampling program will extend downgradient of the site to determine the extent of contamination that could be have migrated off-site. There are three major areas of concern at the FTA site: (1) Northern area where 2 locations of stained soils are present, (2) former Fire Training Pit (FTP) area, and (3) Solvent Plume area located in southeast

corner of the site. The layout for the sampling points are centered around these three areas with upgradient and downgradient soil and groundwater sampling being conducted at each area of concern. The FTP was previously excavated and extensive sampling of soil and groundwater is required in that area to verify clean-up of soils and determine any current groundwater impacts. Figure 4-1 provides the sampling locations for this site. The locations of the temporary well points and new permanent monitoring wells will be established in the field based on the results of real-time GC screening of DPT water samples. Table 4-1 summarizes our field investigations for this site.

Table 4-2 provides a summary of the number of samples to be collected from each media, the number of QA/QC samples to be collected and the analytical requirements. All samples will be analyzed for TCL Volatiles and Semivolatiles, and TPH Heavy and Light fractions. TAL analysis will be conducted on all surface water and sediment samples and for 20 percent of soil and groundwater samples because of their infrequent detection in previous investigations. The soil and groundwater samples for TAL analysis will be distributed among upgradient and downgradient, and various subsurface soil sampling depths. For those groundwater samples which will be analyzed for TAL compounds, both total and dissolved fractions will be conducted. A summary of field activities by media is provided below.

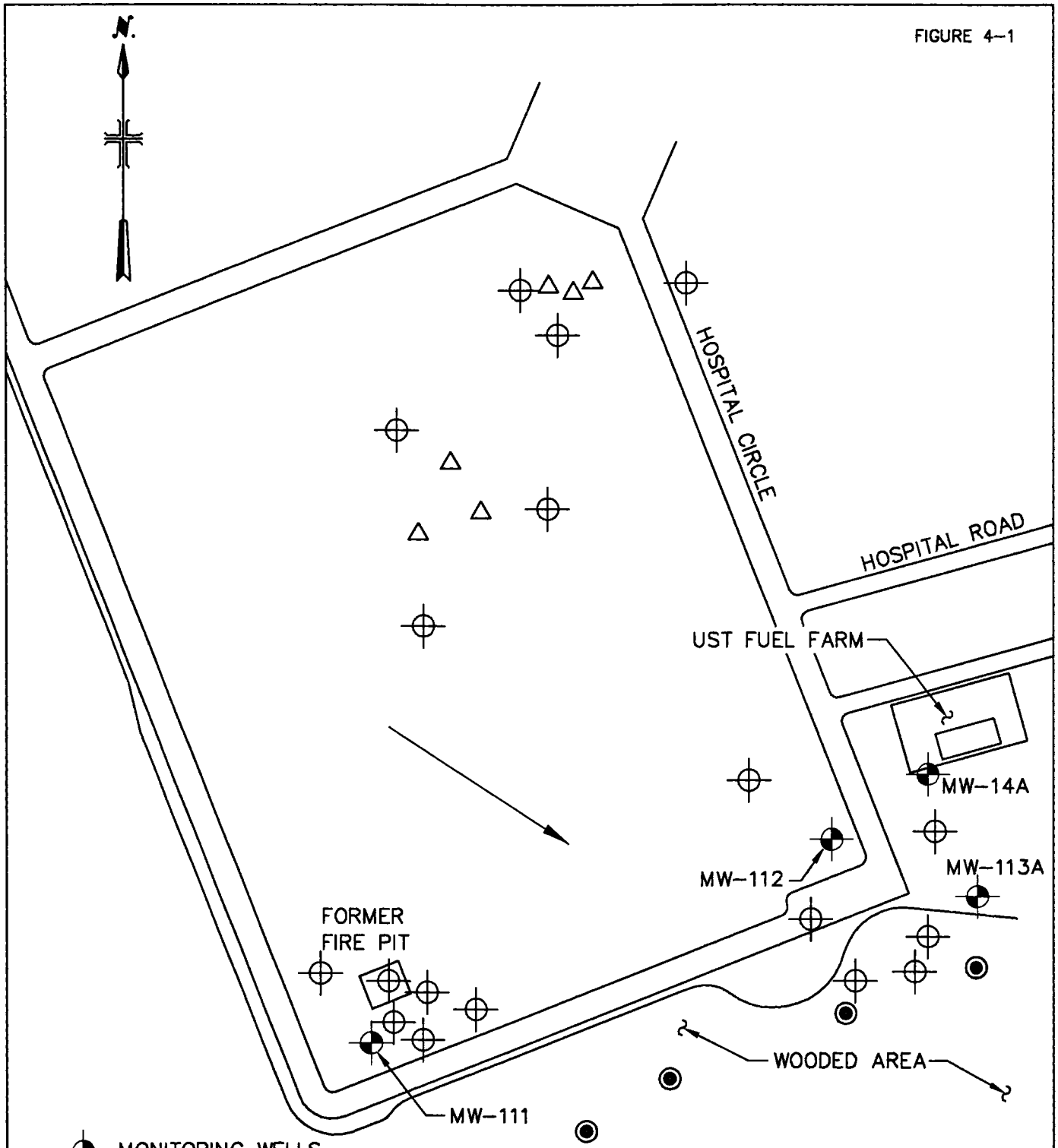
Soil Samples

Twenty-two (22) soil boring locations have been established for the site to determine the vertical and horizontal extent of contamination in surface and subsurface soils. Eight (8) of these borings will be installed in the vicinity of the former fire training pit (FTP). Six (6) soil borings will be installed in the northern section of the site. The final eight (8) soil borings will be installed at the solvent plume area in the southeast corner of the site.

A hand augered sample will be collected from a depth of 0 to 12 inches as described in Section 3.5. The DPT rig will then be used to collect soil samples from two other depths at that location; 2 to 3 feet below ground surface and from immediately above the water table interface (estimated to be 5 to 6 feet below ground surface).

In addition, six (6) surface soil samples will be collected at the northern section of the site in areas of visible soil staining.

FIGURE 4-1



MONITORING WELLS

SURFACE WATER SAMPLES / SEDIMENT SAMPLES

DPWS – DIRECT PUSH WATER SAMPLES / SOIL BORING LOCATIONS

SURFACE SOIL SAMPLES

ESTIMATED GROUNDWATER FLOW DIRECTION

SCALE: 1"=200'

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FORT STORY, VIRGINIA
FIELD INVESTIGATION PLAN
FTA SITE MAP

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TABLE 4-1

SUMMARY OF FIELD INVESTIGATIONS

FTA							
Location	Soil Borings/Samples	Surface Soil	Surface Water	Sediment	DPT Ground Water	Well Points	Permanent Wells
Upgradient	4/12	0	0	0	4	0	0
Northern Area	4/12	6	0	0	4	0	0
Fire Pit	3/9	0	0	0	3	0	1
Solvent Plume	2/6	0	0	0	2	0	1
Downgradient	9/27	0	4	4	5	7	6
Total	22/66	6	4	4	18	7	8

LARC 60						
Location	Soil Borings/Samples	Surface Water	Sediment	DPT Ground Water	Well Points	Permanent Wells
Upgradient	0/0	0	0	0	0	1
UST	4/12	0	0	2	2	1
Oil/Water Separator	4/12	0	0	2	2	2
Sandbox	12/36	0	0	12	0	1
Downgradient	3/9	2	2	3	3	2
Total	23/69	2	2	19	7	7

Auto Craft				
Location	Soil Borings/Samples	DPT Ground Water	Well Points	Permanent Wells
Upgradient	1/3	1	0	0
Building Area	0/0	0	1	1
Downgradient	5/15	5	3	2
Total	6/18	6	4	3

TABLE 4-2
FIELD AND QA/QC SAMPLE SUMMARY

Sampling Task	Media	Analysis Requirements						
		TAL Metals	TAL Hg	TAL Cyanide	TCL VOCs	TCL SOCs	TPH Heavy	TPH Light
FIREFIGHTER TRAINING AREA								
Groundwater Sampling by DPT:								
Field	Water	6	6	6	18	18	18	18
Duplicates(1)	Water	2	2	2	1	1	1	1
Rinsates(2)	Water	1	1	1	4	4	4	4
Trip Blanks(3)	Water	0	0	0	4	0	0	0
MS/MSD(4)	Water	1	1	1	1	1	1	1
ACNED QA Samples(5)	Water	1	1	1	1	1	1	1
Groundwater Well Sampling:								
Field	Water	4	4	4	8	8	8	8
Duplicates	Water	0	0	0	1	1	1	1
Rinsates	Water	1	1	1	2	2	2	2
Trip Blanks	Water	0	0	0	2	0	0	0
MS/MSD	Water	0	0	0	1	1	1	1
ACNED QA Samples	Water	0	0	0	1	1	1	1
Subsurface Soil Sampling by DPT:								
Field	Soil	9	9	9	44	44	44	44
Duplicates	Soil	1	1	1	4	4	4	4
Rinsates	Water	1	1	1	2	2	2	2
Trip Blanks	Water	0	0	0	0	0	0	0
MS/MSD	Soil	1	1	1	2	2	2	2
ACNED QA Samples	Soil	1	1	1	4	4	4	4
Surface Soil Samples:								
Field	Soil	5	5	5	28	28	28	28
Duplicates	Soil	0	0	0	3	3	3	3
Rinsates	Water	0	0	0	1	1	1	1
Trip Blanks	Water	0	0	0	0	0	0	0
MS/MSD	Soil	0	0	0	1	1	1	1
ACNED QA Samples	Soil	1	1	1	3	3	3	3
Sediment Samples:								
Field	Soil	4	4	4	4	4	4	4
Duplicates	Soil	1	1	1	1	1	1	1
Rinsates	Water	1	1	1	1	1	1	1
Trip Blanks	Water	0	0	0	0	0	0	0
MS/MSD	Soil	0	0	0	1	1	1	1
ACNED QA Samples	Soil	1	1	1	1	1	1	1
Surface Water Samples:								
Field	Water	4	4	4	4	4	4	4
Duplicates	Water	1	1	1	1	1	1	1
Rinsates	Water	1	1	1	1	1	1	1
Trip Blanks	Water	0	0	0	0	0	0	0
MS/MSD	Water	0	0	0	0	0	0	0
ACNED QA Samples	Water	1	1	1	1	1	1	1
Decontamination Water:								
Field Blanks - DI & Tap Water	Water	2	2	2	2	2	2	2

Notes:
(1) Duplicates collected at a rate of 10 percent of samples.
(2) Rinsates - One every other day for soil samples, one per day for water samples.
(3) Trip Blanks - One per cooler for water samples collected for VOC analysis.
(4) MS/MDS - Matrix spike/matrix spike duplicates collected at a rate of 5 percent of samples.
(5) Split samples submitted to Army Corps of Engineers New England Division at a rate of 10 percent of samples.

TABLE 4-2
FIELD AND QA/QC SAMPLE SUMMARY

Sampling Task	Media	Analysis Requirements						
		TAL Metals	TAL Hg	TAL Cyanide	TCL VOCs	TCL SOCs	TPH Heavy	TPH Light
LARC 60 MAINTENANCE AREA								
Groundwater Sampling by DPT:								
Field	Water	8	8	8	19	19	19	19
Duplicates(1)	Water	2	2	2	2	2	2	2
Rinsates(2)	Water	1	1	1	4	4	4	4
Trip Blanks(3)	Water	0	0	0	4	0	0	0
MS/MSD(4)	Water	1	1	1	1	1	1	1
ACNED QA Samples(5)	Water	1	1	1	2	2	2	2
Groundwater Well Sampling:								
Field	Water	2	2	2	4	4	4	4
Duplicates	Water	0	0	0	0	0	0	0
Rinsates	Water	1	1	1	1	1	1	1
Trip Blanks	Water	0	0	0	1	0	0	0
MS/MSD	Water	0	0	0	1	1	1	1
ACNED QA Samples	Water	0	0	0	1	1	1	1
Subsurface Soil Sampling by DPT:								
Field	Soil	9	9	9	46	46	46	46
Duplicates	Soil	1	1	1	5	5	5	5
Rinsates	Water	1	1	1	2	2	2	2
Trip Blanks	Water	0	0	0	0	0	0	0
MS/MSD	Soil	1	1	1	2	2	2	2
ACNED QA Samples	Soil	1	1	1	5	5	5	5
Surface Soil Samples:								
Field	Soil	5	5	5	23	23	23	23
Duplicates	Soil	0	0	0	2	2	2	2
Rinsates	Water	0	0	0	1	1	1	1
Trip Blanks	Water	0	0	0	0	0	0	0
MS/MSD	Soil	0	0	0	2	2	2	2
ACNED QA Samples	Soil	1	1	1	2	2	2	2
Sediment Samples:								
Field	Soil	2	2	2	2	2	2	2
Duplicates	Soil	0	0	0	0	0	0	0
Rinsates	Water	0	0	0	0	0	0	0
Trip Blanks	Water	0	0	0	0	0	0	0
MS/MSD	Soil	0	0	0	0	0	0	0
ACNED QA Samples	Soil	0	0	0	0	0	0	0
Surface Water Samples:								
Field	Water	2	2	2	2	2	2	2
Duplicates	Water	0	0	0	0	0	0	0
Rinsates	Water	0	0	0	0	0	0	0
Trip Blanks	Water	0	0	0	0	0	0	0
MS/MSD	Water	0	0	0	0	0	0	0
ACNED QA Samples	Water	0	0	0	0	0	0	0

Notes:
(1) Duplicates collected at a rate of 10 percent of samples.
(2) Rinsates – One every other day for soil samples, one per day for water samples.
(3) Trip Blanks – One per cooler for water samples collected for VOC analysis.
(4) MS/MDS – Matrix spike/matrix spike duplicates collected at a rate of 5 percent of samples.
(5) Split samples submitted to Army Corps of Engineers New England Division at a rate of 10 percent of samples.

TABLE 4–2
FIELD AND QA/QC SAMPLE SUMMARY

Sampling Task	Media	Analysis Requirements						
		TAL Metals	TAL Hg	TAL Cyanide	TCL VOCs	TCL SOCs	TPH Heavy	TPH Light
AUTO CRAFT BUILDING AREA								
Groundwater Sampling by DPT:								
Field	Water	6	6	6	6	6	6	6
Duplicates(1)	Water	2	2	2	1	1	1	1
Rinsates(2)	Water	1	1	1	1	1	1	1
Trip Blanks(3)	Water	0	0	0	1	0	0	0
MS/MSD(4)	Water	1	1	1	1	1	1	1
ACNED QA Samples(5)	Water	1	1	1	1	1	1	1
Groundwater Well Sampling:								
Field	Water	2	2	2	1	1	1	1
Duplicates	Water	0	0	0	0	0	0	0
Rinsates	Water	1	1	1	1	1	1	1
Trip Blanks	Water	0	0	0	1	0	0	0
MS/MSD	Water	0	0	0	0	0	0	0
ACNED QA Samples	Water	0	0	0	0	0	0	0
Subsurface Soil Sampling by DPT:								
Field	Soil	3	3	3	12	12	12	12
Duplicates	Soil	1	1	1	1	1	1	1
Rinsates	Water	1	1	1	1	1	1	1
Trip Blanks	Water	0	0	0	0	0	0	0
MS/MSD	Soil	1	1	1	1	1	1	1
ACNED QA Samples	Soil	1	1	1	1	1	1	1
Surface Soil Samples:								
Field	Soil	1	1	1	6	6	6	6
Duplicates	Soil	0	0	0	1	1	1	1
Rinsates	Water	0	0	0	0	0	0	0
Trip Blanks	Water	0	0	0	0	0	0	0
MS/MSD	Soil	0	0	0	0	0	0	0
ACNED QA Samples	Soil	0	0	0	1	1	1	1

Notes:

(1) Duplicates collected at a rate of 10 percent of samples.

(2) Rinsates – One every other day for soil samples, one per day for water samples.

(3) Trip Blanks – One per cooler for water samples collected for VOC analysis.

(4) MS/MDS – Matrix spike/matrix spike duplicates collected at a rate of 5 percent of samples.

(5) Split samples submitted to Army Corps of Engineers New England Division at a rate of 10 percent of samples.

Groundwater Samples

Groundwater samples will be collected by DPT from eighteen (18) locations to determine the nature and extent of contamination in groundwater. The depth to groundwater at the site is approximately 6 feet below ground surface. It is estimated that 15 of the DPT locations will be shallow samples collected at a depth of approximately 5 feet below the water table. Three DPT locations will be where deeper samples are collected to assess the vertical extent of contamination. Samples will be collected at depth intervals of every 10 feet until organics are no longer detected by the on-site GC.

Groundwater samples will be collected from four (4) existing and four (4) new permanent groundwater monitoring wells. Existing wells will be redeveloped prior to sampling. The new wells will be installed to a depth of approximately 8 feet below the water table elevation. Screened intervals will be established from two feet above the water table to 8 feet below the water table.

Seven (7) temporary direct push well points will be installed but not sampled. Their location will be based on on-site GC analysis. The screens will be placed at a depth of 5 feet below the water table elevation for four shallow points and at unknown depths for the three deep points. These well points may be used for short-term groundwater monitoring.

Sediment Samples

Four (4) sediment samples will be collected from within the wetlands area located to the south of the site.

Surface Water Samples

Four (4) surface water samples will be collected at the same locations as the sediment samples from the wetlands area located to the south of the site.

4.2.2 LARC 60 Maintenance Area

The sampling program will extend downgradient of the site to determine the extent of contamination that could be have migrated off-site. There are three major areas of concern at the LARC site: (1) former UST area, (2) oil/water separator area, and (3) sandbox area. The layout for the sampling points are centered around these three areas with upgradient and downgradient soil and groundwater sampling being conducted at each area of concern. The sandbox was previously excavated, treated and backfilled into the

same area and extensive sampling of soil and groundwater is required in that area to verify clean-up of soils and determine any current groundwater impacts. Figure 4-2 provides the sampling locations for this site. The locations of the temporary well points and new permanent monitoring wells will be established based on the analytical results of the DPT groundwater samples. Table 4-1 summarizes our field investigations for this site.

Table 4-2 provides a summary of the number of samples to be collected from each media, the number of QA/QC samples to be collected and the analytical requirements. All samples will be analyzed for TCL Volatiles and Semivolatiles, and TPH Heavy and Light fractions. TAL analysis will be conducted on all surface water and sediment samples and for 20 percent of soil and groundwater samples because of their infrequent detection in previous investigations. The soil and groundwater samples for TAL analysis will be distributed among upgradient and downgradient, and various subsurface soil sampling depths. For those groundwater samples which will be analyzed for TAL compounds, both total and dissolved fractions will be conducted. A summary of field activities by media is provided below.

Soil Samples

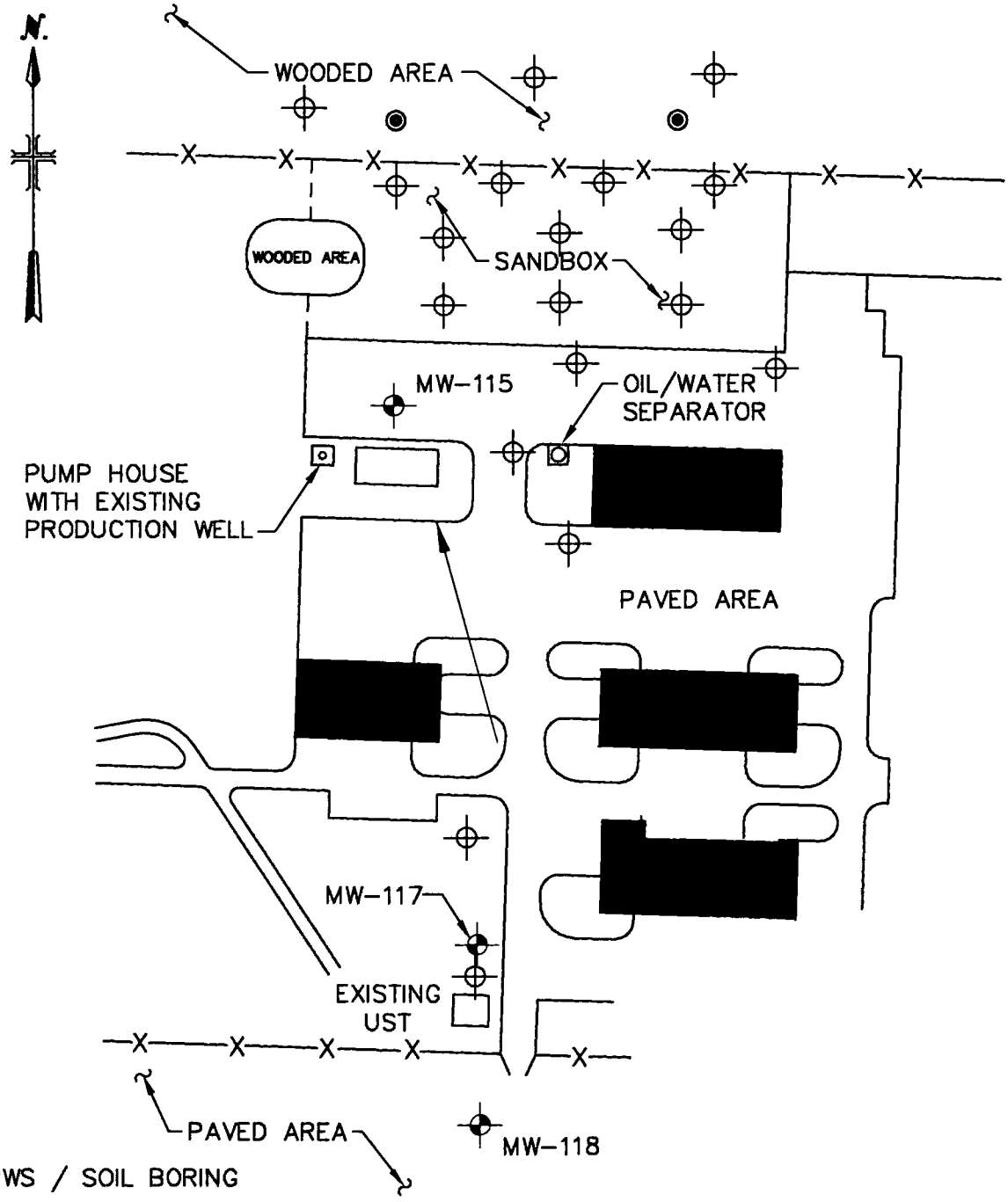
Twenty-three (23) soil boring locations have been established for the site to determine the vertical and horizontal extent of contamination in surface and subsurface soils. Four (4) of these borings will be installed in the vicinity of the waste oil UST on the southern end of the site. Four (4) soil borings will be installed near the oil-water separator in the central section of the site. The final fifteen (15) soil borings will be installed near the "sandbox" area in the northern section of the site.

A hand augered sample will be collected from a depth of 0 to 12 inches as described in Section 3.5. The DPT rig will then be used to collect soil samples from two other depths at that location; 2 to 3 feet below ground surface and from immediately above the water table interface (estimated to be 5 to 6 feet below ground surface).

Groundwater Samples

Groundwater samples will be collected by DPT from nineteen (19) locations to determine the nature and extent of contamination in groundwater. The depth to groundwater at the site is approximately 5 to 8 feet below ground surface. It is estimated

FIGURE 4-2



SCALE: 1"=200'

MALCOLM PIRNIE	FORT STORY, VIRGINIA FIELD INVESTIGATION PLAN LARC SITE MAP	MALCOLM PIRNIE, INC. DECEMBER 1994

that 16 DPT locations will include sampling at 5 feet below the water table and three DPT location will be sampled every 10 feet to assess the vertical extent of contamination.

Groundwater samples will be collected from three (3) existing permanent groundwater monitoring wells and the production well. Existing monitoring wells will be redeveloped prior to sampling. Three (3) new wells will be installed to a depth of approximately 8 feet below the water table elevation. Screened intervals will be established from two feet above the water table to 8 feet below the water table. These new wells will not be sampled as part of this field effort.

Seven (7) temporary direct push well points will be installed but not sampled. These well points may be used for short-term groundwater monitoring. The screens will be placed at a depth of 5 feet below the water table elevation for the four shallow points and at unkonwn depths for the three deep points.

Sediment Samples

Two (2) sediment samples will be collected from the drainage ditch located between the sandbox and the wooded area.

Surface Water Samples

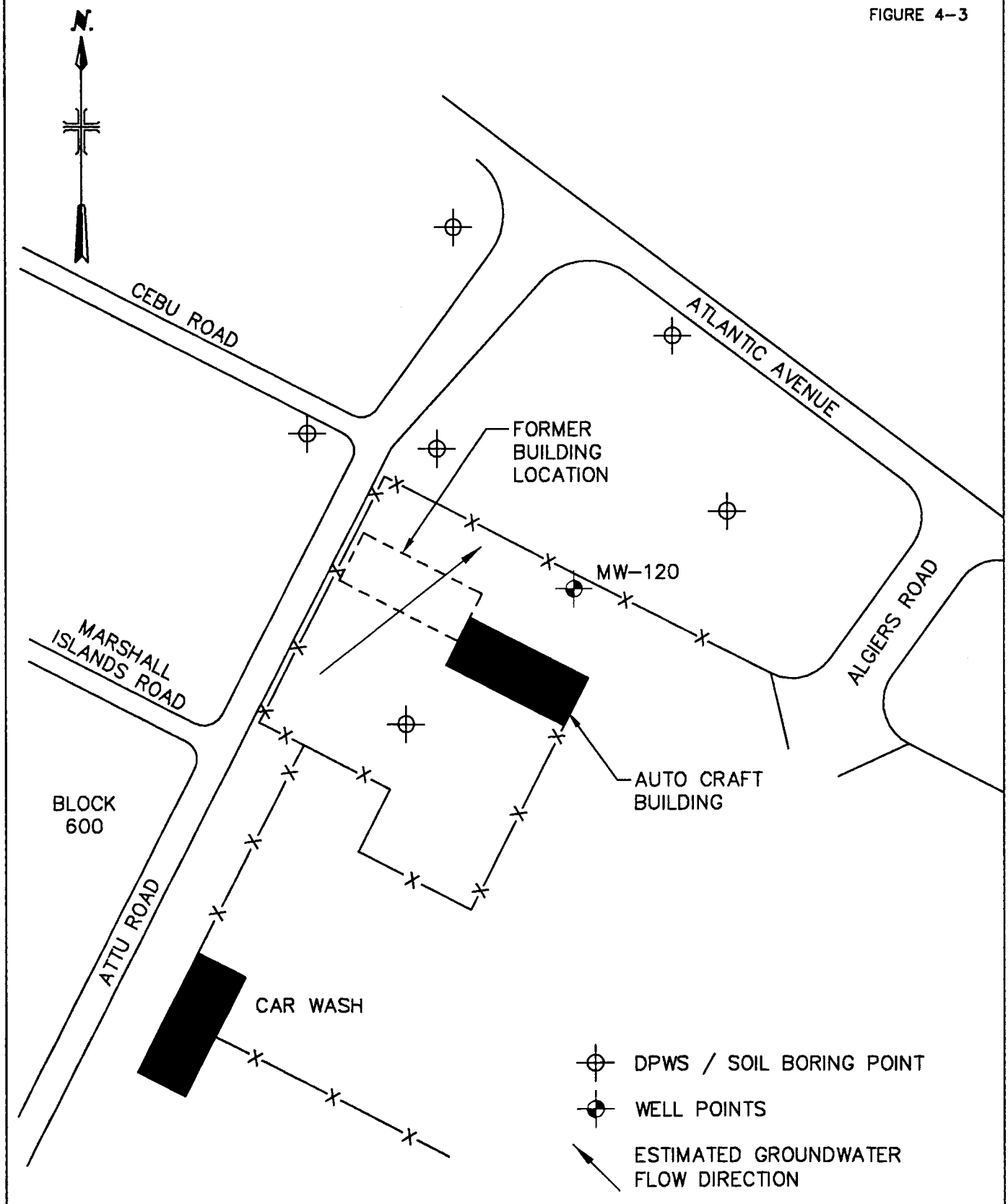
Two (2) surface water samples will be collected from the drainage ditch located between the sandbox and the wooded area.

4.2.3 Auto Craft Building Area

The sampling program will extend downgradient of the site to determine the extent of contamination that could be have migrated off-site. Figure 4-3 provides the sampling locations for this site. The locations of the temporary well points and new permanent monitoring wells will be established based on the analytical results of the DPT groundwater samples. Table 4-1 summarizes our field investigations for this site.

Table 4-2 provides a summary of the number of samples to be collected from each media, the number of QA/QC samples to be collected and the analytical requirements. All samples will be analyzed for TCL Volatiles and Semivolatiles, and TPH Heavy and Light fractions. TAL analysis will be conducted for 20 percent of soil and 50 percent of groundwater samples because of their infrequent detection in previous investigations. The soil and groundwater samples for TAL analysis will be distributed among upgradient and

FIGURE 4-3



SCALE: 1"= 60'

MALCOLM PIRNIE

FORT STORY, VIRGINIA
FIELD INVESTIGATION PLAN
AUTO CRAFT SITE MAP

MALCOLM PIRNIE, INC.

DECEMBER 1994

downgradient, and various subsurface soil sampling depths. For those groundwater samples which will be analyzed for TAL compounds, both total and dissolved fractions will be conducted. A summary of field activities by media is provided below.

Soil Samples

Six (6) soil boring locations have been established for the site to determine the vertical and horizontal extent of contamination in surface and subsurface soils.

A hand augered sample will be collected from a depth of 0 to 12 inches as described in Section 3.5. The DPT rig will then be used to collect soil samples from two other depths at that location; 2 to 3 feet below ground surface and from immediately above the water table (estimated to be 5 to 6 feet below ground surface).

Groundwater Samples

Groundwater samples will be collected by DPT from six (6) locations to determine the nature and extent of contamination in groundwater. The depth to groundwater at the site is approximately 8 to 10 feet below ground surface. It is estimated that five DPT locations will include sampling at 5 feet below the water table and one DPT location will be sampled every 10 feet to assess the vertical extent of contamination.

Groundwater samples will be collected from one (1) existing permanent groundwater monitoring well. This well will be redeveloped prior to sampling. Two (2) new wells will be installed to a depth of 8 feet below the water table elevation. Screened intervals will be established from 2 feet above the water table to 8 feet below the water table. These wells will be installed but not sampled as part of this field effort.

Four (4) temporary direct push well points will be installed but not sampled. These well points may be used for short-term groundwater monitoring. The screens will be placed at a depth of 5 feet below the water table elevation for the three shallow points and at an unknown depth for the deep well point.

5.0 RI REPORTING

Malcolm Pirnie will provide detailed Remedial Investigation (RI) Reporting to the U.S. Army Corps of Engineers (ACE) upon completion of field activities. The report will be submitted in Draft, Final Draft and Final formats and will outline findings for each site. The RI Reports will address the following:

- Site Description and History
- Previous Investigations
- Data Quality Objectives
- Site Investigation Activities
- Physical Characteristics of the Site
- Field and Laboratory Data
- Nature and Extent of Contamination
- Contaminant Fate and Transport
- Baseline Risk Assessment
- Conclusions
- Recommendations

6.0 DATA MANAGEMENT PLAN

The Data Management Plan (DMP) describes the methodology to document and track the data and results generated during the remedial investigation (RI) field investigations. This plan identifies field and laboratory data documentation formats, procedures and file requirements.

6.1 DAILY SITE LOG BOOK

A log book of the site activities will be kept by the Field Manager documenting the following:

- Personnel on-site
- Time on-site and off-site
- Activities conducted
- Problems and resolutions
- Deviations from work plan
- Weather

The site log book should be bound, sturdy, of water repellant construction and kept in the possession of the Field Manager. The Site Log Book shall be identified by a site specific title, as necessary. All entries will be in indelible ink and all pages numbered. On a weekly basis, copies of the preceding weeks activities as recorded in the log book will be sent to the file custodian (Section 6.4).

6.2 STANDARD FIELD LOGS

A number of standard field forms will be used to document site activities. These include:

- Soil Boring Log
- Sample Collection Records
- Sample Chain-of-Custody Record
- Daily Field Reports

Copies of the standard field logs will be kept in files at the Newport News office. Copies of each field log are presented in the CDAP.

6.3 FIELD BOOKS

During field activities, it will be necessary for the project members to record site specific data from drilling activities, sampling activities, etc. This data will be recorded in field books dedicated to this project. The field books will be bound, sturdy, and of water repellent construction, with each page numbered. Each field book will be assigned by the Project Manager to a team member and identified by a site specific title. The assignment of the field book and its identifier will be recorded in the Daily Site Log Book. Field books will remain in the file at the Newport News office when not in use. Upon filling a field book or completion of the project, the book will be turned over to the file custodian and an entry made in the Site Log Book to that effect. On a weekly basis, copies of the previous week activities which were recorded in the Field Books will be sent to the file custodian.

6.4 PROJECT FILING

All sample documentation and field forms collected during this project will be stored in the project files at Malcolm Pirnie, Inc., Newport News, Virginia office. Franco Godoy will be the file custodian. All project files will be stored in an organized and accessible manner. Upon completion of the project, all documentation will be turned over to Mr. Steve Cho, Project Manager for the U.S. Army Corps of Engineers, Baltimore District.

6.5 REPORTING

6.5.1 Progress Reports

Monthly progress reports will be submitted to the ACE. These progress reports will include progress on site activities during the reporting period, problems and resolutions, data collected, deliverables submitted. During field activities weekly progress reports of the field work will be provided to the ACE Project Manager.

6.5.2 Project Deliverables

The draft, final draft and final versions of the Remedial Investigation Report will be sent to the official list of project document recipients as listed in the ACE Scope of Work.

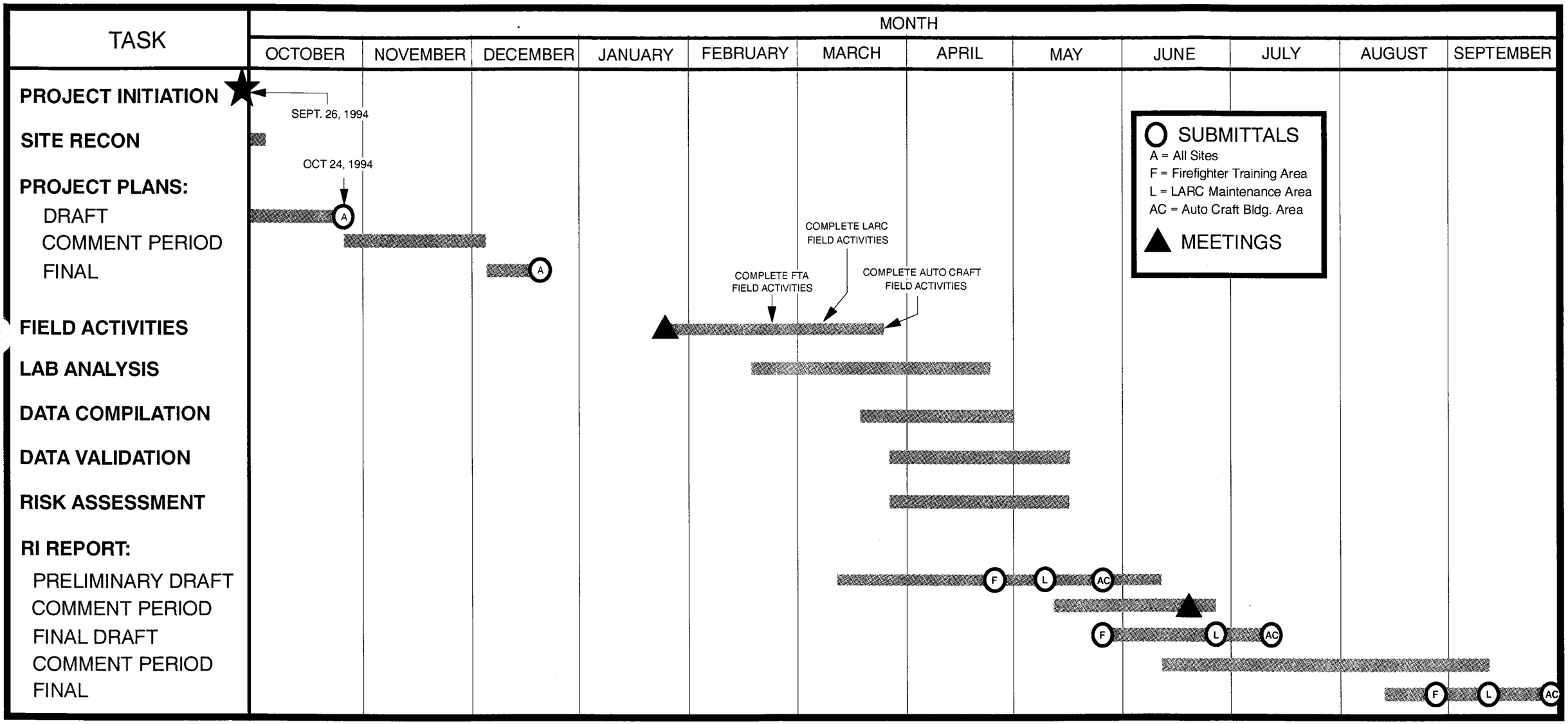
7.0 SCHEDULING

A Preliminary Project Schedule for the Remedial Investigation (RI) work is provided as Figure 7-1. A final schedule will be developed in conjunction with the U.S. Army Corps of Engineers upon acceptance of the Final Work Plan.

FIGURE 7-1

PROJECT SCHEDULE

FTA, LARC, AUTO CRAFT RIs



8.0 PROJECT ORGANIZATION

The Malcolm Pirnie organization structure for this project is shown on Figure 8-1. Steve Cho is the U.S. Army Corps of Engineers (ACE) Project Manager in charge of providing technical direction and monitoring the technical performance of Malcolm Pirnie.

For Malcolm Pirnie, Inc., Paul Busch, President, is the President and Phillip Feeney, Vice President in charge of the Newport News Regional Office, is the Officer providing overall project direction. Richard Brownell, Vice President in charge of Hazardous Waste Programs, is the Officer providing technical review.

The Project Manager for Malcolm Pirnie, Inc. is Franco Godoy, Associate, who specializes in hazardous waste investigation and remediation projects and who is the Hazardous Waste Group Manager for the Newport News Regional Office. The Field Manager is Mary Mullen. Health and safety and quality assurance will be the responsibility of Scott Bailey and Anthony Pace, respectively.

Malcolm Pirnie, Inc. has a matrix organization structure. Project personnel are drawn from throughout the company irrespective of group or locational assignment. The project personnel are selected on the basis of appropriate skills, experience and availability. For purposes of this project, tasks and subtasks will be assigned to Task Managers. Personnel working on specific tasks will report on a daily basis to their respective Task Managers. Task Managers, in turn, will work under the daily direction of the Project Manager.

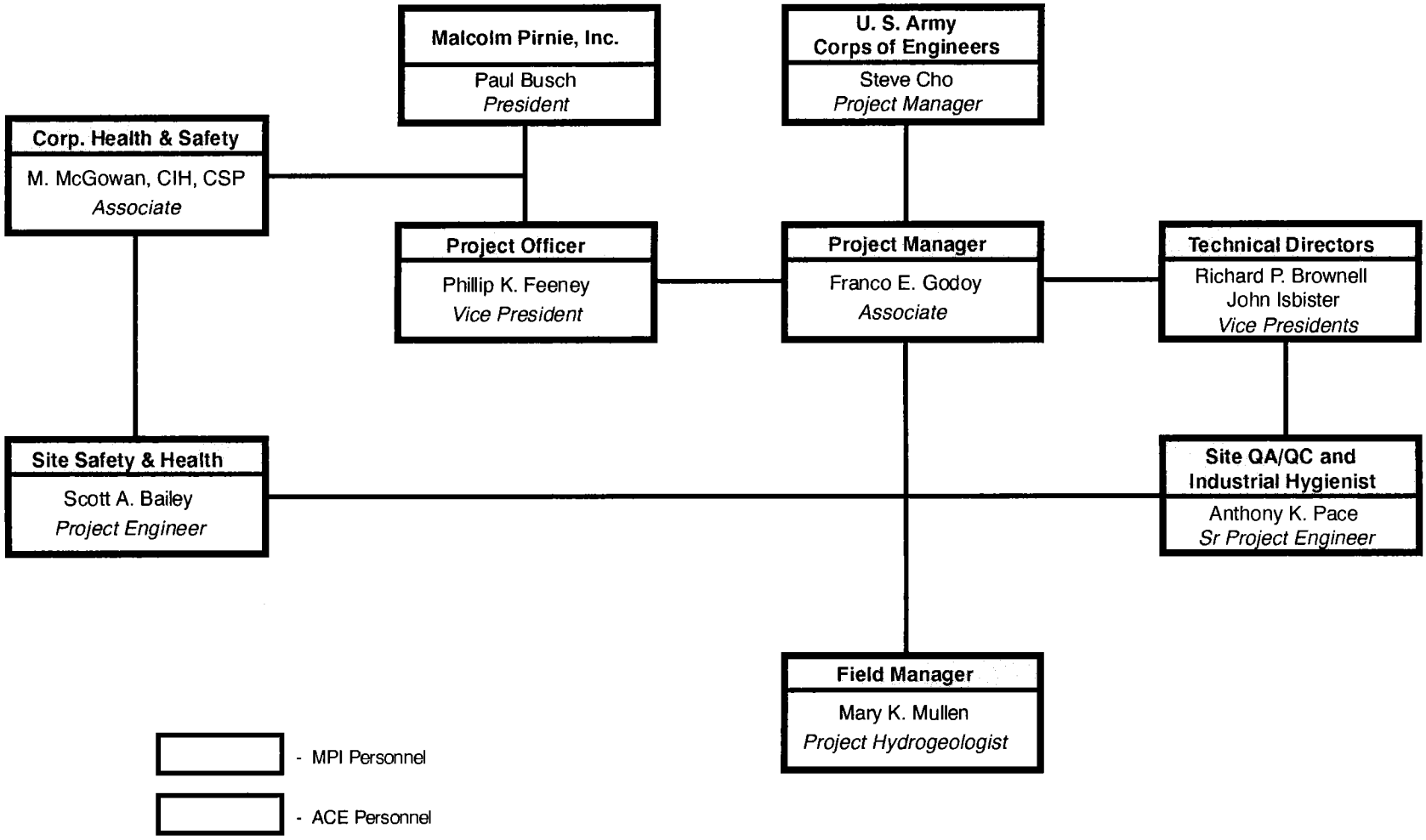
The project personnel responsibilities are summarized below.

Senior Company Officer: Paul L. Busch, Ph.D., President, is the Senior Company Officer at the top of the QA/QC chain of command. He interfaces with the Project Officer on QA/QC issues for the project.

Project Officer: The Project Officer, Phillip K. Feeney, P.E., is the representative of Malcolm Pirnie with contract authority. The Project Officer is responsible for the commitment of the resources required to fulfill Malcolm Pirnie's obligation to the ACE. The Project Officer is accountable to both the ACE and Malcolm Pirnie's President.

FIGURE 8-1

ORGANIZATIONAL CHART



Technical Review Director: The Technical Review Director, Richard Brownell, P.E., provides guidance on technical matters and reviews all technical documents relating to the project. The Technical Review Director may delegate technical guidance to specially trained individuals under his direction. John Isbister provides technical review assistance for hydrogeologic investigations.

Project Manager: The Project Manager, Franco Godoy, is accountable to the Project Officer throughout the duration of the project, and utilizes the Technical Review Officer for any technical assistance. The Manager may delegate authority to expedite and facilitate the implementation of the project plan. The Project Manager is responsible for:

- Review of engineering and interim reports
- Coordination with ACE
- Budget control
- Subcontractor performance
- Project coordination to implement Work Plan
- Allocation of resources and staffing to implement the QA/QC program
- Allocation of resources and staffing to implement Site Safety and Health Plan (SSHP)

Health and Safety Manager: The Health and Safety Manager, Mark A. McGowan, C.I.H., serves as the administrator of Malcolm Pirnie's Corporate Health and Safety program. He is accountable directly to Malcolm Pirnie's President for project health and safety concerns and is responsible for:

- Administering OSHA and DOT compliance training for Malcolm Pirnie field personnel.
- Administering the medical surveillance program.
- Ensuring field personnel having adequate experience with personal protective equipment.
- Providing guidance on data interpretation.

- Reviewing proposed levels of worker protection.

Site Field Manager: The Site Field Manager, Mary Mullen, will serve as the on-site contact person for Malcolm Pirnie for field investigations and tests. The coordinator will be responsible for the logistics of the field activities. The Field Coordinator will:

- Inspect and replace equipment
- Prepare daily and interim reports
- Prepare samples for shipment
- Coordinate field activities
- Schedule sampling and other field activities

Project Quality Control Officer: The Project QC Officer, Anthony Pace, is responsible for the project specific supervision and monitoring of the QC program and reports to the Project Manager. Additional responsibilities include:

- Ensuring that field personnel are familiar with and adhere to proper sampling procedures, field measurement techniques, and sample identification and chain-of-custody procedures.
- Coordinating with the analytical laboratory for the receipt of samples, the reporting of analytical results and recommending corrective actions to correct deficiencies in the analytical protocol or sampling.
- Ensuring that duplicate samples are provided to the ACE as necessary.

Task Managers: Various Task Managers will provide technical support to the Project Manager for implementation of the Work Plan relative to their respective task and have the following responsibilities:

- Preparing task reports and outlining field investigation requirements
- Reviewing daily reports and field notebooks
- Task scheduling

- Task budget management
- Task Work Plan coordination
- Data validation

Site Safety and Health Officer: The Site Safety and Health Officer (SSHO), Anthony Pace, is responsible for ensuring that the field activities are carried out in accordance with the SSHP. The SSHO will provide technical assistance to the Project Manager and field personnel to assure site safety. In addition, the SSHO will:

- Monitor all field activities
- Monitor personal exposure to chemical toxicants
- Develop emergency response procedures
- Monitor for temperature stress
- Establish personnel and equipment decontamination procedures
- Stop work in the event unsafe work conditions are encountered

Field Sampling Team: Field sampling teams will be provided by Malcolm Pirnie, Inc. All personnel will follow the procedures described in this document and associated documents to assure consistency in sample collection.

APPENDIX A

SCOPE OF SERVICES

CENAB-EN-HM

17 August 1994

Scope of Services
Remedial Investigation/Risk Assessment
FIREFIGHTER TRAINING AREA (SITE 4)
AT
FORT STORY, VIRGINIA

1. BACKGROUND

The Firefighter Training Area (FTA) was recommended for further study in the Final Preliminary Assessment/Site Investigation Report submitted in January 1992 for Multi-site studies at Fort Eustis and Fort Story, Virginia. A remedial investigation (RI) is considered to be the first attempt at characterization of the site.

2. OBJECTIVES

The objectives of the RI include the determination of the presence or absence of contamination at the site, ascertaining of the pertinent parameters (including type, concentration, extent, etc.) of any contamination found, evaluation of any contamination with regard to actual or potential hazard to public health and the environment, preparation of recommendations for further required action (or no action) at the site, and documentation of the findings and results of all work.

3. STATEMENT OF SERVICES

The RI work shall be performed in accordance with EPA "Guidance For Conducting Remedial Investigations and Feasibility Studies Under CERCLA",(EPA)/540/G-89/004, ER-1110-1-263, and all other applicable regulations. If any conflicts occur between the various guidance and criteria documents (and/or with this Scope of Services), the AE shall be responsible for presenting these issues in writing (in a timely manner) to the U.S. Army Corps of Engineers for resolution by the Contracting Officer. The AE shall also provide written recommendations for resolution of the conflicts. Specifically, the RI work shall: (1) confirm the presence or absence of contamination at the designated sites; (2) determine the extent and degree of contamination at the designated sites; (3) assess the potential for contaminant migration into, and through, surrounding environments; (4) identify public health and environmental risks of contaminants relative to applicable regulatory standards; and (5) define future investigations and/or actions required at the site. The investigations for this site shall be performed as follows:

Task 1 - Background Information

The Architect-Engineer (A-E) shall conduct a site walk, and a literature search of local hydrogeological conditions which should include topographic, geologic, hydrogeologic, aquifer, climatological, biota, and analytical data. The A-E shall also perform an information search for related site history. This literature and

information search will consist of review of available documents (especially the PA/SI report) and files along with interviews with available current and past personnel related to this site. The literature and information search shall include but not be limited to the following topics:

a. Interviews with Installation personnel familiar with the operation of and/or activities at the particular site.

b. File search to obtain information regarding the operations of and/or activities conducted at the site in question, especially those activities relating to the release of a hazardous substance or any investigations of past releases at the site in question.

c. Topographic Data and As-builts. The A-E shall use available data and drawings from the Installation to identify exact locations of removed and existing tanks, piping, transfer stations, pump houses, and underground utilities. The A-E shall perform all engineering and topographic surveys using the installation's coordinate system for this project. The original surveys and field notes are Government property and shall be furnished to the Government.

d. PA/SI's Applicable or Relevant and Appropriate Requirement (ARARs) Analysis shall be updated. An analysis of local, state, and federal statues related to this project shall be conducted by the AE. These ARARs shall be evaluated relative to the activities and conditions at the site. A summary of the ARARs analysis shall be included in the RI report and shall be used in any recommendation.

Task 2 - Prepare Workplan/CDAP

The A-E shall prepare the workplan/CDAPs to describe a detailed discussion of the technical approach the A-E plans to use to implement the requirements this SOW. This workplan shall comply with the requirements of ER 1110-1-263. Also, a Sampling Plan that addresses all field and drilling activities shall be included. The Sampling Plan will contain a statement of sampling objectives, specification of equipment, analyses of interest, sample types, sample locations, frequency, and schedule. All field and laboratory activities associated with the installation of monitoring wells and soil borings, drilling, sampling, and analytical requirements shall be included in this plan.

Task 3 - Prepare Health and Safety Plan

An A-E H&SP shall be submitted by the A-E. The plan shall include the information outlined in the attached Health & Safety Scope of Work.

Task 4 - Field Investigation

The A-E shall conduct a field investigation to evaluate the extent of groundwater contamination associated with the fire training pit itself, the extent of groundwater contamination by chlorinated solvents detected in the southeastern corner of site 4, and the possible occurrence of groundwater contamination associated with each of the two soil gas anomalies at the northern section of the site. Soil remediation associated with the fire training pit shall be evaluated through confirmatory sampling. Limited surface soil sampling shall be conducted in the northern part of site 4 to evaluate contamination at areas exhibiting soil staining.

Field investigation at the site shall involve determining the extent of ground water contamination using the DPWS with an on-site gas chromatograph as a screening tool. Based on the results of preliminary screening, well points will be installed to determine the extent of the contaminant plumes and to allow for monitoring of contaminant level fluctuations within the plumes.

a. At the fire training pit up to 6 DPWS samples and up to 2 Direct Push Well Point shall be installed around the perimeter of the pit. Up to 24 soil samples shall be analyzed for the purpose of confirming the remediation.

b. At the Northern Section of the site up to a total of 6 near surface (0-6 inches) soil samples shall be collected from areas of visible soil staining and from the vicinity of SB-101 where slightly elevated concentrations of lead were detected. An additional 6 DPWS samples shallow be taken and up to 18 soil samples shall be analyzed. Soil samples shall be collected at depths of 0-6" and 18-24" in each point. These sampling locations shall be determined by the evaluation of aerial photographs, and on-site inspections.

c. Four sediment samples shall be collected from the wetlands area. The sampling locations shall be determined in the field and shall be sited where run off from the fire training area potentially impacts the wetlands area. Sediment samples (or shallow soil samples if the area is dry) shall be collected from the uppermost 6 inches of the sediment column. Unless the areas are dry, four surface water samples shall be collected at the same locations as the sediment samples.

d. At the solvent plume area up to 6 DPWS samples and up to 2 Direct Push Well Point shall be installed around the perimeter of the pit. Up to 24 soil samples shall be analyzed.

e. Water Sampling--Groundwater samples shall be collected from all wells, new (4) old (4), at the site following development of the newly installed wells and submitted for laboratory analysis.

f. Based on the field screening information the A-E shall install up to 4 GW monitoring wells.

Task 5 - Risk Assessment

The A-E shall conduct a risk assessment IAW the attached instructions.

Task 6 - Laboratory Analyses

A total of 66 soil samples, 26 groundwater samples, 6 surface soil samples, 4 sediment samples and 4 water samples (not including QA/QC samples) shall be analyzed for this project at an off-site laboratory. Off-site laboratory analyses shall be conducted on a 28 day turnaround basis. Samples analyses shall be conducted in accordance with the approved workplan/CDAP.

Task 7 - Data Management/Evaluation

The A/E shall complete the necessary data management and assessment of environmental data generated through sampling and analysis activities for use in defining the presence and/or extent of contamination in environmental media as follows:

Data Management/Compilation - To ensure data usability, the A/E shall complete the appropriate level of data management as specified in the CDAP to provide for efficient and accurate validation and evaluation.

Data Validation - The A/E shall examine project data, documentation, and laboratory reports to determine if performance requirements established in project planning documents (Sampling Plan and CDAP) have been met. All chemical analytical data generated in accordance with the Project Work Plan shall be validated to yield SW-846 Level III data quality. During the review process, the following areas, at a minimum, of the data packages shall be reviewed:

- Conformance with sample acquisition SOPs
- Chain-of-custody
- Holding times
- Calibration
- Blanks
- Matrix spike analysis
- Laboratory control samples or check sample analysis
- Instrument detection limits
- Sample results
- Corrective actions taken, as appropriate

Data Evaluation - The A/E shall develop a conceptual site model defining the nature and extent of contamination at the Building 1607 Storage Yard to the extent practicable using data generated

through the Phase I RI and historical data available for the site. The conceptual site modeling will include tabulation of analytical and site data, a summary of all site data and contouring of subsurface data using a computer contouring program. Data evaluation shall establish:

- The nature and extent of contamination in site source soils.
- The presence or nature of contamination in potentially impacted environmental media including groundwater, surface water, sediments, and downgradient soils.

Task 8 - RI Report

Preliminary Draft RI Report - A Preliminary Draft RI Report shall summarize the findings of all field investigations conducted and will include site activity logs, diagrams showing sampling locations, and laboratory results. Analysis and a discussion of the data generated during the investigation along with conclusions and recommendations for further action at the site will be included. This report shall be submitted to USACE and Fort Eustis for review and comment.

Draft RI Report - A Draft RI Report shall be prepared incorporating comments from USACE and Fort Eustis on the preliminary draft. The Draft RI Report shall be submitted to USACE, and Fort Eustis for further comment and to EPA Region III and DEQ for initial comment. A separate response to comments document will be prepared and submitted to all parties. This document shall address how comments have been incorporated into the revised document.

Final RI Report - A Final RI Report shall be prepared incorporating the comments from the draft report. The Final Report will be submitted to USACE, Fort Eustis, EPA Region III and DEQ for their information. A separate response to comments document will be prepared and submitted to all parties. This document shall address how comments have been incorporated into the revised document.

An example table of contents (suggested RI Report format of "Guidance for Conducting RI/FS Under CERCLA", USEPA Guidance Manual, EPA/540/G-89/004, October 1988) for the report is provided as follows:

TABLE OF CONTENTS

1.2.1 Site Description
1.2.2 Site History
1.2.3 Previous Investigations
1.3 Report Organization

2.0 Site Investigation
2.1 Site Characterization Field Activities
2.1.1 Surface Features
2.1.2 Contaminant Source Investigations
2.1.3 Surface Water and Sediment Investigations
2.1.4 Geologic Investigations
2.1.5 Soil Investigations
2.1.6 Groundwater Investigations
2.2 Technical Memoranda Summary

3.0 Site Physical Characteristics
3.1 Surface Features
3.2 Surface Water Hydrology
3.3 Geology
3.4 Soils
3.5 Hydrogeology
3.6 Demography

4.0 Nature and Extent of Contamination
4.1 Sources
4.2 Soils
4.3 Groundwater
4.4 Surface Water
4.5 Sediments

5.0 Contaminant Fate and Transport
5.1 Potential Routes of Transport
5.2 Contaminant Persistence
5.3 Contaminant Migration

6.0 Baseline Risk Assessment (Optional Service)
6.1 Human Health Evaluation
6.2 Environmental Evaluation

7.0 Summary and Recommendations
7.1 Summary
7.2 Conclusions

Appendices
A Technical Memoranda (if available)
B Laboratory Analytical and QA/QC Evaluation Results
C Risk Assessment Methods (Optional Service)

Task 9 - Waste Disposal

Investigation-derived wastes (IDW) shall be sampled and analyzed to determine the appropriate method of waste disposal. Waste samples shall be collected and analyzed for TCLP analyses of organics and metal; TPH; total PCBs; and RCRA characteristics for ignitability

and reactivity. No QA/QC samples shall be collected or analyzed for characterization of IDW samples. The A/E shall serve as an agent to the Government for the disposal of the wastes by completing the required waste characterization profiles and manifests, and coordinating the disposal activities. The A/E shall assume that the IDW is not hazardous waste.

Task 10 - Project Management/Meetings

a. The A-E shall assign a member or employee who shall serve as the project manager. This individual shall be responsible all coordinations with USACE and installation. The A-E shall coordinate all requests for installation support. To avoid conflicts and schedule delays, the A-E shall request all installation support well in advance of their anticipated time of need (at least 14 days minimum).

b. The A-E shall perform the following required travel. Responsible representatives of the A-E's firm from the appropriate disciplines shall attend the following meetings:

Kick-off Meeting The purpose of this meeting is to discuss the project in detail prior to project start. This will aid in ensuring the complete understanding of the project intent and expected results.

Analytical Results Report Meeting. This meeting is to allow the A-E to present and informally discuss this Scope's analytical results with the USACE technical staff and the installation. The A-E shall summarize any technical difficulties encountered during sample analysis, any anomalies, false positives or any other laboratory problems encountered during analysis and present analysis, analytical results, conclusions and recommendations.

Draft RI Report Comment Meeting This meeting is to discuss any comments and responses to the draft RI.

Meeting Notes. The A-E shall be responsible for taking notes and preparing the reports of all meetings. Meeting notes will be prepared in typed form and the original furnished to USACE project manager within five days after the date of the meeting for concurrence and distribution to all attendees by A-E. This report shall include the following items as a minimum:

1) The date and place the meeting was held with a list of attendees. The roster of attendees shall include name, organization, and telephone number.

2) Written comments presented by attendees shall be attached to each report with the conference action noted. Meeting action shall be "A": for an Approved comment, "D" for a Disapproved comment, "W" for a comment that has been Withdrawn, and "E" for a comment that has an Exception noted.

3) Comments made during the meeting, decisions affecting criteria changes, must be recorded in the basic meeting notes. Any augmentation of written comments should be documented by the meeting notes.

C. The A-E shall submit progress reports to the Contracting Officer with each request for payment. The progress reports shall indicate work performed, costs, and problems incurred during the payment period. The reports shall also include the tasks completed and/or percentage completion of particular project tasks, and the upcoming events to be worked on in the next payment period. These Progress Reports shall be submitted two (2) weeks prior to the payment estimate submittal so that the USACE-PM can approve the payment request in a timely manner. (use ENG 93 for payment estimates)

d. The A-E shall develop the following listed reports.

d.1. A-E Daily Quality Control Report (A-E DQCR). During the site investigation activities, the A-E shall provide Daily Quality Control Reports (DQCR's) to the USACE-PM, which will include the information found in "A-E Guidance for Developing A-E Quality Management Procedures for Site Investigative Activities." These reports shall be compiled and sent to the USACE PM by regular mail at the end of every work week. However, should problems arise, the A-E shall notify the USACE-PM immediately. The A-E shall also hand-carry a copy of this A-E DQCR to the IEC on the morning after each reported work day.

d.2. A-E Quality Control Summary Report (A-E QCSR). A draft and final report shall be submitted by the A-E at the conclusion of the site investigations. The report shall outline QC practices employed by the A-E including any problems and acceptable corrective actions taken, and contain consolidation and summary of the A-E daily Quality Control Reports as prescribed in the contract. The A-E shall submit the draft document for review within 60 days from demobilization from the field.

4. DELIVERABLES

The A/E shall submit the following deliverables (IAW table):

1. Draft Workplan/CDAP (28 days after DO Award)
2. Final Workplan/CDAP (14 days after review comments)
3. Draft H&SP (28 days after DO Award)
4. Final H&SP (14 days after review comments)
5. Draft RI Report (60 days after field activities)
6. Draft Final RI Report (14 days after review comments)
7. Final RI Report (14 Days after review comments)

* All deliverables will be submitted with responses to comments.

REVIEW DISTRIBUTION LIST

PROJECTs: Firefighter Training Area
LARC Maintenance Area
and Auto Craft Building RIs

17 Aug 1994

LOCATION: FT Story, VA

SUBMITTAL	REVIEWER DISTRIBUTION A	B	C	D	E	H	I	REVIEW AGENCIES
Draft Workplan/CDAPs	3		3		1			A. USAED-BALTIMORE ATTN: CENAB-EN-HM 10 S. Howard ST. ROOM 10040, S. CHO BALTIMORE MD 21203
Final WorkPlan/CDAPs	3		6		1			
								B. USCENAD-NEW YORK ATTN: CENAD-EN-MM 90 Church Street ROOM 1208A, Mazzola NEW YORK, NY 10007
Draft H&S Plans	3		3		1			
Final H&S Plans	3		6		1			C. Directorate of Public Works U.S. Army Transportation Center ATTN: Dan Musel Bldg 1407 Ft. Eustis, VA 23604-5332
Draft RI Reports	3		3		1			
								D. USCENAO-Norfolk
Draft Final RI Reports	3		3		1	3		
Final RI Reports	4		3		1	3		E. USACE-MRD HTRW Document Distribution 12565 W Center Rd OMAHA, NE 68144-3869 ATTN:CEMRD-EN-H
								F. Cdr, AEC CETHA-IR-A ATTN: Joe King APG, MD 21010-5401
								G. Cdr, AEHA HSHB-ME-SE ATTN: Keith Hoddinott APG, MD 21010-5401
								H. DEQ Federal Programs ATTN:
								I. USEPA, Region III Federal Programs ATTN:

L REVIEW COMMENTS ARE DUE IN BALTIMORE DISTRICT within fifteen calendar days after thereceipt of the documents.

CENAB-EN-HM

17 August 1994

Scope of Services
Remedial Investigation/Risk Assessment
LARC MAINTENANCE AREA (SITE 6)
AT
FORT STORY, VIRGINIA

1. BACKGROUND The Lighter Amphibious Resupply Cargo (LARC) Maintenance Area was recommended for further study in the Final Preliminary Assessment/Site Investigation Report submitted in January 1992 for Multi-site studies at Fort Eustis and Fort Story, Virginia. A remedial investigation (RI) is considered to be the first attempt at characterization of the site.

2. OBJECTIVES The objectives of the RI include the determination of the presence or absence of contamination at the site, ascertaining of the pertinent parameters (including type, concentration, extent, etc.) of any contamination found, evaluation of any contamination with regard to actual or potential hazard to public health and the environment, preparation of recommendations for further required action (or no action) at the site, and documentation of the findings and results of all work.

3. STATEMENT OF SERVICES The RI work shall be performed in accordance with EPA "Guidance For Conducting Remedial Investigations and Feasibility Studies Under CERCLA", (EPA)/540/G-89/004, ER-1110-1-263, and all other applicable regulations. If any conflicts occur between the various guidance and criteria documents (and/or with this Scope of Services), the AE shall be responsible for presenting these issues in writing (in a timely manner) to the U.S. Army Corps of Engineers for resolution by the Contracting Officer. The AE shall also provide written recommendations for resolution of the conflicts. Specifically, the RI work shall: (1) confirm the presence or absence of contamination at the designated sites; (2) determine the extent and degree of contamination at the designated sites; (3) assess the potential for contaminant migration into, and through, surrounding environments; (4) identify public health and environmental risks of contaminants relative to applicable regulatory standards; and (5) define future investigations and/or actions required at the site. The investigations for this site shall be performed as follows:

Task 1 - Background Information The Architect-Engineer (A-E) shall conduct a site walk, and a literature search of local hydrogeological conditions which should include topographic, geologic, hydrogeologic, aquifer, climatological, biota, and analytical data. The A-E shall also perform an information search for related site history. This literature and information search will consist of review of available documents (especially the PA/SI report) and files along with interviews with available current and past personnel related to this site. The literature and information search shall include but not be limited to the following topics:

a. Interviews with Installation personnel familiar with the operation of and/or activities at the particular site.

b. File search to obtain information regarding the operations of and/or activities conducted at the site in question, especially those activities relating to the release of a hazardous substance or any investigations of past releases at the site in question.

c. Topographic Data and As-builts. The A-E shall use available data and drawings from the Installation to identify exact locations of removed and existing tanks, piping, transfer stations, pump houses, and underground utilities. The A-E shall perform all engineering and topographic surveys using the installation's coordinate system for this project. The original surveys and field notes are Government property and shall be furnished to the Government.

d. PA/SI's Applicable or Relevant and Appropriate Requirement (ARARs) Analysis shall be updated. An analysis of local, state, and federal statues related to this project shall be conducted by the AE. These ARARs shall be evaluated relative to the activities and conditions at the site. A summary of the ARARs analysis shall be included in the RI report and shall be used in any recommendation.

Task 2 - Prepare Workplan/CDAP Addendum The A-E shall prepare the workplan/CDAP addendum to the FTA's workplan/CDAP to describe a detailed discussion of the technical approach the A-E plans to use to implement the requirements this SOW. This workplan shall comply with the requirements of ER 1110-1-263. Also, a Sampling Plan that addresses all field and drilling activities shall be included. The Sampling Plan will contain a statement of sampling objectives, specification of equipment, analyses of interest, sample types, sample locations, frequency, and schedule. All field and laboratory activities associated with the installation of monitoring wells and soil borings, drilling, sampling, and analytical requirements shall be included in this plan.

Task 3 - Prepare Health and Safety Plan Addendum An A-E H&SP Addendum to the FTA's H&S Plan shall be submitted by the A-E.

Task 4 - Field Investigation
Investigations at site 6 involve the evaluation of both soil and groundwater contamination associated with a 10 k gallon waste oil UST, an oil water separator, and the sandy area (AKA "the sandbox") where the LARC vehicles are parked and where oily bilge water was reportedly drained directly onto the ground.

a. 10 k gal. Waste Oil UST - Up to 2 DPWS samples shall be collected and up to 2 Direct Push Well Points shall be installed around the UST site. Up to 12 soil samples shall be analyzed.

b. Oil Water Separator - Up to 2 DPWS samples shall be collected and up to 2 Direct Push Well Points shall be installed around the UST site. Up to 12 soil samples shall be analyzed.

c. "The Sandbox" - Up to 10 DPWS sampling locations shall be sampled within the sandbox. Four of the sampling locations shall be along the fence at the northern boundary of the site. The remaining six sample locations shall be located at the midpoint of the sandbox. Up to 5 DPWPs shall be installed around the sand box and in the forested area downgradient of the site. Up to 3 DPWPs shall become GW monitoring wells based on the analytical results. The Up to 45 soil samples shall be analyzed.

d. All existing wells (4) (including the existing production well) at this site shall be sampled. In addition, two surface water samples and two sediment samples shall be collected from the drainage ditch located between the sandbox area and the wooded area.

Task 5 - Risk Assessment

The A-E shall conduct a risk assessment IAW the attached instructions.

Task 6 - Laboratory Analyses

A total of 69 soil samples, 23 groundwater samples, 2 sediment samples and 2 water samples (not including QA/QC samples) shall be analyzed for this project at an off-site laboratory. Off-site laboratory analyses shall be conducted on a 28 day turnaround basis. Samples analyses shall be conducted in accordance with the approved workplan/CDAP.

Task 7 - Data Management/Evaluation

The A/E shall complete the necessary data management and assessment of environmental data generated through sampling and analysis activities for use in defining the presence and/or extent of contamination in environmental media as follows:

Data Management/Compilation - To ensure data usability, the A/E shall complete the appropriate level of data management as specified in the CDAP to provide for efficient and accurate validation and evaluation.

Data Validation - The A/E shall examine project data, documentation, and laboratory reports to determine if performance requirements established in project planning documents (Sampling Plan and CDAP) have been met. All chemical analytical data generated in accordance with the Project Work Plan shall be validated to yield SW-846 Level III data quality. During the

review process, the following areas, at a minimum, of the data packages shall be reviewed:

- Conformance with sample acquisition SOPs
- Chain-of-custody
- Holding times
- Calibration
- Blanks
- Matrix spike analysis
- Laboratory control samples or check sample analysis
- Instrument detection limits
- Sample results
- Corrective actions taken, as appropriate

Data Evaluation - The A/E shall develop a conceptual site model defining the nature and extent of contamination at the Building 1607 Storage Yard to the extent practicable using data generated through the Phase I RI and historical data available for the site. The conceptual site modeling will include tabulation of analytical and site data, a summary of all site data and contouring of subsurface data using a computer contouring program. Data evaluation shall establish:

- The nature and extent of contamination in site source soils.

- The presence or nature of contamination in potentially impacted environmental media including groundwater, surface water, sediments, and downgradient soils.

Task 8 - RI Report

Preliminary Draft RI Report - A Preliminary Draft RI Report shall summarize the findings of all field investigations conducted and will include site activity logs, diagrams showing sampling locations, and laboratory results. Analysis and a discussion of the data generated during the investigation along with conclusions and recommendations for further action at the site will be included. This report shall be submitted to USACE and Fort Eustis for review and comment.

Draft RI Report - A Draft RI Report shall be prepared incorporating comments from USACE and Fort Eustis on the preliminary draft. The Draft RI Report shall be submitted to USACE, and Fort Eustis for further comment and to EPA Region III and DEQ for initial comment. A separate response to comments document will be prepared and submitted to all parties. This document shall address how comments have been incorporated into the revised document.

Final RI Report - A Final RI Report shall be prepared incorporating the comments from the draft report. The Final Report will be submitted to USACE, Fort Eustis, EPA Region III and DEQ for

their information. A separate response to comments document will be prepared and submitted to all parties. This document shall address how comments have been incorporated into the revised document.

An example table of contents (suggested RI Report format of "Guidance for Conducting RI/FS Under CERCLA", USEPA Guidance Manual, EPA/540/G-89/004, October 1988) for the report is provided as follows:

TABLE OF CONTENTS

6.0 Baseline Risk Assessment (Optional Service)
- 6.1 Human Health Evaluation
- 6.2 Environmental Evaluation

7.0 Summary and Recommendations
- 7.1 Summary
- 7.2 Conclusions

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7. Final RI Report (14 Days after review comments)

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REVIEW DISTRIBUTION LIST

PROJECTs: Firefighter Training Area
LARC Maintenance Area
and Auto Craft Building RIs

17 Aug 1994

LOCATION: FT Story, VA

SUBMITTAL	REVIEWER DISTRIBUTION A	B	C	D	E	H	I	REVIEW AGENCIES
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Draft H&S Plans	3		3		1			
Final H&S Plans	3		6		1			C. Directorate of Public Works U.S. Army Transportation Center ATTN: Dan Musel Bldg 1407 Ft. Eustis, VA 23604-5332
Draft RI Reports	3		3		1			
								D. USCENAO-Norfolk
Draft Final RI Reports	3		3		1	3		
Final RI Reports	4		3		1	3		E. USACE-MRD HTRW Document Distribution 12565 W Center Rd OMAHA, NE 68144-3869 ATTN:CEMRD-EN-H
								F. Cdr, AEC CETHA-IR-A ATTN: Joe King APG, MD 21010-5401
								G. Cdr, AEHA HSHB-ME-SE ATTN: Keith Hoddinott APG, MD 21010-5401
								H. DEQ Federal Programs ATTN:
								I. USEPA, Region III Federal Programs ATTN:

ALL REVIEW COMMENTS ARE DUE IN BALTIMORE DISTRICT within fifteen calendar days after thereceipt of the documents.

CENAB-EN-HM

17 August 1994

Scope of Services
Remedial Investigation/Risk Assessment
AUTO CRAFT BUILDING AREA (SITE 7)
AT
FORT STORY, VIRGINIA

1. BACKGROUND The Auto Craft Building Area was recommended for further study in the Final Preliminary Assessment/Site Investigation Report submitted in January 1992 for Multi-site studies at Fort Eustis and Fort Story, Virginia. A remedial investigation (RI) is considered to be the first attempt at characterization of the site.

2. OBJECTIVES The objectives of the RI include the determination of the presence or absence of contamination at the site, ascertaining of the pertinent parameters (including type, concentration, extent, etc.) of any contamination found, evaluation of any contamination with regard to actual or potential hazard to public health and the environment, preparation of recommendations for further required action (or no action) at the site, and documentation of the findings and results of all work.

3. STATEMENT OF SERVICES The RI work shall be performed in accordance with EPA "Guidance For Conducting Remedial Investigations and Feasibility Studies Under CERCLA",(EPA)/540/G-89/004, ER-1110-1-263, and all other applicable regulations. If any conflicts occur between the various guidance and criteria documents (and/or with this Scope of Services), the AE shall be responsible for presenting these issues in writing (in a timely manner) to the U.S. Army Corps of Engineers for resolution by the Contracting Officer. The AE shall also provide written recommendations for resolution of the conflicts. Specifically, the RI work shall: (1) confirm the presence or absence of contamination at the designated sites; (2) determine the extent and degree of contamination at the designated sites; (3) assess the potential for contaminant migration into, and through, surrounding environments; (4) identify public health and environmental risks of contaminants relative to applicable regulatory standards; and (5) define future investigations and/or actions required at the site. The investigations for this site shall be performed as follows:

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a. Interviews with Installation personnel familiar with the operation of and/or activities at the particular site.

b. File search to obtain information regarding the operations of and/or activities conducted at the site in question, especially those activities relating to the release of a hazardous substance or any investigations of past releases at the site in question.

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Task 3 - Prepare Health and Safety Plan Addendum An A-E H&SP Addendum to the FTA's H&S Plan shall be submitted by the A-E.

Task 4 - Field Investigation

a. Up to 6 DPWS samples shall be collected and up to 3 Direct Push Well Points shall be installed around the site. The shall install up to 2 GW monitoring wells. Up to 18 soil samples shall be analyzed.

b. All existing wells at this site shall be sampled.

Task 5 - Risk Assessment

The A-E shall conduct a risk assessment IAW the attached instructions.

Task 6 - Laboratory Analyses

A total of 18 soil samples and 7 groundwater samples (not including QA/QC samples) shall be analyzed for this project at an off-site laboratory. Off-site laboratory analyses shall be conducted on a 28 day turnaround basis. Samples analyses shall be conducted in accordance with the approved workplan/CDAP.

Task 7 - Data Management/Evaluation

The A/E shall complete the necessary data management and assessment of environmental data generated through sampling and analysis activities for use in defining the presence and/or extent of contamination in environmental media as follows:

Data Management/Compilation - To ensure data usability, the A/E shall complete the appropriate level of data management as specified in the CDAP to provide for efficient and accurate validation and evaluation.

Data Validation - The A/E shall examine project data, documentation, and laboratory reports to determine if performance requirements established in project planning documents (Sampling Plan and CDAP) have been met. All chemical analytical data generated in accordance with the Project Work Plan shall be validated to yield SW-846 Level III data quality. During the review process, the following areas, at a minimum, of the data packages shall be reviewed:

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Data Evaluation - The A/E shall develop a conceptual site model defining the nature and extent of contamination at the Building 1607 Storage Yard to the extent practicable using data generated through the Phase I RI and historical data available for the site. The conceptual site modeling will include tabulation of analytical and site data, a summary of all site data and contouring of subsurface data using a computer contouring program. Data evaluation shall establish:

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Preliminary Draft RI Report - A Preliminary Draft RI Report shall summarize the findings of all field investigations conducted and will include site activity logs, diagrams showing sampling locations, and laboratory results. Analysis and a discussion of the data generated during the investigation along with conclusions and recommendations for further action at the site will be included. This report shall be submitted to USACE and Fort Eustis for review and comment.

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TABLE OF CONTENTS

2.1 Site Characterization Field Activities
2.1.1 Surface Features
2.1.2 Contaminant Source Investigations
2.1.3 Surface Water and Sediment Investigations
2.1.4 Geologic Investigations
2.1.5 Soil Investigations
2.1.6 Groundwater Investigations
2.2 Technical Memoranda Summary

3.0 Site Physical Characteristics
3.1 Surface Features
3.2 Surface Water Hydrology
3.3 Geology
3.4 Soils
3.5 Hydrogeology
3.6 Demography

4.0 Nature and Extent of Contamination
4.1 Sources
4.2 Soils
4.3 Groundwater
4.4 Surface Water
4.5 Sediments

5.0 Contaminant Fate and Transport
5.1 Potential Routes of Transport
5.2 Contaminant Persistence
5.3 Contaminant Migration

6.0 Baseline Risk Assessment (Optional Service)
6.1 Human Health Evaluation
6.2 Environmental Evaluation

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b. The A-E shall perform the following required travel. Responsible representatives of the A-E's firm from the appropriate disciplines shall attend the following meetings:

Kick-off Meeting The purpose of this meeting is to discuss the project in detail prior to project start. This will aid in ensuring the complete understanding of the project intent and expected results.

Analytical Results Report Meeting. This meeting is to allow the A-E to present and informally discuss this Scope's analytical results with the USACE technical staff and the installation. The A-E shall summarize any technical difficulties encountered during sample analysis, any anomalies, false positives or any other laboratory problems encountered during analysis and present analysis, analytical results, conclusions and recommendations.

Draft RI Report Comment Meeting This meeting is to discuss any comments and responses to the draft RI.

Meeting Notes. The A-E shall be responsible for taking notes and preparing the reports of all meetings. Meeting notes will be prepared in typed form and the original furnished to USACE project manager within five days after the date of the meeting for concurrence and distribution to all attendees by A-E. This report shall include the following items as a minimum:

1) The date and place the meeting was held with a list of attendees. The roster of attendees shall include name, organization, and telephone number.

2) Written comments presented by attendees shall be attached to each report with the conference action noted. Meeting action shall be "A": for an Approved comment, "D" for a Disapproved comment, "W" for a comment that has been Withdrawn, and "E" for a comment that has an Exception noted.

3) Comments made during the meeting, decisions affecting criteria changes, must be recorded in the basic meeting notes. Any augmentation of written comments should be documented by the meeting notes.

C. The A-E shall submit progress reports to the Contracting Officer with each request for payment. The progress reports shall indicate work performed, costs, and problems incurred

during the payment period. The reports shall also include the tasks completed and/or percentage completion of particular project tasks, and the upcoming events to be worked on in the next payment period. These Progress Reports shall be submitted two (2) weeks prior to the payment estimate submittal so that the USACE-PM can approve the payment request in a timely manner. (use ENG 93 for payment estimates)

d. The A-E shall develop the following listed reports.

d.1. A-E Daily Quality Control Report (A-E DQCR). During the site investigation activities, the A-E shall provide Daily Quality Control Reports (DQCR's) to the USACE-PM, which will include the information found in "A-E Guidance for Developing A-E Quality Management Procedures for Site Investigative Activities." These reports shall be compiled and sent to the USACE PM by regular mail at the end of every work week. However, should problems arise, the A-E shall notify the USACE-PM immediately. The A-E shall also hand-carry a copy of this A-E DQCR to the IEC on the morning after each reported work day.

d.2. A-E Quality Control Summary Report (A-E QCSR). A draft and final report shall be submitted by the A-E at the conclusion of the site investigations. The report shall outline QC practices employed by the A-E including any problems and acceptable corrective actions taken, and contain consolidation and summary of the A-E daily Quality Control Reports as prescribed in the contract. The A-E shall submit the draft document for review within 60 days from demobilization from the field.

4. DELIVERABLES

The A/E shall submit the following deliverables (IAW table):

1. Draft Workplan/CDAP Addendum (28 days after DO Award)
2. Final Workplan/CDAP Addendum (14 days after review comments)
3. Draft H&SP Addendum (28 days after DO Award)
4. Final H&SP Addendum (14 days after review comments)
5. Draft RI Report (60 days after field activities)
6. Draft Final RI Report (14 days after review comments)
7. Final RI Report (14 Days after review comments)

* All deliverables will be submitted with responses to comments.

REVIEW DISTRIBUTION LIST

PROJECTs: Firefighter Training Area
LARC Maintenance Area
and Auto Craft Building RIs

17 Aug 1994

LOCATION: FT Story, VA

SUBMITTAL	REVIEWER DISTRIBUTION A	B	C	D	E	H	I	REVIEW AGENCIES
Draft Workplan/CDAPs	3		3		1			A. USAED-BALTIMORE ATTN: CENAB-EN-HM 10 S. Howard ST. ROOM 10040, S. CHO BALTIMORE MD 21203
Final WorkPlan/CDAPs	3		6		1			
								B. USCENAD-NEW YORK ATTN: CENAD-EN-MM 90 Church Street ROOM 1208A, Mazzola NEW YORK, NY 10007
Draft H&S Plans	3		3		1			
Final H&S Plans	3		6		1			C. Directorate of Public Works U.S. Army Transportation Center ATTN: Dan Musel Bldg 1407 Ft. Eustis, VA 23604-5332
Draft RI Reports	3		3		1			
								D. USCENAO-Norfolk
Draft Final RI Reports	3		3		1	3		
Final RI Reports	4		3		1	3		E. USACE-MRD HTRW Document Distribution 12565 W Center Rd OMAHA, NE 68144-3869 ATTN:CEMRD-EN-H
								F. Cdr, AEC CETHA-IR-A ATTN: Joe King APG, MD 21010-5401
								G. Cdr, AEHA HSHB-ME-SE ATTN: Keith Hoddinott APG, MD 21010-5401
								H. DEQ Federal Programs ATTN:
								I. USEPA, Region III Federal Programs ATTN:

ALL REVIEW COMMENTS ARE DUE IN BALTIMORE DISTRICT within fifteen calendar days after thereceipt of the documents.

APPENDIX B

JAMES M. MONTGOMERY, INC.
PA/SI DATA

TABLE 2-8

SOIL TRIGGER LEVELS
PRELIMINARY ASSESSMENT/SITE INVESTIGATION
FORT STORY, VA

Parameter	Method Reporting Level[a] (mg/kg)	Background 95% Confidence Interval[b] (mg/kg)	Trigger Level[c] (mg/kg)
Pesticides/PCBs			
Chlordane	0.04	ND	-
p,p'DDD	0.02	ND	[d]
p,p'DDE	0.02	ND	[d]
p,p'DDT	0.02	0.0041	[d]
Arochlor 1254	0.02	ND	1[e]
Arochlor 1260	0.02	ND	1[e]
VOCs			
Carbon Disulfide	0.01	ND	-
Chloroform	0.01	ND	-
1,2-Dichlorobenzene	0.01	ND	-
1,3-Dichlorobenzene	0.01	ND	-
1,1-Dichloroethane	0.01	ND	-
1,2-Dichloroethane	0.01	ND	-
1,1-Dichloroethene	0.01	ND	-
cis-1,2-Dichloroethene	0.01	ND	-
Ethylbenzene	0.01	ND	-
Methylene Chloride	0.1	ND	-
Tetrachloroethene	0.01	ND	-
Toluene	0.01	ND	-
1,1,1-Trichloroethane	0.01	ND	-
Vinyl Chloride	0.025	ND	-
m,p-Xylenes	0.01	ND	-
o-Xylene	0.01	ND	-
Total Xylenes	0.01	ND	-
BNAs			
Benzoic Acid	10	ND	-
Di-n-butylphthalate	2	ND	-
Fluorene	1	ND	-
2-Methylnaphthalene	1	ND	-
Naphthalene	1	ND	-
Phenanthrene	1	ND	-
Phenol	1	ND	-
Pyrene	1	ND	-
TFH-L	0.20	ND	100[f]
TFH-H	10	ND	100[f]

TABLE 2-8 (Continued)

SOIL TRIGGER LEVELS
PRELIMINARY ASSESSMENT/SITE INVESTIGATION
FORT STORY, VA

Parameter	Method Reporting Level[a] (mg/kg)	Background 95% Confidence Interval[b] (mg/kg)	Trigger Level[c] (mg/kg)
Inorganics			
Arsenic	2.5	2.1	21
Barium	10	ND	-
Cadmium	0.5	ND	-
Chromium	1.0	2.8	28
Copper	1.0	1.4	14
Cyanide	0.1	ND	-
Lead	1.0	7.1	71
Mercury	0.02	ND	-
Nickel	4.0	ND	-
Zinc	7.0	5.7	57

(a) Method Reporting Level (MRL) represents the minimum concentration of an analyte that can be reported with a known confidence level.
(b) Upper bound of the 95 percent confidence interval on the population mean concentrations for background soil borings at Fort Story.
(c) For metal analytes detected in the background borings, the trigger levels are set at 10 times the 95 percent confidence interval.
(d) All DDT, DDE and DDD levels detected at Fort Story are within the expected background range (Personal Communication, Young, Chase, 1991).
(e) EPA, 1987, *Toxic Substances Control Act (TSCA) PCB Spill Cleanup Policy 40 CFR Section 761 Subpart G.*
(f) Commonwealth of Virginia, State Water Control Board, 1989 VR-680-13-02

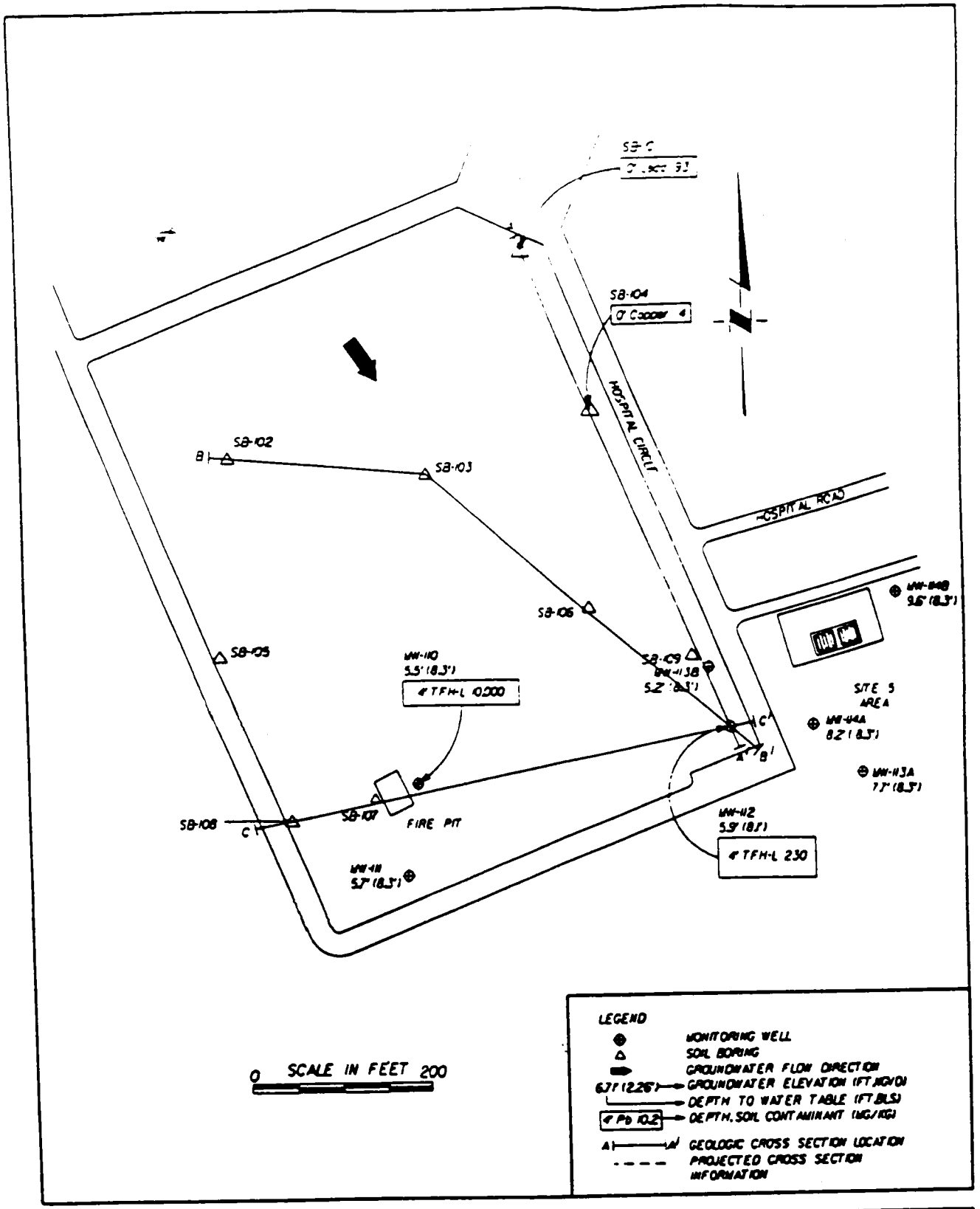
ND = Not Detected in the background borings.

TABLE 2-9

GROUNDWATER TRIGGER LEVELS
PRELIMINARY ASSESSMENT/SITE INVESTIGATION
FORT STORY, VA

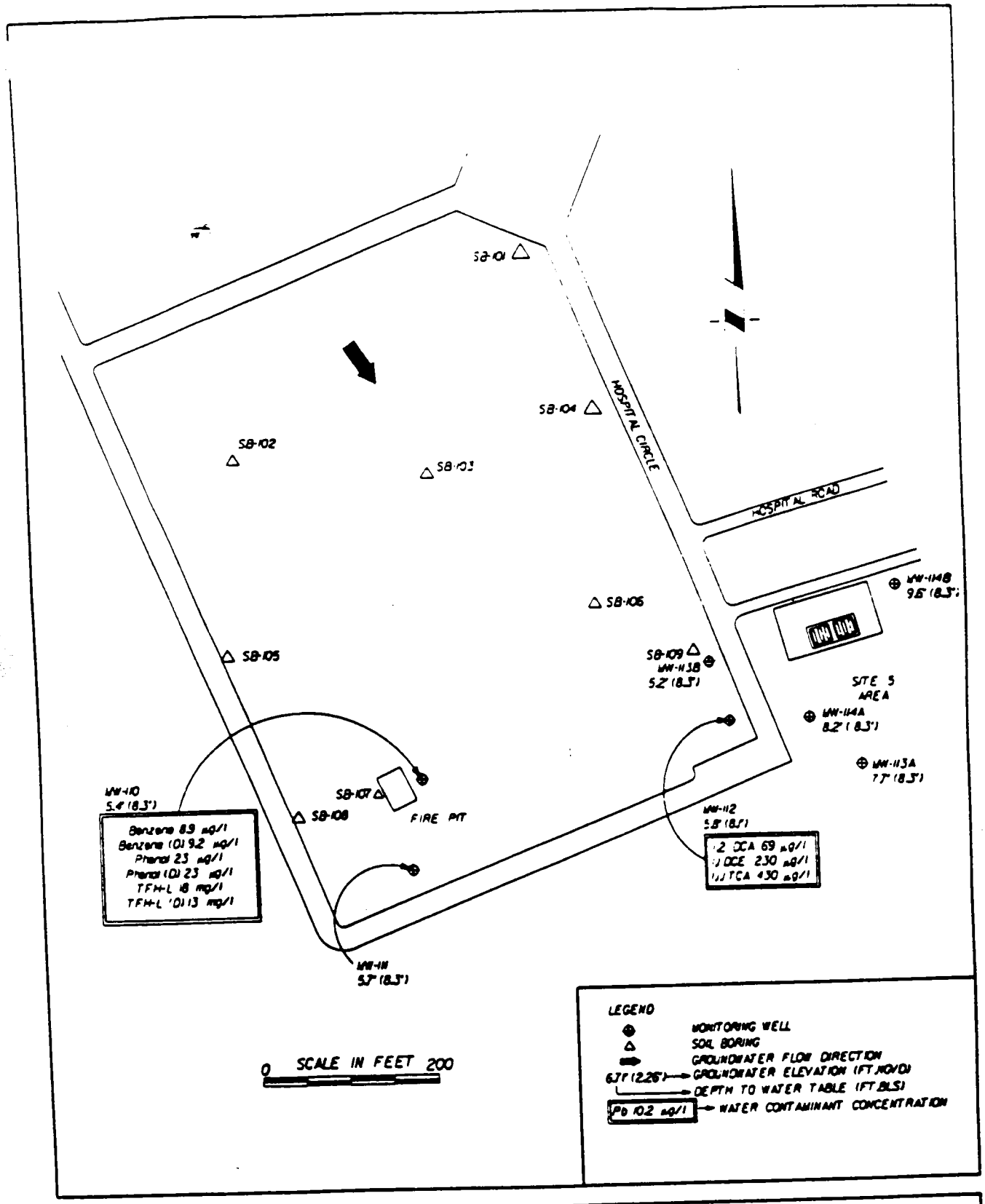
Parameter	Method Reporting Level[a]	Virginia GW Protection Standards[b]	Maximum Contaminant Level[c]	Trigger Level
VOCs (µg/l)				
Benzene	0.2	5	5	5
Carbon Disulfide	0.5	1,000	-	1,000
Chloroform	0.5	5	-	5
1,1-Dichloroethane	0.5	-	-	-
1,2-Dichloroethane	0.5	5	5	5
1,1 Dichloroethene	0.5	7	7	7
Ethylbenzene	0.5	-	700	700
Methylene Chloride	0.5	600	-	600
1, 1, 1-Trichloroethane	0.5	200	200	200
Tetrachloroethene	0.5	7	5	5
Toluene	0.5	1,000	1,000	1,000
Vinyl Chloride	1	2	2	2
m,p-Xylenes	0.5	-	-	-
o-Xylene	0.5	-	-	-
Total Xylenes	0.5	-	10,000	10,000
BNAs (µg/l)				
Anthracene	5	-	-	-
Benzoic Acid	50	-	-	-
bis(2-Ethylhexyl)phthalate	20	-	-	-
Dibenzofuran	5	-	-	-
2-Methylnaphthalene	5	-	-	-
Naphthalene	5	-	-	-
Phenanthrene	5	-	-	-
Phenol	5	1	-	1
Pyrene	5	-	-	-
TFH-L (mg/l)	0.05	1	-	1
TFH-H (mg/l)	0.1	1	-	1
Dissolved Metals (mg/l)				
Arsenic	0.005	0.05	0.05	0.05
Barium	0.1	1	1	1
Cadmium	0.005	0.0004	0.005	0.005
Lead	0.002	0.05	0.015[d]	0.015
Zinc	0.02	0.05	5	5

(a) Method Reporting Level (MRL) represents the minimum concentration of an analyte that can be reported with a known confidence level. The listed values were in effect for the PA/SI project.
(b) Commonwealth of Virginia, Department of Waste Management, 1988, *Solid Waste Management Regulations VR 672-20-10*
(c) EPA, 1991, *National Primary Drinking Water Regulations, 40 CFR Parts 141, 142, and 143*
(d) Takes effect December 1992.



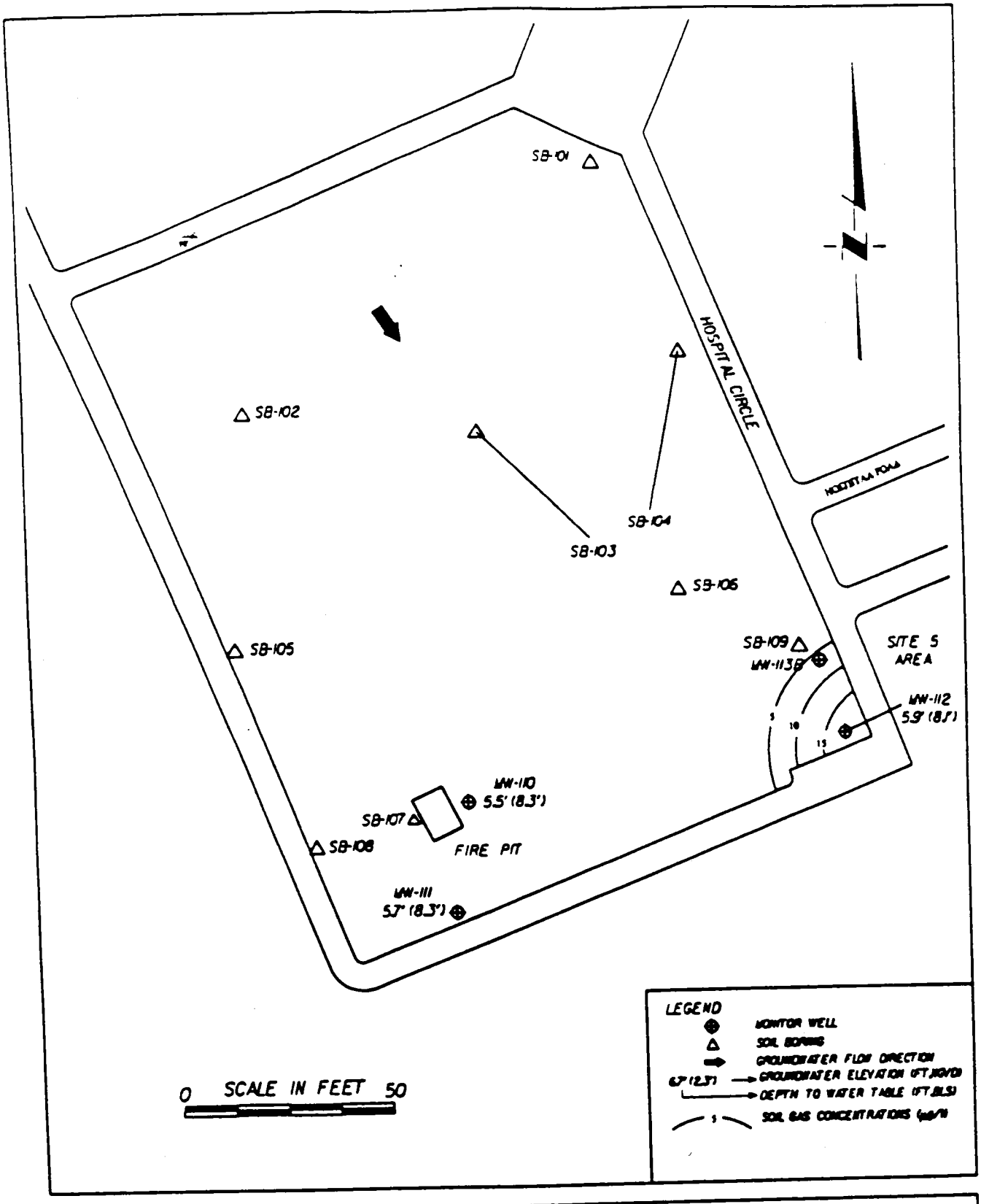
Soil Chemistry Concentrations and Geologic Cross Section Locations,
Site 4, Firefighter Training Area
Ft. Story, VA

Figure 2-9



Groundwater Chemistry Concentrations,
Site 4, Firefighter Training Area
Ft. Story, VA

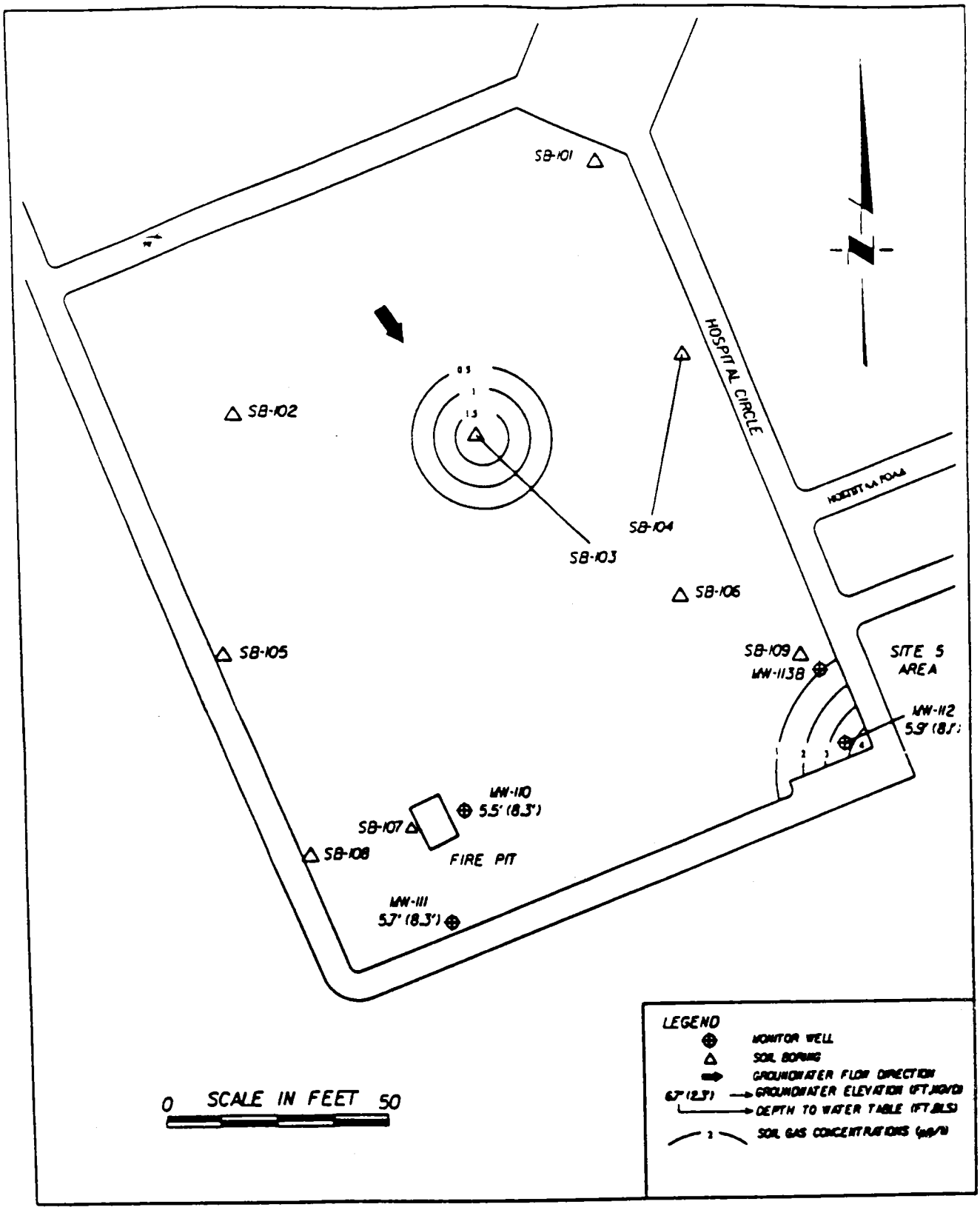
Figure 2-10



JMM

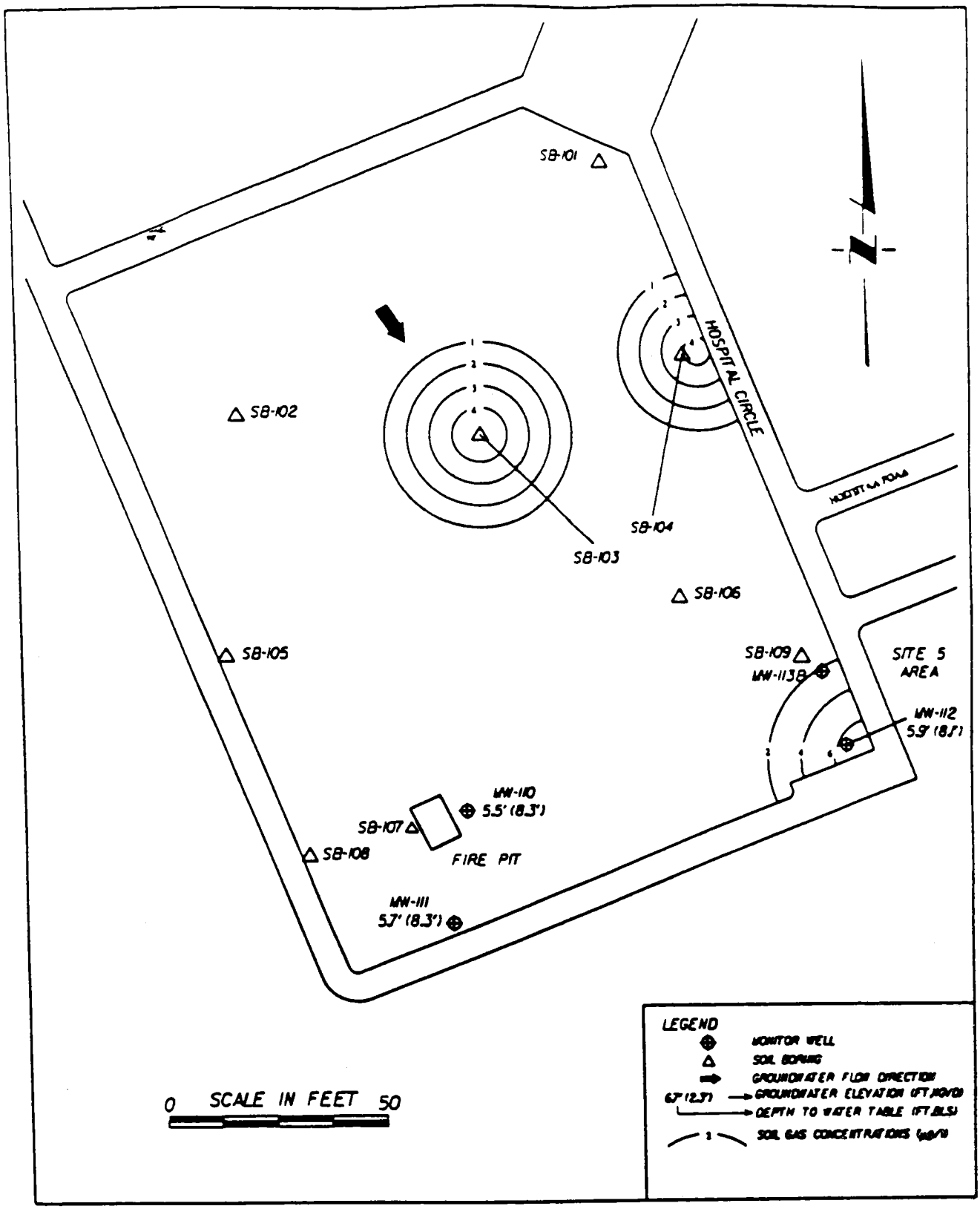
Benzene Concentrations in Soil Gas at Site 4, Firefighter Training Area
Ft. Story, VA

Figure 2-12



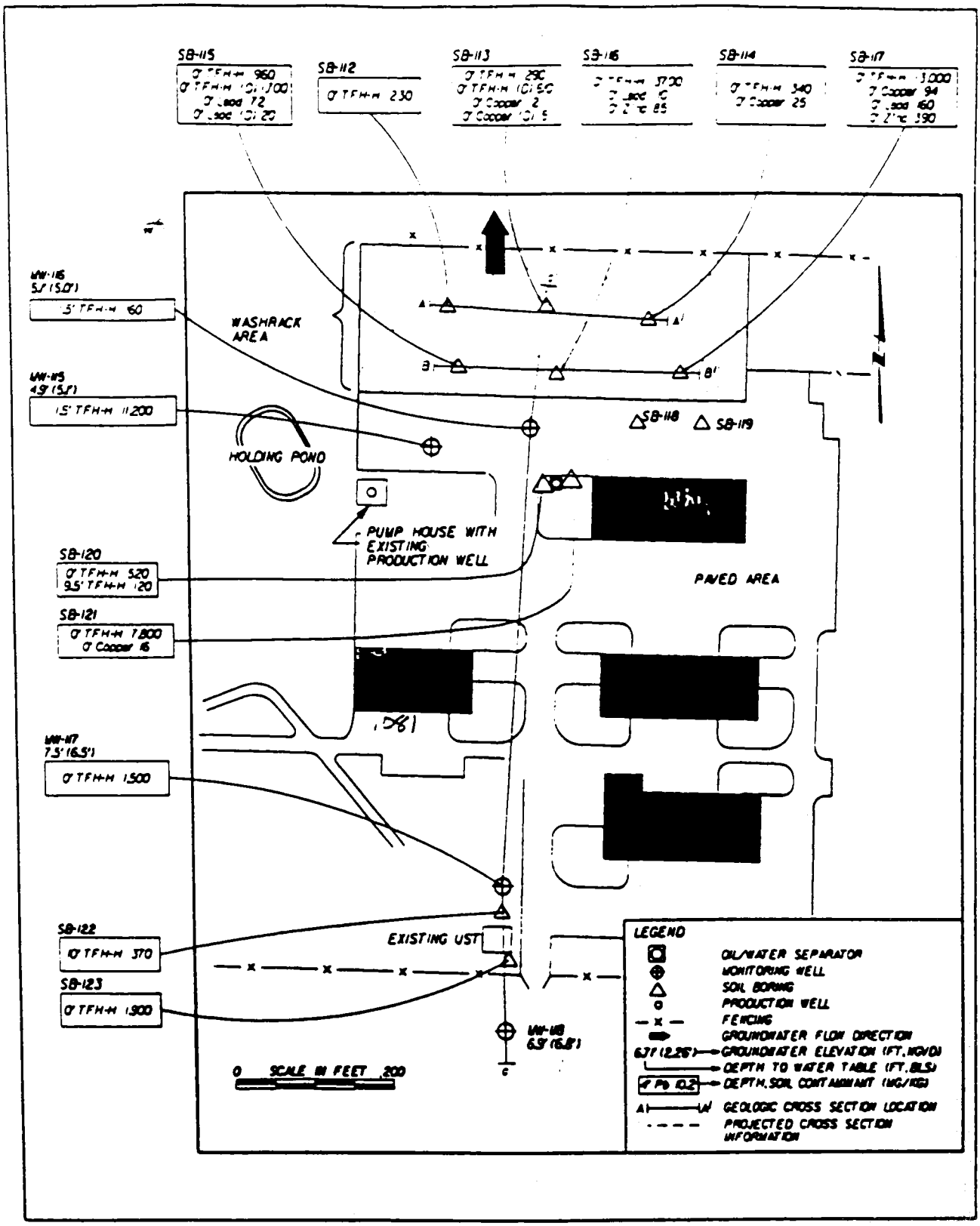
TCA Concentrations in Soil Gas at Site 4, Firefighter Training Area
Ft. Story, VA

Figure 2-13



Total Hydrocarbon Concentrations in Soil Gas at Site 4, Firefighter Training Area
Ft. Story, VA

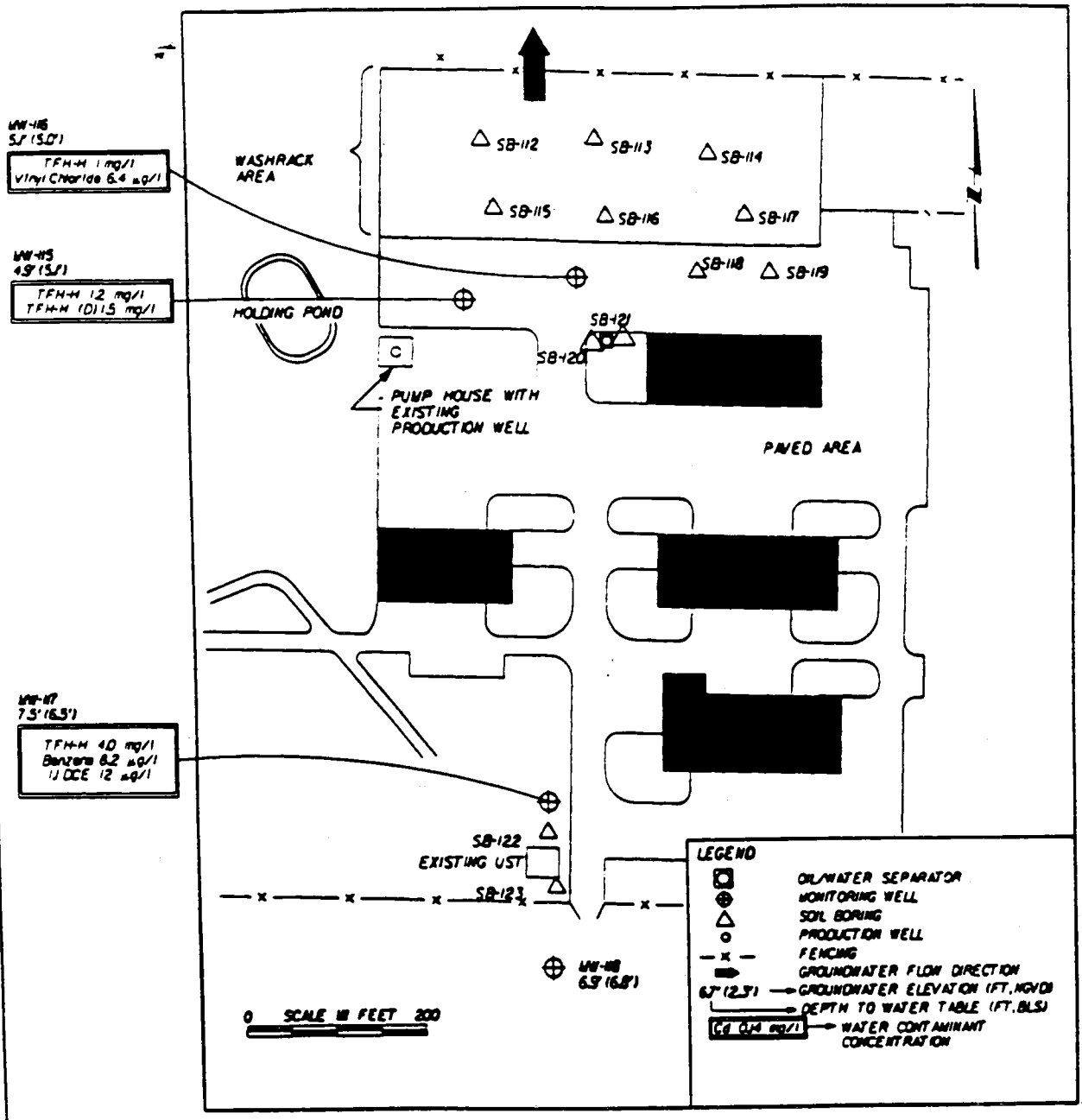
Figure 2-14



JMM

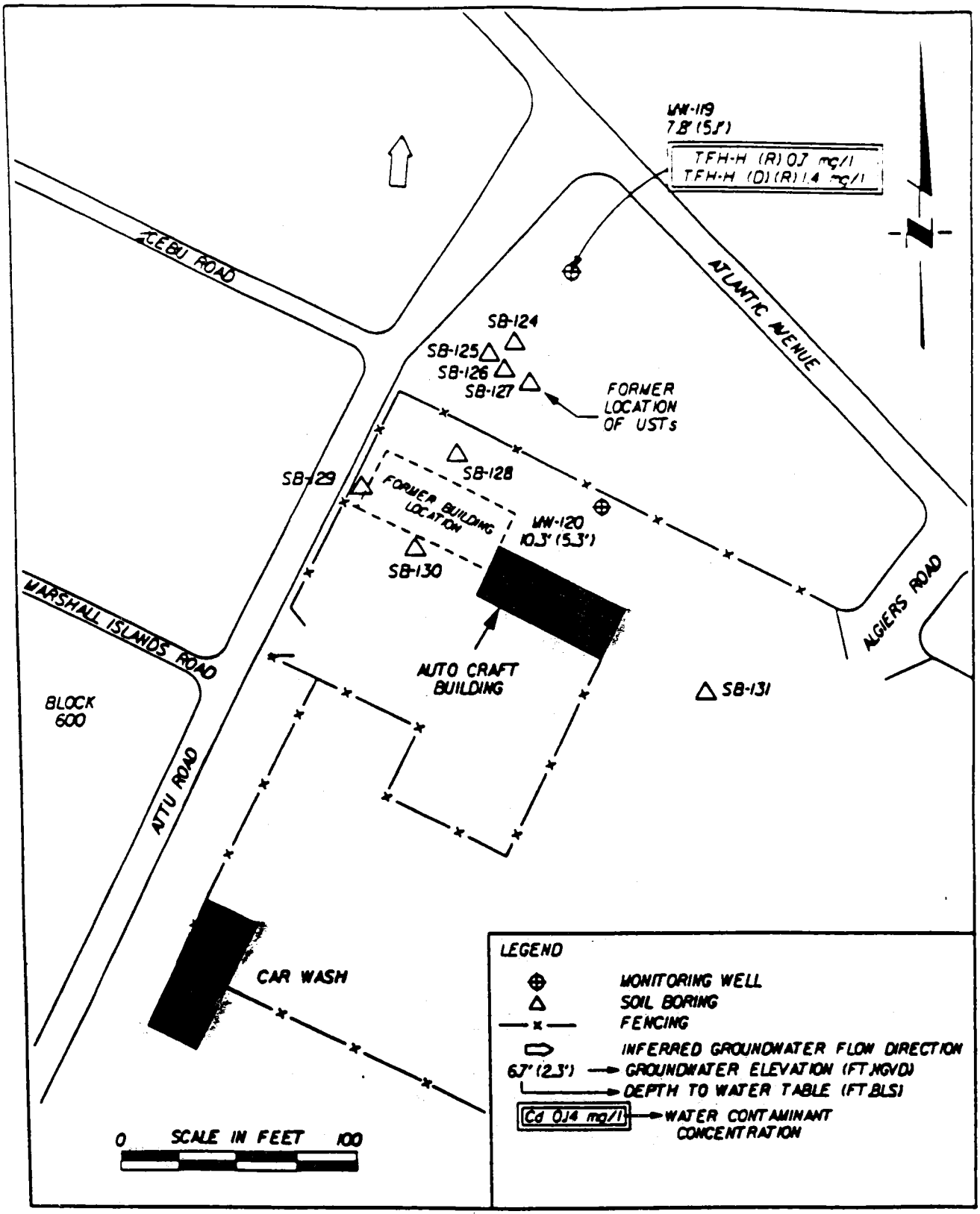
Soil Chemistry Concentration and Geologic Cross Section Locations,
Site 6, LARC Maintenance Area
Ft. Story, VA

Figure 2-20



Groundwater Chemistry Concentrations,
Site 6, LARC Maintenance Area
Ft. Story, VA

Figure 2-21



Groundwater Chemistry Concentrations,
Site 7, Auto Craft Building
Ft. Story, VA

Figure 2-24